125.850 Research Report

The Effects of Derivative Usage on Corporate Value, Risk and Share Return: Empirical Evidence from China

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Abstract

This paper focus on the analyzation of three areas; Through a sample of 1749 firms (including financial institutions) that are listed on the Shenzhen stock exchange and on the GEM(Growth Enterprise Market), with time periods ranging from 2005 to 2015,the goal of this paper is to examine and to draw relationships between corporate value, corporate risk exposure and company stock return respectively, on the behavior of using of financial derivative instruments to hedge for the relevant firm exposures. With sufficient evidence, it is found that the use of financial derivative instrument brought positive and significant premium to corporate value, as well as reducing risk(volatility), and leading to positive stock returns on an average basis. The results however are sensitive to endogeneity, omitted variable concerns.

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Introduction

Financial academics and practitioner in the relevant fields have all paid special emphasis on financial derivative instruments due of its versatility, indeterminacy and two-sidedness. Just like what Warrant Buffet has once descripted: “In my view, derivatives are financial weapon of mass destruction, carrying dangers that, while now latent, are potentially lethal.”, derivatives are often pictured as a double-edge sword in the minds of many financial industry participant.

Despite abundant studies have been done on the good and bad of derivative instruments, the benefit of financial derivative instrument remains controversial. Graham and Rogers (JF, 2002) find evidence that firms hedge to increase debt capacity and interest deductions. Campello et al (JF, 2011), via focusing on creditor’s evaluation of corporate hedging, examined the impact of hedging on firm’s external financing costs, investment spending and z-score and find hedging reduces the cost of external financing, eases the firm’s investment process and thereby renders lower capital expenditure restrictions. Dadalt et al (JFM, 2002), by using alternative analyst forecast as a proxy for asymmetric information, find improvement of information environment of the relevant firm (improvement on asymmetric information on a firm’s earnings), putting it in another phrase, they find derivative hedging’s ability to mitigate noises in earning which are not associated with firm’s true profit generating ability, as a result market participants are left with a more informative picture on firm’s true earning ability as well as the manager’s ability. Smith and Stulz (1985) contend that hedging may reduce the contracting costs with senior management, other employees, suppliers, and customers.
Moreover, Bartram et al (JFQA, 2011), Nelson et al (JFC, 2005) and Allayannis and Weston (RFS,2001) have focused explicitly on relationship between derivative usage and firm value. In which, Allayannis and Weston (RFS, 2001) used a relatively smaller sample of non-financial firms and solely examining impact of currency derivative usage. Bartram et al (JFQA, 2011) with 6888 sample firms and across 42 countries, find strong evidence that financial derivative usage could reduce both total and systematic risk, moreover, having positive effect on firm value.

1.1 Motivation and Research Focus

Taking a closer look at the composite of Bartram et al(2011) ‘s sample, firms that got elected into the sample are mostly listed in developed countries that have a relatively (more than 80% of the 6888 sample firms) sophisticated financial market with a developed systems of relevant law and enforcement, as well as accounting standards fully in place. The skewness of sample origin towards sophisticated and well-established markets is also consistent for all abovementioned papers. This in turn leads to my concern that the abovementioned findings may not be consistent in an emerging country financial market that generally exhibit high policy-dependence (policy could be vulnerable and subject to frequent turnover), and are heavily influenced by government administrative orders. A classic example of unsophisticated government intervention in China is the circuit breaker system introduced by the Shanghai, Shenzhen and the China Financial Futures Exchange; such policy was introduced on 4th Jan 2016 and was suspended four days later. For this reason, I am interested to testify the economic implications behind derivative usage for Chinese firms. I will examine relationships between derivative usage and three aspects of firm criteria. First being the relationship between derivative usage and firm value, secondly, I will devote texts and examination efforts on potential relevancy between derivative usage and firm risk and lastly, I will examine the association between firm abnormal market return as well as stock return and derivative usage.

I find relevant evidence to support the previously mentioned value enhancing, and risk mitigating effect of derivative in our sample firms using different methodologies, I have also found positive impact of derivative on firm stock returns.

The rest of the article is organized as follows: Section 2 will discuss the two areas of study done by previous researchers. Section 3 will take on topics including data collection process, sample establishment, summary statistics, hypothesis development and a brief introduction of methodologies used in this study. Section 4 will present the results for both univariate and multivariate tests, as well as the robustness check. Section 5 is a robustness test done on potential reverse causality relationship between derivative usage and firm value. And lastly in section 6 I will further conclude test results for this study.

2.Literature reviews

In a perfect financial world, like the one described by Modigliani and Miller in 1958(a.k.a., the classic MM theory), there exists no asymmetry information, taxes and transaction costs and agency costs, thus hedging at the corporate level would not add value because it is indifferent for shareholders to hedge by themselves to manage their own desired risk situations. However, in reality, it is not unreasonable to believe that the capital market exists some degree of imperfection and frictions. Thus, with prudence, care and integrity, corporate hedging could be a value enhancing activity.

2.1 How does Hedging add value?

Several articles have shed light on the key motivation as to why manger chooses to hedge. For example, Smith and Stulz (1985) point out that firms might hedge in response to tax function convexity, companies could potentially reduce expected tax liability by hedging to reduce income volatility. Graham and Rogers (2000) adds to the tax incentive argument by addressing the two sources of tax incentive, increase in debt capacity and thus the related interest tax deductions and the potential reduction in expected tax liability if tax function turns out to be convex. They found evidence that the former increases tax benefit. Their findings support Leland (1998)'s argument that hedging increases value through lowering firm's average cashflow volatility as well as the firm's expected default rates and distress costs and thereby increasing leverage capacity. Lewent and Kearney (1990) as well as Froot, Scharfstein, and Stein (1993) propose that hedging substantially mitigates firm underinvestment problem. Rationale being that the firm's internally generated cashflow, one of the critical source to fund investments, could be disrupted by exterior factors such as currency exchange rates, commodity prices and interest rates. Hedging activities, could effectively create value, to the extent that it stabilizes the internally generated cash flows and ensures the firm will process sufficient funds to secure the value-enhancing investment. Moreover, Dadalt et al (2002) argue that manger could reduce noises in earnings contributed by macroeconomic factors through hedging and yield lower analyst earning forecast dispersion, a proxy for asymmetric information and thus add value through rectification of adverse selection as well as subsequent contribution to costliness external financing.

