Foreign currency risk hedging and firm value in China

Hang (Robin) Luo

School of Economics, Xihua University

Chengdu 610039, P.R. China

Tel: 86-28-8772-0573 E-mail: robin_h_luo@163.com

Rui Wang[1]

School of Economics, Xihua University

Chengdu 610039, P.R. China

Tel: 86-28-8772-0573 E-mail: wangrui@mail.xhu.edu.cn

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ABSTRACT

This objective of our study is to investigate the association between the use of foreign currency derivatives and corporate value among Chinese firms by examining listed firms' quarterly data from 2000 to 2013. We find that Chinese firms that engage in hedging activities with derivatives to reduce their foreign exchange exposure tend to have higher corporate value. This finding is shown to be consistent through a series of robustness tests. We also find that the incidence of such effects is higher among firms with greater profitability and investment opportunities. The use of foreign currency derivatives exerts a more prominent impact on firm value when the exchange rate depreciates and when the economy is booming. However, the link between derivative use and firm value is weaker during crisis periods. Moreover, an industrial analysis demonstrates that the value-enhancing effect varies across industries.

Keywords: Derivatives; Exchange rate; Firm value; Hedging; Value-enhancing effect, China

JEL Classification： F31, G32

1. Introduction

In a perfect capital market without information asymmetry, taxes, and transaction agency costs, hedging financial risk should not add value to firms as shareholders could hedge individually (Modigliani and Miller, 1958). In practice, however, imperfection in the capital market creates a rationale for corporate hedging activities. Specifically, hedging becomes an important tool in managing foreign exchange risk for multinational corporations (MNCs). According to a derivatives survey released by the International Swaps and Derivatives Association (ISDA) in 2009, 94% of the world's 500 largest companies use derivative instruments to manage and hedge their business and financial risks.

Many studies investigate the relationship between corporate hedging and firm value with some finding supportive evidence that hedging enhances firm value. Froot et al. (1993) argue that when external financing is more costly than internal financing, hedging activities are value-enhancing because hedging ensures the ability to finance profitable investment, alleviating or avoiding the underinvestment problem. Many empirical studies also find that hedging activities increase a firm's debt capacity, research and development (R&D) spending, and corporate value. Nain (2004) shows that non-hedgers' corporate value is 5% lower than hedgers in industries where foreign currency derivatives are widely used. Allayannis and Weston (2001) find that a hedger's corporate value is 5% higher, using a sample of 720 U.S. multinational companies. Most of these studies focus on the unconditional effects of the use of foreign currency derivatives on firm value (Allayannis and Weston, 2001; Guay and Kothari, 2003; Bartram et al., 2011) and do not touch on other important conditions. A few recent studies attempt to investigate the value-enhancing effect of the conditional use of

derivatives on agency costs and monitoring problems (Fauver and Naranjo, 2010), corporate governance (Allayannis et al., 2012), and corruption (Kim et al., 2017). Nevertheless, existing literature provides inconsistent results on the value-enhancing effect of derivatives use under different conditions.

To fill the gap in the literature, we explore the association between the use of foreign currency derivatives and firm value considering firm characteristics and macroeconomic conditions such as financial crises, exchange rate fluctuations, and economic growth. We investigate this using nearly 70,000 firm-quarter observations of Chinese listed firms from 2000 to 2013. The reasons we select a broad base of Chinese firms are two-fold.

First, although the association between foreign currency derivatives use and firm value in China has attracted attention in recent years, extant literature only considers Chinese MNCs rather than a broader sample of Chinese firms that may not be defined as MNCs but that also use currency derivatives. For instance, Bartram et al. (2011) investigate the determinants of foreign currency derivatives, examining 6,888 MNCs from 47 countries. Their sample includes 32 MNCs based in mainland China. Allayannis et al. (2012) study the relationship between corporate governance and hedging premiums using 1,605 MNCs cross-listed in the U.S. market, including 12 Chinese MNCs. The empirical results based on such a small sample of Chinese MNCs in these studies cannot truly reflect the value-enhancing effect and hedging impact on Chinese firms. The small samples might be due to the short history of the floating of the RMB, starting in July 2005, and the mandatory requirement of disclosing the use of foreign currency derivatives in annual reports starting in January 2007. Notably, after two decades of rapid growth, in 2018, China has 120 firms on

the Fortune Global 500 list, just behind the U.S. (126 firms) and ahead of Japan (52 firms).[2] In addition, many listed firms in China are using currency derivatives for hedging and/or speculation purposes although they are not defined as MNCs. Thus, it makes sense to explore risk management practices, such as derivatives use, and the related value-enhancing effect, among the growing body of Chinese listed firms. We believe that the results from the present study using a comprehensive dataset of all listed firms in China will shed light on other emerging markets where firms are increasingly integrated into international markets.

Second, China has experienced tremendous economic growth and market liberalization after its accession to the World Trade Organization (WTO) in 2001. During this period, the Chinese RMB has dramatically appreciated against other major currencies. According to the statistics of the State Administration of Foreign Exchange, the bilateral exchange rate between the RMB and the U.S. dollar (monthly central parity) has appreciated over 30% through the end of 2014. The data from the Bank for International Settlements show that within this period, the nominal effective exchange rate of the RMB relative to a basket of trade-weighted currencies appreciated by nearly 15%.[3] This appreciation pattern is similar to that of the Japanese yen after the 1985 Plaza Accord (Obstfeld, 2009) and the currencies of the Asian Tigers before the Asian financial crisis (Radelet and Sachs, 1998). The period between 2000 and 2013 provides an ideal window to investigate the value-enhancing effect of derivatives use. Further, as Chinese firms are accelerating their pace of overseas expansion,

[2] "Global 500: Chinese companies race ahead," 20 July 2018, http://www.chinadaily.com.cn/a/201807/20/WS5b518b77a310796df4df7b77.html

[3] Please refer to the Bank for International Settlements (http://www.bis.org/statistics/eer/index.htm) for the relevant statistical data of the RMB effective exchange rate.

exchange rate fluctuations are now a major concern. Moreover, currently, many listed firms show the impact of RMB exchange rate fluctuations in their annual reports.

In February 2006, the Ministry of Finance issued new "Enterprise Accounting Standards" with the first listed firms following this new standard on January 1, 2007. These new enterprise accounting standards make possible the collection of foreign currency derivatives data from listed firms. "Accounting Standards for Enterprises No. 22 - Financial Instruments Recognition and Measurement," "Accounting Standards for Enterprises No. 24 – Hedging," and "Enterprise Accounting Standards No. 37 - Financial Instruments" require listed firms to disclose their risk management objectives, policies, and processes for risk measurement methods, types of financial instruments used, carrying value, fair value and changes in fair value gains, and other descriptive and quantitative information. These regulation requirements enable researchers to obtain more detailed information on foreign currency derivatives and study the relationship between foreign currency derivatives use and firm value.

