The Impact of Government Intervention on Firms' Investment Decisions in China: An Extension in the IS-LM Model

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Abstract: This essay examines how government interventions affect the firms in China, where political connections are valued as one of the essential factors in this fast-growing economy. This research aims to show that the Chinese government treats SOEs and non-SOEs differently by offering different interest rates. This paper contributes to allowing the policymakers to notice the difference in the responsiveness of SOE and non-SOEs investment. The government can plan its expansionary policy schemes by setting the interest rates according to the relative sensitivities of firms to overcome economic fluctuations. The primary methodology is an extension of the IS-LM model, which studies how the exogenous change in policies affects the equilibrium level of income. According to the correlation analysis, SOE investment has an intense negative relationship with interest rates. Still, the non-SOE investment is less responsive than the SOE investment, although it also has an opposite trend with the interest rates. This study modifies the IS-LM curve based on Chinese government intervention behavior and contributes to the further exploration of the investment behavior of firms under policy changes. The Chinese economy is currently rebounding from the aftermath of the pandemic, as the government abandoned its Zero-COVID regime. China's policy-induced recovery will generate a considerable contribution to global growth according to the IMF's forecasts, released on January 30th, 2023. This research topic is necessary to be developed as it studies the reaction of firms when the government applied its policy tools to spur the economy.

Keywords: interest rates, state-owned enterprises (SOEs), non-state-owned enterprises (Non-SOEs), investment, policy

1. Introduction

China is an emerging economy and a major trading partner with numerous countries such as the United States, South Korea, and Japan. Therefore, the variations in the Chinese economy can jeopardize other economies and eventually affect the global economic situation. When the Chinese government intervenes in its economy, it also affects the world economy. Hence, it is important to study how the policies imposed by the Chinese government operate in its domestic economy and boost its overall economic performance. The past evidence suggested a tendency for the Chinese government to offer more generous financial aid to SOEs in contrast to non-SOEs. When the

government deliberately lower its interest rates, it can study the possible changes in the amount of investment and predict whether this stimulus can help the economy to recover or expand aligned with its objectives by considering SOEs' and non-SOEs' reaction separately.

The government is responsible for intervening in the economy during economic downturns to reach full employment according to Keynesian theory [1]. However, the tools utilized by the authorities may vary according to region, and indigenous culture and conventions can affect the policy framework. During recessionary periods, mostly used monetary policy was capital injections through quantitative easing. Such evidence can be found in the US, where the US government adopted a Troubled Asset Relief Program (TRAP) in 2008 to purchase financial assets from financial institutions [2]. On the other hand, the Chinese government introduced the economic stimulus package (ESP) during the same period, which influenced the firms' investment directly and indirectly [3,4]. The ESP included tax reductions and subsidies, lower interest rates, and direct investment by appointing state-owned enterprises (SOEs) to invest in critical areas [2,5]. Studies have shown that the Chinese government heavily relies on social networks and relationships, where private and public-sector businesses are treated differently, as SOEs enjoy privileges, including more accessible bank loans at lower expenses and favorable credit terms than non-SOEs [6]. Moreover, research has proven that government-controlled firms received more significant subsidies and lower tax rates [7]. Thus, it is necessary to analyze the firms' reactions and investment behavior in China under government intervention and tailor an investment function specifically to this circumstance, which can give a more precise prediction of the economy's output after the government intervention, and further aids the evaluation of the effectiveness of government policies.

The IS-LM model shows short-term economic fluctuations where changes in exogenous variables can affect the endogenous variables for a given price level [8]. It is crucial to macroeconomics since it can derive the aggregate demand curve and concerns two fundamental markets-the goods market and the money market. Recent modifications added inflation and unemployment into the model [9], but there needs to be considerations of China's policy framework that influences the firms' investment, which is different from other countries.

The following content of this paper is organized as methodology and data collection, results and discussion of the results using descriptive statistics and correlation analysis, and lastly, the conclusion of the results with the limitations of this essay.

2. Methodology and Data

2.1. An Extension to the IS-LM Model

By considering the policy framework and its mechanisms in China, the investment function and the government expenditure that feeds into the IS curve can be extended.

The IS-LM model determines the point of real output where there is a simultaneous equilibrium in the goods and the money market for a given fiscal policy and real money balances. The government may utilize this model to make macroeconomic policy decisions, which can predict the effect of monetary and fiscal policy changes on the economy's real income. The underlying assumption of this model is that bonds and money are the only financial assets, and the aggregate supply is infinitely elastic. The model indicates a negative relationship between interest rates and investment, and government expenditure is exogenous to the model because it is determined by the authorities.

