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The Impact of U.S. Interest Rate Adjustment on Chinese Corporate Leverage Ratio

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Abstract

Based on the smooth panel data of A-share listed companies during the period of 2013-2020, this paper takes the U.S. Federal Funds Rate as an indicator of U.S. interest rate adjustment to examine the impact of U.S. interest rate adjustment on the leverage ratio of Chinese micro-enterprises as well as the mechanism of the effect. The results show that when the U.S. implements a tight monetary policy, the rise in U.S. real interest rates has a significant positive effect on Chinese corporate leverage. As for the channels of action, the exchange rate, interest rate and asset price channels affect the leverage ratio of Chinese enterprises to different degrees and in different directions.

Keywords

U.S. Interest Rate Adjustment; Chinese Corporate Leverage; Panel Vector Autoregression.

1. Introduction

After the second half of 2016, with the steady improvement of the economy and the accumulation of risks, the focus of macroeconomic regulation and control shifted to risk prevention, and China's economy experienced a round of obvious deleveraging.In 2017, the CBRC, CIRC, SFC and other regulators frequently issued policies to de-channel and de-nesting, which pushed forward the slowing down of financial risks and at the same time drove the deleveraging of leverage of the non-financial sector, and the macro leverage ratio in 2017 growth slowed down significantly.In 2018-2019, although the intensity of deleveraging has weakened, the overall still focuses on stabilizing leverage and structural deleveraging, and the keynote of stabilizing leverage has not changed significantly, with a limited increase in the leverage ratio.In 2020, after the outbreak of the epidemic, China's economy experienced a downward spiral that had never been seen before, and in order to hedge against the negative impact of the Xinguan epidemic, a series of growth-stabilizing fiscal policies were pursued for a short period of time, but the leverage rate has risen sharply. Against this backdrop, as the economy gradually recovers, policies have increased their focus on risk prevention and leverage stabilization, focusing on the goal of "preventing economic and financial risks" put forward in the 14th Five-Year Plan, and continuing to emphasize the resolution of debt risks and the maintenance of a basically stable macro leverage ratio, with deleveraging by government departments as a key priority. It has also made deleveraging by government departments a top priority.

At present, China generally aims to maintain the basic stability of the macro leverage ratio, and how to optimize the adjustment of the leverage structure of the enterprise sector on the tone of stabilizing leverage has become an important issue in preventing and resolving financial risks. Scholars have already pointed out that corporate leverage is not only related to its own financial situation and corporate governance system, but also affected by domestic and foreign financial markets (Saretto & Tookes, 2013). Most of these studies have centered on cross-country spillovers from monetary policy, but little literature has examined the impact of leverage with foreign micro firms and the mechanisms at play.

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U.S. monetary policy can have shocks on domestic interest rates, exchange rates, and asset prices in emerging economies, which are macro-level shocks. And these factors will be transmitted down through the domestic channel is closely related to the cost of financing and liabilities of enterprises, in order to study the linkage between U.S. monetary policy and the liabilities and leverage of enterprises in emerging economies represented by China (Brauning & Ivashina, 2019). Firms' lending behavior is largely constrained by the level of their financing constraints, so the sensitivity of debt and loan adjustments of firms with different levels of financing constraints to macro-level shocks is different (Min Liang & Shen Yue, 2011). Therefore, in the face of macro shocks, changes in firms' leverage tend to be correlated with their level of financing constraints (Faulkender et al., 2012; Yu Wei et al., 2012).

Studying the Fed's monetary policy, a foreign-input macro shock factor, provides important insights into deleveraging at the micro enterprise level in China. Based on the panel data of listed A-share companies from 2013 to 2020, this paper uses the federal funds rate to represent the indicator of the U.S. interest rate adjustment, and the panel vector autoregressive model to obtain the test result that the leverage ratio of Chinese enterprises is significantly affected by the spillover effect of the U.S. interest rate adjustment, which usually has a positive impact effect on the leverage ratio of the enterprises in the short term, and it will be calmed down in the long term slowly.

