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Research on the efficiency of corporate investment and risk prediction for easing monetary policy

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Abstract

To guarantee the quality of corporate economic growth, it is important to investigate the effectiveness of corporate investment focused on accommodating monetary policy. This study starts with a vector autoregressive VAR model and builds a TVP-VAR model utilizing Bayesian inference and time-varying parameters. The Bayesian time-varying parametric vector autoregressive model is used as the basis for the model setting of enterprise investment efficiency. For the constructed enterprise investment efficiency model, an example analysis is conducted with the financial data of SMEs. For both the SOE and non-SOE samples, the monetary policy's correlation coefficients with the amount of inefficient investment are 0.1904 and -0.1128. In terms of financing constraints, the correlation coefficients between financing constraints and the degree of inefficient investment are 0.1125 and 0.0291 for the non-SOE and SOE samples, respectively. This indicates that accommodative monetary policy can enhance enterprise investment However, the financing constraint relatively leads to risks in the efficiency of corporate investment.

Keywords: *vector autoregression, Bayesian inference, TVP-VAR model, monetary policy, corporate investment efficiency.*

Introduction

Investment, as one of the "troika" of the economy, has played a great role in promoting macroeconomic development, optimizing resource allocation, and promoting employment in China (Lin D, 2019; Zhao, Chen, & Hao, 2018). Especially today, when China's economic development is entering a new normal, increasing the effectiveness of investment plays a decisive role in promoting high-quality economic development (He et al., 2019; Mattos, Da Roz, Ultremare, & Mello, 2019). However, the current inefficient investment scenario has always existed in Chinese listed businesses, which not only generates an uneven distribution of financial resources but also negatively impacts the effectiveness of economic development (C, 2018; Fiedler, Gern, Jannsen, & Wolters, 2019).

One of the key macro-control policies, the monetary policy, is crucial for ensuring the efficient use of financial resources and fostering economic growth, while the shift of the combined and targeted regulation of monetary policy also enables monetary policy to achieve the classification and regulation of different types of enterprises (Acharya & Plantin, 2019; Ouerk, Boucher, &

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Lubochinsky, 2020). Monetary policy nowadays takes full care of serving the real economy, promoting the optimization of credit structure and directing credit to small and micro enterprises in its implementation, but it has not paid sufficient attention to its credit resource allocation efficiency and ability to serve the real economy (Dong, Miao, & Wang, 2020; Vlasov & Sinyakov, 2020).

Given the volatility of the financial markets, the literature (Liu & Xiao, 2021) argues that a diversified portfolio helps to control portfolio losses, enabling the optimization of asset allocation while maximizing expected returns and lowering investment risks. Monetary policy is a key factor in how firms invest, and it has a significant impact on how they choose to make their investments. According to the literature (Bank, 2020), financial market development attempts to increase the financial system's capacity to finance investment and consumption as well as accomplish effective risk sharing. Financial markets also play a critical role in ensuring financial stability. In the DGSE model with financial frictions, the literature (Revelo & Levieuge, 2022) tries to completely investigate the possible conflict between macroprudential policy and monetary policy, and monetary policy might lessen its detrimental financial effect by strongly responding to the output gap. A novel monetary transmission channel that creates a new monetary policy trade-off between inflation and real interest rate stability is the quantitative monetary DSGE model, which the literature (Abbate & Thaler, 2019) theoretically builds and estimates. To curb excessive risk-taking and improve the efficiency of investments, central banks may be more willing to put up with higher inflation volatility. The literature (Ezeibekwe, 2020) tried to ascertain how variations in inflation rates impact the capacity of monetary policy instruments to sustain the Nigerian economy and encourage investment. Data from 1981 to 2018 were used, and a vector error correction model was applied. The findings demonstrated that the degree of inflation rate affects how much interest rates affect investments. Based on an analysis of a sample of Chinese A-share listed companies from 2005 to 2019 from macro and micro cross-sectional perspectives, the literature (Yang, Lu, & Tan, 2021) empirically tested the relationship between monetary policy, comparability of accounting information, and investment efficiency and found that doing so can increase corporate investment efficiency. This study offers analytical justifications in three sections to investigate the effects of loose monetary policy on business investment effectiveness and risk forecasting. The first section explains the transmission mechanism of monetary policy and the effects of accommodating monetary policy on corporate investment efficiency with an emphasis on how monetary policy affects the effectiveness of corporate investments. The second step is the model analysis, which builds on the vector autoregressive model as a foundation to jointly build the TVP-VAR model utilizing time-varying parameters and Bayesian inference. The model design involved monetary policy, finance restrictions, and TVP-VAR-based company investment efficiency. The link between monetary policy, financing restrictions, and investment efficiency is statistically examined with yearly financial data of SMEs as the study objective in the third section, which is an example analysis. The three sections mentioned above are used to understand how loose monetary policy affects businesses' ability to invest effectively.

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Monetary policy and corporate investment efficiency

Monetary policy affects economic activities through credit transmission mechanism and monetary transmission mechanism, and is an important tool for the monetary authorities in China to regulate the macroeconomy, and the investment activities of enterprises are also affected by the adjustment of monetary policy. This paper combines monetary policy and enterprise investment efficiency into a single research framework to further explore the impact of monetary policy on the process of enterprise investment efficiency. This helps to reveal the precise mechanism by which monetary policy affects enterprise investment efficiency and allows for the provision of targeted recommendations for the formulation and implementation of monetary policy as well as the improvement of enterprise investment efficiency in China.

The transmission mechanism of monetary policy

A regulatory framework that comprises monetary policy tools, intermediary goals, end goals, the transmission of monetary policy, and its impacts is referred to as monetary policy, and the process by which the monetary policy authority adopts appropriate monetary policy instruments in a specific economic environment to accomplish the regulatory goals of monetary policy through a number of transmission channels and channels is referred to as the transmission mechanism of monetary policy (Li Shunbin, 2019).

