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Capital Adequacy Ratio, Bank Credit Channel and Monetary Policy Effect

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Abstract

This chapter, based on the theory model derived from bank credit transmission channel and the balanced panel data of 18 Chinese commercial banks from 2008 to 2012, conducts empirical test and carries out classified study of China's bank credit transmission channel and the effect of capital adequacy ratio on credit channel. Results show that the bank characteristics have, on a micro level, heterogeneity effects on credit transmission channel of monetary policy. Banks of higher capital adequacy ratio and smaller asset size are more vulnerable to the impacts of monetary policy. Therefore, the author proposes policy suggestions from the perspectives of optimizing the structure of financial markets and improving the monetary policy effect.

Keywords: monetary policy, bank credit channel, bank characteristics, capital adequacy ratio

1. Introduction

The credit channel is the main transmission mechanism by which bank capital adequacy ratio affects monetary policy effect. The credit channel emphasizes the important role of bank assets and liabilities in the transmission mechanism of monetary policy. The bank loan channel theory claims that monetary policy will affect the real economy by changing the bank loan supply behaviors. After the 2008 financial crisis, the Basel Agreement III rushed out. International agencies generally raised the bar of commercial bank capital regulation, which stipulated the minimum capital ratio and improved the capital adequacy ratio at the same time. Tougher capital constraints will reduce the interest rate elasticity of the loan supply, change the loan supply behaviors of commercial banks, and influence the monetary policy effect. Banks of

different capital levels have difference in characteristics, the effect of loan supply to interest rate elasticity and influence on monetary policy.

Since the 1980s, the idea of credit channel of monetary policy transmission began to be widely accepted. Credit channel claims that because of incompleteness of financial markets, information asymmetry, contract cost, and other problems existing in economy operation process, banks play a special and important role in spreading risks, reducing transaction costs, and alleviating the adverse selection and moral risks caused by incomplete information in the credit market, etc. It is because of the special role of banks that a specific borrower can only borrow the needed funds from the banks. So the credit constitutes a significant channel of monetary policy transmission [1–4]. A number of scholars at home and abroad verify the existence of bank credit channel through empirical analysis. Taking the bank capital supervision system, the goal conflicts of central bank, and banking regulator authorities into consideration, new exogenous factors will make the traditional monetary policy credit transmission mechanism different. Scholars at home and abroad have conducted fruitful researches on this issue at the beginning of the 1990s. Kopecky-VanHoose [5] constructed a microeconomic model of a single banking sector, which proved that capital adequacy regulation will change the short-term and long-term credit behaviors of banks, and affect the credit transmission mechanism of monetary policy. Chun and Xiamin [6] examined banks' behaviors by establishing the model of individual bank, and eventually concluded that the bank credit market is a supply-dominated market, in which bank credit rationing behaviors will weaken the effectiveness of monetary policy, but capital regulation can improve the effect of monetary policy transmission. Liu Bin [7] studied the effect of capital adequacy supervision on the transmission mechanism of monetary policy and bank credit behavior by using the banking sector model and general equilibrium model, and concluded that the impacts of monetary policy to credit behavior vary with different capital scales. Wang Tao and Jiang Zaiwen's [8] research confirmed that tightening monetary policies can effectively control the bank credit supply, and is more effective to the smaller-scaled banks. Feng Ke and He Li's [9] research confirmed that the capital adequacy ratio and the bank credit scale are significantly positively correlated, but the transmission function of the bank credit channel to monetary policy is very limited. Li Tao and Liu Mingyu [10] claimed that the impact of bank credit channel on the banking sector varies with the different characteristics of banks represented by the capital adequacy ratio.

The existing literature has analyzed the relationship between the capital adequacy ratio and the bank credit transmission channel from various aspects, but there remain some shortcomings. First, most of the existing literature chooses reserve and disposable deposits as the operation target of monetary policy, while often ignores the role of interest rates¹ in monetary policy transmission. Second, the existing researches ignore the possible differences between the individual banks because of limited sample sizes.

¹On July 19, 2013, the Central Bank of China announced completely unlock financial institutions loan rate control from July 20, 2013 on, which marked China's market-oriented interest rate reform entering a new stage. Interest rates unlocking was likely to be achieved in the last 1 or 2 years.