Our study contributes to previous literature by investigating additional conditions on the association between derivatives use and firm value. First, the study enriches the existing literature by considering the heterogeneity of firm characteristics. Some researchers focus on different aspects of firm characteristics when they test the value-enhancing effect. For example, a recent study by Bae et al. (2018) reports that firms with more exports, more foreign currency debt, and higher exchange exposure are likely to use more currency derivatives for hedging, examining firm-level data from Korea. However, in contrast to existing studies proving the value-enhancing effect, the influence of the heterogeneity of firm

characteristics remains largely unexplored. In comparison to previous studies, our dataset consists of nearly 70,000 firm-quarter observations over a relatively long sample period from 2000 to 2013. This large and comprehensive dataset enables us to detect the value-enhancing effects while considering characteristics such as size, profitability, and investment opportunities.

Second, we extend the literature by looking at the role of heterogeneous macroeconomic conditions. Prior literature largely investigates individual firm characteristics in terms of their impact on the strength of the value-enhancing effect, whereas the role played by macroeconomic conditions remains largely unexamined. The identification of macroeconomic conditions that link derivatives use and firm value can be useful for deriving policy implications for authorities. For instance, exchange rate depreciation and economic growth appear to reinforce the value-enhancing effect, calling for careful contemplation by policy makers to allow for a proper level of depreciation and economic growth and to avoid unfavorable effects from adverse conditions. In addition, as the value-enhancing effect will be weaker during crises, both firms and authorities should take measures to strengthen early warnings of financial crises and adopt prudent supervision to avoid adverse effects on the connection between derivatives use and firm value.

The remainder of the paper is organized as follows. Section 2 briefly reviews the literature on the association between the use of foreign currency derivatives and corporate value. Section 3 describes the measures of foreign currency derivatives and corporate value and the construction of the control variables. Section 4 presents the model, empirical results, robustness checks, heterogeneity tests, and industrial analysis. The final section concludes.

2. Literature Review

Managerial risk aversion theory states that managers' incentive to maximize their personal functional utility is the reason they pursue hedging activities (Stulz, 1984). Mian (1996) and Tufano (1996) also find strong evidence supporting managerial risk aversion theory as managers who hold more stock or options tend to undertake more hedging activities. According to these studies, hedging is not likely to affect corporate value.

Shareholder value maximization theory, however, states that firms undertake hedging activities to reduce various costs caused by the high volatility of cash flows. Hedging can, therefore, create shareholder value through a number of routes. First, hedging plays an important role in tax reduction. Smith and Stulz (1985) argue that the tax function of firms is generally a convex function and under this assumption, the use of derivative hedging can effectively reduce the fluctuation of corporate profits and enhance solvency, thereby increasing tax savings. Second, hedging can reduce the costs of financial distress. The probability of financial distress and the loss afterwards jointly determine the financial distress cost, which reduces the net cash flow expected, and thereby reduces enterprise value. Another important conclusion drawn by Smith and Stulz (1985) is that hedging could reduce the volatility of expected corporate earnings and therefore minimize the costs of financial distress. Leland (1998) also argues that reducing income volatility can increase a firm's debt capacity and thus creates a greater benefit as a tax shield. Third, hedging can solve the problem of underinvestment. Froot et al. (1993) state that hedging can be more valuable if the cost of external financing is greater than the cost of internal financing. They believe that hedging can improve the matching of cash outlay and inflow so that firms using hedging can

have sufficient internal funds to invest in projects with positive net present values (NPVs). Thus, the problem of insufficient investment can be reduced or eliminated. Fourth, information asymmetry can be eased with hedging. DeMarzo and Duffie (1995) establish a two-stage corporate profit maximization model to explore the information effects of risk management. They find that the use of derivatives to manage risk can effectively eliminate additional noise in profits and improve the information transparency between investors and managers.

Several empirical studies on hedging examine which corporate hedging theory can better explain a firm's hedging behavior. Allayannis and Ofek (2001) and Graham and Rogers (2002) report a positive relationship between foreign currency derivative use and corporate investment opportunities, indicating that hedging could mitigate underinvestment problems in many firms. Graham and Rogers (2002) also find that hedging improves firm debt capacity, with increased tax benefits averaging 1.1% of firm value. Haushalter (2000) and Lin et al. (2008) predict a positive linear relationship between a firm's leverage level and hedging, which is consistent with the argument that firms hedge to reduce the potential cost of financial distress. Campello et al. (2011) argue that compared with non-hedgers, hedgers using exchange rate or interest rate derivatives are likely to borrow at lower lending rates and face less capital spending restrictions in loan agreements; the average hedging benefit is equivalent to 4.7% of net income. Alam and Gupta (2018) use data from 129 non-financial Indian firms between 2008 and 2015 and find that hedging firms compared to non-hedgers show less volatility in firm value. Further, the use of hedging during financial crises is value enhancing for hedgers. Other studies, such as Knopf et al. (2002) and Rogers (2002), show

that management risk-taking incentives, represented by stock and option portfolios, are negatively related to derivative holdings, which is consistent with derivatives being used for hedging purposes.

The findings in the existing empirical studies on the association between hedging and corporate value do not all reach the same conclusions. Allayannis and Weston (2001) report an average 5% premium on firm value among those using currency derivatives, looking at a sample of 720 U.S. multinationals. Clark and Judge (2009) analyze the value-enhancing effect of the adoption of various types of hedging instruments, such as forwards, futures, and options, and show that the effect varies from 11% to 34%. Nain (2004) finds a 5% discount on corporate value among firms not using derivatives in an industry where foreign currency derivatives are widely used. Kim et al. (2006) argue that the value-enhancing effect of operational hedging is five times higher than that of financial hedging, although both have a positive impact on corporate value. Allayannis et al. (2012) investigate the impact of foreign currency derivatives on firm value using a broad sample of firms from 39 countries and report evidence that the use of currency derivatives among firms with strong internal or external governance is associated with a significant value premium. Bartram et al. (2011) find that the effect of derivative use on corporate value is positive but more sensitive to endogeneity and omitted variable concerns.

Nonetheless, some researchers challenge the value-enhancing effect of derivatives use. Tufano (1996) reports scant empirical support for the predictive power of theories that view risk management as a means to maximize shareholder value. Guay and Kothari (2003) question the empirical conclusion that derivatives use increases corporate value. They point

out that factors that raise corporate value are likely to be other risk management activities such as enhancement in process management and prevention of operational risks, although there may be some correlation between these activities and derivatives transactions. Magee (2009), analyzing 408 large non-financial companies in the U.S. from 1996 to 2000, Bartram et al. (2011), assessing 6,888 non-financial companies in 47 countries, and Li et al. (2014), examining 134 non-financial firms listed on the New Zealand Stock Exchange, conclude that "derivative use cannot improve corporate value." (Li et al., 2014, p.110) Using a sample of Malaysian firms, Lau (2016) indicates that derivatives use is negatively associated with firm market value but does contribute to better return on assets (ROA) and return on equity (ROE).

