The Impact of Residents' Leverage Ratio on the Effectiveness of Monetary Policy: Evidence from a Panel of Chinese Prefecture-Level Cities

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Abstract: This paper examines panel data from 127 prefecture-level cities between 2015 and 2023 to investigate the relationship between resident leverage ratios and the effectiveness of monetary policy. The study finds that as resident leverage ratios increase, the effectiveness of monetary policy regulation is diminished. By setting different explanatory and response variables, the article demonstrates that an increase in resident leverage ratios diminishes the effects of quantitative monetary policy and price-based monetary policy. Furthermore, the paper reveals that resident leverage ratios lead to regional heterogeneity in the effectiveness of monetary policy, indicating that in areas with lower resident leverage ratios, the effectiveness of monetary policy is reduced.

***Keywords*:** resident leverage, monetary policy effectiveness, economic growth

1. Introduction

In China, in recent years, the booming real estate market and the rise of consumer borrowing have led to a rapid expansion of resident credit levels, resulting in a continuous increase in the leverage ratio of the Chinese resident sector.

The increase in the resident leverage ratio of a country has a significant impact on the effectiveness and transmission mechanism of its monetary policy. Monetary policy operates through different transmission channels. From the perspective of the interest rate transmission channel, when the resident leverage ratio rises, the demand for borrowing decreases, leading to reduced investment demand, and the sensitivity of consumption and investment to interest rates diminishes, thereby weakening the effectiveness of monetary policy under the interest rate transmission channel (Liu Jinquan, 2023). From the credit transmission channel, when the resident leverage ratio is at a high level, the demand for durable goods such as housing decreases, and the credit transmission channel of monetary policy is also hindered. Therefore, this article proposes Hypothesis 1: An increase in resident leverage weakens the effectiveness of monetary policy regulation.

Moreover, there are significant differences in the economic development level, financial structure, and debt structure among different regions in China. Faced with the same monetary policy, different regions may exhibit varied responses, indicating the existence of regional heterogeneity in the effectiveness of monetary policy. Therefore, this article proposes Hypothesis 2: resident leverage will lead to regional heterogeneity in the effectiveness of monetary policy.

2. Preliminary notes

In previous studies, the overall impact mechanism of excessively high resident leverage on the economy and the effectiveness of monetary policy remains unclear, and there is a relative scarcity of comprehensive literature on the relationship between resident leverage and the effectiveness of monetary policy. Nonetheless, direct studies on resident leverage are relatively lacking, and there is scarce literature from the perspective of provincial- or prefectural-level cities. Therefore, this study's marginal contributions are as follows: 1) Focusing on issues specific to China, conducting empirical analyses of the effects of economic growth and inflation under both quantity-based and price-based monetary policies, and discussing how an increase in resident leverage weakens the effectiveness of monetary policy. 2) Using panel data from different provinces and prefectural-level cities in China to explore the impact of resident leverage on the effectiveness of monetary policy. 3) In terms of studying the regional heterogeneity of the effectiveness of monetary policy, attempting to use resident leverage as an explanatory perspective.

3. Data and Methodology

3.1 Data and Sample

The data for this study mainly comes from the National Bureau of Statistics, various provincial and municipal statistics

bureaus, the Wind database, the CEIC database, China Economic Net, and the "China City Statistical Yearbook." We used annual data from all prefecture-level cities in China from 2015 to 2023 as the sample for analysis. The initial sample included relevant data for all prefecture-level cities from 2015 to 2023, covering 293 cities nationwide. However, observations with missing values in key variables were excluded during the research process, resulting in a final sample of 127 cities. To avoid the impact of missing values on other non-core variables, we used interpolation to handle all continuous variables.

3.2 Empirical Design

This study applies a two-way fixed effects model to investigate the relationship between resident leverage ratio and the effectiveness of monetary policy. The model is constructed as follows:

For the quantity-based monetary policy model:

$$MG_{i,t} = \alpha M2_t + \beta residentLR_{i,t} \times M2_t + \gamma residentLR_{i,t} + \theta Control_{i,t} + \varepsilon_{i,t} + c \tag{1}$$

For the price-based monetary policy model:

$$MG_{i,t} = \alpha R_t + \beta residentLR_{i,t} \times R_t + \gamma residentLR_{i,t} + \theta Control_{i,t} + \varepsilon_{i,t} + c \tag{2}$$

In these models, the dependent variable, denoted as MG, represents the ultimate goal of monetary policy as mentioned earlier, serving as a proxy for the effectiveness of monetary policy. Economic growth (GDP) is represented by the logarithm of regional GDP, while inflation (INF) is represented by the inflation rate. M2 and R represent the actual money supply growth rate and the real interest rate, reflecting quantity-based and price-based monetary policies, respectively. residentLR represents the resident leverage ratio in each prefecture-level city, calculated as the ratio of resident loans to total resident income.