This chapter emphasizes the impacts of interest rate on bank credit behaviors and analyses the influences of the banks' characteristics represented by capital adequacy ratio on the credit transmission channel of monetary policy when constructing the theoretical model, and uses 18 banks' panel data to study the effectiveness of the monetary policy credit channel under capital supervision.

2. Theoretical model

In order to study the effect of capital adequacy to bank credit behavior, the author, refers to Feng Ke and He Li's [9] and Jiang Chun and Yu Xiamin's [6] theoretical models on the microscopic characteristics of banks and makes certain simplification to their models.

Take a simplified bank balance sheet as an example. Bank asset is made up of deposit reserve (R), government bonds (SEC), and loans (L), which are composed of total deposit (D) and equity capital (K):

$$R + L + SEC = D + K \quad (1)$$

According to the requirement of statutory deposit reserve:

$$R = \rho D \quad (2)$$

where ρ is the statutory reserve ratio.

According to the requirement of capital adequacy ratio:

$$K = \theta L \quad (3)$$

where θ is the capital adequacy ratio.

L is the function of τ_L ,

$$L = L(\tau_L) \quad (4)$$

where τ_L is the bank loan rate.

The bank's function is:

$$\pi = r_L L + r_{SEC} SEC - r_D D - r_K K \quad (5)$$

where τ_D is the deposit interest rate, τ_{SEC} is the interest rate of government bonds, and τ_K is the return on equity capital requirements.

According to Eq. (2)–Eq. (5) we can further get:

$$\pi = r_L L(r_L) + r_{SEC} SEC - r_D D - r_K \theta L(r_L) \quad (6)$$

In order to maximize the profit, the bank needs to meet the first-order necessary conditions:

$$\pi = r_L L'(r_L) + L(r_L) + r_K \theta L'(r_L) = 0 \quad (7)$$

$$L'(r_L) = \frac{L}{\theta r_K - r_L} \quad (8)$$

So, according to Eqs. (1)–(8), we can clearly see, when $\theta r_K > r_L$, $L'(r_L) < 0$, the number of bank loans is a decreasing function of the loan interest rate; when $\theta r_K < r_L$, $L'(r_L) > 0$, the number of bank loans is an increasing function of the loan interest rate.

This demonstrates when loan supply dominates the credit rationing, banks will weigh the cost of capital rate (θr_K) and the size of loans (r_L) to determine the increase or decrease in the loan supply. If the capital cost rate is higher than the loan interest rate, the number of bank loans will decrease as the interest rates rises. If the capital cost rate is lower than the loan interest rate, even though the loan interest rate rises, banks will increase the number of loans for more profit.

With conditions Eq. (1)–Eq. (8), the partial derivative of capital adequacy ratio is:

$$\frac{\partial(L'(r_L))}{\partial \theta} = \frac{L'(\theta r_K - r_L) - r_K L}{(\theta r_K - r_L)^2} = \frac{L - r_K L}{(\theta r_K - r_L)^2} = \frac{L(1 - r_K)}{(\theta r_K - r_L)^2} > 0 \quad (9)$$

Results show that when there is a capital constraint, the larger the θ is, the more sensitive the bank loans will be to the monetary policy. When there is a stringent capital constraint, tightening monetary policy raises interest rates, reduces the profitability of banks, and the size of the endogenous capital accumulation, thus banks can only reduce loans to meet the minimum capital standards.

According to the analysis above, the author gets the following hypothesis:

Hypothesis 1: For banks of high capital cost rate, the number of loans changes in reverse direction of interest rates. And for banks of low capital cost rate, the number of loans changes in the same direction of interest rates.

Hypothesis 2: The higher the capital adequacy ratio is, the greater the magnitude of the number of loans will be as the interest rates change.

3. Empirical test

3.1. Construction and data processing of empirical model

Kashyp and Stein's [3] two-stage regression model with panel data bank microscopic analysis the effect of the capital adequacy ratio standards to bank credit channel. The first stage is the regression of the credit scale and capital adequacy ratio, and the second stage is the regression

of the proxy variable of currency policy and capital adequacy ratio. On this basis, a cross-term panel regression model of the proxy variables of monetary policy capital adequacy ratio is introduced to conduct regression analysis of the bank characteristics and the cross-term coefficient with the credit scale to study the effect of bank characteristics to the credit transmission channel of monetary policy.

