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Factors influencing the use of financial derivatives in Chinese listed companies

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Abstract

This paper uses A-share chemical companies from 2011 to 2019 to examine the probit model's ability to provide insight on why China's listed companies choose to use financial derivatives. The empirical results show that reducing the cost of financial distress, avoiding underinvestment and increasing firm size are positive determinants of listed companies' use of financial derivatives. However, the empirical results of this paper are also different from the results of international studies. The reduction of expected taxes, substitution factors and agency problems are not the determinants of listed companies' use of financial derivatives. Few listed Chinese companies use derivatives for hedging which may be the cause of the deviation problem. Further analysis shows that managers' interests are not the motivation for listed companies to use derivatives. Thus, it can be seen that the primary goal of Chinese listed companies using derivatives is to avoid hedging risks. This paper helps to predict the possibility that listed companies make hedging decisions depending on the relevant factors and provides policy guidance for the government to implement a modern development strategy for the derivatives market.

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1. Introduction

The multiple impacts of COVID-19 and trade protectionism are increasing market volatility, enterprises are exposed to the risk of fluctuations in raw materials, commodities, exchange rates and interest rates in market operations. Since the 1980s, more and more enterprises have begun to use financial derivatives for hedging to avoid business risks. As a result, the financial derivatives market has become an important part of the international financial market. One of the achievements of the financial industry is the development of derivatives which has contributed to the characteristics of the modern financial market (Park & Kim, 2015). Derivative transactions have provided more marketable capital, improved the international business environment, created new jobs and helped counter the decline in unemployment (Halilbegovic & Mekic, 2017). The International Swaps and Derivatives Association (ISDA) reported that 94% of the world's top 500 companies had financial derivatives trading activities.[1] According to the *Futures Industry Magazine*, the total number of futures and options traded on global exchanges reached a record 46.77 billion contracts in 2020, an increase of 35.6 percent from 2019. The top 10 agricultural derivatives contracts are all from China's futures

[1]Data from the International Swaps and Derivatives Association (ISDA) website. (https://www.isda.org/).

exchanges which are ranked seventh, ninth and twelfth in terms of trading volume.[2] According to the survey of relevant institutions[3], more than 1,000 listed companies in China use financial derivatives to reduce their exposure to risk.

However, the highly leveraged characteristics of financial derivatives can also lead to speculation in derivatives trading. Jeong-Koo and Lee (2013) distinguished hedging from speculation in listed companies. He believed that listed companies should pay more attention to the economic profits and risk control methods brought by derivatives trading, whether it was selective hedging or speculation and that failing to choose the direction of financial derivatives trading would result in economic loss. In recent years, there have been continuous news reports of listed companies using financial derivatives to cause losses. The huge financial loss related to financial derivatives inevitably makes people question their effectiveness. Whether listed companies should use financial derivatives to avoid risks has also given rise to discussion both nationally and internationally. This paper attempts to use a lot of financial derivative hedging theories and A-share chemical industries in China as research samples. Then it empirically analyzes what factors lead listed companies to use financial derivatives which play an important role in the correct use of financial derivatives by domestic listed companies. Meanwhile, this paper can provide experience for the government as it formulates the development strategies for the modern financial derivatives market.

2. Literature Review

In general, the motivation for listed companies financial derivatives for hedging in order to modify the assumptions of MM theory (Modigliani Miller Models)[4]. Under perfect capital markets, the use of financial derivatives has no impact on the value of the firm, stock returns and investment decisions since shareholders can effectively hedge risks at the private level (Bartram, 2019). The main conditions include: first, there is no information asymmetry in the market, second, there are no transaction fees and costs in capital markets, third, there is no corporate income tax, fourth, the company operates sustainably without the possibility of bankruptcy, fifth, investors have maximizing returns as an investment objective and can engage in various arbitrage activities.

Table 1. A review of hedging theory.