The overall transmission process of monetary policy is depicted in Figure 1, and it may be broken down into two parts as follows:

The intermediary aim of monetary policy is communicated with the tools of monetary policy in the first stage. The interim aim of monetary policy is communicated to the end target of monetary policy in the second stage. The monetary policy authority may employ tools to affect financial markets or financial institutions throughout this transmission process. The financial markets or financial institutions then influence consumers and investors through credit and interest rates, which in turn affect the macroeconomy and have an impact on changing inflation and economic growth, etc.

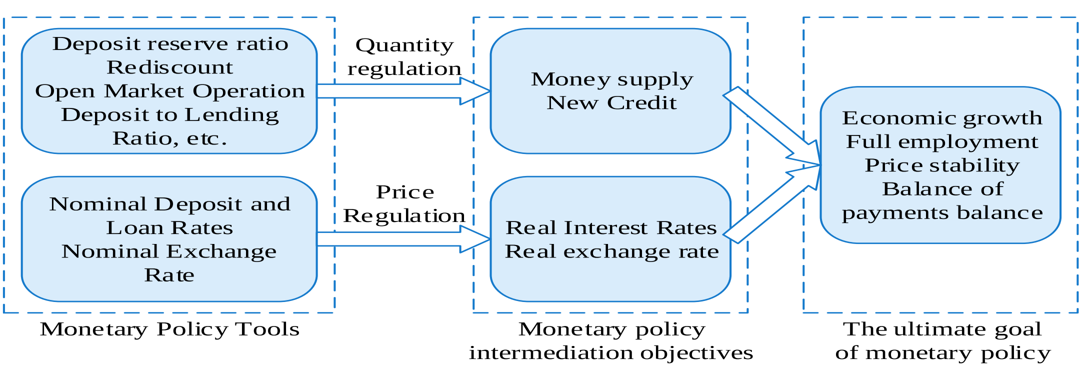

Figure 1. The general conduction process of monetary policy

In order to achieve the ultimate goal of monetary policy regulation, monetary policy authorities frequently adjust quantitative monetary policy instruments to affect the growth rate of the money supply, credit allocation, and other intermediary objectives, or they adjust price-based monetary policy instruments to affect the real exchange rate, real interest rates, and other intermediary objectives.

The transmission mechanism of monetary policy in the corporate investment market

There are many factors that can cause changes in the corporate investment market, but the demand and supply side of monetary policy is the basic factor that influences changes in the corporate investment market. Demand is influenced by "per capita national economic income, demographic situation, disposable income of enterprises, enterprise consumption structure and monetary policy factors". Among them, monetary policy is an important factor influencing the rigid demand for efficiency in the corporate investment market, and it also influences the speculative and improvement demand for corporate investment. Figure 2 illustrates the overall monetary policy transmission mechanism in the business investment market.

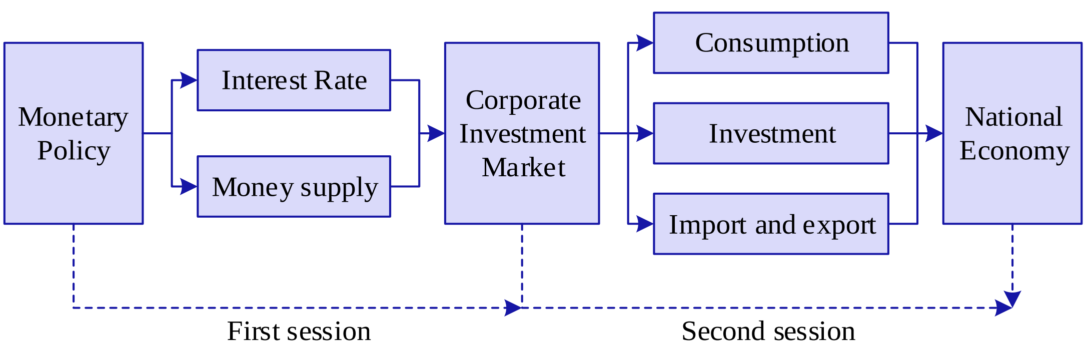

Figure 2. Transmission mechanism of corporate investment market

The effect of accommodative monetary policy on the efficiency of corporate investment

The interest rate transmission mechanism is the most efficient monetary route for monetary policy transmission, and changes in market interest rates affect the cost of financing for enterprises, which in turn has an impact on their financing behavior and investment behavior.

Since rational investors will only invest when the NPV of an investment project is greater than zero, when in expansionary monetary policy conditions, on the one hand, market interest rates fall, which will lead to lower borrowing costs for enterprises and sufficient cash flow in enterprises, the scale of investment will expand in this case. The bank credit transmission mechanism in the credit channel affects corporate financing and investment by influencing the amount of loans available to banks. On the other hand, for the bank credit transmission channel, the expansionary monetary policy increases the amount of loans available to banks through a decrease in the reserve

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requirement ratio, which simultaneously lowers the cost of corporate funding and eventually increases the amount of corporate investment.

Although a lax monetary policy can increase the size of business investment, it will also reduce the effectiveness of that investment. On the one hand, loose monetary policy is usually proposed by the central bank to stimulate economic growth during the economic downturn when there are fewer investment opportunities and demand in the market. On the other hand, despite the fact that commercial banks will increase their credit availability during the time of loose monetary policy, they will give larger businesses and state-owned corporations more credit due to risk factors. The state-owned enterprises have the problem of low governance efficiency, and the flow of credit resources to these enterprises will cause blind expansion and ineffective investment, which will eventually lead to the decline of investment efficiency of these enterprises.

Stable corporate investment efficiency is the desired economic development goal of the accommodative monetary policy authorities, and the path to achieve its goal is shown in Figure 3.