2.2 Prior Research on the Valuing adding and Risk mitigating properties of Derivative Usage

Several literatures have examined whether the abovementioned value adding aspects are fully acknowledged by market participants and exists distinguishable differences to those that did not utilize derivative to hedge. For example, Bartram, Brown and Conrad (2011) Through an ample, world-wide sample, they find solid evidence that the use of financial derivatives reduce both total and systematic risks. They have also found positive association between derivative usage and firm value, but they are more prone to the endogeneity problem as well as the omitted variable issue. On the other hand, Hentschel and Kothari (2001), by using data from 425 large U.S corporations, yield trivial differences in risk associated with derivative use. Allayannis and Weston (2001) examined the relationship between currency derivative usage and firm value, where they find a positive relationship between FCD and firm value, proxied by Tobin's Q. Moreover, Nelson, Moffitt and Affleck-Graves (2005) from their sample of 1308 companies find companies that hedge their currency exposure on average have outperformed those that doesn't hedge, robust to several alternative methods of abnormal return estimations, but no sufficient evidence when utilized an augmented model to control for firm intangible assets. Jin and Jorion (2006) on the other hand conducted a study of derivative usage specifically on the Oil and Gas industry, observed reduction in stock price sensitivity to the oil and gas prices. However lacked the evidence to support any association between hedging and its affect on firm's market value.

Additionally, more and more emphasis and focus are beginning to turn over towards markets outside of the US. Number of recent studies have given insights to those more or less efficient and established markets. Akpinar and Fettahoglu(2016) with a sample of 72 Turkish non-financial firms from 2009 to 2013, using Tobin's Q as a proxy for firm value have, find a positive but insignificant relationship between hedging and firm value enhancement. Identically Luo(2016) conducted an empirical study on multinational corporations listed in China, where he find currency hedging have positive but insignificant relationship with corporate value.

3.Sample Description, Methodology and Hypothesis Development

3.1 Dependent Variables and Hypothesis Development

Sample in this study consists of 1749 firms listed in the Shenzhen Stock Exchange and the GEM(Growth Enterprise Market) from the end of 2005 through to the end of 2015. 15901 aggregate annual observations were obtained in the sample period. Consistent with Luo(2016), financial firms are not excluded from the sample mainly because of the financial institutions in China are mainly market participants rather than market markers in the global derivative market of commodity and foreign exchange rates. Inconsistent with Luo(2016)'s treatment on ST corporates, ST(special treatment corporations) corporations were not excluded from the sample since this study focuses to justify, if any, impacts of derivative usage throughout a relative longer-term trend and with a larger group of firms compared to Luo(2016).

Derivative usage is interpreted in this study as a dummy variable with a value of 1 for firm that uses any type derivatives(forward, futures, options, swaps NDFs, etc.) in a given year and 0 otherwise, consistent Bartram et al(2011)' s specification on derivative usage and Allayannis and Weston(2001)'s specification for foreign currency derivative usage. A portion of derivative usage information was retrieved from the RESSET data base, however, prior to the new enterprise accounting standard implemented in January 2007(which require firms to specifically disclose relevant information regarding their risk management objectives, policies as well as qualitative and quantitative information on financial instruments utilized), derivative information were ambiguous and managers have complete discretion as to whether the firm will disclose the information, thereby derivative information are extremely difficult to be captured with tools employed by commercialized databases. Manual processes were being implemented to thoroughly search for relevant words, phrases and context in annual reports that may yield a firm to be a hedger. Companies with neither disclosed derivative holding summary or relevant investment income/expense (Income statement item), fair value gain/loss items and indication of cashflow hedging(under equity section) are inferred to be non-hedgers. Despite the method, this variable is still prone to moderate human error.

LOG(Tobin's Q), and LOG(Enterprise Value) are used to capture firm value in this study, the former compares the valuation render by the financial market and the replacement value of the firm's asset. Enterprise Value is the sum of firm's market capitalization, debt, minority interest, subtract by its cash and cash equivalents. Tobin' Q measure is obtained from CSMAR database, EV is obtained from RESSET database.

$$\mathrm{TQ} = \frac{[(\text{Total Shares Outstanding} - \text{Bshares Outstanding}) * P_A + Bshare\ Outstanding * P_B * exchange\ rate]}{Total\ Assets}$$

Where:

$$P_A = Closing\ price\ for\ shares\ listed\ in\ Mainland\ China$$

$$P_B = Closing\ price\ for\ shares\ that\ are\ listed\ outside\ of\ China$$

H1a. The usage of Derivative will result in higher company value.

In additional to pooled OLS, the fixed effect(within) model is employed to test the above hypothesis. Fixed effect model removes time-fixed firm idiosyncratic error:

$$LN(TQ|EV)_{it} = \beta_1 Derivative\ Dummy_{i,t} + \sum_k \beta_k CONTROL_{i,t}^k + \varepsilon_i + \mu_{it}\ ,$$

$$t = 1, \ldots, 10 \quad (3a)$$

Where μ_{it} equals the idiosyncratic error for firm i, at time t and ε_i is the heterogeneity

Taking the time average of the entire above equation e.g.:

$$\frac{1}{T}\sum_{t=1}^{T} LN(TQ|EV)_{it} \ldots = \overline{LN(TQ|EV)_i} \quad (3b)$$

Will give us:

$$\overline{LN(TQ|EV)_i} = \overline{\beta_1 Derivative\ Dummy_i} + \overline{\sum_k \beta_k CONTROL_{i,t}^k} + \varepsilon_i + \bar{\mu}_i, (3c)$$

Subtracting (3c) from (3a) is the fixed effect method which will effectively remove the heterogeneity and leave us with a time-variant unobserved idiosyncratic error. The bottom line to use the fixed effect is that if we expect the below assumption is true (highly likely) and pooled OLS would not be appropriate:

$$\mathrm{Cov}(\varepsilon_i, Independent\ Variables_{it}) \neq 0, (3d)$$

LOG(Standard deviation of quarter operating cash flow per share)(Bartram et al.(2011) and the logarithm of its change are used as proxy for risk. Additionally, LOG(Annualized Stock Return Volatility)(Bartram et al(2011) and Hentschel and Kothari(2001))is also used as dependent variable to proxy for risk. The per share measures are obtained from the CSMAR database and Stock Return Volatility is obtained from the RESSET database.

H1b. The usage of Derivative will result in lower risk.

Pooled OLS, fixed effect and random effect regression will be used to examine this hypothesis.

Random effect assumes zero covariance between the error term($\varepsilon_i + \mu_{it}$) and the independent variables, but assuming and correcting for covariance between the error terms ε_i overtime:

$$\mathrm{Cov}(\varepsilon_i + \mu_{it}, \varepsilon_i + \mu_{is}),$$

where covariance between μ_{it} and μ_{is} , ε_i and μ_{is} are all assumed to be zero, leaving the term ε_i to correlate with itself, and thus

$$\mathrm{Var}(\varepsilon_i) > 0$$

Lambda takes on a value between 0 and 1 and multiplied by the time mean of each variable in equation (3a):

$$\lambda\overline{LN(TQ|EV)_\iota} = \lambda\,\overline{\beta_1 Derivative\ Dummy_\iota} + \sum_k \lambda\beta_k CONTROL_{i,t}^k + \varepsilon_i + \bar{\mu}_\iota, (3e)$$

Turns out, lambda is :

$$\lambda = 1 - \sqrt{\left(\frac{\sigma_\mu^2}{\sigma_\mu^2 + (T * \sigma_\varepsilon^2)}\right)}, (3f)$$

where:

σ_μ^2 is the variance of error term μ

T is the total time

σ_ε^2 is the variance of error term ε

The random effect model thereby **takes away equation (3e) from equation (3a)**.

