



# A Mathematical Statistics Analysis on Structural Deleveraging and Corporate Risk-Taking—Based on Data of China's Non-financial Enterprises

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## Abstract

Affected by deleveraging policies, bank loans and business credit vary widely among enterprises with distinctive characteristics. The fluctuating leverage ratio affects enterprises' investment behaviors, which in turn influences their risktaking. This paper takes 2012-2019 listed companies as research samples, establishes multiple linear regression model to analyze the impact of structural deleveraging of non-financial enterprises on corporate risk taking. The research results suggest that structural deleveraging of non-financial enterprises will significantly affect corporate risk-taking. Therefore, the government should continue to implement the "structural deleveraging" policy; Enterprises should strengthen debt transformation in order to reduce the level of corporate debt risk.

*Keywords-Deleveraging; Structural Deleveraging; Risk-taking*

## 1. INTRODUCTION

Since China implemented deleveraging policies in 2016, Chinese enterprises have responded positively to such state policies, actively adjusting their debt capital structures. On the other hand, the leverage ratio of China's non-financial enterprises and sectors increased rapidly in 2020, growing from 151.9% at the end of 2019 to 162.3% in 2020 and remaining at a high level. To ensure the steady development of China's macroscopic economy, it is essential to retain deleveraging achievements aside from resuming work and production. The rapid development of enterprises is undoubtedly indispensable from capital support. Now, debt financing has been an inevitable choice for modern enterprises. Affected by deleveraging policies, bank loans and business credit vary widely among enterprises with distinctive characteristics. The fluctuating leverage ratio affects enterprises' investment behaviors, which in turn influences their risktaking. How does the fluctuation in the leverage ratio affect an enterprise's investment behaviors and its risktaking? Is the impact severe? This paper analyzes the impacts of deleveraging on non-financial enterprises' risktaking from the perspective of heterogenous debts. Next, it explores the impacts of deleveraging bank loans and business credit on risk preferences. Hopefully, the paper's study findings will provide a basis for relevant governmental departments to

formulate structural deleveraging policies and help enterprises adjust their capital structures.

## 2. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

According to the Agency Theory, the difference between the revenue functions of creditors and shareholders result in contradictions: When selecting which project to invest in, creditors wish that the enterprise has stable investment returns to guarantee their investment safety, while shareholders value venture capital projects that may reduce the enterprise's overall values yet generate considerable profits once the project succeeds to maximize their interests. For this reason, creditors generally formulate clauses in the debt contract before providing capital to restrict an enterprise's behaviors, particularly its highly-risky investment behaviors. It thus results in the external governance effect.

Studies on debt heterogeneity hold that multiple economic relations, including claim-right relations, capital trusteeship, and financial consultation, can be found between commercial banks and enterprises. Therefore, commercial banks with long-term cooperative relations are relational creditors [1]. Banks' professional abilities and acute market insights are related to enterprises' attitudes and the degree of cooperation. If a bank grants a large loan to an enterprise, it will expect the

enterprise to obtain excess returns from innovative investment. In this way, cooperation and win-win with the enterprise will bring a long-term interest inflow to this bank [2]. As the deleveraging ratio of bank loans rises, the relationship between banks and enterprises will be attenuated. In this case, banks' supervisory roles become more apparent. Like other creditors, banks wish enterprises to avoid high-risk investments so that they can achieve stable capital and interests [3]. As a result, enterprises decrease high-risk behaviors, including innovation investment, which in turn lowers their risktaking levels. As deleveraging deepens, the cooperation between bank loans and enterprises becomes unimportant, weakening the motivation for banks' supervision. If external supervision is absent, enterprises will increase their inefficient investment behaviors and face higher risktaking. Therefore, the paper proposes the following hypothesis:

Hypothesis 1a: A U-shaped relationship exists between bank loan deleveraging and enterprises' risktaking.