Most previous literature investigating the association between hedging and corporate value is based on U.S. or European multinationals. However, evidence from other economies is emerging in recent years. For instance, Gómez-González et al. (2012) examine the effects of risk management and hedging decisions on firm market value using information from Colombian non-financial firms. Kim et al. (2017) study the value-enhancing effect of derivatives on firm value in an environment of corruption across eight countries in East Asia.

There are relatively few studies using Chinese samples to investigate this link. Luo and Jiang (2007) analyze the effect of foreign exchange exposure on Chinese listed firms' market returns and find the appreciation of the RMB driving up the average stock market return after foreign exchange reform in 2005. However, hedging activities and the use of foreign currency derivatives are not considered in their study. Looking at foreign exchange risk management data from 323 enterprises, the People's Bank of China (PBOC, 2006) reports

that foreign currency derivatives, particularly currency forward, are major tools used to manage foreign exchange risk. Luo (2016) reports a positive but insignificant hedging premium among 30 of the largest Chinese MNCs. Thus, the hedging activities of Chinese firms have not yet been reflected fully in academic studies.

3. Sample Selection and Variable Construction

3.1 Sample selection

The sample used in the study consists of nearly 70,000 firm-quarter observations from 2000 to 2013 in China. The following three categories of corporations are excluded from the sample: 1) Special Treatment corporations or ST firms for short, which are normally in financial distress and face greater risk than other firms; 2) Firms in the financial industry; and 3) Corporations with missing data. To minimize the influence of outliers, we winsorize all variables at the top and bottom 1% of the distribution.

3.2 Measures of foreign currency derivatives

The use of foreign currency derivatives and the magnitude of the foreign currency derivative positions are measured by DERIVATIVE and FCDVAL, respectively. The DERIVATIVE is a binary dummy variable equal to 1 if the firm uses derivatives, and 0 otherwise (Bartram et al., 2011; Allayannis et al., 2012). Chinese listed firms normally disclose foreign currency derivatives use in the notes in their financial reports. However, almost all financial data providers do not include financial statement notes in their databases. Therefore, the DERIVATIVE data are not available in the China Stock Market & Accounting

Research (CSMAR) database. Triki (2005) summarizes three approaches to identify hedgers, namely, the survey approach, the keyword search approach, and the private data approach.

In this study, we use the keyword search approach to obtain DERIVATIVE data by manually searching keywords, such as foreign exchange forwards, foreign exchange futures, currency options, currency swaps, and non-deliverable forwards (NDFs), in the sample corporations' annual reports. If a listed company's annual financial statement notes report the use of foreign currency derivatives to hedge or manage exchange rate risk, disclose the fair value or the nominal value of the derivatives, and recognize the profit or loss of using derivatives as financial expenses or investment income in the relevant income statement items, the firm is identified as a hedger even though it does not hold long or short positions at the end of the financial period.

Some firms disclose the value of foreign currency derivatives under the transactional assets category. Thus, a numerical variable FCDVAL is included to estimate roughly the magnitude of foreign currency derivative positions; FCDVAL is the natural logarithm of transactional assets obtained from the CSMAR database.

3.3 Measures of corporate value

Tobin's Q, used to capture firm market value here, compares the value of a company given in the financial market with the value of the company's assets. It is calculated by dividing the market value of a company by the replacement value of its assets (Blose and Shieh, 1997). When it is computed for new investment only, it is referred to as the marginal Q. When it is calculated for all of a firm's assets, it is referred to as the average Q (also known as simply Q). If the market value of a firm is reflected solely by its recorded assets, Q

equals 1. If Q is greater than 1, the market value of the firm is greater than the cost of replacing its assets, implying that the firm's stock is overvalued. If Q is between 0 and 1, the market value of the firm is less than its asset replacement cost, which implies that the stock is undervalued. High Q values encourage firms to invest more in capital because they are worth more than the price they paid.

There are three different methods to construct Tobin's Q in the literature. It can be measured by the ratio of its market value to its book value of assets (Allayannis and Weston, 2001); an approximate ratio proposed by Chung and Pruitt (1994) using the product of share price and common shares outstanding, the liquidating value of outstanding preferred stock, the value of short-term liabilities net of short-term assets plus the book value of long-term debt, and the book value of total assets; or the more complex procedure of Lindenberg and Ross (1981). Allayannis et al. (2012) compare the above three measures and find that the different measurements of Tobin's Q show little impact on the examination of the relationship between foreign currency derivatives use and corporate value.

The simple method proposed by Allayannis and Weston (2001) is used here to approximate Tobin's Q. The market value of Chinese firms consists of total capitalization and total interest-bearing liabilities. Total interest-bearing liabilities include short-term loans payable, short-term bonds, long-term debt, and long-term liabilities due within one year, excluding accrued liabilities and deferred income tax liabilities. The book value of Chinese firms equals the book value of total assets minus the book value of non-interest bearing liabilities. Both the adjusted Tobin's Q (ATQ) and the price to book value ratio (P/B ratio) are used in the robustness check. The difference between Tobin's Q (TQ) and the ATQ is that

non-tradable shares are valued using the book value in the TQ measurement and they are valued using the market price in the ATQ measurement.

3.4 Construction of control variables

To accurately investigate the association between foreign currency derivatives use and their magnitude and corporate value, following Allayannis et al. (2012), Bartram et al. (2011), and Li et al. (2014), the control variables in the multivariate regressions are as follows:

Firm Size (SIZE). Firm size affects managerial decisions to implement operational hedging since smaller firms may not have the resources to manage international facilities (Dunning, 1980). Agarwal and Ramaswami (1992) and Chow and Chen (1998), following the framework developed by Dunning (1980, 1988), find that when firms are confronted with various choices of entering a foreign market, large firms tend to choose a sole venture while small firms tend to either enter the foreign market or choose a joint venture. A large body of empirical literature suggests that the managerial decision to use derivatives is positively related to firm size (Mian, 1996; Haushalter, 2000; Graham and Rogers, 2002). Large firms are more likely to hedge proactively because they often launch a larger amount of initial investment in any project compared with small firms. At the same time, larger firms benefit from both economies of scale and of scope, which give them more credit on project success compared with their small-sized competitors. Smirlock et al. (1986) provide arguments that size does lead to higher efficiency. Total assets (item A001000000) are obtained from the quarterly reports from the CSMAR database. We use the natural logarithm of total assets to reduce the size effect.

Profitability (ROA). Firms' ability to generate profit is one of the most important considerations when making investment decisions. Risk-averse investors prefer to pay more for profitable firms than for firms with operating losses. Therefore, firms with higher profitability are likely to have a higher TQ. Thus, the ratio of ROA is used, which is represented by net income after tax and the dividend divided by the average of total assets. The return on assets ratio is item T40301 in the CSMAR database.

