Option Incentives and Corporate Debt Default Risk

Haozhan Xu

Shanghai Jiao Tong University, Shanghai 200240, China *Corresponding author

Keywords: Option incentive, Default risk, Risk-taking, Principal-agent

Abstract: This article takes Chinese A-share listed companies from 2007 to 2019 as the research object, and examines the relationship between executive option incentives and corporate debt default risk. The study found that option incentives can reduce corporate debt default risk; further research verified that the main influence channels of option incentives are "agent effect" and "wealth effect", and these two effects are stronger in companies with larger-scale option incentives, higher agency costs, and higher welfare coefficients. This article enriches domestic research on option incentives new ideas for companies to control debt default risks.

1. Introduction

With the vigorous development of China's real economy and the continuous expansion of business operations and production scales, bond financing, as one of the main components of corporate funding sources, has been gradually adopted by more and more companies, and the scale of transactions in the domestic market is also increasing. However, while helping the company to operate, it also exposes the company to the risk of debt default. The increase in the risk of default will increase operating pressure at the enterprise level, reduce the company's investment in high-risk projects, weaken the company's long-term competitiveness. And at the market level, it will increase the degree of information asymmetry and intensify ethics, endanger the normal operation of the financial market, and even form a series of defaults along the industrial chain, causing market pessimism and endangering the normal operation of the entire market (Hongmei Xu, Chuntao Li, 2020). Because of its huge potential harm, both theoretical and practical circles pay close attention to it. Existing research mainly studies the influencing factors of corporate debt default risk from the perspectives of corporate management (Meng Li, Jin Wang, 2020), capital markets (Merton, 1974), government and policy systems (Hongmei Xu, Chuntao Li, 2020). However, few literatures focus on the relationship between executive option incentives and debt default risk.

Since 2006, option incentives have been officially implemented in the Chinese market. With the official introduction of the "Measures for the Management of Equity Incentives for Listed Companies" in 2016, the scope of application of option incentives in China has continued to deepen and has gradually become an important part of executive compensation incentives. In terms of research, a large number of domestic and foreign studies have divided options into incentive option incentives and welfare option incentives according to whether they have an incentive effect. This article attempts to make up for the loopholes in current research by exploring the relationship between executive option incentives and corporate debt default risk.

Specifically, this article uses the non-financial A-share listed companies from 2007 to 2019 as a sample to test the relationship between executive option incentives and corporate default risk through empirical methods, and finds that: (1) On average, granting executive option incentives can reduce the default risk of corporate debt; (2) The scale of option incentives is positively correlated with the reduction of corporate debt default risk; (3) The influence channels of option incentives on default risk include "agent effect" and "wealth effect". The welfare of options and the agency cost of the company are positively correlated with the reduction of corporate debt default risk;

2. Literature Review and Research Hypothesis

2.1 Influencing Factors of Corporate Default Risk

Based on the importance of corporate debt default risk for maintaining stable economic operations, domestic and foreign studies have mainly studied the influencing factors of corporate debt default risk from the perspectives of corporate management, capital markets, product markets and government and policy making. From the perspective of corporate management, Meng Li, Jin Wang (2020) based on the DIB Corporate Internal Control Index found that companies with higher internal control quality tend to have more standardized management and decision-making systems, stronger management and financial risk management capabilities, and correspondingly lower debt default risk. And with the improvement of corporate credit qualifications, the marginal impact of the improvement of internal control quality on corporate debt default risk tends to weaken; Dongjing Wang et al. (2009) used the Brownian motion model to find that the short-term debt ratio has a U-shaped relationship with the default probability, and has a positive correlation with the level of asset risk; Hsu et al. (2015) believed that innovation activities can increase investor recognition, increase corporate value and reduce the risk of corporate debt default when corporate innovation investment is below the threshold. When corporate innovation investment is above the threshold, the uncertainty of innovation investment may reduce the value of the enterprise and increase the risk of enterprise debt default. Zhifeng Ye and Yuming Hu (2009) studied the relationship between corporate earnings management and corporate debt default rates by comparing low-profit companies with their neighboring companies' debt default rates, and found corporations that manipulate cash flow have relatively high debt default rates. From the perspective of the capital market, Merton (1974), regarded corporate equity as a call option for corporate value, and found that corporate equity risk, option duration, asset and equity book value are factors affecting corporate default risk. Chaoyang Luo and Xuesong Li (2020) studied the impact of the financial cycle and total factor productivity on default risk from both micro and macro perspectives, and found that bonds have a higher probability of default at the peak of the financial cycle and low total factor productivity; Brogaard et al. (2017) further pointed out that high stock liquidity can also reduce the risk of default. From the perspective of government and policy systems, Lu Deng et al (2020) took industrial policy and monetary policy into consideration, and found that companies under a loose monetary policy environment and in industries without industrial policy support are more prone to debt default; Hongmei Xu and Chuntao Li (2020) extended the research on default risk to the field of labor economics and found that the enhancement of labor protection increased the probability of debt default.

