Hedging FX Exposure Risk by Foreign Currency-denominated Debt and Derivatives: Evidence from Chinese Listed Companies

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Abstract: This empirical study explores the determinants of foreign currency debt financing for export-oriented companies, utilizing panel data from Chinese listed companies spanning the period 2015-2019. Across the entire sample, raising foreign currency debt appears to serve as a natural hedging mechanism; employing foreign exchange hedging instruments effectively mitigates foreign exchange risks for these firms. Subsequent analysis demonstrates that industry variations can introduce risk exposure in foreign currency debt, with hedging instruments and foreign debt acting effective complements as or substitutes for risk prevention. Additionally, corporate characteristics. debt term structure, and internationalization level significantly influence the use of foreign currency debt and exposure to foreign exchange risks.

Keywords: Corporate Foreign Currency Debt; Foreign Exchange Exposure; Natural Hedging; Financial Derivatives

1. Introduction

Since joining the World Trade Organization (WTO) in 2001, China has embraced a path of enhanced global integration, propelling rapid economic development and resulting in remarkable, swift economic growth. Chinese increasingly companies are establishing factories, holding foreign currency assets, engaging in international cooperation projects through overseas investment, and actively participating in the global economic landscape for mutually beneficial cooperation. As these companies expand their operations, there is a growing need to access international financing channels and bolster corporate cash flow.

At the national level, the Chinese government has implemented various measures to foster a high-level open economic system, catering to the financing requirements of emerging high-tech enterprises and facilitating overseas financing opportunities. With initiatives like the Belt and Road Initiative and the "going global" strategy, the government abolished the quota approval system for foreign debt issuance in 2015, instead installing a registration system. This shift has made issuing overseas bonds an increasingly convenient financing avenue for Chinese companies.

In March 2020, amidst the need to sustain economic development and support companies in resuming operations during the COVID-19 pandemic, the Central bank and the State Administration of Foreign Exchange jointly issued a document. This document aimed to encourage more firms to pursue overseas financing by raising the macro-prudential adjustment parameter from 1 to 1.25, thereby creating a favorable environment for international funding.



Figure 1. Changes in Foreign Currency Debt Incurred By Chinese Non-Financial Companies



Figure 2. Fluctuations in RMB Real Exchange Rate

At the firm level, recent data indicates a growing trend in overseas financing among companies. While Chinese government support plays a significant role, less attention has been given to the internal driving forces within these companies. Since 2015, there has been an increasing proportion of total foreign currency debt borrowed bv Chinese particularly non-financial enterprises, following the "811" exchange rate reform, which led to greater two-way fluctuations in the RMB exchange rate (Figure 1, Figure 2). Consequently, firms have become increasingly concerned about mitigating exchange rate risks when taking on foreign currency debt.

International experience suggests the existence of natural hedge mechanisms through foreign currency debt to counter exchange rate risks, and the use of financial derivatives to hedge exchange against such risks has been widely acknowledged. However, few studies have been conducted in China to test this evidence. and existing research has overlooked the relationship between firms' foreign exchange exposure and their foreign currency debt. The purpose of the present study is to empirically analyze and evaluate the effectiveness and performance of risk mitigation strategies employed by Chinese firms, with special focus on foreign currency debt and financial instruments. The goal is to identify effective methods of foreign exchange risk management for Chinese companies.

This article contributes to the literature in several key aspects. Firstly, it directly measures the foreign exchange risk exposure of companies. Following the approach used by Hoa and Robert, we employ the capital market method to estimate the foreign exchange risk and examine the relationship between foreign exchange risk and foreign currency debt [1]. This reveals the presence of natural hedging and allows us to comprehensively analyze the risk mitigation effects of foreign currency debt and financial instruments across different industries. Previous studies have tended to neglect direct indicators in measuring foreign exchange exposure, making this work a valuable addition to the current research on foreign currency debt at the firm level.

Further, this article highlights the underexplored role of financial derivatives as a hedging mechanism for managing foreign exchange risk among Chinese companies. Previous research has primarily centered on the use of financial hedging instruments, overlooking the potential natural hedging effect of foreign currency debt. Building upon the findings of Tanha et al. in emerging markets, where foreign debt is commonly employed as a readily available hedging instrument for companies engaged in transnational operations [2], our research provides robust support for the theory of natural foreign exchange risk hedging. Our investigation into the motives for companies to take on foreign currency debt holds significant importance, as we not only uncover the rationale for such borrowing decisions but also may assist companies in effectively managing risks at the firm level while mitigating potential systemic financial risks at the macro level.

This study further investigates the term structure and industry-specific characteristics of foreign currency debt to analyze the effects of foreign debt and foreign derivatives on foreign exchange (FX) risk exposure. Previous research on foreign currency debt at the firm level has mainly focused on the impact of using foreign currency debt on firm value, firm investment, and the relationship between foreign currency debt and innovation. However, little attention has been paid to understanding the motivations or influencing factors that drive companies to borrow foreign currency debt. While Guo Fei shed light on the reasons behind Chinese companies borrowing foreign currency debt, a more comprehensive analysis of industry-specific influences was lacking [3].

The remainder of this article is structured as follows. Section II presents the theoretical analysis and hypothesis development, Section III focuses on model construction and variable selection, and Section IV conducts empirical analysis to test the hypotheses. Section V discusses the robustness of our findings, and Section VI provides the conclusions drawn from our study and discusses their implications.