To better reflect the characteristics of banks, the author uses bank total assets (TA, Total Asset) and bank assets adequacy ratio (CAR, Capital Adequacy Ratio) to represent the sizes of banks and capital levels. Since the central bank continues to take the money supply as an intermediate target, and regulates mainly through the statutory deposit reserve ratio, loans and deposit benchmark interest rates, the author takes the one-year benchmark loan rate r , the statutory deposit reserve ratio R , and the narrow money supply $M1$ (because the central bank has a stronger control of $M1$ than $M2$) as the proxy variables of monetary policy.

3.2. The construction of empirical model

Based on the variable selection above, the author constructs the empirical model in this study as follows:

$$\Delta \ln(L_{i,t}) = \alpha_1 + \alpha_2 MP_{i,t} + \alpha_3 \Delta \ln(TA_{i,t}) + \alpha_4 CAR + \alpha_5 \Delta \ln(TA_{i,t}) MP_{i,t} + \alpha_6 CAR MP_{i,t} + \varepsilon_{i,t} \quad (10)$$

Among which $MP_{i,t}$ is the proxy variable of monetary policy, which includes one-year benchmark r_{Lt} loan rate, the legal deposit rate R_t and money supply amount $M1_t$. We use $\partial L / \partial r$ and $\partial L / \partial M1$ to show the effect of monetary policy changes on bank credit, and cross-term coefficient represents bank characteristics' role on that effect. $\partial^2 L / \partial r \partial \Delta \ln(TA)$ and $\partial^2 L / \partial r \partial CAR$ indicate the response to currency policy of bank credit of different asset scale and level of capital. The author focuses on the cross-term coefficient α_6 .

This author selects five big state-owned commercial banks and 13 small and medium-sized joint-stock banks' 2008–2012 annual data,² all data are derived from the 2008 to 2012 annual financial statements of these banks' official websites. Proxy variables of monetary policy are based on data from China Statistical Yearbook website. The reserve ratio and the one-year loan rates are calculated based on the adjusted weight according to the time. In order to eliminate the heteroscedasticity, the author gets natural logarithm and takes the growth rates of all scale variables.

3.3. Descriptive statistics

Table 1 shows the descriptive statistics regression variables in this chapter.

Table 1 shows that from 2008 to 2012, the samples' average commercial banks' loan is 1.8292 trillion Yuan, the highest being Industrial and Commercial Bank of China in 2012, reaching

²The 18 commercial banks include the Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, China Construction Bank, Bank of Communications, China CITIC bank, China Merchants Bank, Hua Xia Bank, China Minsheng Bank, Ping An Bank, China Everbright bank, Shanghai Pudong Development Bank, Industrial Bank, Nanjing Bank, Bank of Ningbo, Anhui Merchants Bank, Guangdong Development Bank, and Bank of Shanghai.

| Variable | Maximum | Minimum | Median | Average | Standard deviation |
|--|----------|---------|--------|---------|--------------------|
| Loan L (hundred million Yuan) | 88,037 | 402 | 8787 | 18,292 | 21,974 |
| Total assets TA (hundred million Yuan) | 1,81,300 | 919 | 16,146 | 36,852 | 45,768 |
| Capital adequacy ratio CAR | 24.12% | 8.58% | 11.52% | 11.98% | 2.11 |

Table 1. Descriptive statistics results.

8.8037 trillion Yuan. From the viewpoint of the total assets, sample banks' average asset is 3.6852 trillion Yuan, the highest being the Bank of China in 2011, reaching 18.13 trillion Yuan. From the viewpoint of the banks' capital strength, sample banks' capital average adequacy ratio is 11.98%. And in 2008, Nanjing Bank reached as high as 24.12% and Pingan Bank being 8.58%.

3.4. Regression results

Due to the different natures of property rights, China's banks' structure presents an echelon distribution, mainly made up of state-owned commercial banks and joint-stock commercial banks. People's Bank of China also classifies them as large financial institutions and small- and medium-sized financial institutions. The author uses Eviews software to all banks, large state-owned banks, and joint-stock small- and medium-sized banks respectively to conduct mixed-panel and fixed-effect-panel regression analysis.