2.2 Option Incentives and Corporate Risk-Taking

In today's corporate governance, there is a principal-agent problem. In order to reduce the inconsistency of interests between shareholders and management, executive options have become one of the important means of management incentives in recent years. The early traditional agency theory generally believed that stock options were a kind of call options, and executives would pay more attention to the value of options in the future, thereby increasing the company's risk-taking behavior. In this regard, Agrawal and Mandelker (1987) studied the relationship between executive option incentives and corporate investment and financing strategies and found that executive securities holdings are positively correlated with corporate variance and changes in financial leverage; In addition, Defusco et al. (1990) found that when the stock options were approved and announced, the variance of stock prices and stock returns would both increase, indicating that executive option incentives are related to corporate risk exposure and may have a positive correlation. However, behavioral agency theory holds a different view. It believes that no matter whether options are exercised, there is value, and executives will pay more attention to the current value of options, become more short-sighted, and adopt risk aversion measures, thereby reducing the level of enterprise risk exposure. In this regard, long before the behavioral agency theory was put forward, Lambert (1991) et al. proposed that the leverage effect brought by options may amplify the risk aversion behavior of executives and reduce the risk level of enterprises; After the behavioral agency

theory was put forward, Carpenter (2000) pointed out that those executives who cannot sell options or hedge option risks due to various reasons cannot benefit from them, so they will rely on their own preference for behaviors that increase subjective value, and considering that most executives are risk-averse, therefore, executive option incentives may have a negative correlation with the level of corporate risk-taking.

Since the domestic option incentive system started late compared to foreign countries, it wasn't adopted by a few companies until 2006, and its development is relatively incomplete. Therefore, there are fewer relevant studies, and the results vary greatly. As for the choice of company-specific risks, operational risk and investment risk are the major ones. For example, Yu Liu et al. (2012) found that the sensitivity of executive options to stock price changes showed multiple positive correlations with the company's operating and investment risks; Dong Wang et al. (2016) and Mei Wang (2019) respectively selected enterprise R&D expenditure and investment efficiency as the research variables of enterprise investment risk. Among them, Dong Wang et al. (2016) believe that option incentives will increase the investment risk of enterprises, while Mei Wang (2019) believes that option incentives will restrain enterprises' excessive investment and reduce investment risks. From the perspective of financial risk, most studies such as Qingsong Ruan et al. (2016) pay more attention to direct indicators such as asset-liability ratio and long-term debt level, respectively, believing that option incentives can increase and reduce financial risks. There haven't been any research on the relationship between executive option incentives and the company's specific debt default risk in China's domestic market yet.

From the perspective of research methods, some domestic studies divide stock option incentives into different types according to whether high performance requirements are imposed. For example, Lihe Tu et al. (2016) classified stock option incentives as incentives type and welfare type, and found that different types of stock option incentives have different effects on the company's risk-taking. It is generally believed that welfare option incentives are unlikely to attract executives to take risks, but there is currently no clear conclusion about whether incentive option incentives will increase or decrease company risk compared with welfare option incentives.

2.3 Research Hypothesis

This article expects executive option incentives to reduce the risk of corporate debt default. According to the existing literature, executive option incentives may affect corporate debt default risks through two channels, which are called "wealth effect" and "agent effect" in this article.