2. Theoretical Analysis and Research Hypothesis

2.1 Natural Hedging Mechanism of Foreign Debt

Natural hedging theory states that if a firm

possesses foreign currency assets or earns income in foreign currencies, servicing foreign currency debt will generate a reverse cash outflow that provides a natural hedge [4]. In the global economy, companies engage in international operations, resulting in foreign currency income and expenditures, foreign currency assets and liabilities, and assets and liabilities of overseas subsidiaries [5]. The currency composition of a firm's assets and often includes components liabilities denominated in foreign currencies, leading to a "currency mismatch" phenomenon. To manage this foreign exchange risk exposure, companies may employ natural currency hedging strategies [6,7].

An important advantage of natural hedging is that it reduces the need for foreign currency debt when the currency depreciates. For emerging countries, a 10% devaluation can reduce foreign currency debt by 3-6%. However, there is limited evidence for the effectiveness of foreign currency debt and financial instruments in hedging foreign exchange risk, making passive avoidance an unsuitable option [8]. Young Mok Choi and Kunsu Park found a significant positive correlation between foreign currency debt and dividend payouts of Korean companies, indicating that foreign currency debt has a notable hedging effect on foreign exchange risk [9]. Gautam Goswami et al. demonstrated that foreign currency debt has a positive impact on economic risk avoidance but no significant effect on other foreign exchange risks [10]. Kim et al. confirmed that foreign currency debt hedges foreign exchange risk more effectively in multinational companies than in export-oriented companies [11].

Managers often consider natural hedging as a risk management strategy to reduce the cost of management before risk resorting to operational and financial hedges [6]. Building upon this notion, Hoa Nguyen and Robert Faff utilized Australian data to highlight the effectiveness of foreign currency debt in hedging long-term economic risks, while observing varied outcomes for trading risks and accounting risks [1]. It is important to note that excessive foreign currency debt or a lack of revenue from overseas operations may actually increase a company's foreign exchange exposure. Hypothesis 1 was formulated based on these findings.

H1: Companies may be encouraged to raise foreign currency debt when there are natural hedging opportunities for foreign exchange exposure.

2.2 Use of Financial Hedging Derivatives

Capital flows in the international financial market create investment opportunities through the arbitrage mechanism between exchange rate and interest rate fluctuations. Companies leverage interest rate differentials to determine optimal investment timing and to borrow in the currency with the lowest cost [12], aiming to indirectly reduce financing costs by increasing the use of financial instruments for hedging.

management perspective, From а risk short-term foreign exchange transaction risks are managed through financial hedging while long-term economic risks are addressed through operational hedging. Foreign currency debt can mitigate risks by adjusting a company's asset structure via operational hedging. Foreign exchange derivatives are commonly used as financial hedging tools. Some scholars argue that foreign exchange derivatives and foreign currency debt are substitutes due to their similar functions. If they are indeed substitutes, then companies can effectively hedge risks by utilizing both approaches. Georgios Gatopoulos et al. constructed an optimal model to empirically analyze emerging countries and found that foreign currency debt can contribute to corporate risk hedging, but is not entirely separate from financial instrument hedging [13]. A combined approach based on both methods is necessary to effectively mitigate risks.

Elliott et al. analyzed a sample of 88 American companies from 1994 to 1997 to find that foreign debt can serve as a hedging tool and can substitute derivatives in reducing currency risks [14]. Clark and Judge identified differences in usage under different circumstances [15]. If two instruments have distinct functions, they may be complementary. Highly leveraged companies may not prefer foreign debt as a primary hedging tool, while smaller firms tend to rely on derivatives, possibly due to a lack of direct access to foreign capital markets. Aado found that both foreign currency debt and foreign exchange derivatives are employed to hedge foreign

exchange risks [16]. Foreign exchange derivatives are predominantly used for short-term exposure, whereas foreign currency debt is mainly for long-term exposure hedging. We argue that, on one hand, foreign currency debt may substitute foreign exchange derivatives as a hedging tool, while on the other hand, both instruments have а complementary relationship in different application scenarios. Hypothesis 2 was developed accordingly.

H2-1: The use of financial hedging instruments is complementary to the use of foreign currency debt.

H2-2: There is a substitution relationship between the use of financial hedging instruments and the use of foreign currency debt.

2.3 Financing Needs and International Lending Facilities

The theory of information asymmetry suggests that investors face varying costs when gathering information, creating different preferences for different companies. As capital demanders, companies encounter uncertain choices when seeking to borrow foreign currency. The Pecking Order Theory and Static Capital Structure Tradeoff Theory indicate the superiority of debt financing over equity financing. Additionally, in line with Ross's signal transmission theory, companies may choose debt financing based on positive expectations and confidence in repaying principal and interest in the future. Thus, when seeking external financing, companies prioritize debt financing over equity financing. Mohapatra et al. analyzed panel data from 2,512 non-financial listed companies in India from 1996 to 2016 to find that foreign currency debt alleviated financing constraints [17].Julian Caballero argued that the effectiveness of natural hedging and financial instrument hedging is limited due to the challenges faced by emerging countries in participating in international financial markets and the institutional constraints on financing [8].Both emerging and developed economies require legal and institutional improvements to enhance corporate credit and resilience to shocks, thereby mitigating uncertainties through debt markets [18].

