

The Study on Deleveraging of State-Owned Enterprises Based on the Perspective of Regional Financial Risk

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ABSTRACT

The rise of China's macro leverage has become one of the main factors inducing financial risks. How to reduce the leverage level of the soft budget constraint sector, especially the leverage level of the state-owned enterprise (SOE) sector, is the key link to prevent systemic risks. Based on the panel data of 30 provinces and cities from 2007 to 2015, this paper studies the impact of de-leverage of SOEs on regional financial risks under the impact of debt financing pressure, and the important role of debt financing demand elasticity in the deleveraging process. The research results show that the pressure of debt financing makes the leverage of SOEs have the effects of "active" and "passive". SOEs with higher debt financing demand elasticity will "actively" reduce the proportion of debt financing and reduce the level of leverage. SOEs with weaker debt financing demand elasticity will "passively" sell assets to meet their rigid financing needs, which will lead to asset price declines and push up leverage. Therefore, the government should exert a reasonable impact on the regional SOEs with better debt financing demand elasticity, guide the sectors to "actively" reduce leverage and ease the local financial risks. The government should also avoid direct impact on regional SOEs with weaker debt financing needs, prevent the sector's deleveraging process from being dominated by "passive" effects, and avoid the expansion and spread of regional financial risks.

Keywords: state-owned enterprise, leverage, pressure of debt financing, regional financial risk

I. INTRODUCTION

At the time of the conversion of old and new kinetic energy, the investment-led economic growth model supported by high saving rate is already unsustainable, and the overall high debt level caused by it has gradually become the main source of China's macro-financial vulnerability. According to the International Monetary Fund (IMF), China's macro leverage ratio at the end of 2016 was 235%. Among them, the state-owned enterprise sector, the private enterprise sector, the government sector, and the local platform and

family sector accounted for 74%, 54%, 46% and 18% respectively. This shows that excessive debt of China's state-owned enterprises is an important reason for increasing the macro leverage ratio. For this reason, the "Guiding Opinions on Strengthening the Asset and Liability Constraints of State-owned Enterprises" issued by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council in September 2018 pointed out that "strengthening asset-liability constraints of state-owned enterprises is an important measure to prevent and resolve major risks", and it also clearly required "to promote the average asset-liability ratio of state-owned enterprises to be reduced by about 2 percentage points by the end of 2020 compared to the end of 2017". It can be seen that the deleveraging of state-owned enterprises has been highly valued by the central government as a key link to prevent systemic risks in China. And inappropriate economic policies often fail to achieve its smooth deleveraging (Ji Yang, 2018), and will also cause financial risks to spread and expand.

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From the actual situation, the current level of leverage in the state-owned enterprise sector has aroused widespread concern in academia. Most of the relevant studies are based on China's macro leverage structure, analyze the differences in leverage levels among different sectors, and point out that the continuous increase in the debt level of soft budget-constrained sectors is one of the main reasons for increasing the macro leverage ratio (Ji Min, 2017; Zhong Ninghua, 2016; Zhang Bin, 2018), and excessive debt of state-owned enterprises is an important factor (Chen Weidong, 2017). It is worth noting that most of the creditors in the state-owned enterprise sector are banks. Once credit risk breaks out, the risk of debt default is easily transferred to the financial system through the credit relationship, which in turn causes unrest in China's financial system (Gou Wenjun, 2016; Ma Jiantang, 2016; Allen, 2002 ; Reinhart and Rogoff, 2010). The experience of developed countries also provides empirical evidence for the above views. For example, before the outbreak of the financial crisis in 1990, Japan's macro leverage ratio was as high as 211.2%, with the non-financial enterprise sector accounting for 141%¹. This shows that the high debt level of China's soft budget constraint sector has threatened the security of the financial system, and the deleveraging of the state-owned enterprise sector has become an effective means for mitigating financial risks.