Fig.1 Exercise Price /Average Stock Price of Last Three Years

First of all, modern corporate finance theory generally believes that corporate executives face non-systematic risks that cannot be diversified because their human capital is completely invested in a specific company. Therefore, they tend to avoid risks in actual company operations, when the option incentive plan is implemented, it brought the risk leverage effect (Carpenter, 2000), that is, the

leverage effect contained in options makes option owners more susceptible to asset fluctuations, which will turn the company's stock price into the risk of the senior management's own wealth. Based on the views of Lihe Tu et al. (2017) that welfare option incentives are usually negatively related to company risks and the actual distribution of Chinese market data, that is, the exercise prices of most option incentives are close to or lower than the company's past three-year average stock price (Figure 2-3-1). This article assumes that most executives have a more optimistic estimate of the company's stock price at the time of the exercise, that is, they believed that the probability that the stock price is lower than the exercise price on the exercise date is low, so the price risk of the option itself is mainly reflected in the risk of the company's equity securities. And because under normal circumstances, the risk of equity securities is often higher than the individual's own wealth risk, the act of granting executive options incentives actually increases the non-dispersible and non-systematic risks of the executive's own wealth. Executives' perception of risks and the intensity of their responses are driven by the desire to protect their own interests (Fama, 1980). Therefore, when the risk exposure faced by executives increases, the possibility of their own interests to be damaged also increases. In order to protect their own interests, the degree of risk aversion adopted by them tends to increase accordingly, including reducing the company's financial risks from the perspective of capital structure and choosing more stable investment projects from the perspective of investment, thereby reducing the company's debt default risk. This article calls it the "wealth effect".

Secondly, according to the principal-agent principle, when the interests of the shareholders and the corporate management are inconsistent, the management may violate the content of the contract and seek benefits for itself without the principal's knowledge. While the granting of option incentives to executives can closely integrate the personal benefits of executives with their behavioral results, reduce the inconsistency of interests between shareholders and management (Jensen and Murphy, 1990), and allow executives to actively and rationally engage in activities that can increase shareholder benefits (Yan Yan, Liu Yi, 2016), and encourage executives to make and implement decisions that are conducive to the company's development based on the principle of maximizing the company's value, and to improve the company's long-term operating performance (Weihua Cu, 2016). It is also generally believed that companies with stable and excellent operating performance generally have a lower risk of debt default. In summary, executive option incentives may reduce corporate agency costs, improve corporate performance, and ultimately reduce corporate debt default risks. This article calls it the "agent effect". At the same time, under normal circumstances, for the same incentive measures and incentive intensity, managers of enterprises with more serious principal-agent problems tend to have lower marginal costs for reducing self-interested behaviors, and there is often more room for improvement. The option incentive measures of this type of enterprise should have a stronger agency effect, that is, more reduction of the enterprise's debt default risk

Based on the above content, this article proposes hypotheses H1 and H2:

Hypothesis H1: Companies that are implementing equity incentives for executives have a lower risk of debt default than companies that have not implemented them.

Hypothesis H2: Compared with companies with low agency costs, companies with high agency costs have a more obvious reduction in the risk of corporate debt default after implementing executive option incentives.

In addition, based on the above analysis, it can be inferred that when the proportion of option incentive shares in the total shares of the company increases, the correlation between the personal wealth of the company's executives and the company's stock prices increases, the "wealth effect" increases, and the management has stronger motivation for risk aversion; At the same time, the increase in the proportion of option incentives can further reduce the inconsistency of the interests of shareholders and management, enhance the "agent effect"; And ultimately lead to a decline in the probability of corporate debt default.

Based on this, this article proposes hypothesis H3:

Hypothesis H3: The ratio of executive option incentive shares to the company's total shares is negatively correlated with the corporate debt default risk.