Highly internationalized foreign-related companies have better access to relevant

financing information, reducing information asymmetry issues and facilitating international borrowing. Hypothesis 3 is proposed in accordance with the above.

H3: Financing needs and access to international lending facilities motivate companies to borrow foreign currency debt.

3. Model and Variables

Below, we first construct the foreign exchange risk exposure model to measure the foreign exchange risk of companies. We then construct the foreign currency debt model, which reveals the determinants of foreign currency debt borrowing by firms. The estimated exposure coefficient is used as an explanatory variable to further analyze the motivations to hedge foreign exchange risk through foreign currency debt.

3.1 Model of Foreign Exchange Exposure

With reference to Jorion's capital market approach, we estimate the exchange rate exposure coefficient of each sample firm as follows [19]:

$$R_{it} = \alpha_0 + \alpha_m R_{mt} + \alpha_i R_{xt} + \varepsilon_{it}$$
(1)

Where R_{it} represents the firm value measured by the individual stock return rate using a select sample of CSI 300 companies; R_{mt} is the market return rate based on the return rate of the CSI 300 index. R_{xt} denotes exchange rate volatility based on fluctuations in the real effective exchange rate (REER) released by BIS. α_i is a coefficient that directly measures the foreign exchange risk, as well as the potential influencing factor of the company's borrowing of foreign currency debt.

We use the measured α_i in Equation (1) as dependent variable and incorporate other control variables to further analyze the relationship between foreign exchange risk exposure level and companies' foreign debt, as shown in Equations (2) and (3).

$$\begin{aligned} |\alpha_{i}| &= \beta_{10} + \beta_{11}FD_{i} + \beta_{12}FCD_{i} + \\ \beta_{13}FSTS_{i} + \beta_{14}CON_{i} + \varepsilon_{1i} \end{aligned} (2) \\ |\alpha_{i}| &= \beta_{20} + \beta_{21}FDTD_{i} + \beta_{22}FCD_{i} + \\ \beta_{23}FSTS_{i} + \beta_{24}CON_{i} + \varepsilon_{2i} \end{aligned} (3)$$

3.2 Model of Determinants of Corporate Foreign Currency Debt

Drawing on previous studies by Guo Fei, Hoa

and Faff, we employ a panel data model to examine the factors influencing companies' decisions to borrow foreign currency debt [1,3]. In Equation (4), we impose a Logit regression to analyze the determinants of foreign debt issuance. The dependent variable FD is a binary variable which is valued at 1 if the company uses foreign currency debt and 0 otherwise. Equation (5) uses a Tobit parallel model to assess the magnitude of foreign currency debt borrowed by the company, represented by the variable FDTD. Both Equations (4) and (5) incorporate individual effects μ_i and time effects v_t .

 $FD_{it} = \gamma_{10} + \gamma_{11} |\alpha_i| + \gamma_{12} FCD_{it} + \gamma_{13} FSTS_{it} + \gamma_{14} FB + \gamma_{15} CE + \gamma_{17} BH + \rho_1 CON_{it} + u_{1i} + v_{1t} + \varepsilon_{1it}$ (4)

 $FDTD_{it} = \gamma_{20} + \gamma_{21} |\alpha_i| + \gamma_{22} FCD_{it} + \gamma_{23} FSTS_{it} + \gamma_{24} FB + \gamma_{25} CE + \gamma_{27} BH + \rho_2 CON_{2it} + u_{2i} + v_{2t} + \varepsilon_{2it}$ (5)

Based on the previous theoretical analysis and existing research, and taking into account the specific context of China, this study introduces four groups of variables to comprehensively examine the factors influencing the borrowing of foreign currency debt by Chinese listed companies in Table 1.

3.3 Variables

The foreign exchange risk hedging indicators we designed include the following:

(1) Foreign currency debt (FD/FDTD): When collecting data on foreign currency debt, we distinguish the debt term structures into long-term debt LFDTD and short-term debt SFDTD. LFDTD includes loans, bonds payable, long-term payables, and employee compensation payable over one year; SFDTD includes interest payable, accounts payable, employee compensation payable, taxes payable, dividends payable, and accounts received in advance within one year.

(2) Foreign exchange derivatives (FCD): This variable is represented as dummy variables, with a value of 1 indicating the company's use of derivatives and 0 otherwise. The term "foreign exchange derivatives" encompasses various instruments such as forwards, options, swaps, hedges, NDFS, and others.

We also designed the following foreign exchange risk indicators.

(1) Foreign exchange exposure α_i , which can be calculated according to Equation (1).

(2) Overseas income ratio (FSTS): This variable reflects the foreign exchange economic risk of enterprises, and is an indirect measure of firms' foreign exchange risk. It has been used in various studies on the foreign exchange risk management of non-financial firms.

(3) Foreign currency deposit ratio (FB): This indicator reflects the firms' foreign exchange accounting risk. To mitigate currency mismatches and protect its equity against currency risk, the company must assess the size of its overseas assets [3].

We also use the following company internationalization level indicators to reflect the international lending facility. The higher the level of internationalization, the higher the international lending facility.

(1) Converted difference in foreign currency statements (CE): As indicated by Guo Fei, this variable reflects whether overseas institutions are truly operating and measures the level of companies' international development [3].