Unlike bank loans, business credit stems from the product market and is a spontaneous debt emerging in transactions. Hence its formation is simple. Besides, the creditors of business credit are scattered and lack professional abilities, failing to provide an excitation or restraint effect. Therefore, business credit has a weak external governance effect on enterprises. On the other hand, business credit and bank loans are complementary and mutually-substitutive [4]. If an enterprise faces a capital shortage, it will actively seek financial support in the financial and product markets. For one thing, the Debt Heterogeneity Theory shows that Chinese enterprises firstly choose operating liabilities with low costs and risks [5]. By comparison, business credit reflects participants' evaluation of operating risks in the product market and signals to banks that an enterprise has low operating risks and reliable credit, which raises the efficiency of applying for bank loans [6]. For another, if banks shrink the size of credit loans, business credit may substitute bank loans and become an essential source of financing for enterprises [7]. Therefore, the fluctuations in business credit change an enterprise's external governance effect by influencing the size of bank loans. If non-financial enterprises conduct business credit leveraging, banks may consider that these enterprises have higher operating risks and thus reduce the loan scale. As the motivation for banks' supervision declines, enterprises participate in more inefficient investment behaviors and have higher risktaking. Despite this, enterprises have stable demands for capital. If the business credit deleveraging continues, enterprises need to seek more credit capital support from banks. Due to risk-based considerations, banks will raise the lending rate and require these enterprises to implement stricter debt contracts. In turn, banks' supervision of enterprises becomes more apparent, undermining enterprises'

motivation for inefficient investment and lowering their risktaking. Therefore, the paper proposes the following hypothesis:

Hypothesis 1b: An inverted U-shaped relationship exists between business credit deleveraging and enterprises' risktaking.

Low-profit enterprises are expected to have a small cash flow, which wins widespread concerns from creditors. If an enterprise has low profitability, its partner banks will be more willing to act as supervisors, give full play to their external governance roles, and restrict enterprises from selecting risks with high risks and returns. By doing so, banks stabilize enterprises' future cash flows to obtain adequate capital and interest revenues. If the bank loans to low-profit enterprises are deleveraged, it will restrict such enterprises' capital source. Correspondingly, such enterprises will be more cautious when selecting investment projects and have lower risktaking. If the business credit of low-profit enterprises is deleveraged, it will signal to the market: These enterprises face high operating risks and are expected to have unsatisfactory performances in the future. As a result, creditors' capital support and supervision motivation decline, which intensifies restrictions on the capital source for these enterprises. Correspondingly, low-profit enterprises shrink their investment size and have lower risktaking. For these reasons, the paper proposes the following hypothesis:

Hypothesis 2: The higher bank loan deleveraging low-profit enterprises face, the lower risktaking is; the higher business credit deleveraging is, the lower risktaking is.

Regarding the formation mechanism, loose monetary policies and ownership discrimination have intensified banks' preferences for credit loans, resulted in certain enterprises' inefficient investment behaviors, and led to excess capacities [8]. In turn, the excess capacity undermines banks' efficiency in allocating credit loans, making it easier for loans to flow to enterprises with excess capacities. Therefore, enterprises with excess capacities consider banks as cooperative partners rather than supervisors because they are inclined to provide financial support for expansion activities. However, the Chinese government has launched a series of credit loan policies in recent years, aiming to prevent enterprises with excess capacity from increasing their backward capacities. If banks deleverage their loans to enterprises with excess capacities and lower the loan leverage ratio, these enterprises will have inadequate capital for inefficient investment behaviors and thus have lower risktaking. Hence banks appear to be more like cooperators rather than supervisors to banks. If the business credit of enterprises with excess capacities is deleveraged, the proportion of business credit will drop. Correspondingly, these enterprises will reduce their investment expenses and have lower risktaking.

Hypothesis 3: The higher bank loan deleveraging exists in enterprises with excess capacities, the higher risktaking enterprises have; the higher credit loan deleveraging exists, the lower risktaking enterprises have.