Finally, according to agency theory and incentive theory, compared with benefit-based stock options, incentive stock options can give executives more incentives to improve their management capabilities, increase management efficiency, reduce agency costs, and optimize the company's overall operating conditions and therefore reducing the risk of a company's debt default and enhancing the "agent effect." However, the resulting increase in the exercise threshold increases the possibility that the company's stock price will be lower than the executive's exercise price on the exercise day, reduces the wealth loss of executives due to the decline in the company's value, increases the benefit executives gain from high-risk projects, and reduce the correlation between the executives' own wealth and the company's stock price, weakening the "wealth effect", thereby reducing the measures taken by executives to control the company's financial risks, and ultimately leading to higher risk of corporate bond default. Based on this, this article proposes hypothesis H4:

Hypothesis H4: An excessively high exercise threshold may inhibit the effect of option incentives in reducing the risk of corporate debt default.

3. Research Design

3.1 Research Sample

Because the option incentive system in the Chinese market has been implemented since 2006, this study uses non-financial A-share listed companies from 2007 to 2019 as the research sample. The data source is the CSMAR database. Samples are screened according to the following rules: (1) Excluding anomalous observations; (2) Eliminate observations with missing main variables; (3) For all variables with multiple different observation values in the same year, the latest observation value shall prevail. In the end, we got 19353 available observations.

3.2 Variable Design

3.2.1 Default Risk Variables

Drawing lessons from Merton (1974), this paper uses the default distance in the Merton DD model to measure the default risk of corporate debt. The calculation method is as follows:

$$DD_t = \frac{\ln\left(\frac{V_{A,t}}{D_t}\right) + \left(\mu - \frac{\sigma_A^2}{2}\right)T}{\sigma_A \sqrt{T}}$$

Among them, V_A represents the value of corporate assets, D_t represents the book value of corporate debt, μ represents the expected rate of return on corporate asset, σ_A represents the volatility of corporate asset value, and T is the maturity of the call option.

In order to obtain a more practical and better estimate of the default risk of corporate debt, this paper refers to the simplified default probability method of Brogaard etal. (2017) to further estimate the default distance put forward by Merton (1974). The calculation method is as follows:

The first step is to calculate the book value D of the corporate debt:

Among them, *ltdebt* represents the book value of the company's long-term debt, and *stdebt* represents the book value of the company's short-term debt.

The second step is to estimate the volatility σ_D of the price of corporate debt based on the volatility σ_E of the price of corporate equity assets:

$$\sigma_D = 0.05 + 0.25\sigma_E$$

Among them, 0.05 represents the structural volatility of corporate debt, and 0.25 represents the volatility related to the risk of default.

The third step is to calculate the volatility σ_V of the total value of the enterprise:

$$\sigma_V = \frac{E}{D+E}\sigma_E + \frac{D}{D+E}\sigma_D$$

Among them, E represents the value of corporate equity.

The fourth step is to calculate the simplified default distance *DD*:

$$DD = \frac{\ln\left(\frac{E+D}{D}\right) + \left(\mu - \frac{\sigma_V^2}{2}\right)T}{\sigma_V \sqrt{T}}$$

Among them, suppose μ is equal to the company's rate of return on the stock market in the previous year, and T is set to one year in accordance with the usual practice.

Finally, calculate the simplified default probability according to the simplified default distance *DD*, which is recorded as *EDF*. The larger the value of *EDF*, the greater the default probability of the company's bonds:

$$EDF = N(-DD)$$

3.2.2 Option Incentive Variables

Drawing lessons from Yinguo Liu (2018), this article uses the following three variables to measure option incentives. The first one is a dummy variable (option_e) to measure whether the company is implementing option incentives for its senior executives during the year: 1 is taken when the option incentive is officially implemented and within the validity period, and 0 is taken when it is not formally implemented or not within the validity period. The second is the welfare coefficient variable (option_s) that measures the degree of welfare of the equity incentive measures being implemented by the company in the year: defined as the ratio of the average stock price of the company in the previous three years to the exercise price. The higher the welfare coefficient indicates that the option incentive is more biased towards welfare type. The third is the option scale (option_r) variable that measures the scale of option incentives implemented by the company during the year: it is defined as the number of options incentive shares divided by the company's total shares (%). When the company does not implement effective option incentives, this variable is set to 0.

