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# The Usage of Derivatives in Corporate Financial Risk Management and Firm Performance

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**ABSTRACT**

We examine the determinants of the intensity of derivatives usage. Using a sample of listed firms in Asia, we find that derivative users tend to have higher foreign exchange exposure, higher debt and short-term liquidity, greater growth options and higher operating profitability. Our results suggest that firms are more likely to hedge in response to financial distress costs, growth options, investment opportunities, and future cash flow needs. We also examine the relation between derivatives usage and firm valuation. We find that firm valuation is positively associated with the intensity of derivatives usage. Furthermore, we document that the positive association between firm valuation and derivatives usage is stronger in firms with stronger corporate governance structures. In well-governed firms, managers are more effectively monitored and this increases the likelihood of usage of derivatives for hedging purposes, instead of value-destroying speculative activities. Additional analysis indicates that hedging increases firm value by lowering earnings volatility, promoting capital expenditures and reducing cost of debt financing.

*JEL Classifications: G32; G34; M21*

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## I. INTRODUCTION

Financial derivatives such as futures contracts, forward exchange contracts, options and swaps are widely used by large listed firms to manage corporate risk. Prior studies provide mixed evidence on the association between derivatives usage and firm value. For example, Allayannis and Weston (2001) find that hedging foreign exchange risk is associated with significant increase in market value. Graham and Rogers (2002) document that listed firms in United States hedge in response to tax incentives and hedging can increase a firm's valuation by increasing its debt capacity. Using a sample of firms in the United States airlines industry, Carter, Rogers and Simkins (2006) provide evidence that hedging is associated with substantial increase in shareholder value. In contrast, using a sample of listed firms in United States, Guay and Kothari (2003) find little evidence that derivatives usage is associated with value creation. Using a sample of oil and gas producers in the United States, Jin and Jorion (2006) find insignificant effects of hedging with derivatives on market value.

Yet, there is little research on the usage of derivatives by listed firms in Asia and more importantly, the potential benefits associated with these derivatives. This paper examines the usage of financial derivatives in large listed firms as a corporate risk management strategy. Specifically, this paper examines four research questions. First, we investigate the firm-level characteristics that affect the intensity of derivatives usage. Second, we examine whether derivatives usage and hedging affect firm valuation. Third, we examine how corporate governance structures affect the association between firm valuation and derivatives usage. Fourth, we investigate some channels though with hedging with derivatives affect firm valuation such as lowering risk, promoting capital expenditure investments and reducing external debt financing costs.

The sample consists of 520 listed industrial firms in Hong Kong, Indonesia, Korea, Philippines, Taiwan, Thailand, Malaysia and Singapore for the period 2007 to 2014. We classify firms as users or non-users of derivatives based on their annual report disclosures on corporate financial risk management and derivatives usage. We find that about 48% of the listed firms use financial derivatives.

We begin our analysis by investigating the determinants of the intensity of derivatives usage. First, we find that derivative users tend to have high foreign exchange exposure such as high foreign sales as a percentage of total sales and foreign assets as a percentage of total assets. Second, we document that derivative users have higher debt and short-term liquidity. If the expected costs of financial distress increase (decrease) with leverage (short-term liquidity), then our result suggests that firms with higher expected costs of financial distress are more likely to use derivatives for hedging purposes. Third, we find that firms that use derivatives (users) are significantly larger in size than non-users. This result is consistent with the notion that larger firms, with higher organizational complexity (such as many business segments) and higher geographic spread (such as operating in many countries) have greater exposure to financial risk. Fourth, we provide evidence that hedging intensity is positively associated with the firm's growth options and investment opportunities. This result is consistent with the notion that by reducing the variation of cash flow realizations, hedging facilitates high growth firms to maintain sufficient funds to finance profitable future investments. We also find that the intensity of derivatives usage is positively associated with operating profitability. Collectively, our results suggest that firms are more likely to hedge in response to

financial distress costs, growth options, investment opportunities, and future cash flow needs.

Using market-to-book equity as a measure of firm valuation, our result suggests that firm valuation is positively associated with the intensity of derivatives usage. In terms of economic significance, we find that derivatives usage increases shareholder value, by between US$ 22 million and US$ 74 million, representing about 2% to 5% of equity valuation. Hence, derivatives usage has substantial economic effect on shareholder value. We also find that the positive association between firm valuation and derivatives usage is stronger in firms with stronger corporate governance structures. In well-governed firms, managers are more effectively monitored and this increases the likelihood of usage of derivatives for hedging purposes, instead of value-destroying speculative activities. Thus, firms with stronger corporate governance structures benefit more from risk management with derivatives. Theory suggests that if the main objective of financial risk management is to reduce the probability of financial distress, then firms that employ derivatives to manage risk are more likely to have experienced significant benefits during periods of economic downturn. Consistent with this prediction, we find that relative to non-users of derivatives, firms that use derivatives have higher valuation during the period of economic downturn.

