Articles

An Empirical Study of the Effect of Money Supply on Fixed Asset Investment in Enterprises [1)]

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Abstract

With more and more investors injecting funds into the capital market, the world capital market has made tremendous development and progress, and the asset price transmission channels of monetary policy have, therefore, received more attention from countries worldwide. The stock market plays a crucial role in the Chinese capital market and has become an indispensable investment and financing channel. At the same time, the impact of stocks on the real economy is increasing daily. When a country's monetary authority uses various monetary policy tools to regulate economic operations, whether intentional or unintentional, it will impact stock prices. Changes in stock prices will cause corresponding changes in consumption and investment, thereby affecting the real economy. Therefore, to enable monetary policy changes to affect the real economy through the stock market effectively, it is imperative to deeply explore the transmission mechanism of China's monetary policy in the stock market.

This article selects ten years of monthly data in China, constructs a vector autoregression (VAR) model, and conducts empirical research using econometric methods. We conclude that the money supply positively impacts the stock price index, but when the index rises, it cannot have a stable and positive impact on fixed asset investment. From the conclusion, the stock transmission mechanism of China's monetary policy lacks effectiveness.

In the conclusion part of the empirical analysis, combined with China's current economic development, stock market operation, and fixed asset investment, the reasons for the blocked transmission mechanism are analyzed. These reasons mainly include the imperfect development of China's stock market, a lack of connection between the stock market and the money market, and the fact that the Tobin Q effect cannot function perfectly. Based on the

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results of relevant empirical analysis, policy recommendations such as strengthening the connection between the money market and the stock market, and improving corporate management are proposed in this article.

Keywords: monetary policy; stock index; fixed assets investment; VAR

1 Introduction

According to Huang Y., Luk, P. (Huang & Luk, 2020), a rise in uncertainty depresses real economic activities such as output. Liu et al. (Liu, et al., 2019) also found in their research that economic uncertainty has a significant inhibitory effect on fixed asset investment, especially in companies with low asset reversibility. To ensure smooth passage through periods of economic uncertainty like the recent COVID-19 epidemic, enterprises often control output and reduce losses by reducing fixed asset investment. However, it can be inferred from the supply curve that commodity prices will rise when supply decreases. A rise in prices can cause further panic during a disaster. If it is possible to increase the amount of investment in production fixed assets during a supply crunch, it might be possible to increase the production quantity appropriately, and the panic caused by the price increases can be relieved.

Although the money supply directly affects corporate investment, it also affects stock prices in the financial market, and stock prices also affect corporate investment. Many scholars around the world have researched the correlation between money supply, stock prices, and fixed asset investment, but perhaps because of the differences in data selection, market selection, statistical methods, and variable selection, they have reached different conclusions.

This article conducts empirical analysis using monthly historical data from January 2007 to December 2016. This paper employs the Johansen cointegration test, the Granger causality test, impulse response function analysis, and comparative decomposition using a vector autoregression model (VAR) and discusses the correlation between the generalized money supply, fixed asset investment, and stock price index. The conclusion section starts from the results of the empirical analysis and suggests how to improve the role of monetary policy in the Chinese real estate market in crisis situations, providing a reference for macroeconomic regulation.

2 Literature Review

2.1 Money supply and the stock market

Yan Dong (Yan, 2016) conducted an empirical analysis through the econometric methods of the time series stationarity test, cointegration test, and Granger causality test and concluded that there is a long-term equilibrium relationship between the narrow money supply M1 and the stock price index; that the stock price index is the Granger cause of the narrow money supply M1, while the narrow money supply M1 is not the Granger cause of the stock price index; and that there is no long-term equilibrium or Granger causality relationship between M2 and the stock price index.

Lu Xiner and Fan Xiaojing (Lu & Fan, 2018) divided the stock price into basic price and foam price and selected M2 as the intermediate monetary policy variable to study the impact of tight monetary policy on China's stock market. To deal with the cointegration relationship of the non-stationary time series, they set up a vector error (VEC) model in the paper and, through a cointegration test, impulse analysis, and other measurement methods, concluded that an increase in broad money supply M2 will reduce the basic price of stocks and push up the foam price of stocks.