3.2.3 Exercising Condition Variables

This article uses the company's stock annual rate of return (year_earning_ratio) to measure the difficulty of exercising option incentives. The annual stock return rate (year_earning_ratio) is defined as the rate of return of the company's stock in the stock market that year. When the stock's annual return rate is high, it means that the company's business performance in the current year is better, and the executive's expectations for the future will also increase, leading to a more optimistic attitude towards the company's stock price when the stock is exercised in the future.

3.2.4 Control Variables

With reference to the existing literature, this article selects factors that may affect the corporate bond default risk as control variables from the perspective of profitability, debt structure, solvency, operating capacity, and governance structure. From the perspective of profitability, select the return on net assets (roe), operating profit rate (opratio), and return on total assets (roa) variables; From the perspective of liability structure, select the equity multiplier (em) variable; From the perspective of solvency, select the cash ratio (cash), current ratio (cr), and quick ratio (qr) variables; From the perspective of operating capability, select variables such as accounts receivable turnover rate (rtr), total asset turnover rate (tatr), and investment growth rate (igr); From the perspective of governance structure, select the enterprise scale (lnasset) and property rights (right) variables. In addition, this article also controls time (year) and industry factors (code). For the specific description of the variables, see Table 1.

Variable	Variable name	Variable symbol	Variable definitions
category			
Explained	Simplified probability	EDF	Simplified estimation of Merton DD model
variable	of default		
Explanatory	Option	option_e	1 is taken if option incentives are being
variables	implementation		implemented, otherwise 0
	Welfare coefficient	option_s	The ratio of the company's stock price to the

Table 1 Variable Definition

			exercise price in the last three years (%)	
	Option scale	option_r	Option incentive shares/number of all company	
			shares (%)	
Exercise	Annual return on	year_earning_ratio	The rate of return of the company's stock in the	
condition	stocks		stock market that year	
variable				
Control variable	Return on equity	roe	(Net profit attributable to owners of the parent	
			company)/(Total equity attributable to owners of	
			the parent company) ending balance	
	Operating profit	opratio	Operating profit/operating income	
	margin			
	Return on total assets	roa	Net profit / ending balance of total assets.	
	Equity Multiplier	em	Total assets/total equity	
	Cash ratio	cash	Closing balance of cash and cash	
			equivalents/current liabilities	
	Current ratio	cr	Current assets/current liabilities	
	Quick ratio	qr	(Current assets-inventory) / current liabilities	
	Accounts Receivable rtr		Ending balance of operating income/accounts	
	Turnover Rate		receivable	
	Turnover rate of total	tatr	Ending balance of operating income/total assets	
	assets			
	Investment growth	igr	(Fixed assets at the end of the current period	
	rate		value-fixed assets at the beginning of the current	
			period value) / (Fixed assets at the beginning of	
			the current period value)	
	Enterprise size	lnasset	ln(Total assets)	
	Nature of property	right	If The final controller is state-owned property, it	
	rights		is 1, otherwise it is 0	
	years	year	1 for certain year, 0 for others	
	industry	code	1 for certain industry, 0 for others	

3.3 Empirical Method

This study examines the relationship between executive option incentives on corporate debt default risk and its influence channels, and studies the influence of the proportion of option incentive shares in the company's total shares on the above relationship.

To this end, the first step is to use the multi-dimensional panel fixed effects method to control the years (year) and industry (code) fixed effects, and estimate equation (1) according to the clustering robust standard error of industry (code), in order to directly estimated the impact of the implementation of option incentives on corporate debt default risk. Subsequently, using the same method to estimate equation (2) to further verified the impact of the proportion of option incentive shares is in the company's total shares on the risk of corporate debt default. In addition, continue to use this method to estimate equation (3) to verify the impact of the welfare nature of option incentives on corporate debt default risks.

$EDF_{i,t} = \beta_0 + \beta_1 Option_{e_{i,t}} + \beta_2 Controls_{i,t}$	(1)
$EDF_{i,t} = \beta_0 + \beta_1 Option_{r_{i,t}} + \beta_2 Controls_{i,t}$	(2)
$EDF_{i,t} = \beta_0 + \beta_1 Option_{s_{i,t}} + \beta_2 Controls_{i,t}$	(3)

Among them, the control variables include return on equity, operating profit rate, return on total assets, equity multiplier, cash ratio, current ratio, quick ratio, accounts receivable turnover rate, total asset turnover rate, investment growth rate, enterprise size, property rights.