One of the channels in which derivatives can reduce financial distress cost is firm risk reduction. Using various measures for firm risk, we provide evidence on the effectiveness of derivatives to reduce firm risk. We find that derivatives usage is negatively associated with cash flow volatility, earnings volatility and stock return risk. More generally, these results are consistent with the notion that hedging with financial derivatives reduces a firm's cost of capital and thus increases the economic profitability of the firm.

Another channel in which hedging with derivatives can help to increase firm value is to increase value-enhancing capital expenditure investments. The results indicate that hedging with derivatives can promote capital expenditure investments. Holding constant other factors, such as firm size, profitability and industry membership, a firm with "high derivative usage" has a capital expenditure investment intensity that is about 13 per cent higher than a "low derivative usage" firm. By reducing the probability of negative cash flow scenarios, hedging with derivatives enables firms to direct more internal funds into capital investments. If these capital investments are positive net present value projects, firm value will increase. Without hedging, unexpected shocks to the cash flow may force firms to rely on costly external financing to support their capital expenditure investments. In the worst case scenario, firms may even have to withhold capital investments all together. Clearly, rejecting positive net present value projects is tantamount to reducing shareholder value.

Given capital market frictions such as information asymmetry between corporate insiders and outside investors, firms face costly external financing. We examine the association between cost of debt and derivatives usage. We find that the cost of debt is negatively associated with the intensity of derivatives usage. In terms of economic significance, a one-standard deviation increase in the hedging intensity leads to a 1.4% reduction in interest expense. These effects are economically significant as they represent a 18% reduction based on the average cost of debt. Thus, hedging has a strong impact on cost of debt. Additional analysis of the sub-sample of firms with floating rate debt indicates that net profit can be increased by up to 4 per cent for every 1 percentage point

fall in interest rates. We find that about 33 per cent of the firms with substantial floating rate debt attempt to hedge interest rate risk by using an interest rate swap. By transforming their floating rate debt into fixed rate debt, they are shielded from future interest rate increases. Hence, effective usage of derivatives can have substantial first-order effect on lowering the cost of debt.

The rest of this paper is organized as follows. Section II describes the data and sample formation. Section III outlines some key trends on the intensity of derivatives usage. Section IV presents the evidence on the key determinants and firm level drivers of derivatives usage. Section V presents the results of the effect of derivatives on firm valuation. Section VI examines the association between derivatives usage and potential reduction of firm risk. Section VII investigates how derivatives shape corporate capital expenditure investments. Section VIII presents the results of the effect of derivatives on cost of debt. Section IX contains the conclusions.

## II. DATA

We begin with all listed firms covered by the Standard and Poor's Global Vantage database. We impose the following screening procedures: (i) the firms have financial statement information to compute the test variables such as return on assets and leverage for the period 2007 to 2014 (see Section IV for details); (ii) firms in the financial industry are deleted; (iii) firms have stock price information, and (iv) the annual report of the firm is available on the relevant country's stock exchange website.

After imposing these screening procedures, we then select 520 listed industrial firms in Hong Kong, Indonesia, Korea, Philippines, Taiwan, Thailand, Malaysia and Singapore for the period 2007 to 2014[1]. The final sample consists of 520 listed industrial firms in Hong Kong, Indonesia, Korea, Philippines, Taiwan, Thailand, Malaysia and Singapore for the period 2007 to 2014. The sample contains firms of different market capitalization spanning across multiple industries such as manufacturing, service, telecommunications, agricultural, petroleum, chemicals and heavy industrials. Under existing financial accounting standards, listed firms in Asia are required to disclose their financial risk management policies on foreign exchange risk, interest rate risk, credit risk, commodity price risk and liquidity risk. By and large, in the audited annual reports, the firms report the usage of derivatives mainly to hedge risk (not for speculative reasons). We classify firms as users or non-users of derivatives based on their annual report disclosures about their corporate financial risk management and usage of derivatives.