From the theoretical perspective, the leverage ratio originates from the structural ratio of enterprise debt to equity, which can measure the degree of enterprise debt management. Enterprises usually aim to maximize the return of equity capital (Kraus and Litzberger, 1973; Jensen and Meckling, 1976), comprehensively considering their own profitability, scale, proportion of tangible assets, tax shielding effect and other factors to determine their "optimal" leverage ratio (Frank and Goyal, 2003; Chivakul and Lam, 2015). However, as far as the main structure of China's enterprise leverage is concerned, while the leverage ratio of state-owned enterprises continues to rise, the asset-liability ratio of private enterprises has continued to decline and it fell to a historical low of 51.6% in December 2017, which means that the two data trends have diverged. There are two main reasons behind this. First, the soft budget constraint provides state-owned enterprises with implicit government guarantees (Kornai, 1980; Jin Penghui, 2017; Wu Jun, 2018). During periods of economic prosperity, the return on capital is relatively high, and companies can continue to increase the scale of assets and liabilities through bank loans to expand the difference between capital returns and debt interest. However, in the context of increasing economic

downward pressure, the rate of return on capital has gradually decreased, and the difference between the capital returns and debt interest has also shrunk, but the policy burden behind the implicit guarantee of the government has made it difficult for the capital structure adjustment of state-owned enterprises (Lin Yifu, 2004 ; Gong Qiang, 2008), which led to the gradual exposure of its debt risk. The second is the macro background and policy environment. In response to the 2008 international financial crisis, China implemented a "four trillion" economic stimulus plan, created an expansionary fiscal policy and a loose monetary policy environment, and strengthened the state-owned enterprises' motivation for active liability. China's financial system dominated by banks has a lower risk appetite (Cecchetti, 2015), which makes financial institutions tend to provide funds to state-owned enterprise sectors with more physical collateral, which in turn leads to a continuous increase in the leverage level of state-owned enterprise sectors (Yu Kun, 2014; Yang Xiaojing, 2017). It can be seen that the causes of the high leverage ratio of China's state-owned enterprises are closely related to the macro background and institutional system. Finding countermeasures along the causes has become the key to reducing its debt risk, and grasping the differences in the impact of this policy on different companies is an important prerequisite for achieving policy goals (Yu Wei, 2012). Based on this, the following will analyze this problem.

II. THEORETICAL FRAMEWORK ANALYSIS

The "stable" deleveraging of state-owned enterprises is inseparable from appropriate economic policies. Based on the MM theorem, this paper analyzes the debt motivation and behavior of state-owned enterprises, and finds that debt financing pressure shocks are reasonable for the deleveraging of state-owned enterprises, and based on the internal level of the region, this paper discusses the impact mechanism of debt financing pressure shock on the internal relationship between the deleveraging of state-owned enterprises and regional financial risks from a micro perspective and a sector perspective, and further measures the impact of its impact mechanism on local risks by measuring financial risks across the country.

A. *The impact of the state-owned enterprise sector's deleveraging on financial risks under the impact of regional interior debt financing pressures*

The leverage ratio reflects the ratio of enterprise equity to debt, which depends on the financing decision of the company, and the famous MM theorem is the theoretical cornerstone of this problem. The MM theorem shows that without considering taxation and bankruptcy costs, complete information and loan interest rates as risk-free interest rates, enterprise

¹ Data sources: BIS, CEIC, Wind information databases, etc. Unless otherwise specified, the data in this paper comes from BIS, CEIC, Wind information databases, etc.

financing structure has nothing to do with financing costs and company value (Rose, 1959). However, Jensen (1976) and other scholars have proposed the MM theorem with enterprise tax (trade-off theory) by relaxing various assumptions beyond the complete information of the MM theorem, that is, because the company will fall into financial difficulties or even bankruptcy due to debt repayment difficulties, when the company makes financing decisions, it will weigh the debt tax reduction benefits and financial distress costs. Undoubtedly, state-owned enterprises still have the problem of government invisible guarantees, which not only reduces the possibility of financial difficulties and bankruptcy of state-owned enterprises, but also enhances the motivation for active liability of state-owned enterprises, which in turn is manifested by the increasing level of leverage in the state-owned enterprise sector in the region (Chen Deqiu, 2013), which is then used to increase the level of local financial risk. This shows that a reasonable deleveraging strategy is to apply appropriate debt financing pressure, increase the difficulty of integrating state-owned enterprises into debt funds, fundamentally weaken the motivation of state-owned enterprises for debt, change the financing structure of state-owned enterprises, adjust the level of leverage in the enterprise sector, and provide assistance for mitigating regional financial risks.