The second step is to verify the influence of option incentives on the risk of corporate debt default through the "agent effect". According to the viewpoints of Yunhe Li and Zhan Li (2012), since asset turnover is an important indicator of enterprise operation and management efficiency, it can intuitively reflect the agency efficiency of the enterprise and provide a good substitute indicator of agency cost from the perspective of output, and it also has the characteristics of being continuous, stable, easy to obtain, and not easily affected by other factors. Therefore, this research divides all

samples into high agency costs group (Total asset turnover rate is lower than the average) and low agency cost group (total asset turnover rate is higher than the average), using a multi-dimensional panel fixed effect method, controlling the year (year) and industry (code) fixed effects, according to the industry (Code) clustering robust standard error, to estimate equation (4), exploring the difference in the role of option incentives in the environment of different principal-agent problem severity.

(4)

 $EDF_{i,t} = \beta_0 + \beta_1 Option_e_{i,t} + \beta_2 Controls_{i,t}$

The third step is to verify the impact of option incentives on corporate debt default risks through the "wealth effect". This study divides all samples into low exercise threshold group (annual return rate higher than average) and high exercise threshold group (annual return rate lower than average), using a multi-dimensional panel fixed effect method to control year (year) and industry (code) fixed effects, and according to the industry (code) clustering robust standard error estimate equation (5) to explore the differences between incentive option incentives and welfare option incentives in environments with different exercise thresholds.

 $EDF_{i,t} = \beta_0 + \beta_1 Option_{e_{i,t}} + \beta_2 Controls_{i,t}$ (5)

4. Empirical Test Results

4.1 Variable Descriptive Statistics

Table 2 reports the descriptive statistical results of the main variables in this article. In terms of default risk, the mean of the simplified probability of default is 0.5 and the standard deviation is 0.46, indicating that the distribution range of the default probabilities of enterprise is relatively large, and the default probabilities of different enterprises and different periods are quite different. In terms of option incentives, the table shows that the average value of option incentives is only 0.19, indicating that the number of companies using effective option incentives in the sample is relatively small; The average value of welfare coefficient is only 0.03, indicating that most companies have not implemented incentive-type option incentives in most of the time.

variable	mean	p50	max	min	sd	Ν
edf	0.500	0.510	1	0	0.460	19353
option e	0.190	0	1	0	0.390	19353
option s	172.951	139.053	1308.657	17.965	125.061	1808
option r	0.340	0	10	0	1.070	19353
year earni~o	0.140	-0.0200	15.21	-0.870	0.660	19353

 Table 2 Descriptive Statistics Of Main Variables

4.2 The Overall Impact Test of Option Incentives on the Corporate Debt Default Risk

Table 3 reports the regression of the comprehensive effect of executive option incentives on the corporate debt default risk. Among them, the independent variable in the first column is the option implementation (option_e), the independent variable in the second column is the option scale (option_r), and the variable in the third column is the welfare coefficient (option_s). The first column shows that the regression coefficient of option implementation is significantly negative at the significance level of 0.01, indicating that the implementation of executive option incentives in the current Chinese market can reduce the company's debt default risk, which is in line with the expectations of Hypothesis H1, but in terms of its economy significancy, in the case of implementing option incentives, the probability of default is reduced by 0.05 times the standard deviation. The second column shows that the regression coefficient of the option size is significantly negative at the significance level of 0.01, indicating that with the increase of the option size, the role of option incentives in reducing corporate debt risk continues to increase. It is in line with the expectations of Hypothesis H3, but the reduction effect is also small. The change in the size of an option with one standard deviation only brings about 0.01 times the standard deviation of the default probability, which is not quite economically significant. The third column shows that the regression coefficient of the welfare coefficient is significantly negative at the significance level of 0.01, indicating that from

the perspective of the full sample, the more welfare option incentives are, the more effective it is to reduce the risk of corporate debt default. From the perspective of economic significance, a change in the welfare coefficient of one standard deviation brings about 0.16 times a standard deviation change of the probability of default, indicating that its impact on the cost of debt default is obvious. This may be because the intensity of the "wealth effect" changes with the threshold of the right of exercise. The specific research on this aspect will be given later.