When constructing the model, the Chinese economy is assumed to be a simple closed economy for the simplicity of calculation. Although the assumption of an open economy is also applicable to this research, but the closed economy can help to explain the relationship between firms' investment with the interest rates as well. However, an open-economy could become future research for further development.

Since the government treats SOEs and non-SOEs financially differently by offering better credit terms, a greater amount of subsidies, and lower tax rates, according to the precedent research, firms with different legal structures may have varying sensitivities to the interest rates when making their investment decisions. In reality, the SOEs are in a more favorable position than the non-SOEs for acquiring loans due to their political ties; however, because the government only announces the same base interest rates that are received by all the firms, whereas SOEs and non-SOEs could receive different interest rates, so this model reflects this phenomenon by suggesting that SOEs and non-SOEs have different sensitivities attached to the interest rates. The following equation is the traditional investment function.

$$I = b_0 + b_1 r \tag{1}$$

Where I stands for investment and r symbolizes interest rates. The exogenous variable b_0 represents the investment that is independently determined by the firms, and b_1 is the marginal propensity to invest which is negatively related to investment. After the adjustment, the equation can be rearranged by adding different sensitivities of SOEs and non-SOEs investment in response to the interest rates.

$$I = (b_{s0} + b_{p0}) + (b_{s1} + b_{p1})r \tag{2}$$

The exogenous variable b_0 is split into two parts, b_{p0} and b_{s0} for private firms and SOEs respectively. In terms of b_1, it is shown as b_{p1} and b_{s1}, referring to the sensitivities that are endogenized by the interest rates for private firms and SOEs, respectively. Hypothetically, b_{s1} may be smaller in magnitude than b_{p1}, given that SOEs are less responsive to increases in interest rates and more active during interest rate reductions ascribed to their cost advantage in borrowing. The expectation is that b_{s1} and b_{p1} are both negative and differ in value, but the size of the discrepancy is not explored, which is the key to the analysis in this research. The expected signs of the weights are negative because interest rates are the cost of investment, and this paper will test the sign of the coefficients for analyzing the effect of government policy on investment, specifically on firms with different legal formations.

2.2. Data

In order to validate the above hypotheses, this study collects data such as interest rates, the percentage change in research and development expenditure of SOEs, China's GDP, and gross fixed capital formation in the private sector as a percentage of China's GDP from the World Bank. The timeframe selected for the study of SOEs investment behavior is chosen between 2020 to 2022, when the pandemic outbreak caused the economic growth to deteriorate, and the Chinese government imposed its expansionary policies to fuel the economy. In this case, the deliberate decrease in interest rates can be analyzed associated with the changes in the trend of SOEs investment.

In addition, estimations are made to interpret further the relationship between private sector investment and its relationship with the interest rates. The latest data publication of non-SOEs' investment is the percentage of gross fixed capital formation (private sector) to China's GDP between 2018 to 2020 as a result of time lag.

Since the interest rates declined over the period, this timeframe also allows concluding the relationship between the private sector investment and the interest rates. Nevertheless, there is inadequate information pertinent to the monetary value of the non-SOEs' investment, so computations are needed by timing the percentage and its corresponding year of GDP. These numbers are used for approximation to illustrate the phenomenon rather than exact figures.

3.   Results

This part of the research gathers the monthly and yearly changes in interest rates and derive the trend of the changes. Furthermore, the corresponding year of SOE and non-SOE investment to each of the interest rates are collected for correlation analysis and descriptive statistics. By interpreting the results, the signs of the coefficients can be deducted, and the relative size of sensitivities can be compared as well.

Table 1 collects the monthly interest rates in three years and derive the mean value of each year as an input value for table 2. From 2020 to 2022, the interest rates falls continuously in aim to stimulate the investment due to the outbreak, it can be seen that 2020 has the greatest value of standard deviation, implying that the interest rates experienced the greatest fluctuation in that year.

Table 1: People's bank of China loan prime rate (%).

	Mean	Median	Standard Deviation	Max	Min	No. of Obs
2020	3.93	3.85	0.124	4.15	3.85	13
2021	3.85	3.85	0.014	3.85	3.80	12
2022	3.68	3.70	0.026	3.70	3.65	12

Source: The People Banks of China

According to the data, the government decreased the interest rates in an attempt to stimulate the economy from the COVID-19 economic downturn. As the interest rates decrease over the year, percentage change in SOEs' R&D expenditure is increasing.