Table 2 shows the regression results of the one-year loan interest rate to the bank credit effect. As a result, it can be seen that all banks and joint-stock small- and medium-sized banks have significant regression coefficients, while the regression results of the large state-owned banks are not significant, which means large banks' credit scale is not sensitive to interest rate changes.

| | All banks | | Large state-owned banks | | Joint-stock small and medium-sized banks | |
|----------------------|------------------------|------------------------|-------------------------|------------------------|--|------------------------|
| | Mixed panel regression | Fixed panel regression | Mixed panel regression | Fixed panel regression | Mixed panel regression | Fixed panel regression |
| <i>C</i> | 1.5570** | 1.2107* | 2.6421 | 2.2802 | 2.0561*** | 1.8251** |
| $\Delta \ln TA$ | 3.4865*** | 2.9308*** | 4.0940 | 3.8629 | 4.2240*** | 3.45191** |
| <i>CAR</i> | -0.1521*** | -0.1251** | -0.2212 | -0.1988 | -0.2270*** | -0.1973** |
| $\Delta \ln TA^* rl$ | -51.3821*** | -43.0599*** | -62.6583 | -59.2758 | -61.3452*** | -49.0242** |
| <i>CAR* rl</i> | 2.4588*** | 1.5638 | 3.5830 | 2.9542 | 3.6939*** | 2.9117** |
| <i>rl</i> | -23.5738** | -12.1744 | -41.2525 | -31.8385 | -32.3879*** | -24.9495* |

Table 2. Regression results of one-year loan rate to banks' credit effect.

Table 3 shows the regression result of deposit reserve rate (RRR) to bank credit effect. As a result, it can be seen that small- and medium-sized joint-stock banks' regression coefficients are significant, while in the regression results of all banks and large state-owned bank, only the banks' balance increment and its cross-term with the RRR are significant, which means bank assets will affect the sensitivity of the credit scale to the changes of RRR.

| | All banks | | Large state-owned banks | | Joint-stock small and medium-sized banks | |
|---------------------|------------------------|------------------------|-------------------------|------------------------|--|------------------------|
| | Mixed panel regression | Fixed panel regression | Mixed panel regression | Fixed panel regression | Mixed panel regression | Fixed panel regression |
| C | 0.9796 | 1.1547 | 1.6342 | 1.6364 | 2.9754*** | 2.5665** |
| $\Delta \ln TA$ | 2.3094*** | 1.8839*** | 5.5258** | 4.7805 | 5.0446*** | 4.3115** |
| CAR | -0.0857 | -0.0910 | -0.1665 | -0.1642 | -0.3124*** | -0.2708** |
| $\Delta \ln TA^* R$ | -0.1091*** | -0.0877*** | -0.2642** | -0.2287 | -0.2733*** | -0.2302** |
| CAR * R | 0.0047 | 0.0035 | 0.0083 | 0.0074 | 0.0188*** | 0.0153* |
| R | -0.0486 | -0.0399 | -0.0767 | -0.0664 | -0.1757*** | -0.1391* |

Note: *, **, and *** represent significant under the significance level of 10, 5, and 1%, respectively.

Table 3. Regression results of reserve requirement ratio (RRR) to bank credit effect.

Table 4 shows the regression results of M1 to bank credit effect. It shows only the asset scale of all banks and small- and medium-sized joint-stock banks have significant regression relationship with their cross-terms with M1, which means bank asset scales can affect the sensitivity of credit scales to the changes of M1.

| | All banks | | Large state-owned banks | | Joint-stock small and medium-sized banks | |
|--------------------------|------------------------|------------------------|-------------------------|------------------------|--|------------------------|
| | Mixed panel regression | Fixed panel regression | Mixed panel regression | Fixed panel regression | Mixed panel regression | Fixed panel regression |
| C | -2.2316 | -6.0126 | 12.2154 | 8.8906 | 0.0645 | -2.7256 |
| $\Delta \ln TA$ | 27.6874*** | 25.2591*** | 11.6582 | 17.3209 | 28.8552*** | 28.6159*** |
| CAR | 0.1749 | 0.4983 | -0.6223 | -0.4625 | -0.1535 | 0.0587 |
| $\Delta \ln TA^* \ln M1$ | -2.1892*** | -1.9984*** | -0.9203 | -1.3714 | -2.2766*** | -2.2596*** |
| $\Delta CAR^* \ln M1$ | -0.0138 | -0.0406 | 0.0495 | 0.0366 | 0.0124 | -0.0050 |
| $\ln M1$ | 0.1859 | 0.5003 | -0.9628 | -0.6948 | 0.0009 | 0.2324 |

Table 4. Regression results of narrow money supply growth rate to bank credit effect.