Leverage (LEVERAGE). It is widely believed that capital structure affects corporate value through its impact on the magnitude of the discount factor when discounting future expected cash flow by cost of capital. Mayers (1998) argues that debt financing has one important advantage, which is that the interest the firm pays is a tax-deductible expense while equity income is subject to corporate tax. This implies that firms with debt financing may have higher TQs. However, a firm faces greater risk of financial distress when it is overly leveraged and, therefore, controlling leverage is necessary. The leverage control variable is computed as the ratio of total liabilities to total assets. The debt to assets ratio is item T30100 in the CSMAR database.

Investment Opportunities (GINC). Géczy et al. (1997) provide empirical evidence that hedgers have a better chance of obtaining better investment opportunities. Thus, we control firm investment opportunities here. Yermack (1996) uses the ratio of capital expenditures to total sales to control the investment growth effect. Morck and Yeung (1991) use R&D expenditure as a proxy for investment growth. R&D generates enormous potential for firm growth but how much a firm will spend on R&D is largely dependent on its industry orientation and size. However, many Chinese listed firms do not present the ratio of R&D

expenditure over total assets in their annual reports properly. Thus, revenue growth (item T81101) is used as a control variable to proxy investment opportunities in the current study.

Capital Constraints (CAPX). The economical way of funding a project is internally. If a firm pays dividends there are fewer funds retained in the firm for future investing. As a result, firms have to finance the proposed projects through the financial market, which costs them more in resources. It is more costly not only in terms of interest expenses but also in terms of time consumed dealing with external financing. In considering the costs of financing a project externally, firms may forgo a number of good investment opportunities. Thus, if a firm pays dividends (item A00211500), it is more likely to outsource its project funding, and, in turn, it is likely to have lower TQs (Servaes, 1996). We use a dividend dummy as a proxy for capital constraints. It is equal to 1 if the firm pays dividends in the sample period and 0 otherwise.

International Diversification (MNC). Previous studies examining the association between international diversification and corporate value do not reach the same conclusions. Morck and Yeung (1991) proclaim that multi-nationality is positively associated with firm value, although agency problems exist. Kim et al. (2006) compare operationally hedged firms (firms with foreign sales) with non-operationally hedged firms (firms with export sales) and find that non-operationally hedged firms use more financial hedging relative to their levels of foreign currency exposure. Operational hedging is more effective in creating firm value, although both operational and non-operational hedging are positively associated with corporate value. Choi and Jiang (2009) report evidence that operational hedging decreases a firm's exchange risk exposure and increases its stock returns. Nevertheless, Allayannis and

Ofek (2001) argue that multinational operations increase exchange rate risk exposure and, therefore, reduce the company's value. The proportion of overseas revenue from foreign subsidiaries has been used to measure international diversification in the existing literature. However, this ratio is very low for most Chinese MNCs as their history of overseas expansion is rather short. In this study, a dummy variable (MNC) is used as the proxy for international diversification. The variable equals 1 if the balance sheet items in the foreign currency translation (item B00130300) are not zero, and 0 otherwise.

3.5 Descriptive analysis

The summary of the statistics is presented in Table 1. The summary statistics include the main variables in the empirical analysis and the robustness checks. Notably, some Chinese listed firms have very high TQs and ATQs, although the mean values of the TQ and the ATQ are 1.691 and 2.395, respectively. The range for the TQ (ATQ) is from a minimum of 0.827 (0.910) to a maximum 5.009 (7.642). The fairly high standard deviation and the wide range for TQ/ATQ suggest a considerable variation in firm value.

The statistics also show that 15.2% of Chinese listed firms are using foreign currency derivatives. This is not a surprising result as the history of Chinese firms using derivatives, particularly currency derivatives, is not comparable with developed countries. Allayannis and Weston (2001) state that over 60% of U.S. MNCs use foreign currency derivatives and Bartram et al. (2011) report a similar result of 61% in their transnational study.

The implication is that some Chinese firms have prominent investment opportunities. Chinese listed firms demonstrate normal levels of profitability as Table 1 shows an average ROA of 3.6%. International diversification and foreign involvement are represented by the

control variable MNC, which reveals that around 17.7% of the sample firms report foreign currency exchange differences in their balance sheet.

[Insert Table 1 Here]

4. Methodology and Results

4.1 Model

Our baseline econometric model is described as follows:

$$\text{Firmvalue}_{it} = c + \alpha \text{FCD}_{it} + \beta \text{Control}_{it} + \gamma \text{Dummy} + f_i + \varepsilon_{it}$$

where the dependent variable, Firmvalue_{it}, is the indicator of firm value, namely, the TQ and ATQ. FCD_{it} reflects the use of foreign currency derivatives over the year in terms of the dummy and the natural logarithm of transactional assets, denoted as DERIVATIVE and FCDVAL, respectively. Control_{it} represents the series of firm characteristics. Dummy is the industry dummies. f_i is the time-invariant firm-specific effect and ε_{it} is the idiosyncratic error. α, β, and γ are the coefficients to be estimated.

We calculate the benchmark model using the firm-specific fixed-effects estimator. On the one hand, as we are using firm-level quarterly data, the fixed-effects model allows for unobservable firm-level individual effects, which may be heterogeneous across firms and constant over time. On the other hand, the fixed-effects model allows the firm-level time-invariant effects to be correlated with explanatory variables. We use heteroskedasticity and within-panel serial correlation robust standard errors that cluster at the firm level. We also employ some other econometric methodologies as robustness check.

4.2 Use of foreign currency derivatives and corporate value

We estimate the benchmark model by including only the use of foreign currency derivatives at first and then add the firm control variables in the regressions. The estimation results are shown in Table 2. The columns (1)-(4) differ by the different foreign currency derivatives measures we use, namely, DERIVATIVE and FCDVAL. The former equals 1 if a firm uses foreign currency derivatives and 0 otherwise, while the latter is the magnitude of the foreign currency derivatives rather than a binary variable.

Consistent with the value-enhancing theory that firms using derivatives to hedge currency exposure are rewarded by investors with higher valuations, a positive and significant relationship between the use of derivatives and the TQ is reported in both the univariate regression (columns (1) and (3)) and the multivariate regression (columns (2) and (4)). The multivariate regression apparently offers better explanatory power than the univariate regression as the R-squared is around 0.22, much higher than 0.011. The coefficient of the DERIVATIVE demonstrates that hedgers have a higher TQ than non-hedgers by nearly 31.4%. The coefficients of FCDVAL are positive and significant at the 1% level in all regressions. Quantitatively, the impact of foreign currency derivatives is also salient. Looking at the result in column (4) as an example, the firm value tends to increase by 0.02% for each percentage point that firms increase their use of foreign currency derivatives.

Most of the control variables are statistically significant at the 1% level. For instance, as in Allayannis and Weston (2001), we find that size has a negative sign; firms with high ROA have higher TQs; and multi-nationality is positively related to corporate value. The coefficient of the debt to assets ratio is also significant at the 1% level with a positive sign, indicating that firms with more leverage have higher corporate value.