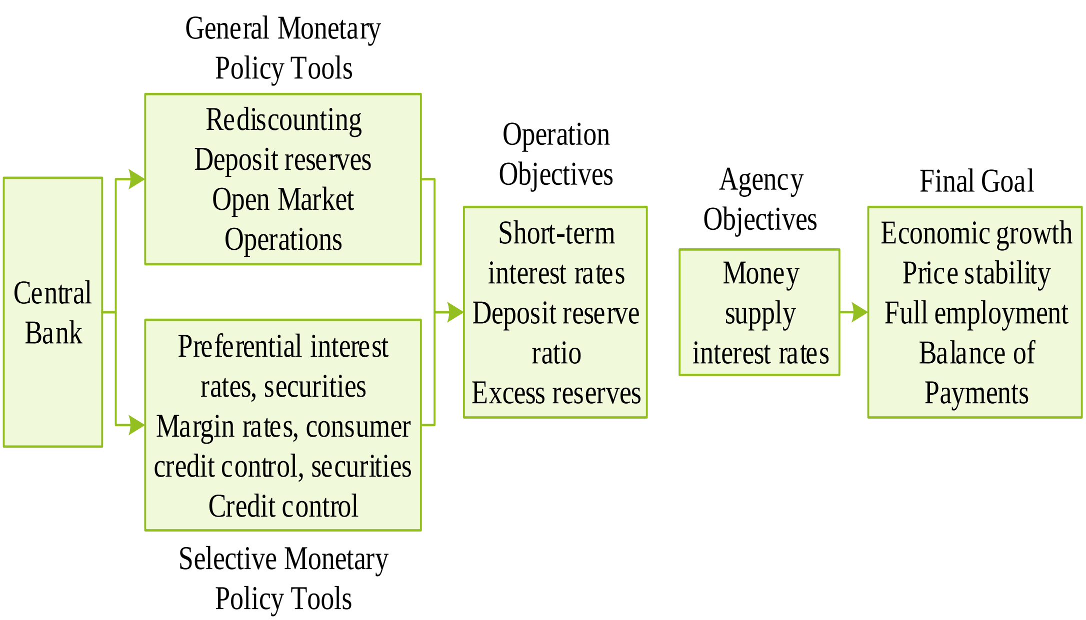

Figure 3. The path of achieving the goal of monetary policy

The following assumptions about the connection between loose monetary policy and business investment effectiveness are made in this article based on the monetary policy analysis presented above:

(1) The investment efficiency of state-owned SMEs can be decreased, while that of private SMEs can be increased, by an accommodating monetary policy.

(2) The investment efficiency of SMEs is hindered by financial limitations, and the effect is

especially obvious among non-state firms.

TVP-VAR-based corporate investment efficiency analysis model

This research uses a Bayesian time-varying parametric vector autoregressive model to investigate the particular influence of accommodating monetary policy on business investment efficiency. This chapter introduces the basic definition and application principles of Bayesian time-varying parametric vector autoregressive model, which also provides theoretical support for the analysis and risk prediction of corporate investment efficiency in the later paper.

TVP-VAR model

Principle of VAR model

Since Sims first introduced the vector autoregressive model (often known as the VAR model) in 1980, it has progressively gained popularity as an econometric tool. To determine the dynamic connection between the endogenous variables, the VAR model employs the concept of regression employing the lags of endogenous variables. For dealing with several interconnected and mutually limited time series data, the VAR model is frequently utilized. A VAR obeying order p model expression is as follows:

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + Bx_t + \varepsilon_t, t = 1, 2, \dots, n \quad (1)$$

Where the sample size is T , p is the lag order, y_t is an endogenous variable with k -dimensional, x_t is an exogenous variable with d -dimensional, $(k*k)$ is a matrix with $A_1, \dots, A_p$ and $(k*d)$ dimensions, and B is the coefficient that needs to be estimated. The aforementioned equation can be represented as the following equation in matrix form, meaning that the $VAR(p)$ model containing k time series is made up of k equations. Let ε_t be the error term, let Σ be a ε_t covariance matrix, and let be a $(k*k)$ positive definite matrix.

$$\begin{pmatrix} y_{1t} \\ y_{2t} \\ \vdots \\ y_{kt} \end{pmatrix} = A_1 \begin{pmatrix} y_{1t-1} \\ y_{2t-2} \\ \vdots \\ y_{kt-1} \end{pmatrix} + A_2 \begin{pmatrix} y_{1t-2} \\ y_{2t-2} \\ \vdots \\ y_{kt-2} \end{pmatrix} + \dots + B \begin{pmatrix} x_{1t} \\ x_{2t} \\ \vdots \\ x_{dt} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \vdots \\ \varepsilon_{kt} \end{pmatrix} \quad (2)$$

A thorough analysis of a VAR model often entails the following procedures in order to establish the model's validity, assess its economic significance, and undertake empirical research:

(1) Smoothness test. In general, the first step when examining a time series model is to conduct a

smoothness test, and the most popular test technique is the ADF test. The precondition assumption of the VAR model is that the variables must satisfy the smooth time series, otherwise the pseudo-regression phenomena may arise.

(2) the selection of the best lag order, VAR model explanatory variables for various lag orders, the model effect is directly impacted by the correctness of the order chosen. Typically, the stage with the greatest number of "*" is chosen as the VAR model's ideal lag order.

(3) Johansen cointegration test. The cointegration test is required to resolve the aforementioned issue because the time series needs to be smooth in order to satisfy the requirements of the VAR model.

(4) Granger causality test. The Granger test determines if there is a causal link between the variables and whether one set of series is exogenous to another set of series.

(5) Model stability test. The characteristic polynomial inverse root plot is a frequent discriminant, and it is also necessary to establish the lag order in order to create a stable VAR model.