Stock return(taken account into dividend) , LOG(Change in stock return) and Alpha(Nelson et al.(2005) are used as dependent variable to examine the impact of hedging on the market price of firm's equity. Both data are obtained from RESSET database.

H1c. The usage of Derivative will result in higher stock return

Fixed effect, random effect is used to test for this relationship.

Table 1. Panel A,B and C presents summary statistics of the main variables used in this study (winsorized mean)

The correlations between all variables descripted in section 3.2 are presented in table 1 Panel D and E. It can be seen from Panel D that Tobin's Q is negatively related to our variable of interest (derivative usage), but not statistically different from zero, on the other hand Panel E depicts a positive correlation between EV and the use of derivative.

3.2 Control Variables

Consistent with Allayannis and Weston(2001) and Luo(2016), below variables are in place to better examine the ceteris paribus effect of the variable of interest in the multivariate regressions：

Variable Definitions	
Variable	Definition
Firm size measure 1	Logarithm of Firm total asset, to control for potential positive linkage between firm size and the decision to use derivative(Gramham and Rogers(2002) ,Retrieved from RESSET
Firm size measure 2	Logarithm of Firm Enterprise Value, Retrieved from RESSET
Leverage	Debt/Total Asset is used to control for leverage abundant of studies argue that capital structure could influence corporate value (lower required rates to discount firm cash flows, tax deductions etc. So as the opposite when firm is distressed, data from Retrieved from RESSET
Capital Constraints	Funding projects via internal resource is a superior way than having to finance the proposed project through financial market. According to Luo (2016), by having to consider the cost to finance a project through outsourcing, firms are more likely to forgo good investment opportunities and leading to a lower Tobin's Q. Dividend/Share is used to proxy for capital constraints. Data are partially RESSET, since there were considerable missing data, relevant data from CSMAR is used as supplement
Investment Opportunities	Lewent and Kearney (1990), Froot el at (1993) have provided evidence to support mitigation of underinvestment problems via hedging and that hedgers are better able to expoilt investment opportunities. R&D should be used as a control, but R&D data are seldom avaiable for Chinese firms. Operating Revenue Growth are used instead.
International Diversification	Kim,Mathur and Nam(2005) find that firms with foreign sales hut no oversee operations tend to use more financial hedging relative to the level of currency exposure and firms with oversee operations tends to hedge less proportion of their currency exposure. Allayannis and Ofek contend that the levels of derivatives used

	depends only on firm's exposure through foreign sales and trade. Here i do not distinguish between oversea operation and merely sales to overseas. The focus here is to draw a distinction between firms that have oversea connections and those that don't. Since firms with oversea connections are more inclined to hedge and easier access to cheaper at the time foreign debts which is belieived to have implication on firm value. The oversea dummy is used, 1 if any of below items are shown in annual report: ;1. FX translation difference under other comprehensive income (Equity item), 2. FX gain/loss (Income statement item),3. other reported foreign currency reserves. Relavent data are obtained from RESSET
Profitability	Return On Asset are used to control for profitability. Investors generally accept higher price for profit generating firms. Retreived from RESSET

4.Results

4.1 Univariate Results

Table 2, panel A presents the number of observations for hedgers and non-hedgers each year from 2005 to 2015. In total, there are about 756 observations for hedgers. Panel B presents the annual average Tobin’s Q value for hedgers (denoted as 1 in the second row, column three) and non-hedgers, from panel B we could see that non-hedger seems to have a higher Tobin’s Q measure a 10 year mean of about 2.47 for non-hedgers versus 1.74 for hedgers. However, we need to acknowledge that market value in the Chinese stock market are substantially right skewed with lots of extremely overvalued stocks (partially due to the difficultness for a company to get listed), for example, the entire GEM market in 2015 has average P/E of 109(492 listed companies). Thereby this relationship could merely be a coincidence since non-hedgers are much greater in quantity. Panel C exhibits the stock return volatility statistics, hedger on average seems to have a smaller volatility over the years. Lastly, panel D presents the firm stock return, similar with panel B for TQ, this could entirely due to other factors such as sample size difference.

Table 2. Univariate Test of Corporate Value, Risk and Return Measures and Derivate Use

Panel A	Observations	
Hedger = 1	0	1
Date		
12-31-2005	772	1
12-31-2006	904	5
12-31-2007	1215	25
12-31-2008	1398	40
12-31-2009	1476	56
12-31-2010	1505	70
12-31-2011	1535	82
12-31-2012	1558	91
12-31-2013	1584	115
12-31-2014	1578	138
12-31-2015	1582	136
Total	15107	759

Panel B	Tobin's Q			
Hedger = 1	0		1	
Date	Mean(winsorized)	SD	Mean(winsorized)	SD
12-31-2005	0.880010432	0.764694432	N/A	N/A
12-31-2006	1.408574788	1.306868728	1.4880155	0.2062215
12-31-2007	3.405450049	2.442412967	1.600778158	1.048949372
12-31-2008	1.388312287	1.234305587	0.846827367	0.520842024
12-31-2009	2.971253522	2.092948202	1.7365672	1.097239197
12-31-2010	3.260460361	2.262955521	2.174642	1.692643208
12-31-2011	1.90033988	1.338871321	1.266894427	0.914085633
12-31-2012	1.732614969	1.282904198	1.184979427	0.97419129
12-31-2013	2.158887477	1.818273991	1.364213631	1.038224218
12-31-2014	2.556116663	2.066004563	1.729050352	1.173922572
12-31-2015	4.241996548	3.663267101	2.80185289	2.332813356
Total	2.471514575	2.299087588	1.739729825	1.535904851

Panel C	Stock Return Volatility			
Hedger = 1	0		1	
Date	Mean(winsorized)	SD	Mean(winsorized)	SD
12-31-2005	0.0294268	0.009568709	N/A	N/A
12-31-2006	0.032284995	0.006741191	0.025053	0.006064148
12-31-2007	0.043757881	0.054602792	0.055938579	0.075988737
12-31-2008	0.04656597	0.039085937	0.042089194	0.00907343
12-31-2009	0.038394662	0.057639149	0.033500525	0.004859796
12-31-2010	0.030185054	0.011120819	0.031963322	0.030883487
12-31-2011	0.026877741	0.021570937	0.024933961	0.006234334
12-31-2012	0.027257673	0.042354285	0.025343619	0.00496784
12-31-2013	0.028379538	0.010641591	0.026211875	0.005163403
12-31-2014	0.027789129	0.00781417	0.026528685	0.006475345
12-31-2015	0.051560911	0.081460366	0.046110082	0.009253427
Total	**0.034037714**	**0.04164659**	**0.032210864**	**0.018999515**