This paper studies the theoretical analysis of whether the U.S. interest rate adjustment has a spillover effect on the leverage ratio of micro enterprises in China and the mechanism of the effect, which enriches the research on the impact of foreign macro-factor shocks on the leverage ratio of enterprises.

2. Literature Review

The literature related to the text study can be started from three aspects. First, the research on the causes of corporate leverage. It has been widely recognized that a country's domestic monetary policy is an important factor affecting corporate leverage. Most studies find that tight monetary policy reduces corporate leverage, while Liu and Zhang (2016) propose China's "leverage paradox," which is that a reduction in the money supply increases leverage because a reduction in the money supply brings about a sharper decline in investment and output. Existing research shows that the micro-level characteristics of enterprises are important factors affecting the leverage ratio of enterprises, including the return on capital, corporate profitability, credit demand and so on. In addition, the monetary policy of major developed economies is also an important factor affecting the leverage ratio of Chinese enterprises (Tan Xiaofen and Li Yuan, 2018). In particular, as the number one economy, U.S. monetary policy affects the global financing situation and liquidity conditions (Bluedorn & Bowdler, 2011), and abundant global liquidity indirectly affects the emerging economies and the economic and financial situation and the direction of macroeconomic policies through the interest rate, exchange rate, commodity trade, and international capital flows, which ultimately affects the financing environment of enterprises in emerging economies and the financing conditions (Jin Chunyu and Zhang Long, 2017).

Second, the study of cross-country micro spillover effects of interest rate adjustment in developed economies. Some scholars have studied the spillover effect of U.S. monetary policy on China's monetary policy from a macro perspective, and found that the dollar input affects China's base money injection, which affects the independence of China's monetary policy and the effectiveness of its implementation (Li Cheng and Zhao Ke Ke, 2012), and in-depth study of the micro spillover effect on China is also a must for scholars. Foreign scholars have examined mainly from the perspective of bank credit that U.S. monetary policy affects the bank credit cycle in emerging economies, and the spillover effect is stronger for firms in riskier economies

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(Brauning & Ivashina, 2019). Domestic scholars have discussed the micro spillover effects of U.S. interest rate adjustments on Chinese firms from the perspective of the impact of U.S. interest rate adjustments on financing costs, net returns, and risks of Chinese firms in the context of trade frictions (Ma Li et al., 2020).

Throughout the existing literature, few scholars have studied the micro spillover effects of U.S. interest rate adjustments on China, and fewer scholars have studied the impact of U.S. interest rate adjustments on the leverage ratio of Chinese enterprises. Therefore, this paper examines the impact of U.S. interest rate changes on Chinese corporate leverage.

3. Theoretical Analysis

The U.S. interest rate adjustment is mainly through the long-term impact of the two countries micro-individuals' behavioral decisions to indirectly affect the two countries' liquidity and capital flows, which in turn affects the leverage ratio of Chinese enterprises, specifically including the interest rate, the exchange rate and asset prices of three channels. First, the interest rate channel. On the one hand, a rise in foreign real interest rates, investors will reduce investment in their own countries, leading to the difficulty of financing domestic enterprises, so that the debt and leverage of domestic enterprises to fall. Transmission based on micro investors is often accompanied by strong psychological expectations (Bai Yue Ming et al., 2015), and the effect will be reflected at the beginning of the foreign monetary policy shock; on the other hand, a rise in the level of foreign real interest rates will increase the interest rate differential between the two countries, attracting a continuous inflow of domestic capital into foreign countries, affecting the stability of the domestic economy, prompting the government of the country to increase the level of interest rates in the country, leading to an increase in the cost of borrowing for domestic enterprises, the Corporate borrowing and leverage declined. It should be noted that there is a time lag in the impact of domestic interest rate policy, so the effect will be more fully reflected in the late stage of foreign monetary policy shocks. Second, the exchange rate channel. According to Obstfeld & Rogoff (1995), when the foreign real interest rate rises, it will lead to a rise in the domestic exchange rate, an increase in domestic exports, an increase in the demand for corporate sector borrowing and a rise in corporate leverage, but this rise will be limited by the amount of loanable funds in the country, and the effect will occur in the early stage and can not be maintained for a long time. Third, the asset price channel. Driven by a rise in foreign real interest rates, a passive rise in home country interest rates reduces home country corporate asset prices (Jiang, Fuwei et al., 2019), which will have a twofold effect. On the one hand, the decline in the asset price of domestic enterprises will lead to a decline in the value of the assets of domestic enterprises and an increase in the leverage ratio; on the other hand, the decline in the asset price of domestic enterprises reduces the funds obtained through mortgage loans, enterprises will look for alternative ways to obtain funds, enterprise liabilities will not immediately decline, but ultimately, the continuous decline in the price of the assets of domestic enterprises dominates the main sources of funds available to enterprises, so that the leverage of domestic enterprises Decrease. Therefore, the change in leverage of domestic firms under the asset price channel depends on the relative reductions in liabilities and total assets from period to period.