(6) Impulse response function. The timing and magnitude of the influence on the model's variables following a shock can be visually represented by the impulse response function of one variable to another. After a shock, a smooth time series model will experience some flux for the first few periods before eventually stabilizing.

(7) Variance decomposition. The process of "variance decomposition" entails breaking down all fluctuations in a time series model into their component parts, calculating each variable's contribution to the variance of shocks, gauging the degree to which fluctuations affect the model's endogenous variables quantitatively, and estimating the magnitude of the effects of various shocks.

TVP-VAR model

This research employs the TVP-VAR model because economic theory and empirical data indicate that the examination of monetary policy effects in China is not reliable when using a non-time-varying model. In contrast to the VAR model, this model has time-varying parameters, which may accurately depict the nonlinear and time-varying aspects of the model. It is more capable of capturing the relationships and characteristics of economic variables in different epochs, so as to obtain the time-varying characteristics of monetary policy effects, while applying MCMC algorithm in parameter estimation. Using this information as a foundation, this study uses a TVP-VAR model based on Bayesian analysis to examine how monetary policy affects the effectiveness of business investment.

A basic VAR model is first constructed:

$$Ay_t = F_1 y_{t-1} + ... + F_s y_{t-s} + u_t, t = s+1,...,n \quad (3)$$

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where y_t is a $k \times 1$-dimensional observable variable, $A, F_1, ..., F_s$ is a $k \times k$-dimensional coefficient matrix, u_t is a $k \times 1$-dimensional structural shock, hypothesis $u_t \sim N(0, \Sigma\Sigma)$, and :

$$\Sigma = \begin{pmatrix} \sigma_1 & 0 & \cdots & 0 \\ 0 & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & \sigma_k \end{pmatrix} \quad (4)$$

where $\sigma_i (i = 1, ..., k)$ is the structural shock's standard deviation. In specifically, it is presummated that the parameter matrix A is a lower triangular matrix:

$$A = \begin{pmatrix} 1 & 0 & \cdots & 0 \\ a_{21} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{k1} & \cdots & a_{k,k-1} & 1 \end{pmatrix} \quad (5)$$

The VAR model is further simplified as:

$$y_t = B_1 y_{t-1} + ... + B_s y_{t-s} + A^{-1} \Sigma \varepsilon_t, \varepsilon_t \sim N(0, I_k) \quad (6)$$

where $B_i = A^{-1} F_i, i = 1, ..., s$.

We stack the row elements of B_i to obtain the $k^2 s \times 1$-dimensional vector β, and then define:

$$X_t = I_k \otimes (y'_{t-1}, ..., y'_{t-k}) \quad (7)$$

The VAR model may be written as follows, where $\otimes$ stands for the Kronecker product:

$$y_t = X_t \beta + A^{-1} \Sigma \varepsilon_t \quad (8)$$

The parameters of the above equation are all non-time-varying. If the parameters in the equation are expanded to be time-varying, the TVP-VAR model can be obtained as follows:

$$y_t = X_t \beta + A^{-1} \Sigma \varepsilon_t, t = s + 1, ..., n \quad (9)$$

where the parameters β_t, A_t, Σ_t are time-varying.

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The lower triangular matrix A_t's components can be stacked into a column vector to produce the following shape:

$$a_t = (a_{21}, \dots, a_{k,k-1})$$
$$h_t = (h_{1t}, \dots, h_{kt})' \qquad (10)$$

where $h_{jt} = \log \sigma_{jt}^2, j = 1, \dots, k, t = s+1, \dots, n$.

Similar to this, it is believed that the parameters in the VAR model follow a stochastic wandering process:

$$\begin{cases} \beta_{t+1} = \beta_t + u_{\beta t} \\ a_{t+1} = a_t + u_{at} \\ h_{t+1} = h_t + u_{ht} \end{cases} \qquad (11)$$

$$\begin{pmatrix} \varepsilon_t \\ u_{\beta t} \\ u_{at} \\ u_{ht} \end{pmatrix} \sim N\left(0, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \Sigma_\beta & 0 & 0 \\ 0 & 0 & \Sigma_a & 0 \\ 0 & 0 & 0 & \Sigma_h \end{pmatrix}\right) \qquad (12)$$

Among them:

$$\begin{cases} t = s+1, \dots, n \\ \beta_{s+1} \sim N(\mu_{\beta_0}, \Sigma_{\beta_0}) \\ a_{s+1} \sim N(\mu_{a_0}, \Sigma_{a_0}) \\ h_{s+1} \sim N(\mu_{h_0}, \Sigma_{h_0}) \end{cases} \qquad (13)$$

and assumes that parameter β_t, a_t, h_t is irrelevant.

Bayesian Inference

Since Bayesian estimation can effectively deal with high-dimensional parameters and model nonlinearities, this paper uses Gibbs sampling in the Markov Monte Carlo simulation algorithm MCMC for sample sampling in a Bayesian framework, after which the parameters of the model are estimated. First, assume that the prior distribution of parameter β, a, h in the trivariate TVP-VAR model constructed in this paper is normal with mean 0 and covariance matrix 0. Assume as well that the gamma distribution shown below governs the i nd diagonal element of the covariance matrix:

$$(\Sigma_\beta)_i^{-2} = (\Sigma_a)_i^{-2} = (\Sigma_h)_i^{-2} \sim Gamma(4.0.02) \qquad (14)$$

Under the assumption that the parameters have a particular prior distribution, the MCMC algorithm selects samples from the high-dimensional posterior distribution of the parameters, which includes the latent variables that are not observed, and uses the time-varying parameters in the model as latent variables to create a full space of time-varying parameters. Constructing the conditional distribution of time-varying parameters and then jointly sampling the time-varying parameters is an efficient method for sampling from the high-dimensional posterior distribution of parameters.