Yan Jiarui (Yan, 2021) used monthly statistical data from the consumer price index (CPI), producer price index (PPI), broad money supply, and Shanghai Composite Index from January 1997 to November 2020 as samples to establish a VEC model. The impact of money supply and inflation on stock prices was measured using methods such as impulse response functions and variance decomposition. Three conclusions were drawn: (1) An increase in money supply and inflation does not have a significant positive effect on stock prices, but rather a weak negative effect; (2) The inflation effect represented by CPI and PPI is positively correlated with stock prices; (3) The fluctuation of stock prices is mainly caused by self-shocks. Finally, policy recommendations were put forward to address the issue of the insufficient effectiveness of the monetary policy transmission mechanism, as reflected in the conclusion.

2.2 Money supply and fixed asset investment

Hua Yufei (Hua, et al., 2021), through theoretical analysis of stock prices with a Tobin Q model and an empirical test using a TVP-SV-VAR model, found that monetary policy not

only has a direct impact on the fixed asset investment price index but also indirectly affects the fixed asset investment price index through stock market prices. In this paper, by applying monetary policy shocks at three different time points, it is demonstrated that the impact of monetary policy has random fluctuations and that the impact of monetary policy on stock market prices gradually transfers to the impact on fixed asset prices over time.

2.3 Differences between this paper and the literature

The difference between this research and the work covered in the literature review is that the current literature review is mostly based on the impact of monetary policy on fixed asset investment through the stock market and the direct impact of monetary policy on fixed asset investment. In this paper, I focus on comparing the response time of the two mechanisms to monetary policy. Through impulse response analysis, I find that if we want to maximize the effect of monetary policy in the short term, the mechanism that directly affects the amount of fixed asset investment should be used for economic adjustment.

3 Selection of Variables and Introduction of Models

3.1 Selection of variables

Compared to M_0 and M_1, M_2 can more comprehensively display the dynamic changes in the quantity of money supply and can more accurately explain and be used to analyze the effects of stock price changes. Therefore, in this paper, M_2 is selected as the indicator to measure the money supply.

The Shanghai stock market was established earlier, has a larger scale, is more important and representative than other Chinese exchanges, and has the highest closing index, characterized by relatively stable but incomplete data. Therefore, this article chooses the highest closing index of Shanghai Securities as the stock market variable.

3.2 Source and processing of data

This article analyzes monthly data for the chosen variables from January 2007 to December 2016. The data is sourced from the website of the National Bureau of Statistics of China. The econometric analysis software used for processing economic data in the article is Eviews10.

3.3 Introduction of models

In this paper, a vector autoregressive（VAR）model is used to study the transmission process of monetary policy. The VAR model assumes that each variable is endogenous and regresses all lagged variables with all current variables. The use of modified models can analyze the dynamic relationships between multiple endogenous variables without prior limitations. Due to its simple and easy-to-understand nature, it has been widely applied.

The general VAR model can be represented as:

$$Y_t = \sum_{i=1}^{n} A_i \times Y_{t-i} + \varepsilon_t$$

where Y_t is a column vector composed of all the observations of period t together; A_i is a matrix composed of the parameters to be estimated; and ε_t is a matrix of random error terms.

4 Empirical analysis of the VAR model

In this section, the collected data is first preprocessed. Secondly, unit root tests are performed on the processed data, and if the sequence is non-stationary, differencing is performed. Then, a Johansen cointegration test is conducted to examine whether stable equilibrium relationships can be observed between these variables in the long term. If a cointegration relationship is observed between these variables during the test, then a Granger causality test is performed. Finally, a VAR model is established, and the relationship between variables based on the impulse response graph is examined.

4.1 ADF unit root test

In this study, several key variables are defined as follows:

- LNM2: the natural logarithm of M2.
- LNHighidx: the natural logarithm of the highest closing index.
- LNFX: the natural logarithm of the fixed asset price.

In time series analysis, if the series is not stationary, it is easy to cause spurious regression. Therefore, it is necessary to first test whether LNM2, LNHighidx, and LNFX are stationary. Using an augmented Dickey–Fuller（ADF）unit root test method, the level

and first-order difference values of LNM2, LNHighidx, and LNFX are tested. The test results are shown in Table 4.1.