(2) Whether a company has an overseas listing (BH): When a company is listed overseas, foreign investors can more conveniently obtain information about it, which is advantageous for foreign currency debt financing. Indicators of foreign income ratio (FSTS) and foreign currency deposit ratio (FB) are also used as estimating variables for the degree of internationalization [20].

Finally, we use the following company characteristic indicators as control variables.

(1) LEVER ratio: The financial leverage of firms affects business activities and value to a certain extent, along with an increase in financial risk.

(2) Asset structure (TANG): This variable reflects the asset liquidity of companies. A larger proportion of fixed assets generally decreases the asset liquidity of small firms, though this varies by industry.

(3) LIQUID: Companies with higher liquidity have more assets and use more hedging tools to manage foreign exchange risks. A company faces greater foreign exchange risk when its liquidity level is lower.

(4) Earnings per share (DY): The rate of return reflects the profitability and operating results of a company.

(5) Book-to-market ratio (BM): Zhang Zheng and Liu Li argued that BM reflects the degree of overvaluation of stock prices and investors' Journal of Statistics and Economics (ISSN: 3005-5733) Vol. 1 No. 2, 2024

optimism regarding the future value of the company. A higher BM indicates greater

Variables	Definition and description	Data source
FV exposure:		Data source
p	Individual firm stock raturn rate is expressed as firm value it is	Wind
Λ_{it}	$(P - P_{i})/P_{i}$	w ma
	calculated by $(t_1 + t_{1-1}) + t_{1-1}$	• 1
R_{mt}	Market return rate is expressed as CSI 300 index. it is calculated by $(P_{1}, P_{2}) \setminus (P_{2})$	wind
_	$(K_{mt} - K_{m0}) / K_{m0}$	
R_{xt}	Exchange rate volatility, the proxy variable is RMB real effective rate	BIS
	which is calculated by $(reer_t - reer_{t-1}) / reer_{t-1}$	
α_{i}	FX risk exposure is estimated by Equation (1).	calculated
Hedge specific:		
FD	Foreign Debt is a dummy variable that takes the value of 1 if a firm	wind
	decide to raise foreign currency debt, otherwise takes the value of 0.	
FDTD	This is the scale of borrowed foreign debt of firms that is represented	Wind
	as foreign debt/total debt	
FCD	This is a dummy indicator that takes the value of 1 if a firm uses	Wind
	foreign derivatives to guide FX risk exposure, otherwise takes the	
	value of 0.	
Risk specific:		
α_i	FX risk exposure is estimated by Equation (1).	Calculated
	Overseas income of a firm. This indicator denicts the economic	CSMAR
	exposure of firms that expressed as overseas income/gross income	COMMIC
FB	Ratio of overseas deposit. This indicator reflects the account risk	CSMAR
	exposure and is used to monitor firms' currency mismatch which is	Comme
	showed as foreign currency deposit/total currency asset	
Internationalization		
level:		
CE	Converted difference in foreign currency statements. This indicator is	CSMAR
-	used to investigate firms' international operations and international	
	lending level which is used as a dummy variable. If there are closing	
	balance, the value is taken as 1, otherwise the value is 0.	
BH	This is a dummy variable that takes the value of 1 if a firm is listed	CSMAR
	overseas, otherwise takes the value of 0.	
Firm specific:		
LEVER	Leverage ratio is expressed as total liabilities/ total asset of a firm. If	CSMAR
	the higher ratio is, the higher the debt.	
TANG	Asset structure. This indicator reflects the composition of the	CSMAR
	company's assets that is measured by net fix asset/total assets	
LIQUID	Liquid ratio is defined as current assets /current liabilities	CSMAR
DY	Earnings per share reflects a company's profitability and operating	CSMAR
	results, and measures the company's investment risk. It is defined as	
	Net profit/common share	
BM	Book-to-market ratio. This indicator is calculated by Shareholders'	CSMAR
	equity/company market value	
L		1

Table 1. Variables Definition

optimism.

4. Empirical Analysis and Results

4.1 Descriptive Statistics of Data

We utilized quarterly data from 2015-2019

sourced from Wind, CSMAR, and the BIS database for the purposes of this analysis. Table 2 displays descriptive statistics on the selected variables for firms listed in the Shanghai-Shenzhen 300 components. The total

number of observations ranges from 985 to 3,983. There are significant differences in the stock return rates among the sample companies. The average quarterly return rate is 6.1, which is higher than the average quarterly return rate of the CSI 300 index (0.015), indicating that the sample firms have higher and more volatile earnings performance. The α_i values, measured in the first-step regression, vary greatly among firms with a maximum value of 1.414 and a minimum value of 0.001. Nearly 80% of the sample companies have foreign currency debt; the number of companies that borrowed foreign

currency debt is significantly higher than the number that used foreign exchange derivatives. Only about 30% of companies actively employed foreign exchange derivatives to hedge foreign exchange risks. Nearly 30% of foreign currency debt is long-term, while the remaining 70% is short-term. On average, overseas sales account for more than 10% of total sales. Among the sample companies, over 70% have established overseas branches, with an average of more than four subsidiaries in foreign countries. Approximately 20% of sample companies have chosen to list shares overseas.