Corporate investment efficiency model based on TVP-VAR

Model design

This part builds a model based on TVP-VAR to examine the influence of monetary policy on the effectiveness of corporate investment and the mediating role of financing restrictions in this impact route. This model is based on the preceding examination of monetary policy theory. Each model has the following details:

(1) Model of monetary policy and investment efficiency

$$\begin{aligned} Inveff_{i,t} &= \beta_0 + \beta_1 M2_{i,t-1} + \beta_2 Lev_{i,t-1} + \beta_3 cash_{i,t-1} + \beta_4 currt_{i,t-1} \\ &+ \beta_5 Size_{i,t-1} + \beta_6 return_{i,t-1} + \beta_7 eqc_{i,t-1} + \beta_8 growth_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{15}$$

(2) Model of financing constraints and investment efficiency

$$\begin{aligned} Inveff_{i,t} &= \beta_0 + \beta_1 SA_{i,t-1} + \beta_2 Lev_{i,t-1} + \beta_3 cash_{i,t-1} + \beta_4 currt_{i,t-1} \\ &+ \beta_5 Size_{i,t-1} + \beta_6 return_{i,t-1} + \beta_7 eqc_{i,t-1} + \beta_8 growth_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{16}$$

(3) Model of monetary policy and financing constraints

$$\begin{aligned} SA_{i,t-1} &= \beta_0 + \beta_1 M2_{i,t-1} + \beta_2 Lev_{i,t-1} + \beta_3 cash_{i,t-1} + \beta_4 currt_{i,t-1} \\ &+ \beta_5 Size_{i,t-1} + \beta_6 return_{i,t-1} + \beta_7 eqc_{i,t-1} + \beta_8 growth_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{17}$$

(4) A model to test the mediating effect of financing constraints

$$\begin{aligned} Inveff_{i,t} &= \beta_0 + \beta_1 SA_{i,t-1} + \beta_2 M2_{i,t-1} + \beta_3 Lev_{i,t-1} + \beta_4 cash_{i,t-1} + \beta_5 currt_{i,t-1} \\ &+ \beta_6 Size_{i,t-1} + \beta_7 return_{i,t-1} + \beta_8 eqc_{i,t-1} + \beta_9 growth_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{18}$$

Equation (15), (17), and (18) can be used together to test the mediating effect of financing constraints. Among them, equation (15), (17), and (18) can test the effect of monetary policy on financing constraints, investment efficiency, and the overall effect of monetary policy on firms' investment efficiency.

Variable Description

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(1) Investment efficiency. The Richardson residual model is used in this chapter to calculate investment efficiency. The enterprise's level of inefficient investment and investment efficiency are inversely correlated with the absolute value of the residual, which increases with its size.

(2) Monetary policy. The change in interest rates can more accurately represent the change in monetary policy when it comes to measuring indicators. As M2 is now a more significant intermediate aim of China's monetary policy than interest rates due to the country's low level of interest rate marketization, this article chooses M2 growth rate as a stand-in indicator of monetary policy.

(3) Financing constraint. For the measure of financing constraint, this paper uses the measured SA index to represent.

(4) Control variables. Based on the analysis of the factors influencing the investment efficiency of enterprises in the previous paper, equity concentration eqc, debt level Lev, cash flow level cf, growth growth, years on the market Age, enterprise size Size and stock return return return are selected. Regarding the cash flow level, this paper uses net cash flow from operating activities to represent it and normalizes it with total assets. According on data from the RESET database, this article also distinguishes between state-owned and non-state-owned firms for businesses whose actual controllers are private enterprises and natural individuals. Table 1 displays the relevant variable descriptions.

Table 1. Illustration table of variables of the investment efficiency model

Variable	Variable name	Variable Description
$Inveff_{i,t}$	Investment efficiency	Residual absolute value measure
$M2_{i,t-1}$	Broad money supply growth rate	M2 growth rate at the end of t-1
$SA_{i,t-1}$	Financing constraints	$SA = -0.737Size + 0.043Size^2 - 0.04Age$
$Lev_{i,t-1}$	Debt level	By year's end, total liabilities/total assets are equal.
$cf_{i,t-1}$	Cash flow level	At the end of year t-1, the ratio of net cash flow from operating operations to total assets
$Age_{i,t-1}$	Number of years on the market	The distinction between the firm's t-1 and IPO years
$Size_{i,t-1}$	Enterprise size	is the natural logarithm of the company's whole asset base as of year t-1.
$return_{i,t-1}$	Stock Yield	Return on individual shares in year t-1 after taking dividend reinvestment into account.
$eqc_{i,t-1}$	Equity Concentration	At the end of year t-1, the initial shareholder's ownership percentage was
$growth_{i,t-1}$	Growth	The operational income growth rate in year t-1
IND	Industry	The sector to which the company belongs, according to the Securities and Futures Commission's classification of the sector.

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Empirical analysis

This chapter will undertake a quantitative data analysis for monetary policy, enterprise investment efficiency, and financing restrictions to examine the efficacy of the enterprise investment efficiency model built based on PVT-VAR. By using examples to demonstrate how changes in monetary policy affect business investment effectiveness and estimating the associated risks, data is provided to help efforts to encourage business investment effectiveness.

Sample selection and data pre-processing

The sample in this chapter is selected from the annual financial data of the SMB enterprises from 2010 to 2020, and the data of the enterprises are obtained from the RESET database. The People's Bank of China website is where macro data can be found. The number of listed firms on the SME board has increased to more than 900 since the advent of the capital market, with exceptional scale advantages, and has progressively expanded to play a significant role in the national economy. Yet, the growth of SMEs faces significant financial challenges as a result of China's capital market's uneven development. To support the growth of SMEs and increase the effectiveness of corporate investment, it is crucial to research the financing challenges faced by SMEs during the investment process.

