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The Correlation of China's Social Fixed Asset Investment with GDP, Fiscal Expenditure and Total Retail Consumer Goods

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Abstract: Since the reform and opening up, China's economy has experienced unprecedented rapid growth, in which social fixed asset investment, as a key driver, has contributed to economic development that cannot be ignored. This study focuses on the period from 2003 to 2022 and employs key economic indicators, including gross domestic product (GDP), fiscal expenditure, and total retail sales of consumer goods, to investigate the correlation between these variables and their impact on fixed asset investment. To this end, econometric analysis is utilized to elucidate the underlying mechanisms through which these variables influence fixed asset investment. The results indicate a positive correlation between fiscal expenditure, retail sales of social consumer goods and overall fixed asset investment. Furthermore, a negative correlation exists between GDP and fixed investment. This is due to the fact that an increase in GDP leads to an increase in total social consumer goods, which in turn reduces the funds available for investment. Consequently, a negative correlation emerges between total social consumer goods and fixed asset investment. This illustrates that fiscal expenditure exerts the greatest influence on social fixed asset investment, followed by GDP and total social consumer goods. The objective of this empirical analysis is to identify the key factors influencing China's fixed asset investment. The findings are intended to inform the formulation of more precise and effective economic policies by the government, facilitate the optimization of the investment structure, and support the advancement of high-quality economic development.

Keywords: Social Fixed Asset Investment, Fiscal Expenditure, Gross Domestic Product, Total Retail Sales of Consumer Goods.

1. Introduction

Since the reform and opening up, the Chinese government has played an important role in promoting economic growth [1]. After the 1990s, the Chinese government increased its investment in large-scale infrastructure construction and fiscal expenditure, which strongly contributed to the formation of social fixed assets [2]. In response to the economic crisis, an increase in fiscal expenditures became an effective means for the Chinese government. With the outbreak of the global financial crisis in 2008, China's fiscal expenditures have continued to increase, resulting in mounting pressure on the

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fiscal budget. Consequently, the allocation of government investment has become a significant challenge for the Chinese government in the present context.

The impact of Chinese government policies on the country's fixed asset investment has also become a topic of significant interest among scholars. Yang Dongyan and Zhang Mei [3] employ an empirical analysis to investigate the relationship between fixed asset investment, fiscal expenditure, and GDP. Their findings indicate the presence of a long-term stable cointegration relationship between the three variables, as well as a bidirectional causal relationship between fixed asset investment and GDP. Guo Jie [4] delves into the source of funds for social fixed asset investment, concluding that government investment exerts an influence on private sector investment by affecting aggregate demand.

A review of existing studies reveals a lack of clarity regarding the impact of GDP, fiscal expenditure, and total retail sales of consumer goods on the growth of social fixed asset investment. While individual studies have explored the relationship between these variables, they have not addressed the underlying mechanism through which they influence social fixed investment. Accordingly, this paper seeks to address these deficiencies in the existing literature. Beginning with an examination of China's national context, this paper will explicate the influence of GDP, fiscal expenditure, and total retail sales of consumer goods on social fixed asset investment, propose specific causal identification conditions, and endeavor to respond to the question of how the government's role in macro-control can be optimized.

2. Empirical Analysis

This paper presents a descriptive analysis of the statistics of China's fixed asset investment and gross domestic product (GDP), fiscal expenditure, and total retail sales of consumer goods in society from 2003 to 2022. The descriptive statistics are presented in Table 1.

Table 1: The social fixed asset investment, GDP, fiscal expenditure, and total retail sales of consumer goods in China from 2003 to 2022.

Variable name	Observed value	Mean	Standard deviation	Min	Max
Fixed Asset Investment	20	230,145	168,164	32,918	513,608
GDP	20	441,467	288,237	100,280	990,865
Fiscal Expenditure	20	100,828	74,709	15,886	238,858
Total retail sales of consumer goods	20	156,753	116,247	37,783	408,017

Note: The source of data is China Statistical Yearbook 2003-2022; all units are in billions of yuan.