Theoretical hypothesis	Briefly describe and represent scholars
Reduce prospective tax revenue	Hedging can reduce the volatility of tax returns which can be obtained through Henson's inequality. Hedging can increase the value of enterprises facing convex tax functions.
Reduce financial distress	Hedging can increase the value of a company by reducing the cost of bankruptcy and financial distress.
Avoiding underinvestment	Lack of internal capital discourages firms from investing in projects with a positive net present value. Hedging can increase the value of a company by increasing the availability of internal funds.
Information asymmetry and agency conflict	The management of the company can obtain additional compensation from the risk position. Hedging is driven by the personal interest of the manager of the company, which derives from the manager's willingness to reduce personal risk or demonstrate management ability to the market. At the same time, the company's management can also get extra compensation from the risky position, thus increasing the company's value.
Alternative factors	Some of the company's decisions, such as issuing convertible bonds, preferred shares, investing in liquid assets and limiting dividend distributions, can replace or reduce the use of derivative hedging instruments.
company size	Smaller firms face greater information asymmetry and higher financing transaction costs, so they are more likely to hedge.
	Large firms are more likely to use derivatives to hedge their exposure than they are to have the resources and knowledge to do so.
	Larger companies have more people who are familiar with finance, so they are more likely to use derivatives to hedge their risks.

However, it is difficult to realize the presuppositions of the MM theory in reality. By modifying their assumption, many researchers analyze why businesses employ derivative financial instruments. Therefore, many theoretical hypotheses have been made about hedging with derivatives, as shown in Table 1.

[2]Data from the American Futures Industry Association (FIA) website. (https://www.fia.org/).
[3] Data from China Hedging Network. (https://www.d-union.net/)
[4] The MM theory was proposed by the American professors Modigliani and Miller in 1963.

2.1. Reduce Prospective Tax Revenue

Smith and Stulz (1985) first suggested reducing the expected tax hypothesis. They argue that if a firm's tax function is convex, the tax rate can force the firm to hedge earnings risk. Hedging can effectively reduce a company's expected tax burden while reducing the volatility of a company's pre-tax value. From the perspective of debt, the risk hedging can increase the company's debt capacity, change its capital structure and the tax shield effect of debt financing can increase the value of the company (Alam, Abbas, Zahid, Batool, & Khan, 2021). The company will lose the time value of the income tax refund because of the operating loss carry forward required by Chinese tax law. The relationship between the amount of income and the actual tax rate is convex. Therefore, the company will reduce the possibility of a loss through hedging, thus reducing the tax burden (Chang & McAleer, 2015). Based on the research of national and international scholars, the following research hypothesis is proposed in this paper:

H_1: The higher the company's effective tax rate, the more likely it is to use financial derivatives to avoid risks.

2.2. Financial Distress Cost

Financial distress is when a company is faced with an insufficient operating cash flow to cover its existing debts and is forced to take corrective action. The cost of financial distress and bankruptcy will directly affect the company's value (Seru & Sufi, 2021). Chikulaev (2020) was the first to explain that the cost of financial distress includes the cost of litigation, loss of profit and borrowing ability. The uses of financial derivatives to manage risks reduce the probability of financial distress or bankruptcy, thus, reducing the cost of financial distress and increasing the company's value. Abdulkadirov, Zasko, and Stepanov (2020) conducted an empirical analysis on the use of financial derivatives by American companies proposed that hedging risk is correlated with the extent to which a company can reduce the expected bankruptcy cost.

In addition, Echenim, Guiol, and Peltier (2020) believed that under the condition of a certain ratio of assets to liabilities, an enterprise should assume a certain interest service and the more the enterprise income fluctuates, the greater the probability that the enterprise will not be able to repay principal and interest, thus, facing financial distress. A large number of scholars have taken corporate leverage ratio as the proxy variable of financial distress cost, which implicitly assumes that a company with a higher leverage ratio is more likely to face financial distress. Therefore, the following hypotheses are proposed in this paper:

H_{2a}: Companies with higher debt to asset ratios are more likely to use financial derivatives to avoid risks.

H_{2b}: The higher the proportion of fixed assets, the more likely to use financial derivatives to avoid risks.