## III. INTENSITY OF DERIVATIVES USAGE

Table 1 reports the proportion of firms that employ financial derivatives to hedge specific financial risk. For the whole sample, about 48% of the listed firms use derivatives to manage financial risk[2]. On average, for the whole sample, 43% of the firms hedge foreign exchange risk and 32% of the firms hedge interest rate risk. For the whole sample, 9% of the firms hedge commodity price risk and 2% of the firms hedge equity investment price risk.

Table 2 reports the typical financial derivatives used by listed firms in Asia. Forward contracts are the most widely used financial derivatives followed by interest rate swaps. On average, for the whole sample, 41% of the listed firms use forward contracts

and 32% of the firms use swaps. Furthermore, for the whole sample, 12% of the firms use futures contracts and 6% of the listed firms use options. In general, the forward contracts and futures contracts are employed to manage foreign exchange risk whereas interest rate swaps are used to manage interest rate risk. Forwards and options are typically used to manage commodity price risk. It should be noted that some firms employ a combination of various derivatives to manage different type of risks.

**Table 1**
Type of financial risk hedged

This table presents the mean percentage of firms that employ financial derivatives to hedge specific financial risk. The sample consists of 520 listed industrial firms in Hong Kong, Indonesia, Korea, Philippines, Taiwan, Thailand, Malaysia and Singapore for the period 2007 to 2014. We classify firms as users or non-users of derivatives based on their annual report for information about the usage of derivatives. For the whole sample, 48% of the listed firms use derivatives to manage financial risk.

| Type of risk | Mean Percentage |
|---|---|
| Foreign exchange risk | 43% |
| Interest rate risk | 32% |
| Commodity price risk | 9% |
| Equity investment price risk | 2% |

**Table 2**
Financial derivatives used by listed firms in Asia

This table presents the mean percentage of usage of various type of financial derivatives. The final sample consists of 520 listed industrial firms in Hong Kong, Indonesia, Korea, Philippines, Taiwan, Thailand, Malaysia and Singapore for the period 2007 to 2014. We classify firms as users or non-users of derivatives based on their annual report for information about the usage of derivatives. For the whole sample, 48% of the listed firms use derivatives to manage financial risk.

| Type of financial derivatives | Mean Percentage of users |
|---|---|
| Forward contracts | 41% |
| Futures contracts | 12% |
| Swaps | 32% |
| Options | 6% |

## IV. THE DETERMINANTS OF DERIVATIVES USAGE

### A. Major Economic Motivations for Hedging with Derivatives

This section reviews some of the major economic motivations for hedging in the literature. As several previous papers (Nance, Smith, and Smithson, 1993; Foot, Scharfstein, and Stein, 1993; Graham and Rogers, 2002; Stulz, 1984) provide detailed discussions of why firms undertake financial risk management, here we briefly describe the four widely-cited theories and predictions.

### 1. Financial distress costs

Financial distress costs refer to situations in which a firm's available liquidity is not sufficient to meet fixed payment obligations such as interest expense when they are due. Other economic financial distress costs include administrative costs, loss of tax shields, and under-exploitation of growth options (Froot, Scharfstein, and Stein, 1993). By reducing cash flow variability, hedging lowers the expected distress and bankruptcy costs (Smith and Stulz, 1985). These theories predict that firms with higher leverage, lower liquidity and shorter debt maturity are more likely to use derivatives to hedge financial risk.

### 2. Underinvestment

High-growth firms that have greater investment opportunities tend to benefit more from the use of derivatives. Without hedging, these firms may find themselves in a situation where they have insufficient internal funds to finance profitable projects (Smith and Stulz, 1985). The use of derivatives can reduce the variation of future cash flow realisations, enabling high-growth firms to maintain sufficient internal funds to finance future profitable projects. Firms operating in volatile business environments, such as those involving fluctuating finished product prices or raw material costs, firms with high research and development expenditures and firms with high sales growth tend to benefit more from hedging their cash flow with derivatives.

The underinvestment problem is exacerbated when the growth options opportunities are short-lived (i.e., the remaining time to exercise the option is short). Hedging can add value by ensuring that the firm does not underinvest in positive net present value projects due to high financial constraints (Froot, Scharfstein, and Stein, 1993). Hedging can mitigate the underinvestment costs by reducing the volatility of the firm's cash flow and by coordinating the financing and investment policies.

### 3. Tax incentives

The convexity of the corporate tax schedule (because of progressive corporate tax rates and the presence of tax shields) implies that hedging increases firm value by reducing the volatility of the taxable income stream (Smith and Stulz, 1985; Graham and Rogers, 2002). In particular, if firms do not reduce income volatility through hedging, then the exploitation of tax shields[3] may have to be postponed, reducing their present value of tax shields. These theories suggest that firms with high effective tax rates are more likely to hedge.