	edf	edf	edf
	(1)	(2)	(3)
option_e	-0.023*** (0.00)		
option_r		-0.004*** (0.00)	
option_s			-0.000*** (0.00)
Control variable	Control	Control	Control
R-sq	0.546	0.545	0.544
adj. R-sq	0.545	0.544	0.534
F	6375.692	7501.492	441.426
Ν	18479	18479	1788
Standard errors in parentheses			
* p<0.10, ** p<0.05, *** p<0.01			

Table 3 Comprehensive Effect Test

4.3 The "Agent Effect" Test of Option Incentives on Corporate Debt Default Risk

Table 4 reports the regression results of executive option incentives on corporate debt default risks under different agency costs groupings. The first column is the low agency cost group, and the second column is the high agency cost group. The independent variables in both columns are option implementation (option_e) variables. It can be seen that the regression coefficients of option implementation in the two columns are significantly negative at the significance level of 0.05, indicating that no matter in the case of high agency costs or low agency costs, executive option incentives can reduce the company's debt default costs. Which is in line with the expectation of hypothesis H1. In addition, the absolute value of the regression coefficient of the option implementation in the high agency cost group is greater than the absolute value of the regression coefficient of the option implementation in the low agency cost, indicating that in the environment of high agency cost, option incentives granted to executives can better improve the principal-agent problem, reduce the agency cost of enterprises and reduce the risk of corporate debt default, which is in line with the expectation of hypothesis H2, indicating that option incentives have significant "agent utility" for corporate debt default risks.

	Low agency cost (1)	High agency cost (2)	
option_e	-0.015**	-0.026***	
	(0.01)	(0.01)	
Control variable	Control	Control	
R-sq	0.587	0.509	
adj. R-sq	0.585	0.507	
F	5869.183	540.503	
Ν	9191	9288	
Standard errors in parentheses			
* p<0.10, ** p<0.05, *** p<0.01			

Table 4 Agency Effect Test

^{4.4} The "Wealth Effect" Test of Option Incentives on Corporate Debt Default Risk

Table 4 reports the regression results of executive option incentives on corporate debt default risks under different exercise thresholds. The first column is the low exercise threshold group, and the second column is the high exercise threshold group. The independent variables in both columns are option implementation (option_e) variables. It can be seen that the regression coefficient of the option implementation in the first column is significantly negative at the significance level of 0.01, and its absolute value is greater than the regression coefficient of the composite effect in the first column of Table 5, indicating that under a low exercise threshold, the wealth effect is strengthened, and the extent to which option incentives reduce the risk of corporate debt default increases. In the second column, the regression coefficient for option implementation is not significant at the significance level of 0.1, and its absolute value is less than the absolute value at the low exercise threshold, indicating that the "wealth effect" is greatly reduced at the high exercise threshold, even partially offsets the effect of reducing default risk caused by the "agent effect", resulting in the insignificant comprehensive effect of option incentives on default risk, which is in line with the expectations of hypothesis H4, indicating that option incentives have significant "wealth effect" for corporate debt default risks and with the increase of exercise threshold, it weakens.

	Low exercise threshold (1)	High exercise threshold (2)	
option_e	-0.027*** (0.00)	-0.013 (0.01)	
Control variable	Control	Control	
R-sq	0.523	0.577	
adj. R-sq	0.520	0.576	
F	9571.884	623.007	
Ν	7561	10918	
Standard errors in parentheses			
* p<0.10, ** p<0.05, *** p<0.01			