Observations	means	Std.	Minimum	Maximum
3938	6.104	26.160	-61.017	364.827
3959	0.015	0.119	-0.284	0.286
3959	0.000	0.020	-0.037	0.045
985	0.131	0.285	-0.508	1.414
983	0.791	0.406	0.000	1.000
984	0.085	0.134	0.000	0.961
985	0.059	0.107	0.000	0.961
985	0.335	0.472	0.000	1.000
985	0.133	0.200	0.000	1.000
985	4.025	5.577	0.000	43.000
985	0.169	0.218	0.000	0.964
985	0.497	0.190	0.031	0.917
985	0.219	0.182	0.001	0.876
985	1.862	1.724	0.146	19.463
985	1.094	1.982	-2.402	35.002
972	1.432	1.797	0.000	13.943
982	0.7597	0.4247	0.000	1.000
985	0.1929	0.3948	0.000	1.000
	Observations 3938 3959 3959 985 983 984 985 982 985	Observations means 3938 6.104 3959 0.015 3959 0.000 985 0.131 983 0.791 984 0.085 985 0.335 985 0.133 985 0.133 985 0.133 985 0.133 985 0.169 985 0.497 985 0.219 985 1.862 985 1.094 972 1.432 985 0.1929	ObservationsmeansStd.39386.10426.16039590.0150.11939590.0000.0209850.1310.2859830.7910.4069840.0850.1349850.0590.1079850.3350.4729850.1330.2009850.1690.2189850.4970.1909850.2190.1829851.8621.7249851.0941.9829721.4321.7979850.19290.3948	ObservationsmeansStd.Minimum39386.10426.160-61.01739590.0150.119-0.28439590.0000.020-0.0379850.1310.285-0.5089830.7910.4060.0009840.0850.1340.0009850.0590.1070.0009850.3350.4720.0009850.1330.2000.0009850.1330.2000.0009850.1690.2180.0009850.2190.1820.0019851.8621.7240.1469851.0941.982-2.4029721.4321.7970.0009850.19290.39480.000

 Table 2
 Descriptive Statistics of Factors Influencing Corporate Foreign Currency Debt

4.2 Measurement of Foreign Exchange Exposure

Table 3 shows the results of OLS estimation by Equations (2) and (3) to assess the foreign exchange risk exposure α_i of each company. Subsequently, we employed the Logit method in Equation (4) to estimate FD and the Tobit method in Equation (5) to estimate FDTD. The results pass the F test with statistical significance.

Equations (2) and (3), as shown in Table 3, reveal that FSTS significantly increases foreign exchange exposure, indicating that companies with higher overseas income are more susceptible to exchange rate fluctuations. Moreover, the use of foreign currency debt and foreign exchange derivatives hedges foreign exchange risk. The coefficient of FD is significant, indicating that borrowing foreign currency debt can effectively reduce the foreign exchange risk exposure. However, for FDTD, the scale of foreign currency debt has no significant effect on weakening foreign exchange exposure.

Additionally, a firm's foreign exchange exposure is influenced by the size of its fixed assets, return per share, and book-to-market value. Per the OLS regression, these variables significantly reduce the foreign exchange risk exposure of enterprises. A higher proportion of fixed assets, higher return per share, and larger book-to-market ratio are beneficial in mitigating foreign exchange risks.

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Variable	Dependent variable			
Group	Equation (2)	Equation (3)	Equation (4)	Equation (5)
	$ \alpha_i $	$ \alpha_i $	FD	FDTD
	OLS	OLS	Logit	Tobit
FD	-0.047**(-1.98)			
FDTD		-0.094(-1.06)		
Hedge specific:				
FCD	-0.050**(-2.48)	-0.053***(-2.62)	-0.0499***(2.88)	0.0172(1.52)
Risk specific:				
FB			0.1628***(3.95)	0.1622***(-2.62)
FSTS	0.263***(5.62)	0.267***(5.54)	0.1218(1.64)	0.1986***(5.98)
α_i			-0.04(-0.50)	-0.0169(-0.63)
Internationalization				
Level:				
CE			0.3138***(6.12)	0.0811***(5.96)
BH			0.0399(1.00)	0.0155(-0.82)
Control variable				
LEVER	0.0010(0.14)	0.0010(0.02)	0.1402(1.03)	0.1441***(3.12)
TANG	-0.352***(-7.72)	-0.347***(-7.61)	0.0250(0.22)	0.0056(0.14)
LIQUID	0.0070(-1.40)	0.0060(-1.26)	-0.0168(1.06)	0.0019(-0.44)
DY	-0.018***(4.92)	-0.018***(-4.64)	0.0011(0.09)	0.0054(-1.31)
BM	0.0005(-1.14)	-0.031***(-5.03)	0.0142*(1.68)	-0.0072**(-2.21)
Constant	0.300***(6.38)	0.273***(6.27)	$0.4242^{***}(4.40)$	-0.1118***(-3.38)
	R2:0.1200;	R2:0.1116;	R2:0.3130;	LR Chi2:207.61
	F:16.32	F:16.9	F:16.32	

Table 3 Determinants of Fir	m Foreign Curr	oney Doht And Ky	vchango Rato Fv	nneure
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		•/		

Note: ***, **, * are significant at the 1%, 5%, and 10% levels respectively, with t values in brackets.