Panel D	Stock Return			
Hedger = 1	0		1	
Date	Mean(winsorized)	SD	Mean(winsorized)	SD
12-31-2005	-0.147154507	0.276842554	N/A	N/A
12-31-2006	0.933880349	0.978725438	1.500474	N/A
12-31-2007	1.996757048	1.473383363	1.543756571	0.921631487
12-31-2008	-0.566446257	0.336783797	-0.569781643	0.198950886
12-31-2009	1.505311905	1.123062303	1.453682	0.840546965
12-31-2010	0.188910882	0.468427068	0.276283326	1.207394671
12-31-2011	-0.319559414	0.264544556	-0.336431956	0.185614603
12-31-2012	0.022429528	0.439656665	0.012624725	0.304232092
12-31-2013	0.37632101	0.630150777	0.245046155	0.353575048
12-31-2014	0.42080819	0.459251002	0.519963339	0.470342988
12-31-2015	0.942700193	0.928892538	0.818014397	0.739865283
Total	**0.438087676**	**0.96556227**	**0.391760758**	**0.784344403**

4.2 Multivariate Results

4.2.1 Results for regressions on firm value measures

The regression results for equation 3a – 3c(fixed effect) and 3a(OLS) are reported in table 3.

Panel A present the results for log of Tobin's Q. The main variable of concerned here is the derivative usage dummy that takes on value 1 or 0. Consistent with the value enhancement theory, under fixed effect regression (column 2) the coefficient for derivative usage dummy positive and significant(t=3.7307), firms with that hedge with derivative instrument when tested in isolation of time-invariant unobserved factors, tend to have a higher Tobin's Q. However it is negative but insignificant under the pooled OLS(column 3) regression. Except for the pooled OLS regression, the direction and significance of all relevant variables holds the same when industry-codes are added to control for the industry-effect(Bartram et al(2011).when industry codes were added, the derivative usage coefficient under pooled OLS becomes significantly negative

Table 3. Derivative use and firm value

The superscripts ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively.

The degree of significance and the direction of the relevant result of interest is **indifferent** when natural logarithm(LN) is used instead of LOG

Panel A:

Dependent Variable: LOG(Tobin's Q)	Fixed Effects	Pooled Regression
Observations	10890	10890
R Squared	0.0974	0.3292
Derivative Usage Dummy	**0.0996**	**-0.02629**
	3.7307* **	**-0.874**
Debt to Asset Ratio	0.0062	0.004212
	14.4387***	5.324***
LOG(Total Asset)	-0.23521	-0.4034
	8.3436***	66.761***
Dividend/Share	0.37381	1.2430
	2.8871**	31.0818***

Operating Revenue Growth	-0.000056982 1.2381	-0.0001 1.242
Oversea		-0.07618 3.203**
Return On Asset	-0.033507 1.5661	-0.03064 3.027**

F-statistic: 166.767 on 6 and 9270 DF, p-value: < 2.22e-16***
F-statistic: 762.9 on 7 and 10882 DF, p-value: < 2.2e-16***(OLS)

Panel B presents similar regressions done on the logarithm of enterprise value, an alternative measurement (arguably better) for firm value. Again, under the fixed effect regression, derivative usage dummy is significantly positive (both with and without industry code). Interestingly though, the pooled OLS become positive and significant (positive but insignificant with industry-effect controlled).

Panel B:

Dependent Variable: LOG(EV)	Fixed Effects	Pooled Regression
Observations	11461	11461
R Squared	0.4697	0.6468
Derivative Usage Dummy	**0.2337** **5.2880*** **	**0.06221** **2.192***
Debt to Asset Ratio	0.0072 10.5201***	0.00955 13.297***
LOG(Total Asset)	0.77615 90.4288***	0.7584 138.443***
Dividend/Share	-0.062246 -1.227	0.3068 8.333***
Operating Revenue Growth	0.00004739 1.1956	0.0001 1.730.
Oversea		0.002657 0.124
Return on Asset	0.0041043 0.5165	-0.005592 -0.823

F-statistic: 1452.29 on 6 and 9840 DF, p-value: < 2.22e-16***

F-statistic: 2996 on 7 and 11453 DF, p-value: < 2.2e-16***(OLS)

4.2.2 Robustness test and correction

The Breusch-Godfrey/Wooldridge test is employed to test for serial correlation, tests are done with order equal to 1 and moving up to 3, with null hypothesis being no serial correlation.The Breusch-Pagan test is employed to test for heteroskedasticity in the fixed effect regression. Null hypothesis being no presence of heteroskedasticity. As it turn out, the fixed effect results are prone to both serial-correlation and heteroskedasticity with null-hypothesis being rejected in both tests.

Table 4. Presents the relevant results for BW and BP tests (results are the same with/without the industry code) – Firm Value

The degree of significance and the direction of the relevant result of interest is **indifferent** when natural logarithm(LN) is used instead of LOG

The superscripts ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively.

Breusch-Godfrey/Wooldridge test		
LOG(EV)		
	Chi-square	P -value
Order 1	79.066	< 2.2e-16***
Order 2	552.67	< 2.2e-16***
Order 3	595.26	< 2.2e-16***
LOG(TQ)		
	Chi-square	P -value
Order 1	87.674	< 2.2e-16***
Order 2	552.67	< 2.2e-16***
Order 3	519.24	< 2.2e-16***

studentized Breusch-Pagan test		
	BP	P-Value
LOG(EV)	807.42	< 2.2e-16***
LOG(TQ)	770.33	< 2.2e-16***

The Arellano-Bond estimator is used to correct for the presence of both serial correlation and heteroskedastic in the fixed-effect regression. Additionally, the non-parametric Driscoll And Kraay estimator are used to correct for potential cross-sectional dependence as well as serial correlation (more conservative).

Table 5. Presents the t-statistics adjusted for heteroscedasticity, serial correlation and potential cross-section dependence.

The degree of significance and the direction of the relevant result of interest is **indifferent** when natural logarithm(LN) is used instead of LOG

The superscripts ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively.