### 4. Managerial incentives

In a levered firm, shareholders equity can be viewed as purchased call option on the firm (Jensen and Meckling, 1976). Thus, the value of managerial equity ownership (such as shares and stock options) is positively associated with firm-specific volatility. Hence, managers who intend to maximize shareholders wealth may have incentives to undertake less hedging so as to increase firm-specific volatility. On the other hand, large managerial equity ownership implies that managers have large undiversified personal financial

wealth tied to the fortunes of the firm. Risk-averse managers can mitigate the effect their exposure to the firm by hedging even if this decision is not optimal for shareholders. These competing arguments suggest that the association between managerial incentives and hedging intensity, is ultimately, an empirical issue.

### B. Empirical Evidence on the Determinants of Derivatives Usage

Table 3 presents the logit regression estimations for the determinants of derivatives usage. The dependent variable (DERIUSER) is a dummy variable that equals one if the firm uses derivatives and zero otherwise. We measure a firm's exposure to exchange risk with FCSALE (foreign sales as a percentage of total sales) and FCASSET (foreign assets as a percentage of total assets). We find that firms using derivatives are more exposed to exchange rate risk. Both the coefficients FCSALE and FCASSET are positive and significant at the 1% level. Thus, derivatives users have significantly more foreign sales as a percentage of total sales and foreign assets as a percentage of total assets. Hence, firms using derivatives are more exposed to exchange rate risk.

Prior studies (Purnanadam, 2008) posit that expected financial distress costs increase with leverage. We measure a firm's expected financial distress costs using LTDEBT (defined as liabilities divided by total assets). The coefficient on leverage is positive and statistically significant at the 1 % level, indicating that derivative users have higher debt. Prior studies (Froot, Scharfstein, and Stein, 1993) argue that access to liquidity can substitute risk management in mitigating financial distress costs. Our proxy for liquidity is QUICK (defined as sum of cash, receivables and marketable securities divided current liabilities). The coefficient on quick ratio is negative and statistically significant at the 5% level, indicating that derivative users have lower current liquidity. Hence, derivative users have significantly higher financial distress costs[4], as measured by higher leverage and lower quick ratios.

Using the natural logarithm of total assets (LOGASSET) as a proxy for firm size, we find that derivatives users are larger than non-users. Results are qualitatively similar based on market value of equity as alternative proxy for firm size. This result is consistent with the notion that larger firms, with higher organizational complexity (such as many business segments) and higher geographic spread (such as operating in many countries) have greater exposure to financial risk. Furthermore, larger firms have the resources to set up risk management program, they have the collateral required by hedging counterparties and they face larger hedgeable risks (Allayannis and Wesron, 2001; Petersen and Thiagarajan, 2000; Purnanadam, 2008).

The coefficient on operating return on assets (ROA) is positive and significant at the 5% level. If derivatives are used for hedging purposes and firms with higher operating profitability have lower expected costs of financial distress, our result suggests that firms with high pre-hedging exposure are more likely to use derivatives.

The coefficient on SALECHG (sales growth) is positive and significant at the 1% level, indicating that high growth firms are more likely to hedge. This result is consistent with notion that derivatives can reduce the variation of future cash flow realisations and thus, enhance the ability of high-growth firms to maintain sufficient internal funds to finance future net present value projects. In other words, hedging mitigates the risk of underinvestment in potential profitable projects.

**Table 3**

Logit regression estimations for the determinants of derivatives usage

This table presents logit regressions of derivatives usage on firm characteristics. The dependent variable (DERIUSER) is a dummy variable that equals one if the firm uses derivatives and zero otherwise. FCSALE is foreign sales as a percentage of total sales. FCASSET is the foreign assets as a percentage of total assets. LTDEBT is total liabilities divided by total assets. QUICK is the quick ratio computed as the sum of cash, receivables and marketable securities divided current liabilities. LOGASSET is the natural logarithm of total assets. ROA is net income after tax divided by total assets. TAX is the effective tax rate computed as total current tax expense and deferred tax expense divided by net income before tax. SALECHG is the annual sales growth. MOWN is managerial common equity ownership at the end of the fiscal year. Standard errors are clustered by firm and year. $^{*}$, $^{**}$, and $^{***}$ denote statistical significance at the 10%, 5%, and 1% levels respectively. p-values are in parentheses.