2.3. Avoiding Underinvestment

Hedging can reduce underinvestment by ensuring that firms have sufficient internal funds avoiding unnecessary investment spending or fluctuations in external financing. Due to management's potential unwillingness to engage in projects with a positive net present value during financial crisis, enterprise value may decline. The use of derivatives by firms to hedge can reduce the likelihood of bankruptcy, thus reducing the incentive for managers and shareholders to underinvest (Zuckerman, 2019). A study by Carter, Rogers, and Simkins (2006) empirically analyzed the data of aircraft fuel hedging in the aviation industry in the United States from 1992 to 2003 and they believed that the investment opportunities in the aviation industry were positively correlated with the cost of aviation fuel and that the higher the fuel cost, the lower the cash flow. Airlines may use derivatives to hedge their future exposure to raw materials due to fluctuations in oil prices.

Companies in the expansion stage will have more investment opportunities in incomplete market conditions. Due to the external financing cost and the maximization of shareholders' interests, the company's management will give up the project which may damage shareholders' interests, resulting in the problem of underinvestment. At this time, the company is inclined to reduce the fluctuation of future cash flow through hedging, reduce the risk and solve the problem of insufficient investment. This paper employs the ratio to assess the calibre of the company's expansion in accordance with the existing literature and combined with the actual national conditions. Therefore, the following research hypotheses are proposed:

H_3: The higher the Price Earnings Ratio, the more likely the company is to use financial derivatives to hedge.

2.4. Information Asymmetry Agency Problem

Agency problems refer to the conflict of interest between managers and shareholders of a company. Compensation and control over the company can motivate managers to act for the interests of shareholders, so managers generally hold a contract that is bound to the company's value. If managers' pay is a convex function of the firm's value and they have stock options, firms generally should not hedge risk. The more undiversified portfolios managers hold, the stronger the link between managers' risk appetite and their use of derivatives (Abdulkadirov et al., 2020). Suppose the compensation incentive makes the interests of managers and shareholders closer. In that case, managers will use derivative financial instruments to reduce frictional costs and avoid market risks to a greater extent, and the hedging is more conducive to increasing enterprise value. On the other hand managers uses derivative financial instruments to avoid personal compensation risk and hedging is more likely to reduce corporate value (Ameer, 2010). Therefore, the following hypotheses are proposed in this paper:

H_{4a}: The higher the proportion of managers in a company, the more likely it is to use financial derivatives to avoid risk.
H_{4b}: Companies with higher executive compensation are more likely to use derivatives to avoid risk.

2.5. Alternative Factors

The use of derivatives financial instruments for hedging can be replaced or reduced by some corporate financial policies, such as issuing convertible bonds, preferred shares, investing in liquid assets and limiting dividend distribution (Li & Chen, 2017). By issuing convertible bonds, enterprises can not only take advantage of the tax shield effect of debt but also control the agency conflict and alleviate the problem of insufficient investment, weakening the motivation for hedging. The issuance of preferred shares does not create tax shields but it can help business to avoid bankruptcy by not paying dividends in the event of financial difficulty. At the same time, companies can also reduce the probability of financial hardships by investing in more liquid assets and reducing dividend payments. Zhang (2020) believed that relatively few listed companies were issuing convertible bonds in China. He uses the quick ratio as a proxy for asset liquidity variables and empirical results prove that the quick ratio is positively correlated with companies' use of financial derivatives. The quick ratio can better reflect the cash flow of an enterprise in the short term. Therefore, the following hypothesis is proposed in this paper:
H_5: Companies with higher quick ratios are more likely to use financial derivatives to avoid risks.