[Insert Table 2 Here]

4.3 Robustness check

We conduct a series of robustness tests to check if our baseline result holds when applying an alternative firm value indicator or different econometric methodologies. First, we replace TQ with alternative indicators of corporate value that are conventionally employed in related literature including the ATQ and the P/B ratio. The P/B ratio can be used as an alternative measure of corporate value to replace TQ if the book value is deemed to be the replacement cost of the net assets of the firm (Dong et al., 2006). As shown in Table 3, the estimated coefficients on the use of foreign currency derivatives, measured by DERIVATIVE and FCDVAL, respectively, are positive and statistically significant in all regressions. This is interpreted as further evidence for our benchmark result that the use of foreign currency derivatives is positively associated with firm value, which shows an increase in ATQ. Most of the coefficients of the control variables show similar signs and significance (see Table 3).

[Insert Table 3 Here]

Second, we estimate our benchmark model by using different econometric methodologies. The estimation results are presented in Table 4. We begin by calculating the random-effects estimator, as Wooldridge (2010) finds that the fixed-effects estimator generates imprecise results when key regressors do not vary over time (Wu et al., 2017), which, in our case, corresponds to the foreign currency derivative dummy DERIVATIVE. We find the coefficients on DERIVATIVE and FCDVAL are still positive and statistically significant, providing evidence in line with the result when the fixed-effects estimator is used.

Second, we use the Fama-MacBeth two-step estimation proposed by Fama and MacBeth (1973). This method first performs a cross-sectional regression for each single period and then obtains final coefficient estimates as the average of the first step estimates. We find that the results are still statistically significant, consistent with our benchmark findings. Moreover, we control for the unobserved time-constant heterogeneity at the firm level by including firm individual dummies and then employ pooled ordinary least squares **(**OLS) to estimate the model. Although using firm individual dummies increases the number of regressors significantly, which reduces the estimate notably and the degree of freedom, we still find the value-enhancing effect when firms use foreign currency derivatives.

Our empirical model may raise a potential endogeneity concern. It could be argued that high-value firms are more inclined to use foreign derivatives; thus, this reverse causality would lead to biased results. Therefore, in a final step, we address the endogeneity issue by employing the two-stage least squares (2SLS) instrumental variable test. Suggested by the findings of Sloan (1996) and Barton (2001), derivatives and accounting accruals are both tools that managers use to smooth earnings and derivatives; and accruals serve as partial substitutes in this situation. It is assumed that managers will decrease their use of derivatives if using derivatives becomes more costly and/or less efficient and increase their use of discretionary accruals to mitigate earnings fluctuation. Therefore, we use the accrual component of earnings as the instrument variable for the use of currency derivatives. The result based on the 2SLS instrumental variable estimator is still qualitatively consistent with our benchmark findings.[4]

[4] Due to space limitations, we do not report the estimation results of the first stage in Table 4. When DERIVATIVE/FCDVAL is the independent variable, we find that the sign on the estimated coefficient of the instrumental

[Insert Table 4 Here]

4.4 Firm characteristics and the value-enhancing effect

After observing that firm value increases with the use of foreign currency derivatives, we next explore some relevant factors in terms of heterogeneous conditions. We focus on two aspects, that is, which types of firms are affected more by the use of foreign currency derivatives and whether the macro environment exerts a pronounced impact. Specifically, here, we examine if the impact of foreign currency derivatives on firm value varies across firm specific features, including size, profitability, and investment opportunity.

We first interact firm size with the indicator of foreign currency derivatives (FCD) and repeat our estimations. The results are displayed in Panel A of Table 5. We find that the coefficient on the stand-alone FCD indicator is positive and statistically significant in all regressions, in line with our benchmark result. Notably, the coefficient on the interactive term, FCD * Size, is significantly negative when the extent of the FCD is gauged by DERIVATIVE and FCDVAL, stating that the size of the firm may offset the positive effect of FCD on firm value. In other words, the value-enhanced effect for larger firms is weaker compared to smaller firms.

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variable in the first-stage regression is statistically (.000/.000) positive (.165/2.546). For the three diagnostic statistics, first, the *p*-value of the Hausman test for endogeneity suggests that the potential endogeneity of derivatives use cannot be ruled out (.062/.082). Second, we report the first-stage *F* statistic based on the Stock and Yogo (2005) test for weak instruments. The *F*-statistic (36.487/20.812) is larger than the critical value (using 10% bias) constructed by Stock and Yogo (2005), which is interpreted as favorable evidence for the strength of our instrumental variables in the first-stage regression. Third, the *p*-value of the Hansen J statistic (.689/.526) based on the Sargan-Hansen test for over identifying restrictions is not significant, thus, we cannot reject the null hypothesis that the instruments are valid. Overall, the diagnostic statistics lend support to the validity of our instrumental variables.

Next, we examine if the impact of FCD on firm value is heterogeneous across firm profitability. We recalculate the estimation by adding the interaction of ROA with the indicator of FCD; the results are presented in Panel B of Table 5. We find that the firm value for more profitable firms improves significantly as firms use more foreign currency derivatives, as the coefficient on the stand-alone FCD variable is positive and highly significant. The estimate of the coefficient on the interactive term, FCD * ROA is also positive and significant in all cases, suggesting that the value-enhancing effect is greater for profitable firms than for less profitable ones. Our results, which are consistent when we use either the dummy or the magnitude to proxy the use of FCD, suggest that more profitable firms benefit more from the use of foreign currency derivatives.

Finally, we assess if more firm investment opportunities improve the value provided by the use of FCD. Here, the measure of investment opportunity, denoted as GINC, is interacted with the FCD indicators. If the increase in firm value through FD use is more for firms with more investment opportunities, the coefficient on this interactive term will be positive and statistically significant. The results are reported in Panel C of Table 5. Our results show that the coefficient on the stand-alone FCD indicator is positive and statistically significant in all regressions, suggesting a value improved status among firms with more investment opportunities from greater use of FCD. The coefficient on the interactive term, FCD * GINC, is positive and significant in all regressions, implying a likely higher value enhancing-effect on firms with more investment opportunities.

[Insert Table 5 Here]

4.5 Macro conditions and the value-enhancing effect

We also investigate whether the effect of foreign currency derivatives on firm value changes across periods of crisis, exchange rate fluctuation, and economic growth. We first analyze how the value-enhancing effect varies during a financial crisis period. We construct a binary dummy variable, Dummy (crisis), which is equal to 1 during the period of 2008-2009. Including the interaction of this dummy with the indicator of FCD, we repeat our estimations and report the results in Panel A of Table 6. We find that the coefficient on the stand-alone penetration indicator is positive and statistically significant in all regressions. Notably, the coefficient on the interactive term, FCD * Dummy (crisis), is negative when the extent of the foreign bank penetration is gauged by either DERIVATIVE or FCDVAL. This result indicates that the value-enhancing effect of FCD on firm value will weaken during crisis periods.