| | |
|---|---|
| Intercept | 1.057 (<0.01)*** |
| FCSALE | 0.582 (<0.01)*** |
| FCASSET | 0.316 (<0.01)*** |
| LTDEBT | 0.452 (<0.01)*** |
| QUICK | -0.167 (0.04)** |
| ROA | 0.034 (0.03)** |
| LOGASSET | 0.718 (<0.01)*** |
| SALECHG | 0.259 (<0.01)*** |
| TAX | 0.009 (0.23) |
| MOWN | 0.021 (0.10)* |
| Country controls | Yes |
| Year controls | Yes |
| Industry controls | Yes |
| Pseudo $R^2$ | 0.243 |

The coefficient TAX is positive but statistically insignificant at the 10% level, indicating that tax motivation is not a major determinant of derivatives usage in Asia. In addition, the coefficient on managerial ownership (MOWN) is positive and marginally significant at the 10% level. Hence, there is some weak evidence higher managerial equity ownership is associated with higher intensity of hedging.

As robustness tests, we employ four alternative measures of derivatives usage: (i) notional amount of financial derivatives by annual sales; (ii) net fair value of financial derivatives divided by annual sales; (iii) notional amount of financial derivatives by total

assets; and (iv) net fair value of financial derivatives divided by total assets. Our results are qualitatively similar. Overall, our results suggest that firms are more likely to hedge in response to financial distress costs, growth options, investment opportunities, and future cash flow needs.

## V. ASSOCIATION BETWEEN DERIVATIVES USAGE AND FIRM VALUE

### A. Main Results

We employ the following model to test the association between firm valuation and derivatives usage:

$$\begin{aligned}TOBINQ = {} & \beta_0 + \beta_1 DERIUSER + \beta_2 LNASSET + \beta_3 DEBT + \beta_4 ROA + \beta_5 SALECHG \\ & + \beta_6 NETPPE + \beta_7 NSEG + Country\ Dummies + Industry\ Dummies \\ & + Year\ Dummies \end{aligned} \quad (1)$$

Following prior studies (Berger and Ofek, 1995; Allayannis and Weston, 2001; Lee, Lev, and Yeo, 2008), our measure of firm valuation is the ratio of market value of equity to book value of equity at the end of the fiscal year. Prior studies find that various firm characteristics affect firm value. These characteristics include the size of the firm, profitability, future growth opportunities, leverage, and business diversification. We control for firm size by including the natural logarithm of book assets (LNASSET). We include leverage (DEBT) to controls for possible capital structure differences that may influence a firm's Tobin's Q. The operating income-to-asset (ROA) variable provides a measure of the firm's profitability and annual sales growth (SALEHG) provides a measure of growth opportunities. Previous studies document that TOBIN Q is positively associated with operating income-to-sales and sales growth. We control for asset tangibility by including the ratio of property, plant and equipment to assets (NETPPE). To control for the effect of corporate diversification on firm valuation, we include the number of business segment (NSEG). In our model, we also include country dummy variables to control for country effects, industry dummy variables to control for country effects, and year dummy variables to control for time effects.

Table 4 presents the regressions of firm valuation on derivatives usage and various firm characteristics. In Column (1), the coefficient on the dummy variable on derivative usage (DERIUSER) is positive and significant at the 1% level. This result suggests that firm valuation is positively associated with derivative usage. In terms of economic significance, this result suggests that derivative usage is associated with an increase market value of US$ 26 million, representing 2% of equity valuation.

In column (2), we employ another proxy for the intensity of derivative usage – the ratio of the net absolute fair value of derivatives divided by total assets (HEDGEINT). The coefficient HEDGEINT is positive and statistically significant at the 1% level. This result suggests that firm valuation is positively associated with the intensity of derivative usage. In terms of economic significance, a one-standard deviation increase in net absolute fair value of derivatives divided by total assets is associated with an increase market value of US$74 million, representing 5% of equity valuation. Thus, the economic benefits of derivatives are substantial relative to the size of the company.

In results (not tabulated), we find the positive association between value creation and derivatives usage is stronger in markets with robust enforcement of shareholder rights such as Malaysia, and Singapore. Moreover, industries with high capital expenditure intensity and high exposure to volatility in foreign exchange rates, such as the chemical, manufacturing and oil industries, also tend to benefit more from the use of derivatives.