Panel.A Arellano-Bond estimator

Dependent Variable: LOG(EV)	Fixed Effects
Observations	9840
R Squared	0.4697
Derivative Usage Dummy	**0.2337**
	4.5588* **
Debt to Asset Ratio	0.0072376
	3.8759***
LOG(Total Asset)	0.77615
	29.8628***
Dividend/Share	-0.062246
	-0.8469
Operating Revenue Growth	0.00004739
	5.6785***
Oversea	
Return On Asset	0.0041043
	0.1255

Dependent Variable: LOG(Tobin's Q)	Fixed Effects
Observations	9270
R Squared	0.0974
Derivative Usage Dummy	**0.0996**
	1.9426*
Debt to Asset Ratio	0.00616
	3.3018***
LOG(Total Asset)	-0.23521
	9.0498***
Dividend/Share	0.37381
	5.0860**
Operating Revenue Growth	-0.000056982
	6.8278***
Oversea	
Return On Asset	-0.033507
	-1.0249

Panel B. Driscoll And Kraay estimator(Conservative)

Dependent Variable: LOG(Enterprise Value)	Fixed Effects
Observations	9840
R Squared	0.4697
Derivative Usage Dummy	**0.2337**
	3.6945* **
Debt to Asset Ratio	0.0072376
	0.6858
LOG(Total Asset)	0.77615
	11.4476***
Dividend/Share	-0.062246
	-0.3109
Operating Revenue Growth	0.00004739
	1.519
Oversea	
Return On Asset	0.0041043
	0.0759

Dependent Variable: LOG(Tobin's Q)	Fixed Effects
Observations	9270
R Squared	0.0974
Derivative Usage Dummy	**0.0996**
	1.8080`
Debt to Asset Ratio	0.00616
	3.9858***
LOG(Total Asset)	-0.23521
	2.4680*
Dividend/Share	0.37381
	1.9512*
Operating Revenue Growth	-0.000056982
	1.8940`
Oversea	
Return On Asset	-0.033507
	0.3197`

Table 5 panel A presents the t- statistics that is corrected for heteroscedasticity and serial correlation using the Arellano-Bond method estimator on LOG(EV) and LOG(TQ). The t-statistics for derivative use under Enterprise Value measures is lower but higher under the Tobin's Q measure, both results remained significant. Coefficient on derivative usage is **4.5588 and 1.9426 respectively for LOG(EV) and LOG(TQ), the t-statistics was 5.2880 and 3.7307 respectively, before the correction.** Panel B presents the t-statistics for the two firm value measures adjusted under a more conservative estimator, the Driscoll&Kraay estimator. The t-statistics under this method are both significantly lowered, with derivative usage variable remaining significant with 90% confidence level.

4.2.3 Results for regression on firm risk measures

Table 6 shows the regression result relevant to the two risk measures, the logarithm of the standard deviation of firm quarterly operating cash flow per share, as well as its change and the logarithm of stock return volatility.

Table 6. Results for firm risk measures

The degree of significance and the direction of the relevant result of interest is **indifferent** when natural logarithm(LN) is used instead of LOG

The superscripts ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively.

Panel A: Ran without industry code, results remain indifferent with industry codes added

Dependent Variable: LOG(CFsd)	Fixed Effects	Pooled Regression
Observations	9194	10801
R Squared	0.0130	0.1191
Derivative Usage Dummy	**-0.0472**	**0.076871**
	-1.2662	**3.0764****
Debt to Asset Ratio	-0.00013369	0.00079623
	-0.2248	1.2714
LOG(Total Asset)	0.038865	0.0535
	4.6737***	9.9402***
Dividend/Share	0.091005	-0.1710
	2.1357*	5.2242***
Operating Revenue Growth	-0.000036861	-0.000026546
	-1.1208	-0.747
Oversea		-0.039433
		2.01*
Return On Asset	-0.0039907	-0.013983
	0.58889	1.7439.

F-statistic: 1.5894 on 76 and 9194 DF, p-value: 0.00087812
F-statistic: 17.8239 on 82 and 10801 DF, p-value: < 2.22e-16

Panel B: Ran without industry code, but results are indifferent

Dependent Variable: LOG(Change in CF volatility)	Fixed Effects
Observations	3590
R Squared	0.0184
Derivative Usage Dummy	**-0.4089**
	2.5436*

Debt to Asset Ratio	-0.0022451
	-0.14
LOG(Total Asset)	-0.13659
	4.2858***
Dividend/Share	1.1324
	6.0846***
Operating Revenue Growth	0.000050167
	0.4719
Oversea	
Return On Asset	-0.011274
	-0.1514

F-statistic: 11.2341 on 6 and 3590 DF, p-value: 1.8346e-12

Panel C: Industry code is used to control for potential sector rotation effect for market data

Dependent Variable: LOG(Stock Return Volatility)	Fixed Effect(time)	Pooled Regression	Random Effect(time)
Observations	10873	10873	10873
R Squared	0.0865	0.0625	0.1463
Derivative Usage Dummy	**-0.0258**	**-0.0259**	**-0.0257**
	2.3027*	**1.7899 `**	**2.2782***
Debt to Asset Ratio	-0.00042	-0.0004	-0.0004
	-1.5027	-1.1090	-1.4923
LOG(Total Asset)	-0.0398	-0.0468	-0.0398
	15.6049***	15.0072***	15.5390***
Dividend/Share	-0.0722	-0.1471	-0.0737
	4.8737***	7.7622***	4.9411***
Operating Revenue Growth	0.00004	0.00003	0.00004
	2.4152*	1.4664	2.3901*
Oversea	-0.00432	-0.0089	-0.0045
	-0.4902	0.7838*	0.6106476
Return On Asset	-0.0019	-0.0038	-0.0019
	-0.5298	-0.8178	-0.5334
F-statistic: 12.4535 on 82 and 10780 DF, p-value: < 2.22e-16			
F-statistic: 8.7751 on 82 and 10790 DF, p-value: < 2.22e-16(OLS)			
F-statistic: 22.0745 on 82 and 10790 DF, p-value: < 2.22e-16(Random)			

Panel A in table 6 presents the standard deviation of quarterly cash flow per share. Results from FE regression is consistent with our hypothesis that hedging reduces risk, however insignificant. On the other hand, pooled OLS yield a significantly positive effect on cash flow standard deviation from using derivative. The result is contradictory, thereby an alternative measure, the log of change in flow standard deviation is presented in Panel B. From Panel B we could see that using derivative in turns lead to decreasing cash flow standard deviation overtime(t=2.5436)

Additionally, market return volatility is used to further examine the relationship between derivative usage and firm risk. As shown in Panel C, our variable of concern is negative and significant under all three methods (Fixed effect, OLS and Random effect), row 3 column, 2,3 and 4. Evidence in Panel C is consistent with the hypothesis that firm tends to exhibit lower risk when they hedge with derivative instruments. Both direction and significance are indifferent with or without industry code.

4.2.4 Robustness test and correction

Similar to the robustness test and correction outlined in section 4.2.2, table 7 presents the relevant test results and corrections for the fixed effect regression conducted in section 4.2.3. As it turned out, our results are prone to both heteroskedasticity and serial correlation (Panel A). Adjustment results are presented in Panel B and C. The relationship between both risk measures and derivative usage remain significant, after both adjustments. Interestingly, the explanation power of derivative usage on stock return volatility actually increased after the Driscoll And Kraay correction(from t = -2.3027 to t = -4.3188).

Table 7. Robustness test results and adjustments with non-parametric estimators – Risk

The degree of significance and the direction of the relevant result of interest is **indifferent** when natural logarithm(LN) is used instead of LOG

The superscripts ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively.