In summary, when a foreign country pursues a tight monetary policy, i.e., when the real interest rate rises, it will have an impact on the leverage ratio of domestic firms through the main channels of interest rates, exchange rates, and asset prices. Based on the above analysis, due to the different transmission paths and the different degree of impact can not be theoretically analyzed to determine whether the U.S. real interest rates rise when corporate leverage is rising or falling, so this paper puts forward the following hypothesis.

Hypothesis: the U.S. interest rate adjustment will affect the corporate leverage ratio.

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4. Empirical Analysis

4.1. Definition of Variables

4.1.1. Dependent Variable: Corporate Leverage Ratio (LEV)

Drawing on the practice of (Cook & Tang, 2010; Liu Guanchun et al., 2018), which is the practice of most scholars. The enterprise leverage ratio is measured by the enterprise's gearing ratio, i.e., it is expressed as the ratio of the enterprise's total liabilities to the enterprise's total assets. The data are obtained from CSMAR database.

4.1.2. Dependent Variable: Federal Funds Rate (USinterest)

Referring to the studies of Bluedorn & Bowdler (2011), He Guohua and Peng Yi (2014), the U.S. Federal Funds Rate per annum is selected as a proxy variable for the U.S. interest rate. The relevant data are from WIND database.

4.1.3. Control Variables

Referring to Zhao Yanping and Ping (2020), asset tangibility (Tasset), corporate profitability (ROA), corporate growth (Growth), and equity concentration (Top10) are selected. The source of data is CSMAR database. The specific index calculation method as well as the description are as follows.

Table 1. Control variable and explanation

Variable name	Calculation method	Explanation
Asset Tangibility (Tasset)	(Fixed Assets + Inventory)/Total Assets	Asset Structure of Enterprise
Profitability of enterprise (ROA)	Net Profit/Total Assets	Profitability of enterprise assets
Growth Rate(Growth)	Growth rate of total income	Potential for Future Development of the Company
Shareholding Concentration (Top10)	Sum of Shareholding Proportions of Top 10 Shareholders	Enterprise Shareholding Structure

4.2. Sample Selection

This paper selects the annual balanced panel data of A-share listed companies from 2013 to 2020 as the research sample, excluding "ST and ST*" companies and companies in the financial industry; excluding companies with serious missing financial data; and excluding companies that have been listed for less than three years. Finally, 1893 companies with 15144 observations were screened out. Finally, the continuous variables are shrink-tailed at 1% level.

4.3. Model Construction

The empirical study of the article adopts the panel vector autoregressive model (PVAR) in the following form:

$$Z_{it} = \Gamma_0 + \sum_{q=1}^{n} \Gamma_q Z_{it-q} + \sum_{q=1}^{n} \Gamma_q X_{it-q} + \varphi f_i + \mu_{it} \quad (1)$$

Where is the variable {LEV, USinterst} which consists of the explanatory and interpretive variables of the model. is the matrix of coefficients needed for estimation, i is the sample firm, t is the annual data, q is the lag order, is the fixed effect, is the random disturbance term, and is the control variable of the model. For the fixed effects, this paper eliminates the fixed effects in the equations through the forward difference Helmert transformation method (in this paper, we use the helm command transformation in STATA) to ensure that the exchanged variables are orthogonal to the lagged variables, and the lagged variables are used as the instrumental

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variables to obtain the consistent and efficient estimators of the parameters to be estimated through the system GMM.