### B. The Role of Corporate Governance Structures

Corporate governance structures consist of mechanisms in which firms ensure the suppliers of external debt and equity capital obtain a reasonable rate of return on their invested capital. Firms with strong governance structures, such as a high proportion of independent directors on the board, strong accounting and finance expertise on the risk management committees, and separation of the chief executive and chairman positions, are likely to have less agency costs between managers and shareholders (Jensen and Meckling, 1976). Thus, we predict that strong governance structures promote the likelihood that a company will use derivatives for value-enhancing hedging activities, instead of speculative ones that can destroy shareholder value. They help ensure that senior executives are effectively monitored, discouraging them from using derivatives for speculative reasons[5].

In Table 4 column (2), we also examine whether corporate governance structures affect the association between firm valuation and derivatives usage. We include an interaction term between a corporate governance index[6] and derivatives usage (HEDGEINT * CG). The interaction term between a corporate governance index and derivatives usage is positive and significant at the 5% level. This result indicates that the positive association between firm valuation and derivatives usage is stronger in firms with stronger corporate governance structures. Thus, in well-governed firms with lower agency costs and monitoring problems, derivatives have a more pronounced positive effect on firm valuation.

Indeed, in many cases where derivatives led to massive value destruction, corporate governance structures were weak, with poor board independence, low accounting and finance expertise on their risk management committees, and a dominant top management team that overrides risk management controls. Using survey data, Geczy, Mitton and Schrand (2007) document that firms with weak internal governance structures are more likely to indicate that they "take a view" (i.e., speculate) on interest rate and currency movements with derivatives. Hull (2008) shows how derivatives speculation and abuse can lead to large financial losses in large corporations such as Barings, Sumitomo, Long Term Capital Management, Midland Bank and National Westminister Bank.

### C. Are Derivatives More Beneficial During Economic Downturn?

During 2008 and 2009, many countries experienced economic downturn. Global equity market declined sharply in this period. The economic recession and global financial crisis led to an increase in corporate bankruptcies and a decrease in new and seasoned equity issuances. Thus, if the main objective of financial risk management is to reduce the probability of financial distress, then firms that employ derivatives to manage risk are likely to have experienced significant benefits during this period of economic downturn.

**Table 4**
Regression of firm valuation on derivative usage

This table presents the estimation results of the regression of firm valuation on derivative usage. The dependent variable (TOBINQ) is computed as the market value of common equity plus book value of liabilities divided by total assets. DERIUSER is a dummy variable that equals one if the firm uses derivatives and zero otherwise. HEDGEINT is hedging intensity defined as the absolute notional amount of derivatives divided by total assets. CG is the corporate governance index with higher scores denoting stronger corporate governance. DOWN is a dummy variable for economic downturn that equals one for year 2008 and year 2009 and zero otherwise. LOGASSET is the natural logarithm of total assets. ROA is net income after tax divided by total assets. TAX is the effective tax rate computed as total current tax expense and deferred tax expense divided by net income before tax. SALECHG is the annual sales growth. LTDEBT is total liabilities divided by total assets. NETPPE is the ratio of property, plant and equipment to total assets. NSEG is the number of business segment. In all models, we include country dummy variables to control for country effects, industry dummy variables to control for country effects, and year dummy variables to control for time effects. Standard errors are clustered by firm and year. $^{*}$, $^{**}$, and $^{***}$ denote statistical significance at the 10%, 5%, and 1% levels respectively. t-statistics are in parentheses.

| | 1 | 2 | 3 |
|---|---|---|---|
| Intercept | 2.974 | 4.081 | 3.165 |
| | (3.87)*** | (4.75)*** | (4.91)*** |
| DERIUSER | 0.021 | | |
| | (3.14)*** | | |
| HEDGEINT | | 0.429 | 0.318 |
| | | (2.98)*** | (2.61)*** |
| HEDGEINT*CG | | 0.117 | |
| | | (2.03)** | |
| CG | | 0.253 | |
| | | (2.71)*** | |
| HEDGEINT*DOWN | | | 0.397 |
| | | | (2.04)** |
| DOWN | | | -0.802 |
| | | | (-3.49)*** |
| LOGASSET | -0.219 | -0.332 | -0.416 |
| | (-2.66)*** | (-3.41)*** | (-3.09)*** |
| DEBT | -0.715 | -0.675 | -0.589 |
| | (-3.25)*** | (-2.87)*** | (-2.73)*** |
| ROA | 0.974 | 1.213 | 0.716 |
| | (4.21)*** | (3.37)*** | (2.80)*** |
| SALECHG | 0.708 | 0.413 | 0.629 |
| | (2.13)** | (2.88)*** | (2.02)** |
| NETPPE | 0.113 | 0.063 | 0.044 |
| | (2.01)** | (1.80)* | (1.15) |
| NSEG | -0.065 | -0.043 | -0.017 |
| | (-1.42) | (-1.21) | (-0.85) |
| Country controls | Yes | Yes | Yes |
| Year controls | Yes | Yes | Yes |
| Industry controls | Yes | Yes | Yes |
| Adjusted $R^2$ | 8.9% | 12.3% | 7.1% |