Panel A

Breusch-Godfrey/Wooldridge test		
LOG(ΔCF volatility)		
	Chi-square	P -value
Order 1	301.15	< 2.2e-16***
Order 2	502.42	< 2.2e-16***
Order 3	624.07	< 2.2e-16***
LOG(Stock Volatility)		
	Chi-square	P -value
Order 1	143.05	< 2.2e-16***
Order 2	152.59	< 2.2e-16***
Order 3	160.36	< 2.2e-16***

Studentized Breusch-Pagan test		
	BP	P-Value
LOG(ΔCF volatility)	23.431	0.0009568***
LOG(Stock Volatility)	177.84	4.829e-09 ***

Panel.B Arellano-Bond estimator

Dependent Variable: **LOG(ΔCF volatility)**	Fixed Effects
Derivative Usage Dummy	**-4.0885e-01** **-2.0362***
Debt to Asset Ratio	-2.2451e-03

	-0.2551
LOG(Total Asset)	-0.13659
	-3.5465***
Dividend/Share	1.1324
	5.3566***
Operating Revenue Growth	0.000050167
	2.0220*
Oversea	
Return On Asset	-0.011274
	0.1439

Dependent Variable: **LOG(**Stock Volatility**)**	Fixed Effects
Derivative Usage Dummy	**-0.0258**
	-2.1914*
Debt to Asset Ratio	-0.00042
	-3.6690***
LOG(Total Asset)	-0.0398
	-11.1864***
Dividend/Share	-0.0722
	4.4771***
Operating Revenue Growth	0.00004
	1.1239
Oversea	0.00432
	-0.28
Return On Asset	-0.0019
	0.7137

Panel C. Driscoll And Kraay estimator(Conservative)

Dependent Variable: **LOG(ΔCF volatility)**	Fixed Effects
Derivative Usage Dummy	**-4.0885e-01**
	-4.3188***
Debt to Asset Ratio	-2.2451e-03
	-0.0784
LOG(Total Asset)	-0.13659
	-2.4168*
Dividend/Share	1.1324
	6.0279***
Operating Revenue Growth	0.000050167
	0.3717
Oversea	
Return On Asset	-0.011274
	0.1610

Dependent Variable: **LOG(Stock Volatility)**	Fixed Effects
Observations	9270

R Squared	0.0974
Derivative Usage Dummy	**-0.0258**
	-4.4269***
Debt to Asset Ratio	-0.00042
	-0.1486
LOG(Total Asset)	-0.0398
	-5.5845***
Dividend/Share	-0.0722
	-3.2825**
Operating Revenue Growth	0.00004
	0.1043
Oversea	0.00432
	-0.2632
Return On Asset	-0.0019
	0.1056

4.2.5 Regression results on Firm Stock Return

Table 8. Results for firm stock return measures (with industry code)

The superscripts ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively.

Panel A

Dependent Variable: Change in stock return	Fixed Effect(Time)	Pooled Regression	Random Effect(Time)
Observations	8933	8933	8933
R Squared	0.0551	0.1001	0.0568
Derivative Usage Dummy	**0.1057**	**0.22798**	**0.10843**
	2.2510*	**3.3802*****	**2.2704***
Debt to Asset Ratio	-0.0005409	0.00011339	-0.00050862
	-0.5204	0.0758	-0.4812
LOG(Enterprise Value)	-0.261	-0.50317	-0.27122
	20.7570***	30.4331***	21.2681***
Dividend/Share	0.20586	0.5796	0.22064
	2.9773**	5.8791***	3.1382**
Operating Revenue Growth	-0.000048352	0.000017081	-0.000045743
	-0.817	0.2005	-0.76
Oversea	0.12274	0.2092	-0.3474
	3.3141***	3.9352***	3.3710***
Return On Asset	-0.0049398	0.0058559	-0.0047221
	-0.3696	0.3045	-0.3474

F-statistic: 6.28283 on 82 and 8841 DF, p-value: < 2.22e-16***(FE)
F-statistic: 12.0084 on 82 and 8850 DF, p-value: < 2.22e-16***(OLS)
F-statistic: 6.50583 on 82 and 8850 DF, p-value: < 2.22e-16***(Random)

Panel B

Dependent Variable: Alpha Market cap weighted)	Fixed Effect(Time)	Pooled Regression	Random Effect(Time)
Observations	10882	8933	10882
R Squared	0.0140	0.0148	0.0140
Derivative Usage Dummy	**-3.806E-05**	**0.0001**	**-0.00004**
	-0.1628	**0.2426**	**-0.1517**
Debt to Asset Ratio	-3.61E-05	-0.000036032	-0.000036096
	6.1693***	6.1391***	6.1728***
LOG(Total Asset)	-9.03E-05	0.0000	-0.000087117
	1.6970.	0.6554	-1.6399
Dividend/Share	2.99E-05	-0.0002	0.000025984
	0.0965	-0.6851	0.084
Operating Revenue Growth	1.64E-07	1.171E-07	1.6318E-07
	0.4953	0.3516	0.4921
Oversea	-6.00E-04	-0.00074531	-0.00060336
	3.2592**	4.0538**	3.2810**
Return On Asset	2.71E-04	0.00025825	0.00027094
	3.6220***	3.4368***	3.6197***

F-statistic: 1.86874 on 82 and 10789 DF, p-value: 3.5531e-06(FE)
F-statistic: 1.97799 on 82 and 10799 DF, p-value: 3.8268e-07(OLS)
F-statistic: 1.86975 on 82 and 10799 DF, p-value: 3.4823e-06(Random)

Panel A in table 8 showcases the regression results using **LOG (change in dividend adjusted stock return)**. All models employed reveal a positive relationship between derivative usage and the change in stock return, results are directional consistent when we use LOG (Total Asset) as the control for firm size rather than LOG(EV), but results are insignificant. Panel B reveals regression result from using abnormal stock return Alpha to proxy for stock return. In contrast with Panel A, Panel B result yields no relationship between derivative usage and stock abnormal return (controlling size effect with log(EV) yields similar results), t value equals 0.1628 under fixed effect, 0.2426 under pooled OLS and -0.1517 under random effect

4.2.6 Robustness test and correction

Identical to robustness tests and correction outlined in section 4.2.2, the BW and BP test is conducted on the market return regression outlined in section 4.2.5. The market return regression in the previous section seems to exhibit some degree of heteroskedasticity and serial correlation (rejection of the null hypothesis in both BW and BP test, Panel A). Similar adjustments are made using the A-B estimator and a more rigorous estimator (the D-K estimator). The relationship between derivative usage and Δstock return remain positive and significant (Panel B and C), albeit a lower explanatory power under the D-K adjustment. Only the variable of interest is disclosed to conserve space.

Table 9. Robustness test results and adjustments with non-parametric estimators – Market Return

The superscripts ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively.