1) *Micro-level debt financing pressure's impact on the deleveraging of state-owned enterprises:* From a micro perspective, the realization of deleveraging of state-owned enterprises depends on changes in the financing structure of state-owned enterprises. This structural adjustment is not only related to its balance sheet status, but also closely related to government policies. With the rise of China's macro leverage level, high leverage has become the overall root of macro-financial vulnerabilities. Excessive responsibility of soft-constrained entities is one of the important reasons for pushing up the level of leverage. Reasonably exerting debt financing pressure and guiding state-owned enterprises to actively deleverage is the key to mitigating China's financial risks. Debt financing pressure as an exogenous shock tightens the debt financing constraints faced by state-owned enterprises, restricts the financing options of enterprises, and thus affects the dynamic adjustment of state-owned enterprises' capital structure. However, in the face of the same impact, due to the different elasticity of demand² for debt financing of state-owned enterprises, there is also a difference between the "active" and

"passive" effects in the adjustment of their financing structure. Among them, the "active" effect is mainly reflected in the state-owned enterprises with higher capital returns. These types of state-owned enterprises have a larger choice of financing methods and a higher elasticity of external financing needs, which can more fully weigh the benefits and costs of various financing methods and are more sensitive to debt financing costs. Under the impact of debt financing pressure, the higher the cost of debt financing, the more motivated companies are to reduce the debt financing ratio, improve the balance sheet, and reduce the level of leverage. The "passive" effect mainly occurs in state-owned enterprises with low or even negative returns on capital. The external financing needs of such enterprises are strong, but the choice of financing methods is limited, which makes them have rigidity for debt financing needs, which is reflected in the fact that the financing capabilities of enterprises are severely constrained by credit policies. When it is under the pressure of debt financing, due to the urgent need for funds, it will inevitably cause the company to be forced to sell assets, and the sale of a large amount of assets may cause "disposal risk" and give rise to asset prices to fall, and then a phenomenon of "increasing leverage along with deleveraging" may appear.

2) *The impact of state-owned enterprise sector's deleveraging on financial risks under the impact of sector-level debt financing pressure:* The above analyzes the "active" effect and "passive" effect of the micro-individuals in the state-owned enterprise sector; further from the perspective of the sector in the region, the adjustment of the capital structure of the state-owned enterprise sector mainly depends on the combined effect of the "active" and "passive" effects within the sector. When this comprehensive effect is manifested as an "active" effect, it means that the level of debt financing needs of the regional state-owned enterprise sector is low (the DI is used to indicate the level of debt financing needs of the original regional state-owned enterprise sector, which will be affected by credit policies, and let $DI_0 < X$, X will be the critical value to measure the level of its demand), and the debt elasticity of debt financing is high (the e is used to represent the debt elasticity demand elasticity decision function, which is related to the original debt fund demand degree and satisfies the $\frac{\partial e(DI)}{\partial DI} < 0$, and set $e(DI_0) = e_0$, then $e_0 > e(X)$), so financing costs are more sensitive. And under the effect of debt financing pressure (that is, DI tends to decrease), it can "actively" increase the proportion of sector equity financing, gradually reduce the leverage level (L can be used to represent the function of the state-owned enterprise

² "Debt financing demand elasticity" refers to the sensitivity of debt financing demand to debt financing costs, and the sensitivity is also higher (lower) when the elasticity is higher (lower).

sector leverage level change. Under the pressure of debt financing, it is a function of the demand elasticity of debt financing, namely $L(e)$, and increase the stability of the local financial system. On the other hand, when this comprehensive effect is manifested as a "passive" effect, it means that the regional state-owned enterprise sector has a high degree of debt capital demand (ie $DI_1 > X$), the debt elasticity of debt financing is poor (ie $e(DI_1) < e(X)$), the financing capacity is more constrained by credit policies, and the pressure of debt financing will tighten the sector's financing constraints and cause the sector to sell a large amount of assets to meet its own rigid financing needs. As a result, asset prices fall, which in turn increases the level of sectoral leverage and increases local financial risk (PB is used to indicate the level of regional financial risk, which is affected by changes in the level of leverage in the state-owned enterprise sector, satisfying).