This paper treats the sample of SMEs listed companies as follows:

(1) Financial and insurance companies with special financial data performance are excluded.

(2) The data of enterprises that have been PT, ST or long-term suspended are also not comparable with those of normal business enterprises and are excluded.

(3) Some enterprises with missing data are also excluded.

To reduce the impact of outliers, winsorization was applied to all continuous variables at the 0.02 level.

Empirical analysis of the investment efficiency model

Impact of variables in the investment efficiency model

Using the prior description of the investment efficiency model's variables, Figure 4 illustrates the outcomes of this section's quantitative examination of the data using the investment efficiency model.

The investment efficiency model's effect findings indicate that the mean value of inefficient investments by SMEs is 0.0501, the mean value is 0.3065, the very tiny value is close to 0.0103, and the standard deviation is 0.0392. The very tiny value has a negative growth rate of -0.3572, the big value reaches 1.3217, and the standard deviation of the growth rate of business income of SMEs is 0.2911. This suggests that the rates of expansion of SMEs vary. With a mean value of 0.3562, a maximum value of 0.8283, and a lowest value of 0.0467, the gearing ratio for SMEs has a low

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standard deviation of 0.1828. This shows that SMEs make inefficient investments since they concentrate on their own gearing during the investment process.

The current ratio's standard deviation is 0.03, with extreme values of 0.21 and 0.01, indicating that there are differences in the short-term solvency of SMEs and the asset sizes of various businesses. The standard deviation of individual stock returns of SMEs is large, some have high individual stock returns of 2.5401, but some have low individual stock returns, some even have negative values of -0.6394. While the standard deviation of the financing constraint index is 0.1164, with a high value of 3.2569 and a very low value of 2.5875, the yearly year-over-year growth rate of M2 has a tiny standard deviation and the shift is not very evident.

In conclusion, it can be seen that the variables chosen for this study all have an effect on the investment efficiency of businesses, and that when loose monetary policy is implemented, SMEs are confused about which investments to make because of their own assets and cash flow, and the investment efficiency of businesses remains low.

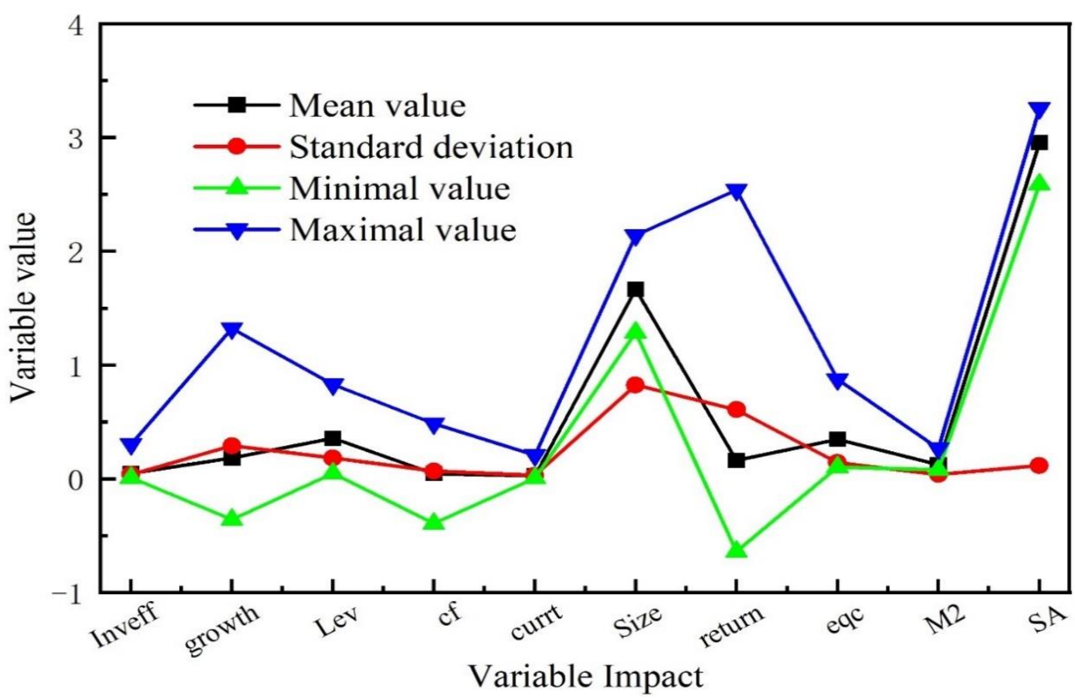

Figure 4. Analysis of the impact of variables

Multicollinearity test of the investment efficiency model

The model variables were evaluated for multiple cointegration to confirm that the selection of the model variables for investment efficiency in this paper was fair, and the test results are displayed in Table 2.

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Table 2. Results of multi-collinearity test of variables

Variables	VIF	1/VIF
$growth_{t-1}$	1.05	0.98
Lev_{t-1}	1.66	0.61
cf_{t-1}	1.06	0.94
$currt_{t-1}$	1.32	0.72
$Size_{t-1}$	1.32	0.72
$return_{t-1}$	1.32	0.72
eqc_{t-1}	1.09	0.94
$M2_{t-1}$	1.33	0.75
SA_{t-1}	1.31	0.76
Mean VIF	1.27	

The variance inflation factor VIF values of the investment efficiency model's nine primary variables are all between 1 and 2, according to the findings of the multicollinearity test of the variables, and the average VIF value is 1.27. This demonstrates that the variables in the investment efficiency model developed in this study do not exhibit multicollinearity, making it feasible to assess and defend the investment efficiency of firms using a variety of factors.

Analysis of regression results of the investment efficiency model

Monetary Policy and Investment Efficiency

This article performed a regression analysis on the model of firm investment efficiency in order to examine the impact of monetary policy on the level of inefficient investment of enterprises. The findings of the regression analysis are displayed in Figure 5.