4. Empirical results

4.1 Baseline Regression

Result presents the results of the fixed effects baseline regressions, which investigate the empirical impact of the household leverage ratio on the effectiveness of monetary policies from 2015 to 2023. This includes both quantitative monetary policies and price-based monetary policies. In the estimation results, the coefficient of the actual money supply growth rate, M2, is significantly positive at the 10% significance level, indicating that an increase in the money supply growth rate leads to economic expansion, i.e., an increase in GDP levels. On the other hand, the coefficient of the interaction term between the actual money supply growth rate and residentLR, denoted as M2×residentLR, is significantly negative at the 1% significance level, suggesting that an increase in the household leverage ratio weakens the regulatory effect of the quantitative monetary policy.

Furthermore, in the estimation results of another model, the coefficient of the real interest rate, R, is significantly negative at the 5% significance level, indicating that an increase in the interest rate leads to a decrease in the inflation rate, thereby achieving a policy effect of inflation control. Similarly, the coefficient of the interaction term between the real interest rate and residentLR is significantly positive at the 1% significance level, indicating that, under the backdrop of a higher household leverage ratio, the effectiveness of the price-based monetary policy is also somewhat weakened. All control variables in the running process are significant at the 1% significance level, enhancing the accuracy of the estimation results. Therefore, Hypothesis 1 of this study is supported.

4.2 Heterogeneity Analysis

This study introduces a dummy variable (Group) to explore the regions with different resident leverage ratios, in order to examine whether there is regional heterogeneity in the effectiveness of monetary policy. Specifically, in accordance with the approach by Zhai (2023), this study categorizes the 127 sample prefecture-level cities into groups based on the high and low resident leverage ratios, sorting the cities from high to low according to the average resident leverage ratio of each city. The value of Group is set to 1 for prefecture-level cities with resident leverage ratios below the sample average, and 0 otherwise. Following Zhai (2023), given the time lag effect of monetary policy on the economy, this model applies a one-period lag to the variables, denoted as L.

From the estimated results in the result above, we can observe that in the output effect model, the coefficient of M2 is significantly positive and statistically significant at the 1% level. This indicates that an increase in the growth rate of the money supply leads to economic expansion, namely, an elevation in GDP levels. The coefficient of M2×Group is opposite to

that of the M2 coefficient, reflecting a decline in the effectiveness of monetary policy in regions with lower resident leverage ratios. In regions with lower resident leverage ratios, the impact of quantity-based monetary policy is weaker, suggesting a significant decrease in the regulatory effectiveness of monetary policy on economic growth in regions with lower resident leverage ratios. Resident leverage ratios contribute to the regional heterogeneity of the effectiveness of monetary policy, thus validating Hypothesis 2.

5. Robustness Check

In order to enhance the robustness of the baseline regression, this study conducted two types of robustness checks to validate the results. Firstly, an alternative proxy for price-based monetary policy was employed. In this section, the weighted average interest rate of the interbank 7-day repurchase agreement (R007), the Shanghai interbank offered rate for 7-day interbank borrowing (SHIBOR), and the weighted average lending rate for general loans by financial institutions (LIR) were used to re-estimate the price-based monetary policy. Additionally, considering other factors that may influence the effectiveness of monetary policy, such as changes in international interest rates affecting the overall tightness of monetary policy, as well as the impact of payment scale and consumer behavior, this study sequentially included the US federal funds rate (FFR) and the year-on-year growth rate of third-party payment scale (MPYOY) as control variables for further regression analysis.

(1) This study re-estimated the results using R007, SHIBOR, and LIR as proxies for price-based monetary policy. The findings indicated that the results remained significant when using alternative proxy variables for price-based monetary policy, demonstrating the robustness of the conclusions drawn in this study.

(2) This study conducted separate regression analyses with FFR and MPYOY included as control variables. The results indicated that even when controlling for other potentially influential variables, the findings remained significant, thus affirming the robustness of the conclusions drawn in this study.

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