2.6. The Company Size

A study by Mi and Xu (2020) investigated the relationship between company size and hedging. They believed that small companies were more likely to hedge because they faced greater information asymmetry and higher financing transaction costs. However, the negative relationship between company size and hedging is being opposed by many scholars. Geyer-Klingeberg, Hang, and Rathgeber (2019) believed that large companies are more likely to use derivatives to hedge risk exposure compared with sufficient resources and knowledge. Middelberg, Buys, and Styger (2012) used logistic regression analysis to investigate the relationship between enterprises' use of derivative and enterprise size and found that there is a positive relationship between enterprise size and enterprises' use of derivatives hedging. Larger companies have more distinctive variables that are positively correlated with corporate hedging, such as more growth opportunities and greater risk exposure. Through field investigation, Bartram (2019) found that small companies are relatively short on proficient employees in derivative financial instruments which will become an obstacle for enterprises to use derivative financial instruments. On the other hand, employees of large companies may have more talents and be familiar with finance. Therefore, they are more likely to use derivative financial instruments to hedge their risks. Therefore, the following hypothesis is proposed in this paper:
H_6: The larger the company, the more likely it is to use derivatives to avoid risk.

3. Research Methodology

3.1. Data Source

In China's current financial derivatives market, dozens of derivatives cover commodity futures of agricultural products, energy, chemicals, metals and other commodities as well as several financial futures. Many chemical enterprises use corresponding financial instruments for hedging. The chemical industry is a typical industry uses derivatives for hedging. Firstly, this paper selects A-share listed companies in the chemical industry from the industry classification standard of the China Securities Regulatory Commission as the research sample and conducts preliminary screening:

1) Delisted companies were excluded for data-matching purposes.
2) In order to find the effect of using financial derivatives in normally operating companies, the interference of financial risk with the research results is considered and the companies identified by ST[5] and ST*
3) are excluded.

In this paper, the collection of financial derivatives ranges from 2011 to 2019. The annual reports of 134 listed companies in the chemical industry were downloaded one by one from JUCHAO Information Net[6] and the use of financial derivatives was searched using Python keywords. The variables of other listed companies were obtained from the China Stock Market Accounting Research database[7] and 1204 observation samples were finally obtained. In the empirical test, STATA15.1 software was used. In order to eliminate the influence of extreme values, the continuous variables were treated with a 1% and 99% bilateral tail reduction.

3.2. Variable Definitions

The dependent variable in this paper is represented by a dummy variable. If the company uses derivative hedging this year, it is 1 otherwise, it is 0. As for the data on the use of financial derivatives by Chinese multinational corporations, national scholars generally use search keywords to obtain the data but the use of software is different. Ameer (2010) obtained data for his study by manually sorting out and searching the use

[5] Listed companies with ST means Special Treatment
[6] JUCHAO Information Net: http://www.cninfo.com.cn/new/index.
[7] China Stock Market Accounting Research: https://www.gtarsc.com/

of financial derivatives in the annual reports of sample companies. Furthermore, Wu, Yang, Yuan, Fu, and Tsai (2021) used Microsoft development tools to compile programs to search two groups of keywords. If one or more keywords can be screened out at the same time, the value is assigned to 1, otherwise it is 0. A recent study by Zhang (2020) was the first that searched keywords in R language and then manually checked the annual report.

This paper decided to use the keyword search method twice in order to ensure the authenticity of the data. The difference is that due to the effectiveness and simplicity of Python at present, we first used Python to search the keywords, including Futures, options, swaps, forwards, hedging and hedging contracts and then manually collate the annual report data for verification to ensure the authenticity of the data. Other variables are annual continuous variables which can be obtained by downloading, sorting and calculating from the database of China Stock Market Accounting Research. The code and calculation method for the variables are shown in Table 2.

Table 2. Variable code and measurement method.

Variable name	Code	Measurement method
Whether to use financial derivatives	USE	The dummy variable, if financial derivatives were used in the observation year has the value of 1, otherwise, take 0.
Effective income tax rate	TAX	Income tax rates/gross profits
Asset-liability ratio	DEBT	Total liabilities/total assets
Proportion of fixed assets	FIXED	Fixed assets/total assets
Quick ratio	QUI	(Current assets - inventory)/current liabilities
Company size	SIZE	Take the natural log of total assets
Price earnings ratio	PE	Year-end price/earnings per share
Executive shareholding ratio	HOLD	(Executive shareholding/total number of shares outstanding) *100
Executive compensation	PAY	The natural logarithm of the top three executives' compensation is taken

Note: "*" represents multiplication, "/" stands for division, "-" stands for minus sign.