Panel A

Breusch-Godfrey/Wooldridge test			**Studentized Breusch-Pagan test**		
ΔStock Return				BP	P-Value
	Chi-square	P -value	ΔStock Return	168.14	6.833e-08***
Order 1	1408.7	< 2.2e-16***			
Order 2	1532.1	< 2.2e-16***			
Order 3	1541.3	< 2.2e-16***			

Panel B. Arellano-Bond estimator

Dependent Variable: ΔStock Return	Fixed Effects
Derivative Usage Dummy	**0.1057** **3.3380*** **

Panel C. Driscoll And Kraay estimator(Conservative)

Dependent Variable: ΔStock Return	Fixed Effects
Derivative Usage Dummy	**0.1057** **1.95***

5. Robustness test

5.1 Reverse causality test

The reverse causality test conducted in this section is the replication of a similar test done by Allayannis and Weston(2001). In table 3 we found derivative usage increase firm value, especially when using LOG(Enterprise Value) as the measure for firm value. Consistent with Allanyannis and Weston's concern, this relationship may be due to firms with higher valuation having profitable investment opportunities and thereby added incentive to hedge. That being, higher values for firms that use derivatives may merely reflect the fact that high valuation firms have an incentive to hedge and not the other way round.

To test for this possible reverse causation, firms are classified into four categories:

1. Firms that choose not to hedge in the **current** and the **next period**(NN). Assigned value = 1
2. Firms that hedge in the current period but decide not to hedge in the next period(HN) Assigned value = 2
3. Firms that did not hedge in the current period but chooses to hedge in the next period(NH). Assigned value =3
4. The base being firms that hedge in both time t and t+1.

Below regression is ran:

$$Q_t = \partial + \beta_1(Firm\ remains\ unhedged, NN) + \beta_2(Firm\ quits\ hedging\ in\ the\ next\ period, HN) + \beta_3(Firms\ begin\ to\ hedge\ in\ the\ next\ period, NH) + \sum Control\ Variables_t + \in_t, (5a)$$

Q_t being the Tobin's Q at time t.

If it turns out that firms with high valuation(Qs) choose to hedge, we would expect $\beta_3 > \beta_1$(Firm that hedge in the next period having higher Q than firm that remain unhedged).

Oppositely, we would expect $\beta_2 < 0$(firm that quit hedging in the next period having lower Q in the current period than firm that remain hedged.

Also, we would expect none hedger in both period is indifferent to those that remain hedged in both periods, $\beta_1 = 0$.

Hypothesis 1. $\beta_1 = 0$ (hedging adds no value)

Hypothesis 2. $\beta_2 = 0$ (Decision to quit hedging is unaffected by firm value)

Hypothesis 3. $\beta_3 = \beta_1$ (Decision to begin hedging is not affected by firm value)

Due to sample size restriction (insufficient data in one year from either non-hedger to hedger or vice versa), three tests are conducted using a time gap of 2 or 3 years with arbitrary time periods. The first test is carried out with current period t = 2013 and next period being t=2015. We are effectively looking at whether firm's latter decision to hedge or quit hedging (in 2014) has and connection with firm value in 2010. Second test is carried out with t=2011 and T=2014, final test is carried out with t=2009, T=2011.

Table 7. Results for reverse causality testing (equation 5a)

The superscripts ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively.

Panel A. Current period t = 2013, Next period T=2015

LOG(TQ) 2013 and 2015	Pooled OLS	LOG(EV) 2013 and 2015	Pooled OLS
Observations	1391	Observations	1376
NN	1.32E-01	NN	8.68E-02
	2.282*		**1.812·**
HN	-6.22E-02	HN	3.51E-01
	-0.371		**2.563***
NH	1.85E-01	NH	1.68E-01
	1.669·		**1.857·**

Panel B. Current period t = 2011, Next period T=2014

LOG(TQ) 2011 and 2014	Pooled OLS	LOG(EV) 2011 and 2014	Pooled OLS
Observations	1277	Observations	1265
NN	1.19E-01	NN	-7.10E-02
	1.870*		**-1.249**
HN	-2.32E-01	HN	-1.61E-01
	-1.298		**-0.959**
NH	2.32E-02	NH	-6.24E-02
	0.251		**-0.762**

Panel C. Current period t = 2009, Next period T=2011

LOG(EV) 2008 and 2012	Pooled OLS	LOG(TQ) 2008 and 2012	Pooled OLS
Observations	725	Observations	642
NN	-0.1565089	NN	0.15233
	-2.001**		**1.683**
HN	-0.1843499	HN	-02954478
	-0.872		**-1.171**
NH	-0.2236680	NH	0.01198
	-1.516		**0.068**

Panel A presents the relationship between the three relevant hedging decision dummy and our firm value measures. For TQ, we cannot reject hypothesis 2 and 3(t: -0.371 and 1.669 respectively) with sufficient confidence and draw any relationship between the latter hedging decision and current firm's Q. However, we would reject hypothesis 1, but in an opposite direction (coefficient of NN is positive, meaning non-hedger possess a higher Q than hedger). Using EV yields similar result for hypothesis 1, however this time we would reject hypothesis 2, but in a different direction. A positive HN effectively mean that firm chooses to quit hedging in the latter period has higher EV in the current period, inconsistent with the reverse causality situation where firm with higher Q tends to hedge. However, we would reject hypothesis 3(coefficient of NH greater than the coefficient of NN).

Panel B presents the result for current period t=2011 and subsequent period T=2014.We cannot reject hypothesis 2 and 3 with both TQ and EV measure. Result for NN is contradictory between the two-value measure, nevertheless hypothesis 1 is not our main focus in the test for reverse-causality.

For results in Panel C, we cannot reject hypothesis 2 and 3 with sufficient confidence using both EV and TQ. However, we are able to reject hypothesis 1 with EV, consistent to the value enhancing theory that hedging add value. Coefficient of NN under TQ is positive and thereby against the value enhancing theory, but lack significance.

Overall, the reverse causality problem remains unclear as in most cases we cannot reject hypothesis 2 and 3 to yield existence of reverse causation, nevertheless, the test results are still prone to human error that firms are classified as non-hedger when they are in fact hedgers and vice versa.

6. Conclusion

This study examines the use of derivative instruments in a sample of 1749 Chinese listed firms (including financial firms) between 2005 to 2015. The goal is to examine whether firms with derivative usage:

1. Leads to higher firm value
2. Exhibit lower risk
3. Associated positively with stock return

Using both Tobin's Q and Enterprise value as a proxy for firm value, we find (<95% confidence level before and after the robustness test) significant evidence that the use of derivative instrument is positively related to firm value.

Using Cashflow per share Standard Deviation (calculated using cashflows measures reported quarterly), we find negative but insignificant relationship(t=-1.2662) using the fixed effect model and significantly positive relationship when using the pooled OLS model. We subsequently replaced the CF per share Standard Deviation with its change, despite a smaller sample size (sample sizes are halved with no 2015 CF Standard Deviation change estimates), we find a significantly negative relationship(t=-2.5436) between derivative usage and the change in cashflow volatility. Additionally, we also find significantly negative relationship on derivative usage and stock return volatility, results are consistent with all three models (fixed effect t value:2.3027, OLS t value:1.7899, random effect t value:2.2782).