4.3 Analysis of Influencing Factors of **Foreign Currency Debt**

This subsection reports and analyze different results of the distinct results obtained from Logit and Tobit estimations for FD and FDTD, as presented in Table 3 based on Equations (4) and (5).

(1) Hedging foreign exchange risk motivates companies to take on foreign debt

The scale of foreign currency deposits (FB) positively influences the use of foreign currency debt, as evidenced by the significant positive effects for both FD and FDTD as the dependent variable. This implies that firms are more likely to choose foreign currency debt when they have larger foreign currency deposits. Additionally, when FDTD is considered the dependent variable, FSTS has a significant positive effect. This indicates that companies with higher overseas incomes tend to utilize more foreign currency debt, aligning with the concept of natural hedging. Foreign currency deposits and overseas operating income also serve as indicators of companies'

internationalization level, supporting the findings of Zhao Feng et al. whereby internationalization motivates firms to hedge foreign exchange risks[20]. This finding supports H1.

(2) Financial hedging instruments facilitate the borrowing of foreign debt

The use of foreign exchange derivatives (FCD) has a significant positive effect on FD in Equation (4), while for FDTD, it is positive but not significant. This indicates that companies using foreign exchange derivatives also tend to use foreign currency debt. There is a complementary relationship between the two, although the scale of foreign currency debt has no relationship with the use of derivatives. These findings align with those of Guo Fei[3], and support H2-1. The use of financial hedging instruments affects the borrowing of foreign currency debt by enterprises, and the two have a significant complementary relationship.

(3)Financing demand and international lending facilities promote enterprises to borrow foreign debt

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CE has a significant positive effect on FD and FDTD; if a company has overseas operations, it is more inclined to borrow foreign currency debt. Both FB and FSTS appear to encourage the use of foreign currency debt, which reflects influence of companies' the internationalization level on foreign currency debt. The LEVER ratio of companies also benefits FDTD. Foreign investors can more easily obtain information about international companies, so an international lending facility affects enterprises' decisions to borrow foreign currency debt. These findings support H3.

4.4 Analysis of Influencing Factors of Short-term and Long-term Foreign Currency Debt

The above analysis of the influence factors of foreign currency debt confirms the three Hypotheses of this paper. In this section we further consider debt liquidity differences and divide foreign currency debt into long-term and short-term to refine the study. Here, we continue to use the Tobit method in equation (5).

(1) Analysis of short-term foreign currency debt (SFDTD)

The level of companies' internationalization and their exposure to foreign exchange risk influence the borrowing of short-term foreign debt. In Table 4, CE in SFDTD demonstrates a positive effect whereby companies with overseas operations tend to borrow short-term foreign currency debt. This finding confirms that the degree of internationalization impacts firms' borrowing foreign currency debt. FB also appears to promote the use of foreign currency debt; companies are more inclined to use short-term foreign currency debt as the scale of foreign currency deposits increases, aligning with the objective of hedging against exchange rate risk. Moreover, FSTS significantly influences the scale of short-term foreign currency debt. The coefficient of FSTS is higher than that of LFDTD, indicating its role in hedging foreign exchange risk.

(2) Analysis of long-term foreign currency debt (LFDTD)

The borrowing of long-term foreign debt is influenced by financing needs, foreign exchange and financial hedging risk, instruments. As shown in Table 4, the LEVER variable promotes LFDTD, indicating that companies borrow long-term foreign currency debt for financing purposes. Further, CE positively appears to affect LFDTD. Companies with overseas operations are more inclined to borrow more long-term foreign currency debt, which supports H1. Both FSTS and FB promote LFDTD as well. Their coefficients are significant, indicating that companies with larger overseas business income and higher proportions of foreign currency deposits are more inclined to borrow long-term foreign currency debt.

In addition, the coefficient of FCD in SFDTD is positive, but not significant. However, in LFDTD, there is a significant relationship between the scale of long-term foreign currency debt and the use of foreign exchange derivatives. Companies that use more foreign exchange derivatives also use more long-term foreign currency debt. Aado similarly found that foreign currency debts existing for more than one year can be used as long-term hedging instruments, which further indicates a complementary relationship between the two and supports H2-1.

Variable Group	Dependent	Variables
	Equation (5)	Equation (5)
	SFDTD	LFDTD
Hedge specific:		
FCD	0.0134(1.23)	0.0170*(1.56)
Risk specific:		
FB	0.1625***(5.91)	0.0792***(3.32)
FSTS	0.1226***(5.85)	0.0630**(2.03)
$lpha_i$	-0.03(-1.26)	-0.0070(0.23)
Firm internationalization		
CE	0.0756***(6.40)	0.0654***(4.42)
BH	0.0185(-1.24)	0.0146(0.90)
Control variables		

Table 4. Determinants of Foreign Currency Debt of Different Maturities

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Lever	0.0515(1.34)	0.2363***(5.04)
TANG	-0.0102(-0.32)	0.0549(1.49)
LIQUID	-0.0030(-0.80)	0.0005(0.09)
DY	0.0050((-1.49)	-0.0037((-080)
BM	0.0055*(-1.86)	-0.0006(-0.20)
Constant	0.0677***(-2.43)	-0.2543***(-6.66)
	LR Chi2:191.34	LR Chi2:107.3

Note: ***, **, * are significant at the 1%, 5%, and 10% levels respectively, with t values in brackets.