Therefore, based on the analysis of the impact of debt financing pressure and the state-owned enterprise sector's deleveraging on financial risk, it is found that there is a non-linear relationship between DI and PB, which is then pushed to the regional level. According to the differences in regional economic endowments, the following two propositions can be obtained:

- When the regional $DI < X$, the impact of debt financing pressure will tend to reduce the DI in the region. Combined with $\frac{\partial L(e)}{\partial DI} > 0$, the $\frac{\partial PB(L)}{\partial DI} > 0$ can be obtained, that is, the impact of debt financing pressure will tend to reduce the leverage level of the state-owned enterprise sector in the region, thereby mitigating local financial risks. It also shows that the comprehensive role in the region is reflected as an "active" effect.
- When the regional $DI > X$, the impact of debt financing pressure will tend to reduce the DI in the region, and combined with $\frac{\partial L(e)}{\partial DI} < 0$, the $\frac{\partial PB(L)}{\partial DI} < 0$ can be got. That is to say, the impact of debt financing pressure will tend to increase the leverage level of the state-owned enterprise sector in the region, which in turn will increase local financial risks, which means that the comprehensive role in the region will appear as a "passive" effect.

B. Main regional financial risk measurement indicators

Accurate measurement of regional financial risk levels is a prerequisite for analyzing the impact of state-owned enterprises' deleveraging in various regions on

their risks, and the construction of risk measurement indicators depends on the local economic structural framework. This paper is based on the four-sector economic structure constructed by the financial sector, government sector, corporate sector and residential sector, and comprehensively measures local risks by analyzing the risks of each sector.

1) *Economic structure analysis of regional financial risks*: In December 2002, the International Monetary Fund (IMF) constructed a macro-financial risk analysis framework based on four major economic sectors³ to more effectively supervise the financial systems of its member countries, thereby proposing a balance sheet approach (BSA) to prevent financial crisis. This paper adjusts part of the BSA macro-risk analysis framework in an innovative way in order to apply to the practice in various regions of China. The specific adjustments are as follows. On the one hand, it redefines the concept of each sector at the regional level⁴. On the other hand, the focus of regional risk lies on the internal solvency change of various sectors⁵.

2) *Construction of regional financial risk indicators*: According to Altunbas's(2017) expansion of the EDF model, combined with the actual situation of various sectors in China, a regional financial risk indicator is constructed. The risks are mainly reflected in the credit risk of the financial sector, government sector, corporate sector and residential sector. Therefore, the sector capital can be regarded as the underlying asset, the sector equity contains a call option, and the liability contains a put option (Merton, 1974). When the value of the sector's debt is greater than the value of capital, it will lead to a large number of defaults, which then will lead to a credit crisis. In order to accurately measure the risk level, this paper calculates the probability of incurring a credit crisis by calculating the default probability of each sector. The specific process is as follows:

It can assume that the capital value of each sector follows the process of geometric Brownian motion process:

$$dV_{it} = g V_{it} dt + \sigma_V V_{it} dw_t(1)$$

Among them, the capital value of i sector in year t is V_{it} , and dV_{it} represents the instantaneous change in

³ "Four major economic sectors" refers to the financial sector, government sector, corporate sector and residential sector.

⁴ The "financial sector" is redefined as a local financial institution, excluding branches of the central bank; the "government sector" is the local government; the "corporate sector" and the "residential sector" are the corresponding sectors in the region.

⁵ The "internal settlement problem" mainly manifests whether changes in the solvency of local sectors will cause a local credit crisis (Song Lingfeng et al., 2011).

capital value; g is the growth rate of capital value; dt represents a very small amount of time change; σ_V is the rate of change of capital value; dw_t is a standard geometric Brownian motion change, and $dw_t = \varepsilon\sqrt{dt}$ and $\varepsilon \approx N(0,1)$.