### 3. MODEL CONSTRUCTION, VARIABLE DEFINITION, AND DATA SOURCE

#### 3.1 Model Building

This paper built models to test the impact of structural deleveraging on enterprises' risktaking. More details are listed as follows:

$$\text{risktaking}_t = \alpha_0 + \beta_1 \times \text{bankcle}_t + \beta_2 \times \text{bankcle}_t^2 + \beta_3 \times \text{assets}_t + \beta_4 \times \text{roa}_t + \beta_5 \times \text{taxshield}_t + \beta_6 \times \text{growth}_t + \beta_7 \times \text{morast}_t + \beta_8 \times \text{ohrate}_t + \beta_9 \times \text{age}_t + \beta_{10} \times \text{yeart} + \beta_{11} \times \text{industry}_t + \varepsilon \quad (1)$$

$$\text{risktaking}_t = \alpha_0 + \beta_1 \times \text{bankcle}_t + \beta_2 \times \text{assets}_t + \beta_3 \times \text{roa}_t + \beta_4 \times \text{taxshield}_t + \beta_5 \times \text{growth}_t + \beta_6 \times \text{morast}_t + \beta_7 \times \text{ohrate}_t + \beta_8 \times \text{age}_t + \beta_9 \times \text{yeart} + \beta_{10} \times \text{industry}_t + \varepsilon \quad (2)$$

$$\text{risktaking}_t = \alpha_0 + \beta_1 \times \text{creditlev}_t + \beta_2 \times \text{creditlev}_t^2 + \beta_3 \times \text{assets}_t + \beta_4 \times \text{roa}_t + \beta_5 \times \text{taxshield}_t + \beta_6 \times \text{growth}_t + \beta_7 \times \text{morast}_t + \beta_8 \times \text{ohrate}_t + \beta_9 \times \text{age}_t + \beta_{10} \times \text{yeart} + \beta_{11} \times \text{industry}_t + \varepsilon \quad (3)$$

$$\text{risktaking}_t = \alpha_0 + \beta_1 \times \text{creditlev}_t + \beta_2 \times \text{assets}_t + \beta_3 \times \text{roa}_t + \beta_4 \times \text{taxshield}_t + \beta_5 \times \text{growth}_t + \beta_6 \times \text{morast}_t + \beta_7 \times \text{ohrate}_t + \beta_8 \times \text{age}_t + \beta_9 \times \text{yeart} + \beta_{10} \times \text{industry}_t + \varepsilon \quad (4)$$

#### 3.2 Variable Definition

##### 3.2.1 Dependent Variables

Based on referring to the practices of John<sup>[9]</sup> and Yu Minggui<sup>[10]</sup>, the paper measures risktaking with the standard deviation of  $\left(\frac{\text{ebitda}}{\text{asset}}\right)$ . Its measurement formula is as follows:

$$\text{risktaking} = \sqrt{\frac{1}{T-1} \sum_{t=1}^T \left(E_{i,c,t} - \frac{1}{T} \sum_{t=1}^T E_{i,c,t}\right)^2} \quad T=3 \quad (5)$$

Firstly, calculate the EBITDA rate by dividing ebitdai, c, t with asseti, c, t. Secondly, calculate the adjusted corporate earnings (Ei, c, t) with the industrial average of EBITDA rate. Thirdly, calculate risk taking (risk taking) with the standard deviations of corporate earnings in three years.

##### 3.2.2 Independent Variables

To reflect the degree of structural deleveraging in non-financial enterprises, this paper measured the degree

of bank loan deleveraging with the decrease in the ratio of bank loans to assets. Its formulation is  $\text{bankcle}_t = \text{bankcle}_{t-1} - \text{bankcle}_t$ . Next, it measures the bank loan deleveraging degree of non-financial enterprises with the decrease in the ratio of business credit to assets:  $\text{creditlev}_t = \text{creditlev}_{t-1} - \text{creditlev}_t$ .