3.3. Model Design

In this paper, regression Equation 1 is used to estimate the influencing factors of the company's use of financial derivatives hedging:

$$USE_{i,t} = \partial + \beta_1 TAX_{i,t} + \beta_2 DEBT_{i,t} + \beta_3 FIXED_{i,t} + \beta_4 HOLD_{i,t} + \beta_5 PAY_{i,t} + \beta_6 QUI_{i,t} + \beta_7 SIZE_{i,t} + \beta_8 PE_{i,t} + \text{company} + \text{year} + \varepsilon \quad (1)$$

where, $USE_{i,t}$ as the dependent variable represents the hedging of financial derivatives used by listed companies, ∂ represents the intercept term, β represents the regression coefficient, company+year represents the individual effect of the firm and the time effect of the year, and ε represents the residual term.

The fixed effect model is selected through the Hausman test. Since the dependent variable is a dummy variable, we adopt the Probit (probabilistic regression) model. Under the heteroscedasticity hypothesis, the robust standard error is used to represent the unbiased estimate of the standard error.

Having collected a large body of literature over the years on the motivations for using financial derivatives to avoid risk, Arnold, Rathgeber, and Stöckl (2014) believed that there are two basic motivations for companies to use financial derivatives in hedging decisions: maximizing shareholder value and maximizing managers' private benefits. Therefore, in this study, the regression Equation 2 and 3 were constructed to group and compare the overall experimental results, just like Equation 1.

$$USE_{i,t} = \partial + \beta_1 TAX_{i,t} + \beta_2 DEBT_{i,t} + \beta_3 FIXED_{i,t} + \beta_4 QUI_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 PE_{i,t} + \beta_7 \sum \text{control}_{i,t} + \text{company} + \text{year} + \varepsilon \quad (2)$$

$$USE_{i,t} = \partial + \beta_1 HOLD_{i,t} + \beta_2 PAY_{i,t} + \beta_3 \text{control}_{i,t} + \text{company} + \text{year} + \varepsilon \quad (3)$$

4. Results

4.1. Descriptive Statistics

As shown in Table 3, using a financial derivatives virtual variable mean value is 0.238. Not many companies use financial derivatives in China's chemical industry, which shows that the use of financial derivatives for hedging by Chinese listed companies is still in its infancy. The overall level is relatively low. The average holding ratio of senior executives reached 7.16%, indicating that the proportion of senior executives holding shares in listed companies in China's chemical industry was not very high. The standard deviations of executive compensation, liquidity ratio, P/E ratio and executive ownership reached 0.303, 2.075, 207.56 and 13.31, respectively, indicating the internal characteristics of listed companies in China's chemical

industry are greatly different. As can be seen from the correlation analysis of all variables in Table 4, the correlation coefficient of all variables is less than 0.6 and there is no multicollinearity among the independent variables tested. Therefore, empirical regression analysis can be conducted for all variables.

Table 3. Descriptive statistics.

Variables	N	Mean	Sd	Min	Max
USE	1,204	0.238	0.426	0	1
TAX	1,204	0.160	0.191	-0.867	0.846
DEBT	1,204	0.397	0.204	0.0594	0.921
FIXED	1,204	0.314	0.165	0.0316	0.750
PAY	1,204	6.182	0.303	5.352	7.048
QUI	1,204	1.835	2.075	0.169	12.51
SIZE	1,204	9.531	0.480	8.479	10.75
HOLD	1,204	7.160	13.31	0	56.13
PE	1,204	80.838	207.56	3387.562	-201.71

Note: "USE" means Whether to use financial derivatives, "TAX" means Effective income tax rate, "DEBT" means Asset-liability ratio, "FIXED" means Proportion of fixed assets, "PAY" means Executive compensation, "QUI" means Quick ratio, "SIZE" means Company size, "HOLD" means Executive shareholding ratio, "PE" means Price Earnings Ratio.

Table 4. Correlation between variables.