We test this prediction by examining whether the association between firm valuation and derivatives usage for risk management differs between economic downturn and economic upturn. Table 4 column (3) presents the results of this analysis. The variable DOWN is a dummy variable that equals one in the years of economic downturn (which are year 2008 and year 2009) and zero otherwise. The coefficient DOWN is negative and statistically significant, indicating that firms have lower valuation during the years of economic downturn. Consistent with our prediction, the interaction between derivative usage and years of economic downturn (HEDGEINT * DOWN) is positive and statistically significant at the 5% level. This result indicates that the negative association between firm valuation and years of economic downturn is mitigated by derivative usage. In other words, relative to non-users of derivatives, firms that use derivatives have higher valuation during the period of economic downturn. We interpret our result as implying that firms that employ derivatives to hedge financial risk have a higher probability of experiencing benefits (such as lower financial distress costs) during the period of economic downturn. More generally, our result is consistent with the conjecture that derivatives that destroyed shareholder value during the 2008-2009 economic downturn are those mainly held by the financial firms. In contrast, there are relatively fewer instances of value-destroying derivatives in non-financial firms during the economic downturn.

## VI. DERIVATIVES AND FIRM RISK

This section examines the association between derivatives usage and firm risk. We employ three measures of firm risk: (i) volatility of operating cash flow, (ii) volatility of return on assets and (iii) standard deviation of stock returns.

Table 5 presents the regressions of firm risk on derivatives usage. In column (1), the dependent variable is the standard deviation operating cash flow divided by total assets in the past five years (SIGMAOCF). The coefficient DERIUSER is negative and statistically significant at the 1% level, indicating that derivative users have lower operating cash flow volatility that is almost 9% lower than that of non-users of derivatives. In column (2), the dependent variable is the standard deviation of return on assets in the past five years (SIGMAROA). The coefficient DERIUSER is negative and statistically significant at the 5% level, indicating that derivative users have lower return on assets (profitability) volatility that is almost 4% lower than that of non-users of derivatives. In column (3), the dependent variable is the standard deviation of daily stock returns in the past year (SIGMARET). The coefficient DERIUSER is negative and statistically significant at the 5% level, indicating that stock return volatility of derivative users is about 7% lower than the stock return volatility of non-users of derivatives.

Collectively, our results suggest firms reduce cash flow risk, profitability volatility and stock return risk substantially via financial risk management with derivatives. In other words, smoothness and predictability of cash flows and earnings are important reasons that firms hedge with derivatives. Lower firm risk may indicate that hedging with financial derivatives reduces a firm's cost of capital and thus the economic profitability of the firm. This explains and reinforces our prior result that derivative users have higher firm valuation.

**Table 5**
Regression of firm risk on derivatives usage

This table presents the estimation results of the regression of firm risk on derivative usage. In column (1), the dependent variable is the standard deviation operating cash flow divided by total assets in the past five years (SIGMAOCF). In column (2), the dependent variable is the standard deviation of return on assets in the past five years (SIGMAROA). In column (3), the dependent variable is the standard deviation of daily stock returns in the past year (SIGMARET). DERIUSER is a dummy variable that equals one if the firm uses derivatives and zero otherwise. The control variables are as follows. LOGASSET is the natural logarithm of total assets. ROA is net income after tax divided by total assets. SALECHG is the annual sales growth. LTDEBT is total liabilities divided by total assets. In all models, we include country dummy variables to control for country effects, industry dummy variables to control for country effects, and year dummy variables to control for time effects. Standard errors are clustered by firm and year. $^{*}$, $^{**}$, and $^{***}$ denote statistical significance at the 10%, 5%, and 1% levels respectively. t-statistics are in parentheses.