##### 3.2.3 Control Variables

The paper selected assets, roa, taxshield, growth, morast, ohrate, and age as control variables. Besides, it controlled virtual variables, including year and industry.

#### 3.3 Data Source

Considering the impact of the 2008 financial crisis on the capital market and the need to measure risktaking, this project selected A-share companies listed between 2012 and 2019 as research samples. Next, all samples underwent the following screening and processing: a. Excluded ST enterprises and financial enterprises; b. Excluded insolvency data and incomplete data; c. To measure the risks undertaken by enterprises, enterprises that have been listed for less than three years were excluded; d. To prevent abnormal values from affecting the regression results, the continuous variables underwent Winsorization on the 1% level. Eventually, the paper selected 3, 312 sample enterprises from listed enterprises in Shandong Province and obtained 18,139 pieces of valid data. All initial data were collected from CSMAR. Its screening and processing were conducted through Excel 2016.

Following the Industry Classification Standards 2012 of China Securities Regulatory Commission, this project classified collected enterprises whose ROA exceeded the industrial level (measured by the accounting year and profession) into high-profit enterprises and those below the level into low-profit enterprises. Next, it referred to the studies of Han Guogao (2012) and classified enterprises with the securities codes of B06, B07, B08, C31, C32, D44, and D45 into industries with excess capacities and industries without excess capacities.

## 4. ANALYSIS OF REGRESSION RESULTS

### 4.1 Descriptive Statistics

The maximum, minimum, and mean value of bankcle are respectively 0.6654, -0.8460, and 0.0297. The maximum, minimum, and mean value of creditlev are respectively 0.7557, -0.6950, and 0.0009. Thus it can be seen that the deleveraging degree of non-financial enterprises varies widely.

### 4.2 Correlation Test

The correlation coefficient between bankcle and risktaking is -0.0214, which is significant at the 5% level.



Industry	control	control	control	control	control	control
N	18138	18138	9120	9120	1289	1289
Adj R2	0.2181	0.2138	0.5007	0.5001	0.2128	0.2071
F	145.51	141.93	269.98	269.36	11.24	10.90

Note: (\*, \*\*, \*\*\* are significant at the level of 10%, 5%, and 1%, respectively)

## 5. CONCLUSIONS AND POLICY SUGGESTIONS

### 5.1 Research Conclusions

On the whole, there is a U-shaped relationship between non-financial enterprises' bank loan deleveraging and their risktaking. Conversely, there is an inverted U-shaped relationship between business credit deleveraging and enterprises' risktaking. The impacts of corporate features on non-financial enterprises' deleveraging are reflected as follows: The higher bank loan deleveraging is, the lower risktaking low-profitting enterprises have. The higher business credit deleveraging is, the lower risktaking is. For enterprises with an excess capacity, a higher bank loan deleverage means lower risktaking.

### 5.2 Policy Suggestions

#### 5.2.1 Governmental Suggestions

Firstly, governmental departments should continue to implement structural deleverage policies and guide enterprises to optimize their capital structures through debt-to-equity swaps, lower the debt burden, and reduce financial risks, so as to solve overall risks in the financial industry. Secondly, efforts should be taken to optimize the financial ecology, allocate financial resources according to the market mechanism, establish a sound financial order, tighten law enforcement in the financial sector, and continually optimize the financial ecology, and guarantee the healthy development of enterprises.

#### 5.2.2 Suggestions for Enterprises

Firstly, enterprises should be aware of their debt obligations. It is necessary to determine the priorities, intensity, and schedule of deleveraging according to the conditions, industrial characteristics, operating conditions, and development strategies of the financial market, so as to meet enterprises' short-term demands for capital and long-term demands for development. Secondly, enterprises should step up efforts to transfer debts, make full use of policies on "three elimination, one reduction, and one supplement", optimize their long-term capital allocation, reduce the financial leverage through bond issuance and debt restructuring, and lower their debt risks.

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