Table 4.1 ADF test results

Series	Inspection type	ADF statistics	Critical value 1%	Critical value 5%	Critical value 10%	Prob.	The results
lnM_2	(0,0,0)	-3.659284	-3.49021	-2.88767	-2.58078	0.006	stable
lnHighdx	(c,t,0)	-2.122154	-3.48655	-2.88607	-2.57993	0.2365	not stable
DlnHighdx	(c,t,0)	-5.208582	-4.03767	-3.44835	-3.14933	0	stable
lnFx	(c,0,1)	-5.208582	-4.03767	-3.44835	-3.14933	0.0002	stable

Source: Eviews10.0

Note: c in the inspection type indicates the presence of a constant term, t indicates the presence of a time trend term, 1 indicates the lag order, and D indicates the first-order difference of the variable.

Table 4.1 shows that LNM2, LNHighidx, and LNFX are first-order integrated, so we can perform a Johansen cointegration test on these three series.

4.2 Johansen cointegration test

Since the three sets of variables, LNM2, LNHighidx, and LNFX are all first-order integrated, the Johansen cointegration test can be conducted to examine whether stable equilibrium relationships can be reflected between these variables in the long run. The results are shown in Table 4.2.

Table 4.2 Cointegration test results

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.244396	50.32758	29.79707	0.0001
At most 1 *	0.084528	18.10023	15.49471	0.0198
At most 2 *	0.066746	7.943917	3.841466	0.0048

Source: Eviews10.0

The results in Table 4.2 indicate that there is a stable linear combination among LNM2, LNHighidx, and LNFX, which suggests that there is a stable equilibrium relationship among these three variables in the long run.

4.3 Granger causality test

LNM2, LNHighidx, and LNFX exhibit equilibrium relationships in the long run. Next, a Granger causality test is conducted to test whether there is a statistically causal

relationship between them. The results are shown in Table 4.3.

Table 4.3 Granger Causality Test

Dependent variable: X1LNM_2			
Excluded	Chi-sq	df	Prob.
X2LNHIGHIDX	6.040070	2	0.0488
YLNFX	0.928466	2	0.6286
All	6.937252	4	0.1392
Dependent variable: X2LNHIGHIDX			
Excluded	Chi-sq	df	Prob.
X1LNM_2	0.893291	2	0.6398
YLNFX	4.948623	2	0.0842
All	7.256675	4	0.1229
Dependent variable: YLNFX			
Excluded	Chi-sq	df	Prob.
X1LNM_2	32.96314	2	0.0000
X2LNHIGHIDX	7.478564	2	0.0238
All	40.85976	4	0.0000

Source: Eviews10.0

The results in Table 4.3 indicate that LNM2 and LNHIGHIDX are Granger causes of LNFX. In addition, LNM2 is a Granger cause of LNHIGHIDX.

4.4 Determining the optimal lag order of the model.

Because the variables LNM2, LNHIGHIDX, and LNFX exhibit a stable equilibrium relationship over the long term, a VAR model will be established to examine their dynamic relationship. First, the lag order is selected. The test results are shown in Table 4.4.

Table 4.4 Selection Criteria for Lag Order

Lag	LogL	LR	FPE	AIC	SC	HQ
1	419.6359	NA	1.31e-07	-7.332784	-7.114334*	-7.244152
2	433.7419	26.70066	1.20e-07	-7.423963	-6.987062	-7.246698*
3	439.7941	11.13174	1.26e-07	-7.371324	-6.715972	-7.105427
4	448.6803	15.86807	1.27e-07	-7.369290	-6.495487	-7.014761
5	455.9453	12.58410	1.31e-07	-7.338309	-6.246055	-6.895147
6	471.4153	25.96751*	1.17e-07*	-7.453845*	-6.143140	-6.922050
7	475.2309	6.200293	1.29e-07	-7.361266	-5.832110	-6.740839
8	479.5727	6.822862	1.41e-07	-7.278084	-5.530478	-6.569025

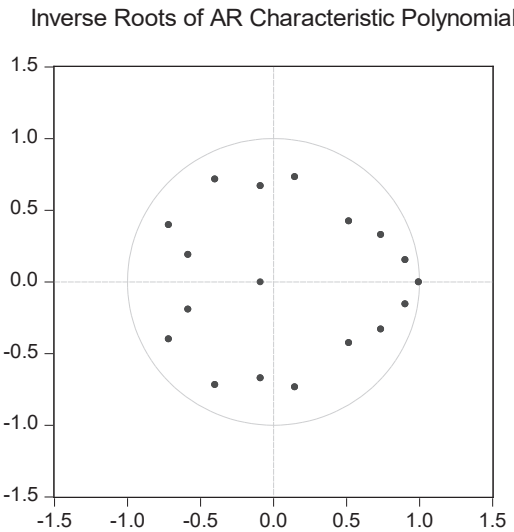
Source: Eviews10.0

Note: * indicates the selection of the optimal lag order under the standard
As shown in Table 4.4, the optimal lag order is 6.