Next, we examine whether the link between foreign currency derivatives use and firm value will change during a period of exchange rate depreciation. We construct a binary dummy variable, Dummy (depreciation), which is equal to 1 if the changes in the RMB/US dollar exchange rate are positive. We include the interaction of this dummy with the FCD indicator; the results are shown in Panel B of Table 6. We find that the coefficient on the interactive term, FCD * Dummy (depreciation), is positive for all regressions, suggesting that the value-enhancing effect of FCD on firms will improve when the exchange rate depreciates.

Finally, we examine how the business cycle influences the relation between foreign currency derivatives use and firm value. We construct a binary dummy variable, Dummy (economic growth), which is equal to 1 if the growth rate of GDP is beyond the median. We include the interaction of this dummy with the FCD indicator and the results are displayed in

Panel C of Table 6. We find that the coefficient on the interactive term, FCD * Dummy (economic growth), is positive for all regressions, suggesting that the value-enhancing effect of FCD on firms will improve when the economy is booming.

[Insert Table 6 Here]

4.6 Industrial analysis

We also explore the value-enhancing effect on Chinese listed firms across different industries. The Appendix lists summary statistics by industry. The China Securities Regulatory Commission (CSRC) classifies 19 major industries although only 12 are reported in Table 8, as six do not have sufficient data to conduct panel regressions. Further, the financial industry is deliberately removed.

As shown in the Appendix, of the 12 industries reported, firms in the Leasing and Commercial Service industry (Category L) display the highest tendency to use foreign currency derivatives with a mean value of DERIVATIVE of 20%; those in the Utility industry (Category D) present the lowest mean at 12%. In terms of corporate value measures, firms in the Leasing and Commercial Service industry (Category L) again have the highest ATQ, 2.03, while those in the Utility industry (Category D) have the lowest at 1.34. Profitability across industries displays a different pattern; firms in the Mining industry (Category B) show the highest average ROA, 7%, while those in the Agriculture, Forestry, Animal Husbandry and Fishery (Category A) and Construction industries (Category E) show the lowest at 3%, respectively. The mean value of the variable representing international diversification and foreign involvement (MNC) varies substantially across industries. Firms

in the Construction industry (Category E) have the highest mean MNC at 30%, while those in the Utility industry have the lowest at 6%.

The estimated coefficient and P-value of DERIVATIVE and FCDVAL using fixed-effect regressions are reported for the 12 different industries in Table 7. Similar to the results for the entire sample, the relationship between foreign currency derivatives use and corporate value is positive and significant for all industries except for the Utility (Category D) and Construction industries (Category E). The analysis reports that the three industries that receive the highest value-enhancing premium are Leasing and Commercial Service (78.1% based on DERIVATIVE and 5% based on FCDVAL), Scientific Research and Technical Service (50.5% based on DERIVATIVE and 3.3% based on FCDVAL), and Agriculture, Forestry, Animal Husbandry and Fishery (45.6% based on DERIVATIVE and 3.3% based on FCDVAL).

[Insert Table 7 Here]

5. Conclusions

Using a sample of nearly 70,000 firm-quarter observations from 2000 to 2013, this study investigates the value-enhancing effect of the use of currency derivatives to hedge currency risk among Chinese listed firms. We are able to confirm the unconditional value-enhancing effect of derivatives use on firm value. The conditional effect, considering heterogeneous firm characteristics and macroeconomic conditions, is still prominent and the results prove to be robust by adopting alternative measures of derivatives use and firm value and different econometric methods.

Firm characteristics and macroeconomic conditions play important roles in influencing the value-enhancing effect. Small firm hedgers attain higher value-enhancing premiums than large firm hedgers. Firms with greater profitability and with more investment opportunities attain more benefit by using currency derivatives to hedge foreign exchange risk. The value-enhancing effect is prominent when the exchange rate depreciates or the economy is expanding. The association between derivatives use and firm value weakens during financial crises.

These findings provide some meaningful implications for policy makers and firm managers. The suggestion is that among firms exposed to foreign exchange risk, firm managers design their hedging strategy in accordance with the characteristics of their firm and adjust the position of foreign currency derivatives proactively to attain a greater value-enhancing premium under different macroeconomic conditions.

The present study also has some limitations. Due to information disclosure constraints for Chinese listed firms, we are not able to explore some unique and interesting firm characteristics, such as overseas investments through a network of subsidiaries in various locations and different channels, and the purpose of using currency derivatives. We believe that we could further extend the present study to redevelop an empirical model by distinguishing among MNCs, importers, exporters, and pure domestic firms if such information becomes available.

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Table 1 Summary statistics

Variable	Number of observations	Mean	Std. Dev.	Min	Max
TQ	78250	1.691	.910	.827	5.009
ATQ	77358	2.395	1.505	.910	7.642
DERIVATIVE	80139	.152	.359	.000	1.000
FCDVAL	80119	2.323	5.570	.000	18.250
SIZE	80089	21.509	1.209	19.232	24.630
GINC	71772	.135	.523	-.698	2.200
ROA	80078	.036	.042	-.057	.194
LEVERAGE	80077	.480	.224	.071	.982
CAPX	80139	.508	.499	.000	1.000
MNC	80139	.177	.381	.000	1.000

Table 2. Impact of foreign currency derivatives on the firm value.

	（1）	（2）	（3）	（4）
Foreign currency derivatives				
DERIVATIVE	.230***	.314***		
	(.000)	(.000)		
FCDVAL			.014***	.020***
			(.000)	(.000)
Firm characteristics				
Size		-.237***		-.239***
		(.000)		(.000)
ROA		2.551***		2.550***
		(.000)		(.000)
LEVERAGE		.218**		.220***
		(.017)		(.000)
GINC		-.072***		-.072***
		(.000)		(.000)
CAPX		-.082***		-.081***
		(.000)		(.000)
MNC		.228***		.227***
		(.000)		(.000)
Constant	1.719***	6.644***	1.723***	6.680***
	(.000)	（.000）	(.000)	(.000)
Industry dummies	Yes	Yes	Yes	Yes
Observations	78250	70471	78230	70452
Number of groups	2644	2629	2644	2629
R^2	.011	.223	.011	.222

* p < 0.1, ** p < 0.05, *** p < 0.01.

Table 3. Robustness check: alternative measure of firm value

Dependent variable:	ATQ	ATQ	P/B	P/B
	（1）	（2）	（3）	（4）
Foreign currency derivatives				
DERIVATIVE	.370***		1.174***	
	(.000)		(.000)	
FCDVAL		.024***		.076***
		(.000)		(.000)
Firm characteristics				
Size	-.662***	-.665***	-2.540***	-2.544***
	(.000)	(.000)	(.000)	(.000)
ROA	4.401***	4.394***	5.895***	5.897***
	(.000)	(.000)	(.000)	(.000)
LEVERAGE	.198***	.200*	.1.008***	1.019***
	(.000)	(0.091)	(.002)	(0.005)
GINC	-.084***	-.084***	.144***	.144***
	(.000)	(.000)	(.000)	(.000)
CAPX	-.110***	-.110***	-.264***	-.264***
	(.000)	(.000)	(.000)	(.000)
MNC	.142***	.141***	-1.289***	-1.293***
	(.000)	(.000)	(.000)	(.000)
Constant	16.317***	16.375***	15.913***	15.923***
	(.000)	(.000)	(.000)	(.000)
Industry dummies	Yes	Yes	Yes	Yes
Observations	69867	69848	58688	58671
Number of groups	2606	2606	2209	2209
R^2	0.336	0.337	0.132	0.131

* p < 0.1, ** p < 0.05, *** p < 0.01.