Using the change in stock return as a measure for market performance, we find positive and significant association (fixed effect t value: 2.2510, pooled OLS t value: 3.3802, random effect t value: 2.2704) between changes in stock return and firm derivative usage. On the other hand, using the market-capitalization adjusted alpha obtained from RESSET database, no conspicuous relationship can be drawn (t value too small to reject the null hypothesis that there is no relationship between derivative dummy and alpha).

Lastly, this paper follows the reverse causality test conducted by Allayannis and Weston (2001) to test for the possible reverse causation in the firm value and derivative usage relationship. There exhibits insufficient evidence to reject the null hypothesis in order to support the possible existence of reverse causation between firm value and derivative usage.

The results in this paper are consistent with the value enhancing theory(Allayannis and Weston(2001), Luo(2016), Bartram et al(2011), as well as the risk mitigating ability concluded by Bartram et al(2011).Nevertheless, results are prone to problem such as endogeneity.

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Table 1

Summary statistics (winsorized mean)

Table 1. Panel A:

Year	Average of Total Asset	Average Derivative Usage Dummy	Average oversea	Average of ROA	Average of TQ	Average Dividend/Share	Average Operating Revenue growth	Average of EV
2005	1165287087.5945	0.0013	0.8900	0.0252	0.8800	0.0426	0.1959	2540621235.1628
2006	1107158501.1133	0.0055	0.8999	0.0551	1.4089	0.0509	5.3746	3311374415.9081
2007	1155952792.0408	0.0202	0.9048	0.1648	3.3515	0.0482	0.5296	5893903386.8874
2008	1237238613.4028	0.0278	0.9047	0.0959	1.3660	0.0438	1.4796	3126302217.1180
2009	1297804723.8042	0.0366	0.9008	0.1005	2.9110	0.0671	0.8093	5622091760.0229
2010	1427528204.6200	0.0444	0.8971	0.0893	3.2038	0.1172	0.7960	7685974671.7590
2011	1607942640.5772	0.0507	0.8887	0.0735	1.8657	0.1317	10.4849	7023677806.4832
2012	2061677820.4208	0.0552	0.8708	0.0550	1.7027	0.1157	0.4930	7876149005.6020
2013	2256143618.6627	0.0677	0.8481	0.0565	2.1039	0.1014	0.4413	9374577486.9414
2014	2744675611.2079	0.0804	0.8392	0.0510	2.4888	0.0955	0.2096	12161521952.9597
2015	3304891660.1469	0.0792	0.8359	0.0461	4.1308	0.0850	0.2578	19657580683.9255

Table 1. Panel B:

Year	Max of Total Asset	Max of ROA	Max of TQA	Max of Div/Share	Max of OPrevenuegrowth	Max of EV
2005	229216000000	0.5385	10.4283	0.7470	13.0845	235000000000
2006	260576000000	0.5967	13.7783	0.8800	3782.7129	281000000000
2007	352539000000	64.7546	15.7327	1.2000	50.1322	426000000000
2008	474440000000	5.0801	11.5550	1.6720	1497.1559	485000000000
2009	587810233140	0.8274	15.7578	1.2000	827.2020	641000000000
2010	727207000000	2.9330	15.8609	2.0000	355.6016	746000000000
2011	1258180000000	0.7238	17.5426	1.5200	14883.0596	1260000000000
2012	1606540000000	1.8524	15.7568	2.0000	367.5320	1600000000000
2013	1891740000000	10.0281	14.7643	2.0067	174.8993	1890000000000
2014	2186460000000	7.1963	19.5933	3.0000	14.3528	2220000000000
2015	2507150000000	0.4022	31.4232	1.8000	21.0074	2500000000000

Table 1. Panel C

Year	MIN of Total Asset	Min of ROA	Min of TQ	Min of Dividend/Share	Min of Operating revenue growth	Min of EV
2005	28901989	-1.6826	0.0302	0.0000	-1.1044	0
2006	3070803	-1.7174	0.0480	0.0000	-1.0455	1128612
2007	1408532	-0.7965	0.1307	0.0000	-1.0000	0
2008	51134	-1.8090	0.0272	0.0000	-1.0000	0
2009	477333	-0.9986	0.1026	0.0000	-1.0000	0
2010	477331	-6.7139	0.0757	0.0000	-1.0000	3066139
2011	10688797	-1.9926	0.0619	0.0000	-0.9297	3309002
2012	9986118	-1.3470	0.0511	0.0000	-0.9466	4928102
2013	113960863	-1.5229	0.0472	0.0000	-1.0000	0
2014	106632344	-0.9019	0.0733	0.0000	-0.9418	0
2015	179552130	-0.6415	0.0684	0.0000	-0.9150	0

Table 1. Panel D Correlation Matrix (Tobin's Q)

All the variables are as defined earlier. The superscripts a, b, and c represent the 1%, 5%, and 10% levels of significance, respectively.

	Tobin's Q	Derivative Usage	Overseas	Debt/Asset	Total Asset	Dividend/Share	Operating Revenue Growth	ROA
STobin's Q	1	0.0029286	0.0032046	0.1942497	-0.0017868	-0.0065934	0.0002637	-0.9256138
Derivative Usage		1	0.055234 [a]	-0.0020691	0.1705056	0.0630586 [a]	0.0024149	-0.005966
Overseas			1	0.0068187	0.0238363 [a]	0.0363088 [a]	0.0282716 [a]	-0.0064903
Debt/Asset				1	0.0008021	-0.018419 [b]	0.0003160	-0.0402761 [a]
Total Asset					1	0.0491516 [a]	0.0013942	-0.0020790
Dividend/Share						1	0.0013179	0.0161346 [b]
Operating Revenue Growth							1	0.0001026
ROA								1

Table 1. Panel E Correlation Matrix (Enterprise Value)

All the variables are as defined earlier. The superscripts a, b, and c represent the 1%, 5%, and 10% levels of significance, respectively.

	EV	Derivative Usage	Overseas	Debt/Asset	Total Asset	Dividend/Share	Operating Revenue Growth	ROA
EV	1	0.180636406 [a]	0.030903377 [a]	0.000404262	0.98152715 [a]	0.103846572 [a]	0.007554741	-0.004996284
Derivative Usage		1	0.055234447 [a]	-0.002069177	0.170505658 [a]	0.063058682 [a]	-0.002414939	-0.005966
Overseas			1	0.006818725	0.023836331 [a]	0.036308873 [a]	-0.028271681	-0.0064903
Debt/Asset				1	0.000802155	-0.01841915 [b]	0.000316098	-0.0402761 [a]
Total Asset					1	0.049151663 [a]	0.001394259	-0.0020790
Dividend/Share						1	-0.001317998	0.0161346 [b]
Operating Revenue Growth							1	0.0001026
ROA								1