When the debt of the i sector reaches the T period ($T=t+1$), the value of the sector's debt is B_{iT} . If the value of the sector's capital is less than the value of the debt at this time, that is, $V_{iT} < B_{iT}$, it will cause a credit crisis. Therefore, if assuming that G is the option price, letting $G=G(x,t)$, and assuming that the variable x

After substituting formula (2) into (3), the following can be got:

$$\begin{aligned} dG &= \frac{\partial G}{\partial x}(adt + bdW_t) + \frac{\partial G}{\partial t}dt + \frac{1}{2}\frac{\partial^2 G}{\partial x^2}(adt + bdW_t)^2 + o(x,t) \\ &= \frac{\partial G}{\partial x}(adt + bdW_t) + \frac{\partial G}{\partial t}dt + \frac{1}{2}\frac{\partial^2 G}{\partial x^2}[a^2(dt)^2 + 2abdtW_t + b^2(dW_t)^2] + o(x,t) \end{aligned}$$

Since $dw_t = \varepsilon\sqrt{dt}$ and $\varepsilon \approx N(0,1)$, the following can be got:

$$\begin{aligned} dG &= \frac{\partial G}{\partial x}(adt + bdW_t) + \frac{\partial G}{\partial t}dt + \frac{1}{2}\frac{\partial^2 G}{\partial x^2}(bdW_t)^2 \quad (4) \\ &= \left(\frac{\partial G}{\partial x}a + \frac{\partial G}{\partial t}dt + \frac{1}{2}\frac{\partial^2 G}{\partial x^2}b^2\right)dt + bdW_t \end{aligned}$$

After defining $G=\ln V$, the following can be known:

$$\frac{\partial G}{\partial V} = \frac{1}{V}, \frac{\partial^2 G}{\partial V^2} = -\frac{1}{V^2} \quad (5)$$

$$\Delta \ln V_t = \ln V_t - \ln V_{t-1} = \ln \frac{V_t}{V_{t-1}} = \left(g - \frac{1}{2}\sigma_V^2\right)\Delta t + \sigma_V \Delta w_t$$

And so:

$$E[\ln V_t] = \ln V_{t-1} + \left(g - \frac{1}{2}\sigma_V^2\right)\Delta w_t \quad (6)$$

$$\text{Var}[\ln V_t] = \sigma_V^2 \Delta t \quad (7)$$

It can further assume that $t = n^6$, $t_0 = 1$ for extrapolation, and g and σ_V can be derived from equations (6) and (7):

$$g = \frac{1}{n-1} \sum_{t=1}^{n-1} \ln \frac{V_t}{V_{t-1}} + \frac{1}{2}\sigma_V^2$$

Since the asset value follows a log-normal distribution, the default distance and default probability of the i sector in period T are:

follows the Ito process, then the following can be obtained according to the Ito theorem:

$$dx = a(x,t)dt + b(x,t)dw_t \quad (2)$$

Among them, dw_t follows Wiener process, and a and b are functions of x and t . The variable x has a drift rate of a and a variance rate of b^2 .

After differentiating G , the following can be got:

$$dG = \frac{\partial G}{\partial x}dx + \frac{\partial G}{\partial t}dt + \frac{1}{2}\frac{\partial^2 G}{\partial x^2}dx^2 + o(x,t) \quad (3)$$

From equations (4) and (5):

$$dG = \left(g - \frac{1}{2}\sigma_V^2\right)dt + \sigma_V \Delta w_t$$

Simultaneously:

$$\Delta G = \Delta \ln V = \left(g - \frac{1}{2}\sigma_V^2\right)\Delta t + \sigma_V \Delta w_t$$

If the t -year sector capital value is selected to measure the probability of default in year T , $T = t + 1$, then:

$$DD_i = \frac{\ln \frac{V_{it}}{B_{it}} \left(g - \frac{1}{2}\sigma_{iV}^2\right)\Delta t}{\sigma_{iV} \sqrt{\Delta T}}$$

$$P_i = N(-DD_i) = N\left(-\frac{\ln \frac{V_{it}}{B_{it}} \left(g - \frac{1}{2}\sigma_{iV}^2\right)\Delta t}{\sigma_{iV} \sqrt{\Delta T}}\right)$$

Among them, the $\Delta T = T - t = 1$, and then based on the assumption that the capital value of each sector follows the geometric Brownian motion process, the $PB = 1 - \prod_{i=1}^4 (1 - P_i)$ based on the comprehensive default rate of the four sectors can be got, and the PB can be used to measure regional financial risk.