Variables	TAX	DEBT	FIXED	PAY	QUI	SIZE	HOLD	PE
TAX	1							
DEBT	0.0410 (0.321)	1						
FIXED	0.0410 (0.294)	0.223*** (0.004)	1					
PAY	0.078*** (0.001)	0.0180 (0.622)	-0.064** (0.042)	1				
QUI	-0.0310 (0.185)	-0.457*** (0.000)	-0.355*** (0.000)	-0.153*** (0.000)	1			
SIZE	0.188*** (0.005)	0.442*** (0.003)	0.231*** (0.002)	0.479*** (0.000)	-0.383*** (0.008)	1		
HOLD	0.014 (0.349)	-0.261*** (0.002)	-0.281*** (0.006)	-0.024 (0.234)	0.311*** (0.006)	-0.222*** (0.001)	1	
PE	0.142 (0.521)	-0.091** (0.038)	-0.065*** (0.001)	0.084 (0.657)	0.136*** (0.003)	-0.195*** (0.002)	-0.275 (0.392)	1

Note: ** means significant at 5% level, and *** means significant at 1% level. P-value is shown in parentheses. "USE" means Whether to use financial derivatives, "TAX" means Effective income tax rate, "DEBT" means Asset-liability ratio, "FIXED" means Proportion of fixed assets, "PAY" means Executive compensation, "QUI" means Quick ratio, "SIZE" means Company size, "HOLD" means Executive shareholding ratio, "PE" means Price Earnings Ratio.

4.2. Analysis of Empirical Results

Probit regression was conducted through STATA15.1 and the regression results are shown in Table 5. It can be seen that the regression coefficient of the actual income tax rate is -0.162 which fails the significance test. Therefore, it is inconsistent with the tax theory and Hypothesis H_1 is invalid. The regression coefficient of asset-liability ratio DEBT is 0.792 and it is significant at the level of 5%. The regression coefficient of the proportion of fixed assets is 1.105 and it is significant at the level of 1%, so it is consistent with the financial distress cost hypothesis. Hypotheses H_{2A} and H_{2B} are valid. The regression coefficient of PE is -0.001 and it does not pass the significance test, so it is inconsistent with the hypothesis of avoiding underinvestment, and the H_3 hypothesis is not valid. The regression coefficients of executive compensation and executive shareholding ratio are -0.147 and 0.001, both of which fail to pass the significance test. Therefore, they are inconsistent with the hypothesis of information asymmetry and agency problems and hypotheses H_{4a} and H_{4b} are not valid. The regression coefficient of the quick ratio is 0.101and it is significant at the 1% level, so it is consistent with the substitution factor hypothesis and hypothesis H_5 is valid. The regression coefficient of the size of the company is 1.114, which is significant at the 1% level. Therefore, it is consistent with the hypothesis of the size of the company. The hypothesis H_6 is established. Through models (2) and (3) as you can see, the results of the regression of managers of private interests and China's chemical industry listed companies by using financial derivatives show that Chinese listed company management is more standard as compared with abroad executives' graft is relatively small that the question of agency is less prominent and that Chinese securities market supervision is strong.

Table 5. Empirical regression results.

Model	(1)	(2)	(3)
Variables	Use	Use	Use
TAX	-0.162	-0.152	
	(-0.75)	(-0.72)	
DEBT	0.792**	0.715**	
	(2.53)	(2.39)	
FIXED	1.105***	1.049***	
	(3.74)	(3.72)	
PAY	-0.147		1.252*
	(-0.88)		(1.65)
QUI	0.101***	0.094**	
	(2.63)	(2.33)	
SIZE	1.114***	1.054***	
	(8.86)	(9.97)	
HOLD	0.001		-0.006
	(0.13)		(0.06)
PE	-0.001	-0.006	
	(-0.016)	(-0.023)	
Constant	-9.636***	-10.041***	-12.923***
	(-8.74)	(-10.17)	(-10.98)
Observations	1,204	1204	1204
Company FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Note: * means significant at 10% level, ** means significant at 5% level, and *** means significant at 1% level. The significance test z-value is shown in parentheses. "USE" means Whether to use financial derivatives, "TAX" means Effective income tax rate, "DEBT" means Asset-liability ratio, "FIXED" means Proportion of fixed assets, "PAY" means Executive compensation, "QUI" means Quick ratio, "SIZE" means Company size, "HOLD" means Executive shareholding ratio, "PE" means Price Earnings Ratio.