4.5 Analysis of Influencing Factors of Foreign Currency Debts by Industry

We further examined the influence of different industries on the term structure of foreign currency debt for various companies. A total of seven industries were selected based on available data, including the real estate industry, manufacturing industry, wholesale and retail industry, health and social work industry, transportation, storage, and postal industry, mining industry, and the electricity, heat, gas, and water production and supply industry. The results according to Equations (5) are shown in Table 5.

(1) Real estate. α_i , FSTS, and FB of this industry all have significant positive coefficients. This suggests that the foreign debt raised by the real estate industry is affected by foreign exchange risk, emphasizing the impact of foreign exchange risk on firm value. The coefficients of CE and LEVER indicate that foreign currency debt is also driven by financing needs and international lending facility.

(2) Manufacturing. Variables such as α_i , FSTS, FB mostly show significant coefficients. This indicates that the use of foreign currency debt hedges foreign exchange risk in the manufacturing industry. The variables CE and LEVER, which reflect a relatively high

financial leverage ratio and proportion of fixed assets exceeding 0.2, suggest that the industry faces heavy financial pressure. As a result, foreign currency borrowing is also influenced by financing demands and international lending facilities.

(3) Wholesale and retail. The industry's α_i variable is significant, indicating a high proportion of overseas branches in CE and exposure to foreign exchange risk. Therefore, the borrowing of foreign currency debts may be for the purpose of foreign exchange risk management.

(4) Health and social work. The FB of this industry has a significant coefficient, and account for the highest proportion and the degree of foreign business is relatively large, the foreign currency debt of this industry has the purpose of hedging foreign exchange risks. The higher the financial leverage and the lower the liquidity, the more foreign currencies will be borrowed. At the same time, the overseas listing also enables foreign investors to reduce the impact of information asymmetry. Therefore, the foreign currency debt of this industry is also affected by the financing demand and international lending facility. The coefficient of foreign exchange derivatives FCD verifies H2-1: The use of financial derivatives and foreign currency debt presents a complementary relationship.

	Real estate	manufacture	Wholesale and retail	Health society	Transportation	mining	Electric heat
FCD	0.010	0.0218	0.0140	0.297***	-0.240***	0.115***	-0.241*
TCD	(0.91)	(1.47)	(0.94)	(3.59)	(-2.52)	(3.48)	(-1.84)
	0.056**	-0.061*	0.178***	-9.704**	0.585 ***	0.162	0.333***
α_i	(2.01)	(-1.61)	(2.70)	(-2.46)	(2.88)	(-0.96)	(3.25)
ECTC	2.165***	0.227***	0.253	-0.601	-0.141	-0.268***	4.554**
<i>F313</i>	(3.11)	(5.15)	(0.71)	(-1.42)	(-0.56)	(-2.70)	(2.54)
FR	0.280***	0.116***	-0.129	0.695***	0.403***	0.456***	-0.005
ID	(3.48)	(3.85)	(-1.36)	(4.28)	(2.60)	(5.69)	(-0.16)
CE	0.032***	0.019***	0.070**	-1.222	0.245**	0.330	-0.001

 Table 5. Influencing Factors of Foreign Currency Debt Borrowed by Different Industries

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	(2.77)	(4.37)	(2.48)	(-0.08)	(2.34)	(0.02)	(-0.08)
вн	0.006	037	0.024	5.973***	0.011	-0.354	-0.022*
DII	(0.34)	1.25	1.04	(2.60)	(0.07)	(-0.02)	-1.91
LEVED	0.111*	0.210***	-0.042	1.385**	0.688	0.226	0.089
LEVER	(1.66)	(3.22)	(-0.43)	(2.41)	(1.13)	(1.09)	(1.25)
מווסנו	0.047**	-0.001	-0.032	-0.029*	0.097	0.083*	0.055**
LIQUID	(2.41)	(-0.21)	(-0.84)	(-0.34)	(1.54)	(1.61)	(2.18)
DY	0.004	-0.007	0.032**	-0.089	-0.127	-0.049**	0.012
	(1.19)	(-1.30)	(2.07)	(-0.70)	(-1.36)	(-2.41)	(0.92)
DM	0.001	-0.010	-0.003	-1.332***	-0.016	-0.123***	-0.006*
БМ	(0.48)	(-1.07)	(-0.41)	(-3.13)	(-0.43)	(-5.40)	(-1.78)
TANC	0.499***	-0.004	0.069	4.331***	-0.031	0.108	-0.201***
TANG	(2.23)	(-0.05)	(0.31)	(4.60)	(-0.13)	(0.71)	(-3.09)
Constant	-0.205***	-0.129***	-0.036	1.469	-0.510	-0.056	0.159**
Constant	(-2.64)	(-2.94)	(-0.33)	(0.10)	(-1.44)	(-0.36)	(2.05)
LR Chi ²	57.07	132.33	24.07	138.80	53.17	111.83	203.31

Note: ***, **, * are significant at the 1%, 5%, and 10% levels respectively, with t values in brackets.

(5) Transportation, warehousing and postal services. In this industry, the coefficient α_i and FB is significant, so foreign exchange risk hedging affects the borrowing of foreign currency debt. The significance of the FB also indicates the impact of an enterprise's internationalization level on foreign currency debt, so the impact of international lending facilities. The coefficient of foreign exchange derivatives FCD validates H2-2.