Table 2 indicates that there is a strong negative linear correlation, because the results shown in the table is approaching to -1, indicating that the decrease in interest rates will lead to a closely proportionate increase in investment. The calculated figure from correlation analysis strongly suggested that the sign of the coefficient b_{s1} should be negative as predicted.

Table 2: Percentage change in SOEs' R&D expenditure.

	Interest Rates in %	R&D of SOEs
2020	3.93	11.3%
2021	3.85	16.1%
2022	3.68	19.7%
Correlation	**-0.9613**	

Source: The State Council Information Office, The People's Republic of China

Table 3 presents information regarding to the estimated monetary value of gross fixed capital formation in private sector, and it increased over the 3-year period. After the occurrence of COVID-19, the economic activities in China plummeted ascribed to the strict enforced zero-Covid policy and the following reduction in business confidence due to uncertainties. Consequently, the Chinese government keep lowering the interest rates to provide incentive for investment and business activities. The gross fixed capital formation in private sector stands for private sector investment, which climbed from 4.86 trillion dollars to 5.44 trillion dollars accompanied by the reduction of interest rates from 4.3% to 3.93%, as shown in Table 4.

The correlation analysis in Table 4 explained that there is also a negative relationship between private sector investment and the interest rates, but the value to relatively smaller in comparison with the correlation results of SOEs' R&D expenditure. Yet the result still gives a strong correlation.

Table 3: Gross fixed capital formation in private sector.

	China's GDP (in trillion dollars)	Gross Fixed Capital Formation (% GDP)	Gross Fixed Capital Formation (in trillion dollars)
2018	13.89	35%	4.86
2019	14.28	38%	5.43
2020	14.69	37%	5.44

Source: The World Bank

All in all, firms' investment is negatively associated with the interest rates which means the signs of b_{s1} and b_{p1} are negative as predicted. Therefore, this discovery supports that IS curve has a negative gradient and its downward sloping under China's policy framework. On top of that, the correlation results boost the previous hypothesis that private firms are less responsive when the interest rates decline for political reasons. Specifically, SOEs' R&D expenditure will increase to a greater extent and more responsive when the Chinese government introduced their economic stimulus package, because -0.9613 implicates a stronger negative relationship than the value of -0.7367.

Table 4: Interest rates and capital formation.

	Interest Rates in %	Gross Fixed Capital Formation (in trillion dollars)
2018	4.30	4.86
2019	4.19	5.43
2020	3.93	5.44
Correlation	**-0.7367**	

Source: The State Council Information Office, The People's Republic of China

The above data analysis proved that the initial expectation was correct as the firms under different legal structures react differently under changes in the interest rates, and thus having different sensitivities attached to it. By inserting this new founding into the IS curve equation, the new equation can be shown as exogenous components that shifts the curve and endogenous components that provides a relationship to the two variables.

$$Y = \frac{1}{1-c}[E_0 - b_{s1}r - b_{p1}r] \tag{3}$$

E_0 is exogenous variable containing taxes, government expenditure, desired consumption and investment, and *c* represents the marginal propensity to consume. This finding can help policymakers to estimate the effectiveness of the interest rate reductions by considering the sensitivities of SOEs and non-SOEs separately. If the government wishes to combat recession or adjust its demand-side policy to reach the target level of output, it can predict the responses from the SOEs and non-SOEs to ensure that the increase in investments can propel economic growth [10].

4.   Conclusion

This paper explores the investment pattern due to the change in interest rates by breaking down the investment function into two parts for SOEs and non-SOEs. The data proves that non-SOEs' investment increase by a smaller extent than SOEs when there is a decline in interest rates, which validate the hypothesis that non-SOEs may have b_{p1} that is greater than b_{s1}. The results also correspond to the previous research that the Chinese government's intention to decrease the interest rates and encourage investment may have different effects on SOEs and non-SOEs due to political connections and social relationships.

However, there are limitations of this research that can be carried on in the future. Firstly, the insufficient database has little information about SOEs' investment, and it only provides the R&D expenditure growth rates instead of the exact number, which may influence the preciseness of the data. Moreover, the data about private sector investment is not available, so the value is estimated. The limited access to data also restricts the period that allows it to be analyzed. The value of the SOE R&D expenditure is reported between 2020 to 2022, but information about the private sector investment was only updated until 2020. Despite the interest rates declining over these two separate periods and enabling the relationship to be analyzed, the results can be more accurate if SOEs' investment and non-SOEs' investment can be compared over the same period under the same policies or simultaneous decline in the interest rate. Furthermore, more information about the interest rates and the corresponding year of SOEs' and non-SOEs' investments can be collected. In that case, regression analysis may be applied and can be used to explain the investment trend to the interest rate.

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