4. Empirical results and policy implications

4.1. Empirical result analysis

First, through the analysis of proxy variables of monetary policy, it can be seen that the regression coefficient of the one-year loan rate is significantly negative, indicating that tight monetary policy will lead to incremental reduction of bank loans, which are mainly manifested as the incremental reduction of small- and medium-sized banks' loans and large banks' loan scales unaffected by the rate. Statutory RRR increase will result dramatic fall of the incremental loans of small- and medium-sized banks and the scale of banks' loans have no response to the narrow currency amount changes, which is consistent with Hypothesis 1. Bank capital absorbs risk and compensates for the loss, therefore, on average, medium- and small-sized banks' capital ratios are higher than that of the large banks [11]. And their core capital ratios are significantly higher than large banks. According to pecking order theory, equity financing cost is the highest among all manners [12]. So, because of a higher capital cost ratio, the scales of the loan of medium and small-sized banks will change in the opposite direction as the rate varies. That is to say, small- and medium-sized banks are more sensitive to interest rate changes. China's monetary policy is mainly transmitted through the small- and medium-sized banks. Large state-owned banks, due to government funding, are barely restrained to capital cost, so large banks are not sensitive to monetary policy changes and show stronger credit rationing ability.

The reasons are as follows: first, on the one hand, China's large state-owned banks occupy more credit resources, large banks are able to choose the loan customers and decide the pricing; On the other hand, state-owned banks' main loan customers are state-owned enterprises, while small- and medium-sized banks loan customers are mainly small- and medium-sized enterprises. State-owned enterprises, because of its own particularity, their fund and financing are more policy-oriented, so state-owned banks' loan increments are not sensitive to the market rate, but small- and medium-sized banks are mainly dominated by the marker rate.

Second, through the analysis of the proxy variables of bank characteristics, it can be seen that the regression coefficients of all banks' and small banks' assets increment is significantly positive, the incremental loans of large banks are not affected by the scale of bank assets, indicating the size of bank loans will increase with the expansion of assets, among which small banks have greater loan expansion impulse. Because compared to other banks, the higher the capital assets scale are, the safer they are. So, when the total assets scale expands, the public's confidence increases. And at the same level of interest rates, the public will be more inclined to put money into larger-scaled banks. This demonstrates that, in China, the size of the banks will produce a heterogeneous impact on loan business, namely to say, small- and medium-sized banks' loan business development space is limited, while large banks will get a broader space for development.

The regression coefficients of the capital adequacy ratio of small- and medium-sized banks are significantly negative and the incremental loans of large banks are not affected by the capital adequacy ratio, indicating that the banks' loan increment will decrease as the capital adequacy ratio increases. Take the Bank of Nanjing as an example, the capital adequacy rate Bank of

Nanjing in 2012 reached 14.98%, the highest among 18 sample banks, while its loan increment is 2.2464 trillion Yuan, the lowest among 18 sample banks. This is because as Chinese government's emphasis on capital supervision increases and supervision ability improves, banks must incorporate the regulatory requirements into operation development strategies. But the capital adequacy ratio, as an important indicator of bank balance sheets, its increase will make the banks maintain more capital to meet regulatory requirements, and the loan expansion scales will be reduced accordingly.

Third, through the analysis of cross-term variables of banks' characteristics and the proxy variables of monetary policy, it can be seen that the cross term variables of the proxy variables of monetary policy and capital adequacy ratio of small and medium-sized banks are significantly positive, which is consistent with the theoretical model of formula (9) and proves Hypothesis 2. As the banks' capital assets ratio increase, their sensitivity of the credit scale to the monetary policy will gradually increase, and the sensitivity of large banks' credit increment to monetary policy is not affected by the capital adequacy ratio. The currency policy will bring greater impact to banks of higher capital adequacy ratio. One possible explanation is that tight monetary policy will firstly influence the loanable funds and as banks' loan supply and interest margin decreases, the banks' profit are compressed, capital value declines, and equity capital financing becomes more difficult. To maintain a high capital adequacy ratio, banks need to reduce the size of the loan more dramatically, thus the amplification effect of capital constraints on bank credit channel appears. Expansionary monetary policy increases the value of the banks' capital and under the original capital constraints; more capital can promote larger scale of loans.