(6) Mining. Both FB and FSTS variables in this industry exhibit significance. With more than 40% of companies utilizing foreign exchange derivatives, over 70% establishing overseas operations or listings, and a high proportion of fixed assets, this industry is asset-intensive and internationally engaged. Moreover, given that around 80% of iron ore is imported from Australia and other countries, China is primarily a net importer in the mining

5. Robustness Test

A robust test was conducted by altering the important explanatory variables to assess their impact. The indicators used to measure a firm's internationalization level in the model include CE and BH. CE represents the conversion cost, which serves as a proxy for the existence of overseas branches, providing an alternative dimension of overseas institutional presence. In the robustness test, industry rather than an exporter. FSTS serves as a hedge against import risks, contributing to overall risk management. Additionally, considering companies with higher foreign currency debt but lower return on DY, financing demands also play a role. The significantly positive coefficient of foreign exchange derivatives FCD suggests a complementary relationship for hedging risks associated with foreign currency debt.

(7) Electricity, heat, gas, and water production and supply. The coefficients α_i and FSTS in this industry are significantly positive. The borrowing of foreign currency debt is promoted by the motivation of hedging foreign exchange risk. At the same time, the coefficient of FCD of foreign exchange derivatives is significantly negative, so H2-2 is verified: the use of financial derivatives forms a substitution relationship with foreign debt.

we adopted the approaches of Aabo and Hansen and Deng Xinming and Xiong Huibing by incorporating FCOUNT, the number of countries with overseas subsidiaries [1], as a replacement for CE in the regression Equation (4) and Equation (5).

Table 6 shows the results. For FD, FCOUNT has a positive effect on the borrowing of foreign currency debt. Companies with subsidiaries in a higher number of countries are more likely to borrow in foreign currencies, benefiting from the financing opportunities available through cross-border operations. Additionally, BH promotes the utilization of foreign currency debt, as it assists foreign investors in obtaining relevant information about enterprises and reduces information asymmetry. This result also supports H3.

Regarding FDTD, FCOUNT shows no significant positive role in borrowing behavior, but the coefficient of FSTS, the overseas income ratio, is significantly positive. Following Caves, the establishment of foreign subsidiaries is considered indicative of long-term foreign currency cash flow. Thus, H1 is validated.

Both FD and FDTD confirm a significant positive relationship between the use of foreign exchange derivatives and foreign currency debt, indicating that enterprises employing more financial hedging tools have a higher likelihood and wider scale of foreign currency debt borrowing. This finding further supports H2, which aligns with our earlier analysis.

Variable Group	Dependent	Variables
	Equation (4)	Equation (5)
	FD	FDTD
Hedge specific:		
FCD	0.0744***(3.500)	0.0232***(2.0200)
Risk specific:		
FB	0.1908***(4.4300)	0.1717***(6.95)
FSTS	0.1079(1.3500)	0.2065**(5.87)
α_i	-0.0001(-0.1400)	-0.0147(-0.53)
Firm internationalization		
FCOUNT	0.0132***(3.5700)	0.0021(1.47)
BH	0.0836*(1.9300)	-0.0037(-0.19)
Control variables		
Lever	0.1427(0.9500)	0.1442***(3.14)
TANG	0.0296(0.2500)	-0.0117(-0.29)
LIQUID	-0.0170(-0.99)	-0.0023(-0.53)
DY	0.0052(0.41)	-0.0051(-1.20)
BM	0,0250*(2.53)	-0.0050(-1.45)
Constant	0.5627***(6.07)	-0.0620*(-1.90)
	R2:0.17	LR Chi2:189.09

Table 6. Robust Test

Note: ***, **, * are significant at the 1%, 5%, and 10% levels respectively, with t values in brackets.

6. Conclusions and Implications

This study investigated the determinants of foreign currency debt borrowing by Chinese listed companies theoretically and empirically. By analyzing quarterly data from 2015 to 2019, we found that foreign-related operations significantly increase firms' exposure to foreign exchange risk, with higher foreign currency operating income leading to greater exposure. We also employed Logit and Tobit models to empirically analyze the motivations and scale of foreign currency debt borrowing. empirical results confirmed The three hypotheses. First, firms use foreign currency debt as a hedging mechanism for foreign exchange risk. Second, there is a general complementary relationship between the use

of financial derivatives and foreign currency debt, although there are variations across different industries. Specifically, the two are complementary in the mining industry whereas they are substitutable in the electricity, heat, gas, and water industry. Based on our findings, draw several policy implications. we Companies can employ different tools to manage long- and short-term foreign exchange risks. Specifically, foreign currency debt can be considered as a natural hedging tool when companies have both capital demands and the need to manage foreign exchange risk. It is crucial for companies to tailor their borrowing decisions in foreign currencies to their specific needs, taking into account factors such as financial leverage ratio, corporate return rate, characteristics, industry degree of

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foreign-related business, amount of foreign exchange risk exposure, and the nature of foreign exchange risk. Currently, China has implemented pilot programs to open up certain areas, streamline procedures for foreign currency debt borrowing, and provide foreign debt quotas to some small, medium, and micro high-tech enterprises. Going forward, the geographical coverage of these policies can be moderately expanded, and the limits on foreign debt can be adjusted flexibly in response to the development needs of different industries and fluctuations in the economic cycle.

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