The full-sample results of the monetary policy and investment efficiency regression study show an investment efficiency and monetary policy fixed-effect regression called Inveff is performed on the entire sample. Moreover, the findings demonstrate a positive correlation between loose monetary policy and the amount of inefficient investment made by businesses, suggesting that loose monetary policy lowers the investment efficiency of businesses.

The impact of monetary policy on the level of inefficient investment by businesses produces diverse effects according to the varying form of property rights. The monetary policy and amount of inefficient investment have a 0.1904 correlation coefficient in the sample of state-owned businesses, which is significant at the 1% level. The sample of non-SOEs has a -0.1128 at the 1% level correlation coefficient between monetary policy and the amount of inefficient investment by businesses. It shows that the loose monetary policy increases the amount of wasteful investment

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by SOEs while decreasing the amount of inefficient investment by non-SOEs. This suggests that flexible monetary policy boosts the investment efficiency of privately held companies while decreasing the investment efficiency of state-owned companies.

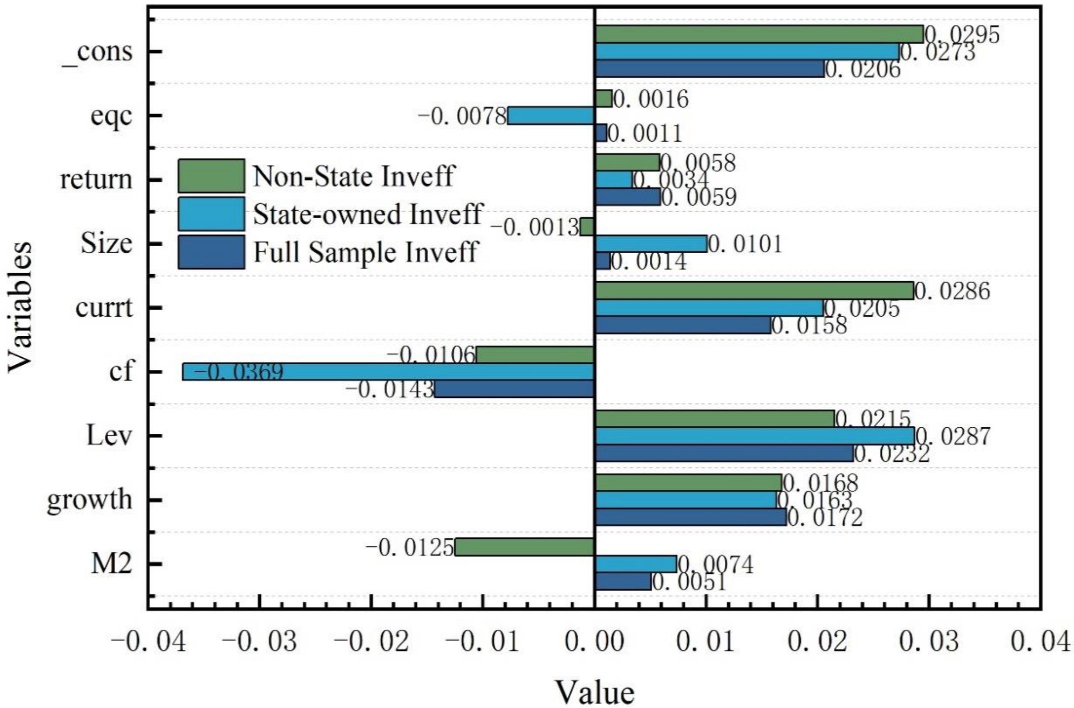

Figure 5. Monetary Policy and Investment Efficiency

Financing constraints and investment efficiency

To investigate the impact of financing restrictions on the level of inefficient enterprise investment, the model of funding limitations and investment efficiency was subjected to a regression analysis in this work, and the findings are shown in 6.

Based on the regression analysis of investment effectiveness and financial limitations, the whole sample Inveff is a fixed-effect regression of investment efficiency and finance restrictions on the entire sample, and the findings demonstrate a substantial positive relationship between financing limitations and the amount of inefficient investment made by businesses at the 1% level, demonstrating that a shortage of cash affects the investment efficiency of businesses.

Comparing the performance of SOEs and non-SOEs, the correlation coefficient between funding restrictions and the amount of wasteful investment in the sample of non-SOEs is 0.1125, which is significant at the 1% level. The SOE sample's correlation coefficient between monetary policy and the amount of inefficient investment is 0.0291 at the 1% level, demonstrating that non-SOEs are more negatively impacted by the financing restriction than SOEs. This also indicates that when the

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lower the liquidity rate leads to less efficient investment by firms, the greater the financing constraint, the less efficient investment by firms will become.