The empirical testing of the panel vector autoregressive model for this paper was completed using the PVAR2 instruction package program from Abrigo & Love (2016). In this paper, the balanced panel data was obtained by means of missing value deletion and tested that the optimal lag order is 1st order.

4.4. Empirical Analysis

4.4.1. Descriptive Statistics

The descriptive statistics of the main variables in this paper are shown in Table 2, from 2013 to 2020, the U.S. federal funds rate reaches a maximum of 2.2% and a minimum of only 0.1%, with a large volatility. The average value of corporate leverage is 43.2%, and the debt ratio is consistently in a high position, with a minimum value of 5.7% and a maximum value of 88.4%, which can be seen that the difference in leverage between different enterprises can also be very large.

Table 2. Descriptive statistics of main variables

Variable	Obs	Mean	Median	Std.	Minimum	Maximum
USinterest	15144	0.008	0.004	0.008	0.001	0.022
Lev	15144	0.432	0.427	0.198	0.057	0.884
Age	15144	2.930	2.996	0.309	1.609	3.497
Tasset	15144	0.364	0.348	0.178	0.023	0.810
Size	15144	22.50	22.32	1.290	19.81	26.14
ROA	15144	0.035	0.033	0.054	-0.237	0.192
Cost	15144	0.008	0.0130	0.033	-0.17	0.064
Growth	15144	-0.058	-0.082	0.267	-0.693	1.231
Top10	15144	0.565	0.566	0.147	0.233	0.903

4.4.2. Granger Causality Test

Since the optimal lag order of the model variables is 1st order through the test, the next step is to conduct Granger causality test with the smooth panel data.

As the results in Table 3 show, the p-value of the test results for Lev and USinterest are less than 0.001, and the results are significant at the 1% level, and USinterest is the Granger cause of Lev.

Table 3. Granger causality test

Equation	Excluded	chi2	df	Prob > chi2
h_Lev	h_USinterest	22.523	1	0.000
h_Lev	h_Tasset	.10309	1	0.748
h_Lev	h_ROA	.46612	1	0.495
h_Lev	h_Growth	1.076	1	0.300
h_Lev	h_Top10	6.3502	1	0.012
h_Lev	ALL	39.084	5	0.000

4.4.3. GMM Estimation Results

Table 4 gives the baseline estimation results of the PVAR model and from the test results, it is known that the lagged one period coefficient of US interest rate is significantly positive. The possible reason for this is that the rise in the level of interest rates in the U.S. leads to the depreciation of the RMB, which causes Chinese firms to increase their borrowing in order to

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expand exports, and the leverage of the firms rises. On the other hand, a rise in the U.S. interest rate level and the change in the interest rate differential between China and the U.S. will attract Chinese capital to flow into the U.S., which leads to a rise in the Chinese interest rate and the difficulty of corporate financing, and a decline in corporate leverage. From the empirical results, the depreciation of RMB leads to a greater factor of expanding exports resulting in a significant positive coefficient.

Table 4. GMM estimation results

Explained variable: leverage of Chinese firms		
Explanatory variable	Ratio	Std.
Federal funds rate (-1)	0.2850***	0.6001
Tasset(-1)	0.0051	0.0159
ROA (-1)	-0.0181	0.0265
Growth(-1)	-0.0039	0.0037
Top10(-1)	-.00911*	0.0361

4.4.4. Impulse Response Results

This section uses an impulse response function (set Monte Carlo simulation for 1000 simulations with a response length of 10 periods) to further examine the process and relationship of the long-run dynamic effects between the variables. As can be seen from Figure 1, given a positive shock to the federal funds rate, Chinese corporate leverage shows a positive as well as a slowly receding response.

For a one standard deviation positive shock to the US interest rate (USinterest), the response of Chinese firms' leverage ratio has a large positive trend in the initial period, and slowly fades from period 4 onwards.