Table 4. Robustness check: alternative estimation methodologies

Dependent variable:	RE	RE	Fama MacBeth	Fama MacBeth	POLS	POLS	2SLS	2SLS
TQ	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign currency derivatives								
DERIVATIVE	.313***		.065***		.254***		1.648***	
	(.000)		(.000)		(.000)		(.000)	
FCDVAL		.020***		.004***		.016***		.106***
		(.000)		(.000)		(.000)		(.000)
Firm characteristics								
Size	-.261***	-.262***	-.365***	-.367***	-.350***	-.352***	-.414***	-.425***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
ROA	2.681***	2.680***	5.104***	5.109***	3.977***	3.975***	3.871***	3.869***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
LEVERAGE	.264***	.267**	.281***	.281***	.211***	.214***	.207***	.228***
	(.001)	(.001)	(.000)	(.000)	(.002)	(.001)	(.000)	(.000)
GINC	-.072***	-.072***	-.024**	-.024**	-.068***	-.068***	-.044***	-.045***
	(.000)	(.000)	(.014)	(.015)	(.000)	(.000)	(.000)	(.000)
CAPX	-.068***	-.068***	.046***	.046***	-.015	-.015	-.047***	-.047***
	(.000)	(.000)	(.000)	(.000)	(.405)	(.404)	(.000)	(.000)
MNC	.202***	.201***	.085***	.083***	.125***	.123***	-.057	-.086*
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.132)	(.086)
Constant	7.037***	7.076***	9.216***	9.244***	8.971***	9.012***	10.125***	10.357***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	70471	70452	70471	70452	70471	70452	70471	70452
R^2	.062	0.62	.295	.295	0.206	.206	.104	.104

* p < 0.1, ** p < 0.05, *** p < 0.01.

Table 5. Firm characteristics and foreign currency derivatives

Panel A: Size		
Independent variable	DERIVATIVE	FCDVAL
Dependent variable: TQ	(1)	(2)
FCD	2.708***	.197***
	(.000)	(.000)
FCD * Size	-.109***	-.008**
	(.000)	(.000)
Size	-.219***	-.219***
	(.000)	(.000)
(Number of firms)	2629	2629
R^2	.220	.219
Panel B: Profit		
Independent variable	DERIVATIVE	FCDVAL
Dependent variable: TQ	(3)	(4)
FCD	.261***	.017***
	(.000)	(.000)
FCD * ROA	1.430***	.093***
	(.000)	(.000)
ROA	2.324***	2.326***
	(.000)	(.000)
(Number of firms)	2629	2629
R^2	.225	.225
Panel C: Investment opportunity		
Independent variable	DERIVATIVE	FCDVAL
Dependent variable: TQ	(5)	(6)
FCD	.310***	.020***
	(.000)	(.000)
FCD * GINC	.031***	.002***
	(.000)	(.005)
GINC	-.077***	-.076***
	(.000)	(.000)
(Number of firms)	2629	2629
R^2	.223	.222

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Macro conditions and foreign currency derivatives

Panel A: Crisis period		
Independent variable	DERIVATIVE	FCDVAL
Dependent variable: TQ	(1)	(2)
FCD	.429***	.026***
	(.000)	(.000)
FCD * Dummy(crisis)	-.300***	-.016**
	(.000)	(.000)
(Number of firms)	2629	2629
R^2	.224	.223
Panel B: Exchange rate depreciation		
Independent variable	DERIVATIVE	FCDVAL
Dependent variable: TQ	(3)	(4)
FCD	.290***	.019***
	(.000)	(.000)
FCD * Dummy(depreciation)	.180***	.010***
	(.000)	(.000)
(Number of firms)	2629	2629
R^2	.227	.226
Panel C: Economic growth		
Independent variable	DERIVATIVE	FCDVAL
Dependent variable: TQ	(5)	(6)
FCD	.213***	.014***
	(.000)	(.000)
FCD * Dummy(economic growth)	.193***	.012***
	(.000)	(.000)
(Number of firms)	2629	2629
R^2	.233	.231

* p < 0.1, ** p < 0.05, *** p < 0.01.

Table 7. Use of foreign currency derivatives across industry

		FCD measure	
Industry Code	Observations	DERIVATIVE	FCDVAL
A	1,408	.456***	.033***
		(.001)	(.000)
B	1,525	.338***	.022***
		(.000)	(.000)
C	41,061	.306***	.027***
		(.000)	(.000)
D	2,626	.110	.007
		(.137)	(.128)
E	1,437	.039	.002
		(.430)	(.409)
F	2,799	.158***	.009***
		(.003)	(.006)
G	4,760	.380***	.025***
		(.000)	(.000)
H	4,095	.334***	.020***
		(.000)	(.000)
J	3,628	.165**	.010**
		(.012)	(.017)
K	2,308	.334***	.021***
		(.001)	(.000)
L	693	.780***	.050***
		(.000)	(.010)
M	3,201	.505***	.033***
		(.000)	(.000)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix

Variables	Observations	Descriptive Statistics				
		mean	sd	P50	min	max
Industry Category A: Agriculture, forestry, animal husbandry and fishery						
TQ	1683	1.78	0.9	1.5	0.83	5.01
ATQ	1644	2.46	1.32	2.12	0.91	7.64
FCD	1703	0.15	0.36	0	0	1
FCDVAL	1703	2.14	5.2	0	0	18.25
SIZE	1702	21.06	0.8	20.96	19.23	23.68
GINC	1410	0.2	0.72	0.03	-0.7	2.2
ROA	1701	0.03	0.04	0.02	-0.06	0.19
LEVERAGE	1699	0.43	0.21	0.42	0.07	0.98
CAPX	1703	0.55	0.5	1	0	1
MNC	1703	0.12	0.33	0	0	1
Industry Category B: Mining industry						
TQ	1704	1.78	0.98	1.46	0.83	5.01
ATQ	1617	2.65	1.66	2.11	0.91	7.64
FCD	1729	0.15	0.36	0	0	1
FCDVAL	1729	2.38	5.7	0	0	18.25
SIZE	1728	22.45	1.4	22.4	19.23	24.63
GINC	1526	0.13	0.47	0.06	-0.7	2.2
ROA	1728	0.07	0.05	0.06	-0.06	0.19
LEVERAGE	1728	0.42	0.18	0.44	0.07	0.98
CAPX	1729	0.43	0.5	0	0	1
MNC	1729	0.25	0.43	0	0	1
Industry Category C: Manufacturing industry						
TQ	50110	1.68	0.88	1.39	0.83	5.01
ATQ	49629	2.43	1.46	1.98	0.91	7.64
FCD	51641	0.12	0.33	0	0	1
FCDVAL	51623	1.83	4.96	0	0	18.25
SIZE	51613	21.31	1.1	21.17	19.23	24.63
GINC	41845	0.11	0.44	0.05	-0.7	2.2
ROA	51606	0.04	0.05	0.03	-0.06	0.19
LEVERAGE	51603	0.46	0.21	0.46	0.07	0.98
CAPX	51641	0.47	0.5	0	0	1
MNC	51641	0.16	0.37	0	0	1
Industry Category D: Industry of electric power, heat, gas and water production and supply						
TQ	3173	1.34	0.51	1.19	0.83	5.01
ATQ	3131	1.87	1.06	1.53	0.91	7.64
FCD	3275	0.11	0.31	0	0	1
FCDVAL	3275	1.67	4.83	0	0	18.25
SIZE	3271	22.14	1.26	21.97	19.23	24.63
GINC	2692	0.11	0.47	0.04	-0.7	2.2