4.5 Unit root test

Using the three variables LNM2, LNHighidx, and LNFX, we construct a vector autoregressive model with a lag order of 1, denoted as VAR1. In order to determine the stability of this model, we perform a unit root test on VAR1, and the results are shown in Figure 4.1. Since the reciprocal of the modulus of all unit roots is less than 1, VAR1 is stable.

Figure 4.1 Unit root test results

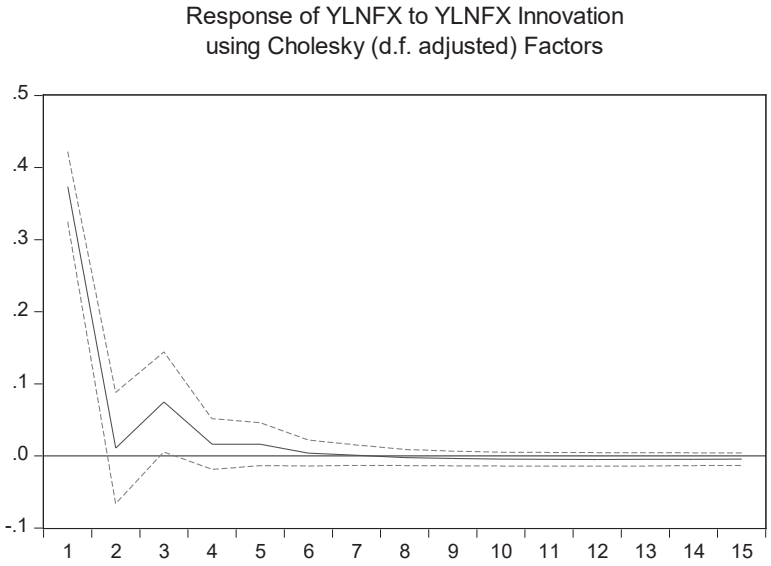


Source: Eviews10.0

4.6 Impulse response analysis

Under the stable condition of the established VAR model, we can analyze the response of LNFX to the shocks of LNM2, LNHIGHIDX, and LNFX through the impulse response diagram. It can be seen from the figure 4.2 below that the impact of LNM2 representing the money supply, LNHIGHIDX representing the stock price, and LNFX representing the fixed asset investment on the fixed asset investment amount LNFX shows the characteristics of changing with the increase of the lag number.

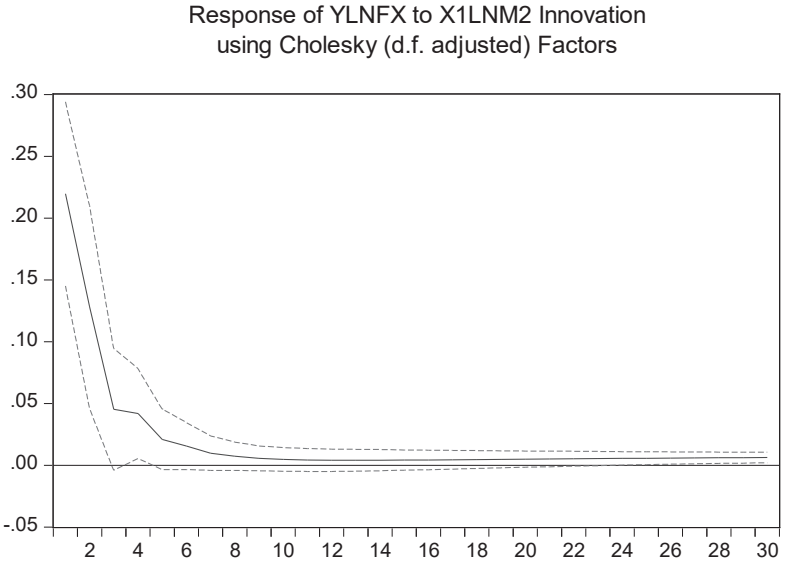
Figure 4.2 LNFX's impulse response to LNFX



Source: Eviews10.0

As seen from Figure 4.2, when faced with a standard unit positive shock, LNFX will immediately respond positively, with slight fluctuations between periods 2 and 4. However, as the number of periods increases, the fluctuations gradually smooth out, and after period 15, they gradually approach zero.