Table 6. Comparison of robust recommendations.

Model 1: Regression results		Robust regression results	
Variables	Use	Variables	Use
TAX	-0.162	TAX	-0.237
	(-0.75)		(-0.09)
DEBT	0.792***	DEBT	0.934**
	(2.53)		(2.15)
FIXED	1.105***	FIXED	0.869***
	(3.74)		(2.64)
PAY	-0.147	PAY	-0.052
	(-0.88)		(-0.06)
QUI	0.101***	QUI	0.091***
	(2.63)		(3.16)
SIZE	1.114***	SIZE	1.658***
	(8.86)		(9.64)
HOLD	0.001	HOLD	0.013
	(0.13)		(0.06)
PE	-0.001	BM	-0.249
	(-0.02)		(-0.09)
Constant	-9.636***	Constant	-10.387***
	(-8.74)		(-9.35)
Observations	1,204	Observations	1204
Company FE	Yes	Company FE	Yes
Year FE	Yes	Year FE	Yes

Note: ** means significant at 5% level, and *** means significant at 1% level. The significance test z-value is shown in parentheses. "USE" means Whether to use financial derivatives, "TAX" means Effective income tax rate, "DEBT" means Asset-liability ratio, "FIXED" means Proportion of fixed assets, "PAY" means Executive compensation, "QUI" means Quick ratio, "SIZE" means Company size, "HOLD" means Executive shareholding ratio, "PE" means Price Earnings Ratio, "BM" means book-to-market ratio.

4.3. Robustness Test

This paper uses a method of robustness test by substitution of variables in order to test the robustness the empirical results using the book-to-market ratio of listed companies in China's A-share chemical industry to substitute the price-earnings ratio. The higher the book-to-market ratio is, the higher the company's growth will be and there will be more investment opportunities. Probit regression was carried out through Stata, as shown in Table 6. The regression results show that the regression coefficients for the proportion of fixed assets and company size are positive and significant at the level of 1%. The regression coefficient of the quick ratio and the asset-liability ratio is positive and significant at 5%, so the hypotheses H_{2A} and H_{2B}, H_3 and H_6 are valid. The coefficients of the effective income tax rate, executive compensation and book-to-market ratio are negative and do not pass the significance test. The regression coefficient of executive ownership is positive and does not pass the significance test, so hypotheses H_1, H_4 and H_5 are not valid. In conclusion, the empirical results are consistent with the findings obtained from the regression above, which verifies the empirical results' robustness.

5. Conclusion and Recommendations

This paper shows that reducing the cost of financial distress, avoiding underinvestment and firm size are the critical factors that induce listed firms to use financial derivatives. However, the empirical results of this paper are also different from the results of international studies: the reduction of expected tax, substitution factors and agency problems are not the decisive factors for listed companies to use financial derivatives and the problem of deviation may lie in them. First, the Chinese derivatives market emerged late, the market is imperfect and there are more derivatives in foreign countries. However, few Chinese companies engage in hedging and few Chinese listed companies use derivatives for hedging, second, Chinese enterprises that use hedging for risk management generally lack experience and cannot use financial derivatives skilfully, correctly and flexibly for hedging, which leads to differences in empirical research results at national and international levels.

Therefore, this paper puts forward the following policy recommendations: First, China should improve the derivatives market provide diversified derivatives and enrich the instrument library of enterprises so that enterprises have more and appropriate choices in risk control and solve the problem. Enterprises have appropriate motives but no channels for implementation. Second, it is necessary to improve the legal system and establish a sound information disclosure and supervision system to ensure the healthy and stable operation of the derivatives market based on this system. Finally, it is necessary to increase awareness and education, vigorously promote relevant talents and improve the investment level of enterprises as investment subjects in order to increase enterprises as investment subjects improve the ability of enterprises to manage derivatives.

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