ROA	3270	0.04	0.04	0.04	-0.06	0.19
LEVERAGE	3271	0.51	0.21	0.52	0.07	0.98
CAPX	3275	0.64	0.48	1	0	1
MNC	3275	0.06	0.24	0	0	1
Industry Category E: Construction industry						
TQ	1671	1.37	0.66	1.16	0.83	5.01
ATQ	1589	1.84	1.16	1.42	0.91	7.64
FCD	1687	0.16	0.37	0	0	1
FCDVAL	1687	2.65	6.07	0	0	18.25
SIZE	1687	22.03	1.31	21.97	19.23	24.63
GINC	1437	0.24	0.68	0.1	-0.7	2.2
ROA	1687	0.03	0.03	0.02	-0.06	0.19
LEVERAGE	1687	0.64	0.17	0.67	0.07	0.98
CAPX	1687	0.56	0.5	1	0	1
MNC	1687	0.3	0.46	0	0	1
Industry Category F: Wholesale and retail industry						
TQ	3284	1.42	0.64	1.22	0.83	5.01
ATQ	3229	2.03	1.24	1.62	0.91	7.64
FCD	3385	0.13	0.34	0	0	1
FCDVAL	3385	2.07	5.45	0	0	18.25
SIZE	3383	22.11	1.35	22.07	19.23	24.63
GINC	2854	0.08	0.36	0.04	-0.7	2.2
ROA	3383	0.05	0.05	0.04	-0.06	0.19
LEVERAGE	3383	0.44	0.23	0.4	0.07	0.98
CAPX	3385	0.63	0.48	1	0	1
MNC	3385	0.15	0.36	0	0	1
Industry Category G: Transport, storage and postal service industry						
TQ	5870	1.97	1.03	1.63	0.83	5.01
ATQ	5829	3.07	1.77	2.53	0.91	7.64
FCD	5934	0.14	0.34	0	0	1
FCDVAL	5934	2.07	5.31	0	0	18.25
SIZE	5932	20.92	1	20.85	19.23	24.63
GINC	4766	0.17	0.57	0.07	-0.7	2.2
ROA	5932	0.04	0.05	0.03	-0.06	0.19
LEVERAGE	5931	0.4	0.24	0.38	0.07	0.98
CAPX	5934	0.44	0.5	0	0	1
MNC	5934	0.26	0.44	0	0	1
Industry Category H: Accommodation and catering industry						
TQ	5252	1.6	0.77	1.36	0.83	5.01
ATQ	5251	2.2	1.24	1.83	0.91	7.64
FCD	5334	0.16	0.37	0	0	1
FCDVAL	5333	2.54	5.84	0	0	18.25
SIZE	5332	21.39	1.07	21.27	19.23	24.63
GINC	4147	0.09	0.41	0.04	-0.7	2.2

ROA	5331	0.04	0.05	0.03	-0.06	0.19
LEVERAGE	5332	0.55	0.2	0.56	0.07	0.98
CAPX	5334	0.69	0.46	1	0	1
MNC	5334	0.12	0.32	0	0	1
Industry Category J: Industry of information transmission, software and information technology services						
TQ	4289	1.52	0.86	1.22	0.83	5.01
ATQ	4258	2.07	1.39	1.57	0.91	7.64
FCD	4630	0.14	0.35	0	0	1
FCDVAL	4630	1.97	4.99	0	0	18.25
SIZE	4625	21.89	1.35	21.87	19.23	24.63
GINC	3902	0.34	0.97	0.03	-0.7	2.2
ROA	4625	0.03	0.04	0.02	-0.06	0.19
LEVERAGE	4625	0.59	0.19	0.62	0.07	0.98
CAPX	4630	0.54	0.5	1	0	1
MNC	4630	0.15	0.36	0	0	1
Industry Category K: Real estate industry						
TQ	2821	1.81	0.95	1.5	0.83	5.01
ATQ	2765	2.82	1.66	2.31	0.91	7.64
FCD	2858	0.12	0.33	0	0	1
FCDVAL	2858	1.83	4.98	0	0	18.25
SIZE	2857	21.18	1.1	21.07	19.23	24.63
GINC	2325	0.2	0.64	0.06	-0.7	2.2
ROA	2857	0.04	0.05	0.03	-0.06	0.19
LEVERAGE	2857	0.39	0.2	0.37	0.07	0.98
CAPX	2858	0.57	0.5	1	0	1
MNC	2858	0.14	0.34	0	0	1
Industry Category L: Leasing and Commercial Service Industry						
TQ	855	2.03	1.05	1.7	0.83	5.01
ATQ	855	3.53	1.88	2.96	0.91	7.64
FCD	861	0.2	0.4	0	0	1
FCDVAL	861	3.02	6.23	0	0	18.25
SIZE	861	21.01	1.13	21.01	19.23	23.39
GINC	694	0.16	0.55	0.05	-0.7	2.2
ROA	859	0.04	0.05	0.03	-0.06	0.19
LEVERAGE	860	0.4	0.24	0.34	0.07	0.98
CAPX	861	0.58	0.49	1	0	1
MNC	861	0.09	0.29	0	0	1
Industry Category M: Scientific Research and Technical Service Industry						
TQ	4970	1.79	0.95	1.47	0.83	5.01
ATQ	4972	2.71	1.7	2.15	0.91	7.64
FCD	5051	0.12	0.32	0	0	1
FCDVAL	5050	1.79	4.99	0	0	18.25
SIZE	5046	20.98	1.07	20.98	19.23	24.63
GINC	3225	0.21	0.69	0.04	-0.7	2.2

ROA	5045	0.04	0.05	0.03	-0.06	0.19
LEVERAGE	5046	0.54	0.21	0.55	0.07	0.98
CAPX	5051	0.65	0.48	1	0	1
MNC	5051	0.14	0.35	0	0	1