III. CONCLUSION AND ENLIGHTENMENT

A. Conclusion

This paper attempts to reveal whether the deleveraging of state-owned enterprises in various regions in China is "active" or "passive" from the

⁶ In view of the completeness and availability of relevant data, $n=4$ is used in the actual calculation.

perspective of regional financial risks, and provides a basis for reducing the level of leverage of state-owned enterprises. The theoretical research is based on the MM theorem. This paper analyzes the debt motivation and behavior of state-owned enterprises, and finds that the reasonable application of debt financing pressure is the key to achieving stable deleveraging of state-owned enterprises. Further focusing on the internal level of the region, this paper discusses the internal mechanism of state-owned enterprises' deleveraging under the impact of debt financing pressure from a micro perspective and a sectoral perspective. The results show that there are two types of effects: "active" and "passive". Micro-level analysis shows that in the face of impact, enterprises with high elasticity of debt financing demand will actively reduce the proportion of debt financing, improve their own capital structure, and reduce the level of leverage, that is, there is an "active" effect; enterprises with low elasticity of debt financing demand will sell assets to meet their own rigid financing needs, which in turn will lead to a fall in asset prices, deteriorate their own capital structure, and increase the level of leverage, that is, there is a "passive" effect. Analysis at the sector level shows that the impact of debt leverage by state-owned enterprises on regional financial risks under the impact of debt financing pressure is closely related to the elasticity of debt financing demand. In other words, the state-owned enterprise sector with high elasticity of debt financing demand will be dominated by the "active" effect, and will then steadily increase the proportion of the sector's equity assets, optimize the capital structure, gradually reduce the level of leverage, and increase the stability of the local financial system; the state-owned enterprise sector with low elasticity of debt financing demand will be dominated by the "passive" effect, resulting in a tightening of financing constraints for a large number of micro-subjects within the sector. Due to its own liquidity constraints, it will sell a large amount of assets, trigger asset price decline, exacerbate the imbalance of capital structure, and increase the level of sectoral leverage, leading to the expansion and spread of regional financial risks.

B. Enlightenment

Based on the above conclusions, this article makes the following suggestions:

1) *The deleveraging of state-owned enterprises needs to fully stimulate the "active" effect:* Specifically, for the regional state-owned enterprise sector with good elasticity of debt financing demand (ie, the ratio of sector debt increase to interest is less than 8.05), the government should reasonably exert pressure on debt financing to guide the sector to "actively" deleverage, reduce the level of sector debt, optimize the asset

structure of the state-owned enterprise sector, and enhance local financial stability.

2) *The deleveraging of state-owned enterprises should also avoid being dominated by "passive" effects:* In other words, for the regional state-owned enterprise sector with low elasticity of debt financing demand (ie: the ratio of sector debt increase to interest is greater than 8.05), the impact of debt financing pressure is not the best way to achieve deleveraging of the state-owned enterprise sector in the region. At this time, on the one hand, the government should clear out the zombie enterprise in a timely manner and firmly reduce the excess capacity to free up valuable market space, credit resources and various production factors. On the other hand, for state-owned enterprises that are profitable but whose debt burden is too heavy and their profits have been severely eroded, the government should actively fulfill the responsibilities of funders, improve corporate governance, and use capital injection, mergers and acquisitions to reduce the proportion of debt capital. At the same time, the government should also help these enterprises with preferential tax policies to reduce the tax burden of business operations, and then play the policy effect of fiscal and tax coordination to jointly stimulate the vitality of enterprises and resolve local risk points.

3) *Attention needs to be paid to the contagious effects of local risks so as to prevent and manage systemic risks in China:* Financial supervisory authorities should strictly control the "channel" of risk contagion among regions. Specifically, when a central financial institution sells a certain amount of assets in a large amount, it is appropriate to buy such assets, implement targeted reverse adjustments, block the spread of panic emotions, avoid large fluctuations in asset prices and prevent further spread of regional financial risks through breaking market expectations.

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