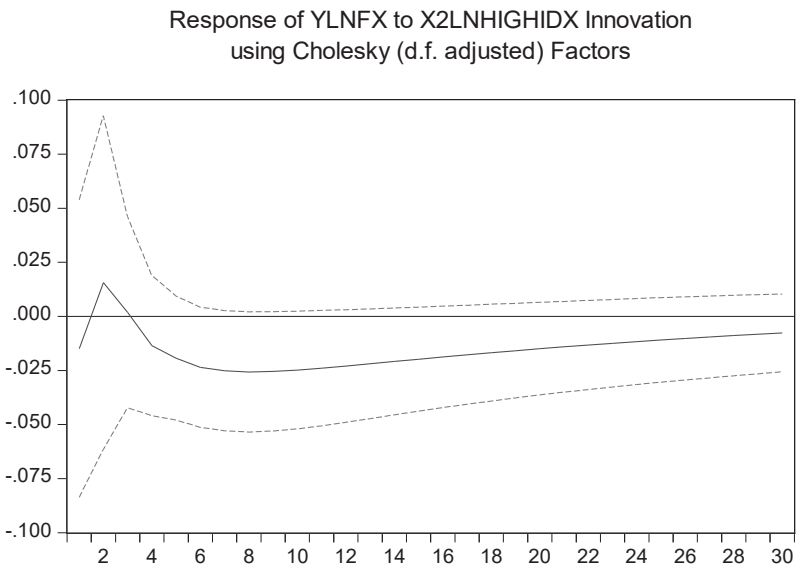
Figure 4.3 LNFX's impulse response to LNM2



Source: Eviews10.0

Zhang Hao（Zhang & Ren, 2021）concluded in his research that monetary policy has a short-term impact on corporate investment behavior. Through Figure 4.3, this article draws a similar conclusion: LNFX will produce a positive effect when facing the positive impact of a standard unit of money supply LNM2, which indicates that the increase of money supply may cause the increase of fixed asset investment to some extent, but the effect gradually flattens with the increase of the number of periods and tends to zero after 30 periods.

Figure 4.4 LNFX's impulse response to LNHIGHIDX



Source: Eviews10.0

As can be seen from Figure 4.4, when facing a standard unit positive shock from the stock price index LNHIGHIDX, LNFX gradually rises from initial negative effects to positive effects, reaching a peak in the third period. After the third period, the effects are all negative. Overall, LNFX's response to the shock from LNHIGHIDX is negative, indicating that when the stock price index rises, corporate investment in fixed assets will decrease. However, the effects gradually disappear after 30 periods.

From the impulse response chart, both the money supply and the stock price index can affect the amount of fixed asset investment. Compared with the weak negative impact of the stock price index, the positive impact of the money supply is stronger.

4.7 Variance decomposition

Variance decomposition refers to decomposing the changes in endogenous variables into component shocks to the VAR model. The purpose is to study the impact of three variables on C in future changes, in addition to the impact of their own shocks. It is used to analyze the contribution of standard deviation to its impact. Table 4.5 shows the prediction results for the first 20 periods.