Table 5 Wealth Effect Test

5. Conclusion

This article uses Chinese A-share listed companies from 2007 to 2019 as a sample to analyze the relationship between executive option incentives and corporate debt default risks. The study found that granting executive option incentives can reduce the risk of corporate debt default in the Chinese market. Further research also found that executive option incentives are mainly through reducing the "agent effect", that is, reducing the agency cost of the enterprise, increasing the efficiency of executive management, and the "wealth effect", that is, increasing the correlation between the personal wealth of executives and the value of the company, increasing the degree of risk aversion of executives, these two channels to affect the company's debt default risk. Specifically, the higher the proportion of option incentives in the company's total shares, the more obvious the effect of reducing default risk; The more serious the company's principal-agent problem, the more obvious the effect of reducing the risk of default; The more the granted option incentives are toward the nature of welfare, the more obvious the degree of default risk reduction is. The research results of this article show that in the current Chinese market, the implement of welfare-based executive option incentives is one of the feasible measures for companies to reduce default risks, but in the actual operation process, the supervisory authority should pay close attention to the setting of its exercise price. The reduction of the option incentive welfare coefficient caused by the excessively high exercise price may weaken the reduction effect of the default risk, and even increase the default risk.

References

[1] XU Hongmei, LI Chuntao. Labor Protection, Social Insurance Pressure and Corporate Default Risk: Evidence from the "Social Insurance Law" in China [J]. Journal of Financial Research, 2020(03):115-133.

[2] Li Meng and Wang Jin. Internal Control Quality and Enterprises' Debt Default Risk [J]. Studies of International Finance,2020(08):77-86.

[3] WANG Dong-jing, ZHANG Xiang-jian, ZHANG Jing-qing. Corporate debt maturity structure and default risk [J]. Journal of Management Sciences in China,2009,12(02):77-87+141.

[4] YE Zhi- feng, HU Yu- ming. Earnings Management, Creditor Protection and Debt Default Rates-- Evidence from Security Market in China[J]. Journal of ShanXi Finance and Economics University,2009,31(11):67-73.

[5] DENG Lu, LIU Huan, HOU Canran. Financial Asset Allocation and Default Risk: The Reservoir Effect versus the Profit - Seeking Effect [J]. Journal of Financial Research,2020(07):172-189.

[6] LUO Chao-yang, LI Xue-song. Financial Cycle, Total Factor Productivity, and Corporate Bond Default [J]. Economic Management,2020,42(02):5-22.

[7] LIU Yu, CHENG Dong-quan, GU Feng. An Empirical Study on the Relationship between Stock Options Compensation and Risk of Chinese A-share Listed Companies[J]. Journal of Shanghai Jiaotong University, 2012(9):1516-1521.

[8] Wang Dong, Wu Desheng.Equity Incentive and Risk Taking: Evidence from China Listed Companies [J].Nankai Business Review,2016(3):157-167.

[9] Wang Mei. Research on the Impact of Equity Incentives of Listed Companies on Investment Efficiency [D]. Northwest University,2019.

[10] Ruan Qingsong, Huang Ying, Wang Yao, Lv Dayong. The stock option incentive and risk management – Based on behavioral decision perspective [J]. Shanghai Management Science, 2016(1):67-71.

[11] Tu Lihe, Sun Shimin. Executive stock option incentives, market competition and risk-taking [J]. Securities Market Herald, 2017(4): 44-54,65.

[12] Tu Lihe, Sun Shimin, Chen Yixiu, Dai Xiling. Relationship between Stock Option Incentive and Executive' s Risk-taking: Regulatory Effect of Media Attention. Technology Economics, 2016(7): 112-122.

[13] TU Lihe, SUN Shimin, CHEN Yixiu. Stock Option Incentive, Executive Firing Pressure and Corporate Risk-taking [J]. Research on Economics and Management, 2017(10):125-135.

[14] SUN Gui-qin, MA Chao-qun, WANG Yu-jia. Effects of Different Stock Option Types on Managers' Risk-taking Behavior --Base on Panel Data of Chinese Listed Companies During 2006-2012 Period[J]. Research on Economics and Management, 2013(11):25-32.

[15] Yan Yan and Liu Yi. Comments on the Work of Oliver Hart and Bengt Holmström--Nobel Prize Winners in Economic Sciences in 2016 [J]. Management Review, 2016,28(10):3-10.