The investment in fixed assets of the whole society can be defined as the quantity and scope of investment in fixed assets within a country or region, expressed in terms of value. As a comprehensive indicator, it reflects the scale of construction [5]. This paper examines the relationship between the investment in fixed assets of the whole society and GDP, fiscal expenditure, and total retail sales of social consumer goods. It identifies the primary influencing factors, and provides a scientific basis for the government's investment decision-making. GDP is the optimal indicator for measuring the economic situation, which is closely related to the investment in fixed assets [6]. Fiscal expenditure represents the government's financial payment for providing public products and services, which has a significant impact on fixed asset investment [7]. Total retail sales of consumer goods offer insight into the expenditure patterns of urban and rural residents and social groups, and have been theorized to exhibit a negative correlation with fixed asset investment [8].

This paper employs stepwise regression to construct a model that circumvents the issue of multicollinearity by incorporating variables in a stepwise manner and evaluating the degree of model

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fit. The correlations and evolutionary patterns of these four indicators are examined to provide policy recommendations.

2.1. Estimation of Parameters for a Bivariate Model

This paper initially assesses the linear correlation between social fixed asset investment and GDP. The regression results presented in Table 2, column (1), demonstrate that the model exhibits a high degree of fit, with an adjusted R^2 value of 0.990 and a minimal standard estimation error. This indicates that GDP can explain the overwhelming majority of the observed changes in social fixed asset investment. Furthermore, the coefficient of the explanatory variables is 0.581 and is statistically significant at the 1% level.

2.2. Parameter Estimation of the Three-variable Model

Since the reform and opening up, the Chinese government has had a huge impact on promoting economic growth, which theoretically will have a significant impact on fixed asset investment. In this paper, we further add the fiscal expenditure variable to establish a triple linear regression model, with fixed asset investment as the dependent variable and GDP and fiscal expenditure as the explanatory variables. The results are shown in column (2) of Table 2.

The fit of the proposed ternary linear regression model is highly satisfied, with an R^2 value of 0.995. The results of the ANOVA demonstrate that the F-statistic is 1814.68, accompanied by a markedly low P-value, indicating that the independent variable exerts a significant influence on the dependent variable. In the coefficient analysis, the coefficient of GDP is -0.80, corresponding to a t-statistic of -0.50, and the coefficient of fiscal expenditure is 2.552, corresponding to a T-statistic of 4.14. These results indicate that fiscal expenditure has a greater impact on social investment in fixed assets.

Table 2: Main regression results

	Fixed Asset Investment		
VARIABLES	(1)	(2)	(3)
GDP	0.581***	-0.0796	-0.0499
	(-0.0133)	(-0.16)	(-0.165)
Fiscal Expenditure		2.552***	2.393***
		(-0.616)	(-0.649)
Total retail sales of consumer goods			0.0356
			(-0.0418)
Constant	-26,207***	7,962	5,304
	(-6,966)	(-9,671)	(-10,239)
Observations	20	20	20
R-squared	0.991	0.995	0.996

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

2.3. Parameter Estimation of the Four-variable Model

To gain a more comprehensive understanding of the influence of consumption on fixed asset investment, this paper introduces total retail sales of social consumption as a core explanatory variable, thereby extending the original model through regression analysis.

The results in column (3) of Table 2 demonstrate that the coefficient of determination (R^2) of the model is 0.998, indicating a very highly significant degree of fit. The F-statistic is 1190.374 ($p<0.000$),

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which verifies the significance of the model. The coefficient of fiscal expenditure (β2=2.393) and the t-statistic (3.690) are statistically significant. While the coefficient of GDP (β1=-0.50) and total retail sales of consumer goods (β3=0.036) may suggest the opposite. This phenomenon is possibly due to the small sample size. Nonetheless, these two variables are significant in the theoretical model and are therefore retained in the model of this paper.

3. Further Discussion

3.1. Tests and Corrections for Multicollinearity

In a multiple linear regression model, there may be correlations between the statistics of many variables, resulting in the variables influencing each other and multicollinearity invalidating the parameter estimates. If the model has serious multicollinearity (VIF>10), the economic significance test or t-test of the parameters will fail, indicating that the model is not reasonably constructed and fails to accurately fit the reality [9]. Thus, the data must be processed via the variable transformation method to enhance the model's fit. Both the visualization of the goodness of fit values and the results of the correlation coefficient test on the core explanatory variables indicate that the model may exhibit potential multicollinearity issues.