Table 4.5 Variance decomposition results

Period	S.E.	X1LNM_2	X2LNHIGHIDX	YLNFX
1	0.010681	24.21144	0.000387	75.78817
2	0.014950	29.66382	0.156002	70.18018
3	0.019378	36.39040	0.189117	63.42049
4	0.024374	39.01178	0.515988	60.47223
5	0.028137	37.61190	4.105949	58.28215
6	0.030553	37.38625	4.537151	58.07660
7	0.033161	35.79391	7.173532	57.03256
8	0.035285	35.75738	9.075055	55.16756
9	0.037018	35.40263	10.86339	53.73398
10	0.038868	34.92972	11.95130	53.11898
11	0.040588	34.93994	11.93891	53.12115
12	0.042166	34.73173	12.34360	52.92468
13	0.043842	34.74140	12.34118	52.91742
14	0.045540	34.72679	12.33103	52.94219
15	0.047213	34.75125	12.33514	52.91361
16	0.048984	34.82013	12.36555	52.81432
17	0.050792	34.85421	12.37284	52.77295
18	0.052606	34.88172	12.41897	52.69931
19	0.054470	34.92283	12.42119	52.65598
20	0.056346	34.93434	12.44860	52.61707

Source: Eviews10.0

In Table 4.5, the last column shows the influence of LNFX on itself in each period of variance decomposition. The second and third columns show the influence of the remaining factors on LNFX in each period of variance decomposition. From the last column, the influence of LNFX on itself gradually weakens over time. From the third column, the influence of LNHIGHIDX on LNFX shows a gradual upward trend and reaches the maximum in the fifth period. From the second column, the influence of LNM2 on LNFX first increases and then decreases, reaching a peak in the fourth period.

4.8 Empirical conclusions

In this paper, I build a (VAR) model to empirically study the mechanism of monetary policy affecting fixed asset investment. First, through an ADF test, a Johansen cointegration test, and Granger causality analysis, this section draws a conclusion that the first-order difference sequence of the three variables is stable. Although money supply, stock price index, and fixed asset investment have a stable equilibrium relationship in the long term, there is only a one-way statistical causal relationship between the three. That is, money supply and stock price index are Granger causes for fixed asset investment, while fixed asset investment is not a Granger cause for money supply and stock price. Then, the optimal lag order is determined using statistical criteria, and the model is re-estimated with the optimal lag order. Finally, the unit root test of the model confirms that there is no spurious regression problem in the model. According to the impulse response chart, it can be seen that the amount of fixed asset investment has a positive effect on the impact of a standard unit from the money supply, but the impact of a standard unit from the stock index fluctuates from negative to positive in the period from zero to three, and from the fourth period, it is all negative, and the impact from the stock index is relatively small.

4.9 General conclusions

As mentioned above, in periods of economic uncertainty, companies usually reduce losses by controlling output, but this approach can bring supply shocks to the economy, namely price shocks. However, price shocks during periods of economic uncertainty can cause further panic. Therefore, it is urgent to issue effective macroeconomic policies to regulate the real economy. This paper focuses on the impact of monetary policy on fixed asset investment directly and on fixed asset investment indirectly through the stock market and explores these effects using a VAR model of monetary policy, stock market index, and fixed asset investment. The following conclusions are drawn: an increase in money supply has a continuous positive impact on the amount of fixed asset investment. Although the impact of the stock price index on fixed asset investment fluctuated slightly, it showed a negative trend in general. Therefore, in order to alleviate a supply shock by increasing the amount of fixed asset investment in a short period of time, fixed asset investment should not be adjusted indirectly through the stock market but rather should

be directly controlled as the object of monetary policy, so the role of monetary policy in regulating the real economy can be carried out in a stable manner.

4.9.1 Fact findings

Yan Dong (Yan, 2016) demonstrated through empirical analysis in his paper that there is no Granger causality between M2 and the stock price index. However, in this article, as shown in Table 4.3, the stock price index is the Granger cause of the broad money supply M2. Hua Yufei (Hua, et al., 2021) used the TVP-SV-VAR model in his paper to demonstrate that the impact of monetary policy on stock market prices gradually transitions over time to its impact on fixed asset prices. However, in this article, as shown in Figure 4.4, the impact of stock prices on fixed assets fluctuates slightly in the first three periods and gradually returns to zero after the thirtieth period, making it impossible for the expected utility of monetary policy to be transmitted to fixed assets through the stock market.

4.9.2 Future tasks

This paper empirically studies the transmission mechanism of the impact of monetary policy on fixed asset investment, but there are still some deficiencies. Future work could include two approaches. First, it could explore and compare the impact of monetary policy on fixed asset investment in different industries. Secondly, it could discuss the different mechanisms of monetary policy's impact on fixed asset investment through the stock market when Tobin's Q is greater than 1 and less than 1.

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