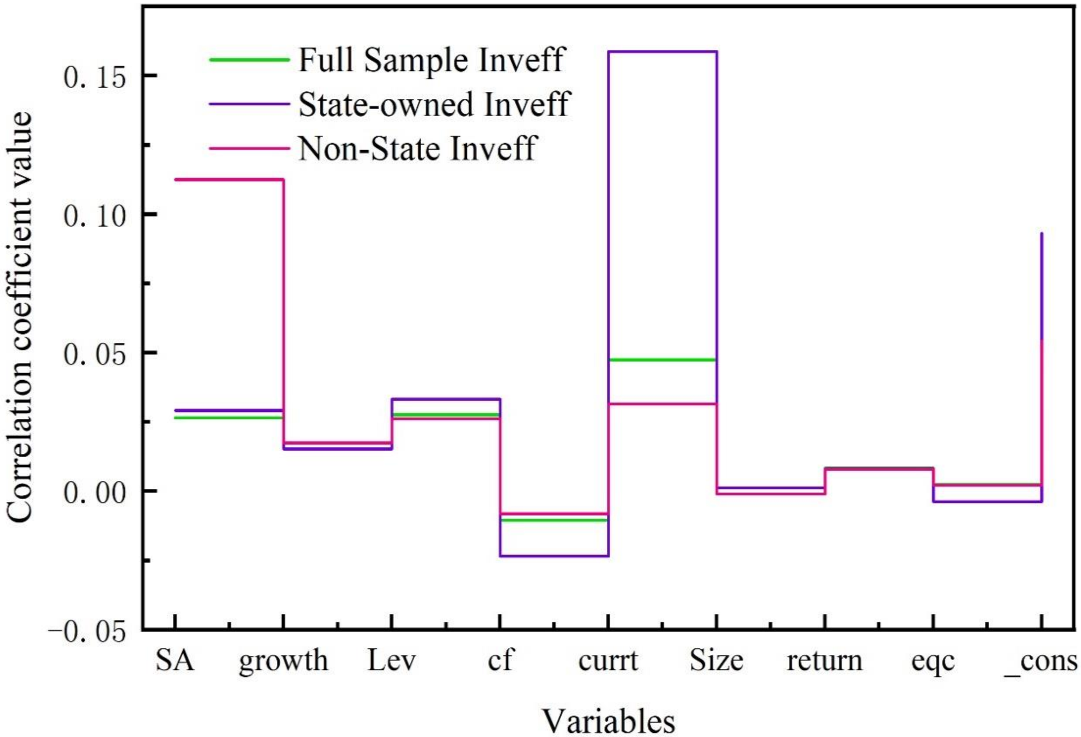

Figure 6. Financing constraints and investment efficiency

Conclusion

Considering accommodating monetary policies, this study examines the effectiveness of business investment. In this study, a TVP-VAR model based on a vector autoregressive model is proposed. Its optimization uses Bayesian time-varying parameters. The investment efficiency model is created using the TVP-VAR model, and the model's regression analysis is carried out. The analysis's findings are summarized in the following paragraphs:

(1) The correlation coefficients between monetary policy and the amount of inefficient investment are 0.1904 and -0.1128 in the samples of state-owned and non-state-owned businesses, respectively. These correlations are significant at the 1% level.

(2) The correlation coefficients between financing limitations and the level of inefficient investment are, respectively, 0.1125 and 0.0291 in the sample of non-SOEs and SOEs, and they are both significant at the 1% level.

In order to strengthen support for SMEs in accordance with market-based and legalistic principles,

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the government should use a variety of inclusive and accommodating monetary policy measures, including standing lending facilities, open market operations, and medium-term loan facilities.

References

Abbate, A., & Thaler, D. (2019). Monetary Policy and the Asset Risk-Taking Channel. *Journal of Money, Credit and Banking, 51*(8), 2115-2144.

Acharya, V. V., & Plantin, G. (2019). *Monetary easing, leveraged payouts and lack of investment*. Retrieved from

Bank, S. A. R. (2020). Financial market development, monetary policy and financial stability in emerging market economies. *BIS Papers chapters, 113*, 293-305.

C, H. (2018). Monetary Policy, Manager's Risk Preference Heterogeneity and Business Investment Efficiency. *Communication of Finance and Accounting*.

Dong, F., Miao, J., & Wang, P. (2020). Asset bubbles and monetary policy. *Review of Economic Dynamics, 37*, S68-S98.

Ezeibekwe, O. F. (2020). monetary policy and domestic investment in Nigeria: the role of the inflation rate. *Economics and Business, 34*(1), 139-155.

Fiedler, S., Gern, K.-J., Jannsen, N., & Wolters, M. (2019). Growth prospects, the natural interest rate, and monetary policy. *Economics, 13*(1).

He, L., Wu, M., Zhong, Z., Xia, Y., Yu, J., & Jiang, Y. (2019). Can monetary policy affect renewable energy enterprises investment efficiency? A case study of 92 listed enterprises in China. *Journal of Renewable and Sustainable Energy, 11*(1), 015903.

Li Shunbin, T. J. (2019). Adequate level of monetary policy, financing constraint and corporate financial asset allocation: A reexamination of the "reservoir" and "substitution" motives. *Research in Financial Economics, 34*(02), 3-13.

Lin D, C. X., Gong L. (2019). Monetary Policy, Consumption, and Investment Goods Inflation : A Financial Accelerator Perspective. *Journal of Financial Research*.

Liu, S., & Xiao, C. (2021). Application and Comparative Study of Optimization Algorithms in Financial Investment Portfolio Problems. *Mobile Information Systems, 2021*, 1-10.

Mattos, O. B., Da Roz, F., Ultremare, F. O., & Mello, G. S. (2019). Unconventional monetary policy and negative interest rates: a Post-Keynesian perspective on the liquidity trap and euthanasia of the rentier. *Review of Keynesian Economics, 7*(2), 185-200.

Ouerk, S., Boucher, C., & Lubochinsky, C. (2020). Unconventional monetary policy in the Euro Area: Shadow rate and light effets. *Journal of Macroeconomics, 65*, 103219.

Revelo, J. D. G., & Levieuge, G. (2022). When could macroprudential and monetary policies be in conflict? *Journal of Banking & Finance, 139*, 106484.

Vlasov, S., & Sinyakov, A. (2020). Public investment efficiency and monetary policy consequences: The case of investment ratio enhancing policy in Russia. *Voprosy Ekonomiki*(9), 22-39.

Yang, Z., Lu, Y., & Tan, W. (2021). Monetary policy tightening, accounting information comparability, and underinvestment: Evidence from China. *Economic Analysis and Policy, 70*, 123-147.

Zhao, J., Chen, X., & Hao, Y. (2018). Monetary policy, government control and capital investment: Evidence from China. *China journal of accounting research, 11*(3), 233-254.