The positive and corresponding climbing phase from period 0 to 4 mainly reflects the interest rate channel transmitted by foreign countries when they implement tight monetary policies. The rise in the US real interest rate leads to a rise in China's exchange rate, an increase in China's exports, and an increase in the borrowing demand of Chinese firms and a rise in the leverage ratio of firms, but this rise is limited by the amount of capital available for borrowing by Chinese firms, which also partly explains why the rise in leverage ratio of domestic firms slows down after the 4th period. This can also partly explain why the rise in leverage of Chinese firms slowed down after the 4-period. The slower rise in Chinese corporate leverage after 4 periods is also due to the interest rate channel, which reacts more slowly to Chinese corporate leverage due to the time lag in China's interest rate policy. As US interest rates continue to rise, China's capital flows continue to flow to the US, reducing China's liquidity and forcing the Chinese government to raise interest rates in response to the outflow of capital from China. Due to the time lag in interest rate policy, the effect of China's interest rate policy is gradually reflected after the fourth period, resulting in increased difficulty in financing for Chinese enterprises, and a decline in Chinese corporate liabilities and leverage; in the asset price channel, a passive rise in China's interest rates will reduce the price of Chinese corporate assets, and a decline in the asset price of Chinese corporations will result in a decline in the value of China's assets and an increase in the leverage ratio. Under the combined effect of the above interest rate channel and asset price channel, the leverage ratio of Chinese enterprises that received the shock after the 4th period will rise slower.

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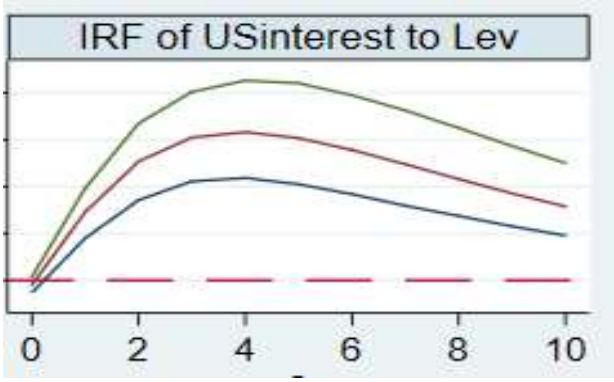

Figure 1. Impulse Response Results of usinterest to lev

5. Research Conclusion and Policy Recommendations

The main conclusions of this paper are as follows: China's corporate leverage is significantly affected by the spillover effect of U.S. monetary policy, and the conduction as well as fading are relatively smooth, with a long-term positive spillover effect. In the long run, the rise of US interest rates will lead to the increase of Chinese enterprises' leverage ratio.

In order to stabilise the leverage ratio and prevent and resolve the risks brought about by changes in US monetary policy in an open economy, this paper puts forward the following policy recommendations in response to the findings of the study.

The tight monetary policy of the United States as a whole has led to an increase in the leverage ratio of Chinese enterprises, which is not conducive to the macro policy objective of "deleveraging and stabilising leverage". In order to prevent China's micro enterprise leverage ratio from being too high, leading to an increase in enterprise risk and affecting the stability of the capital market.

Firstly, we should prevent enterprises from over-borrowing to increase exports by restricting the limit of loanable funds, ensure the orderly and stable supply of funds to Chinese enterprises, deepen the reform of the supply side of the financial sector, gradually improve the domestic financial market, and strengthen the macro-financial regulation and control. At the same time, the interest rate channel should be open, according to the U.S. interest rate adjustment in a timely manner to make interest rate adjustment response, to prevent excessive narrowing of the interest rate differential between China and the U.S., and to guide enterprises to make the correct borrowing and lending behaviours and investment behaviours.

Second, in the asset price channel, can stabilise the enterprise collateral asset prices, broaden the enterprise investment and financing channels, prompting enterprises to get rid of the dependence on a single financing method. By broadening the channels to make enterprises no longer subject to the impact of interest rate adjustments alone, making corporate financing more diverse also reduces the risk of corporate financing.

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