4.2. Policy implications

Based on the above empirical results, the author gets the following policy implications.

First, the existence of China's banks' credit channel is consistent with many domestic scholars'³ study results [13]. The proportion of indirect financing in China is more than 70%, bank loans being the most important external funding source in nonfinancial sectors. The banks' credit market controls the capital availability by credit rationing, which is very important in the transmission of monetary policy. Therefore, in order to improve the effect of monetary policy, the central bank should attach importance to the credit scale control and incorporate the total credit amount into the current monetary policy framework.

Second, banks' characteristics will have influence on the heterogeneity of credit transmission channel of monetary policy at the micro level, and make the monetary policy show asymmetric effects. Banks of high capital adequacy ratio and small asset sizes are more vulnerable to the impact of the monetary policy. The Central Bank and China Banking Regulatory Commission (CBRC) should adopt differentiated treatment, set different standards for small- and medium-sized banks, and large state-owned banks, provide appropriately relaxed policy environment

³Sheng Zhaohui (2007) finds credit channels are still China's main channel of the monetary policy transmission by using data since the 1990s.

to small- and medium-sized joint-stock banks. And for large state-owned banks, because its capital adequacy ratio is much higher than the basic standard and capital constraints have little impact on them, the government should appropriately raise the capital adequacy ratio and other standards to strengthen the credit transmission channel, promote fair competition in the financial market, so as to achieve better monetary policy effect.

Third, credit channel of monetary policy in China is mainly transmitted through the small- and medium-sized joint-stock banks, so to further optimize the structure of the banking market is an effective way to improve monetary policy effect. Since the 1980s, along with the restructuring of Bank of Communications, China Merchants Bank, Guangdong Development Bank, and other joint-stock commercial banks have been established, and a rudiment of joint-stock banks in China emerged. By the 1990s, the market system reformed, to relax the access conditions for the banking industry, a large number of joint-stock commercial banks came into being, accelerating the process of marketization of the banking system. With China's access to the WTO in 2001, small- and medium-sized joint-stock banks begun to attract investment and go into the market. The number of local banks and rural credit cooperatives is expanded continually. Although the development of small- and medium-sized joint-stock banks and promoting full competition in the financial markets has become the general trend, it is undeniable that the state-owned commercial banks is still in the monopoly position in the credit market. At the end of the December of 2013, the loans balance of financial institutions was 71.9 trillion Yuan, among which, the balance of loans of Chinese large national banks⁴ was 38.2 trillion Yuan, accounting for 53% of the total RMB loans. It is seen that to enhance competition in China's credit market, the government also need to vigorously develop small- and medium-sized banks and further optimize the market structure of banks.

At the same time, small- and medium-sized enterprises, as an important part of China's economy, its external funding sources rely mainly on small- and medium-sized joint-stock banks, the small- and medium-sized joint-stock banks, therefore, undertake the important responsibility to activate the economy market and promote employment. To improve the monetary policy formulation and supervision, the government should provide some favorable policies to small- and medium-sized joint-stock banks to make them better develop, which will help to clear the financing channel of small- and medium-sized enterprises, tackle the problems caused by the shortage of funds. Compared with the large state-owned banks, small- and medium-sized joint-stock banks are more vulnerable to policy impacts because of the small asset scales and low quality. Therefore, small- and medium-sized joint-stock banks should improve their asset quality and vigorously develop intermediary business, expand funding channel, reduce the pressure of capital occupancy, and form diversified income and profit structure to improve the their own competitiveness.

⁴Chinese national large Banks refers to the banks of more than 2 trillion Yuan total quantity of domestic and foreign currency (take the total amount of domestic and foreign currency of every financial institutions by the end of 2008 as reference standard), including ICBC, China Construction Bank, Agricultural Bank, Bank of China, China Development Bank, Bank of Communications, and Postal Savings Bank of China.

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