In this paper, the correction is conducted by the variable transformation method. Firstly, an auxiliary regression model was established in which each explanatory variable was regressed as the dependent variable and the other variables were regressed as independent variables. The diagnostic results demonstrated that the three equations exhibited a goodness-of-fit of 0.997, 0.996, and 0.995, respectively. Thereby, the gross domestic product (GDP) was selected as the variable transformation factor, with all variables in the model divided by the GDP to obtain the new equations for estimation. The variable transformation method effectively mitigated the impact of multicollinearity on the model, resulting in a superior fit. The outcomes of this approach are illustrated in Table 3.

Table 3: Auxiliary regression results

Fixed Asset Investment	
VARIABLES	-1
GDP	-2.870***
	(0.785)
Fiscal Expenditure	1.247***
	(0.382)
Total retail sales of consumer goods	0.0764
	(0.0627)
Constant	0.246**
	-0.0928
Observations	20
R-squared	0.946

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

3.2. Tests for Autocorrelation

The potential for autocorrelation between the model error terms may result in a reduction in the model's predictive accuracy and an inability to obtain unbiased estimates of the coefficients. In this study, the graphical method with DW test was used to address the issue of autocorrelation in the model. A scatter plot of e_i against e_{i-1} was constructed, and the findings are presented in Figure 1.

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The results suggest that e_i is more randomly distributed and may not be autocorrelated. Additionally, the DW test indicates that the original hypothesis of H_0:e_i is random is not rejected.

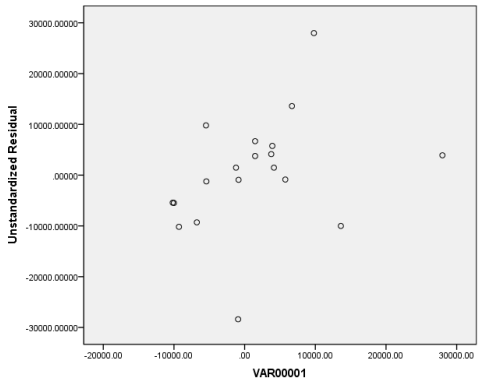

Figure 1: Scatter plot of e_i against e_{i-1}

4. Conclusion

This paper applies a quantitative analysis to investigate the influencing factors of China's social investment in fixed assets from 2003 to 2022. The findings indicate that fiscal expenditure exerts the most significant influence on social investment in fixed assets, and the two variables are positively correlated. This implies that a 2.4% change in fixed investment can be attributed to a 1% change in fiscal expenditure, which demonstrates that the incremental enhancement of infrastructure exerts a considerable influence on fixed asset investment. Additionally, a 1% change in GDP is associated with a 0.05% change in fixed investment in the opposite direction, due to the fact that an increase in GDP leads to an increase in total social consumer goods, which in turn reduces the funds available for investment, resulting in a negative correlation between total social consumer goods and fixed asset investment. Lastly, for every 1% change in retail sales of consumer goods, fixed investment changes by 0.036% in the same direction, manifesting the greatest impact on social investment in fixed assets, followed by GDP and total social consumer goods.

Although the sample size of the model is relatively limited, it exhibits notable clarity, goodness of fit, and robust predictive capacity. These attributes enable the model to elucidate the interrelationships between variables with greater precision and to anticipate economic phenomena with greater accuracy.

In order to facilitate the advancement of social fixed asset investment, it is imperative that the Chinese government intensify its financial backing, implement a more prudent allocation of financial resources, and leverage the full potential of financial investment in macro-control [10]. It is recommended that fiscal investment be oriented toward the promotion of industrial structure upgrading, with a particular focus on increasing investment in emerging industries. Furthermore, fiscal investment should continue to prioritize infrastructure construction, with the objective of improving the supply of public products and stimulating consumer demand. Concurrently, limited fiscal investment should be allocated primarily toward enhancing people's livelihoods, promoting scientific and technological progress, and maintaining economic stability and security. Finally, the government should undergo a transformation into a service-oriented government, with a view to reducing market intervention and improving the level of public services.

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