| | 1 | 2 | 3 |
|---|---|---|---|
| Dependent variable | SIGMAOCF | SIGMAROA | SIGMARET |
| Intercept | 1.923 | 0.873 | 1.826 |
| | (4.17)*** | (3.91)*** | (4.05)*** |
| DERIUSER | 0.087 | 0.043 | 0.072 |
| | (2.57)*** | (2.02)** | (2.05)** |
| LOGASSET | -0.615 | -0.713 | -0.587 |
| | (-3.14)*** | (-2.69)*** | (-3.11)*** |
| ROA | 0.062 | 0.301 | 0.294 |
| | (2.04)** | (2.52)*** | (2.67)*** |
| SALECHG | 0.059 | 0.097 | 0.061 |
| | (2.75)*** | (2.81)*** | (2.52)*** |
| LTDEBT | 0.392 | 0.238 | 0.417 |
| | (2.93)*** | (2.75)*** | (2.90)*** |
| Country controls | Yes | Yes | Yes |
| Year controls | Yes | Yes | Yes |
| Industry controls | Yes | Yes | Yes |
| Adjusted $R^2$ | 6.8% | 7.2% | 5.1% |

## VII. DERIVATIVES AND CAPITAL EXPENDITURE INVESTMENTS

Our previous findings suggest that hedging increases firm valuation and hedging reduces volatility of cash flow. Hedged cash flows can support firm's capital expenditure planning decisions such as capital investments that are planned years in advance when it is difficult to predict its cash flows or access to external financing (Carter, Simkins and Rogers (2006)). This section examines whether financial hedging programs shape the firms' capital expenditure investments. We employ the following model to examine the effect of derivatives on capital expenditure:

$$CAPEX = \beta_0 + \beta_1 DERIUSER + \beta_2 LNASSET + \beta_3 DEBT + \beta_4 CFFO + \beta_5 SALECHG + Country\ Dummies + Industry\ Dummies + Year\ Dummies \quad (2)$$

The dependent variable CAPEX is defined as capital expenditure divided by lagged total assets. The main test variable is derivative usage (DERIUSER). Based on prior studies on corporate investment (Kaplan and Zingales, 1997), we identify several

determinants of capital expenditures. We control for firm size by including the natural logarithm of book assets (LNASSET). We include leverage (DEBT) to control for capital structure differences that may affect a firm's capital expenditures. The operating cash flow divided by lagged total assets (CFFO) provides a measure of the firm's internal funds and annual sales growth (SALEHG) provides a measure of growth opportunities. Previous studies document that capital expenditures are positively associated with operating cash flow and growth opportunities. In our model, we also include country dummy variables to control for country effects, industry dummy variables to control for country effects, and year dummy variables to control for time effects.

Table 6 presents the estimation results of our regressions of capital expenditure on derivative usage. In Column (1), the coefficient on the dummy variable on derivative usage (DERIUSER) is positive and significant at the 5% level. This result suggests that firms that use derivatives are able to invest more than non-users of derivatives. In terms of economic significance, this result suggests that being a derivative user increases a firm's capital expenditure by 6% relative to a non-user.

**Table 6**

Regression of capital expenditure investments

This table presents the estimation results of the regression of capital expenditure investments on derivative usage. The dependent variable (CAPEX) is computed as capital expenditure divided by lagged total assets. DERIUSER is a dummy variable that equals one if the firm uses derivatives and zero otherwise. HEDGEINT is hedging intensity defined as the absolute notional amount of derivatives divided by total assets. The control variables are as follows. LOGASSET is the natural logarithm of total assets. CFFO is operating cash flow divided by lagged total assets. LTDEBT is total liabilities divided by total assets. In all models, we include country dummy variables to control for country effects, industry dummy variables to control for country effects, and year dummy variables to control for time effects. Standard errors are clustered by firm and year. $^{*}$, $^{**}$, and $^{***}$ denote the 10%, 5%, and 1% levels respectively. t-statistics are in parentheses.

| | 1 | 2 |
|---|---|---|
| Intercept | 2.174 | 1.849 |
| | (3.29) $^{***}$ | (3.05) $^{***}$ |
| DERIUSER | 0.061 | |
| | (2.03) $^{**}$ | |
| HEDGEINT | | 0.079 |
| | | (2.86) $^{***}$ |
| LOGASSET | 0.009 | 0.025 |
| | (1.04) | (1.12) |
| SALECHG | 0.029 | 0.087 |
| | (2.78) $^{***}$ | (2.79) $^{***}$ |
| LTDEBT | -0.012 | -0.017 |
| | (-1.08) | (-1.15) |
| CFFO | 0.043 | 0.051 |
| | (2.72) $^{***}$ | (2.61) $^{***}$ |
| SALECHG | 0.049 | 0.053 |
| | (2.81) $^{***}$ | (2.66) $^{***}$ |
| Country controls | Yes | Yes |
| Year controls | Yes | Yes |
| Industry controls | Yes | Yes |
| Adjusted $R^2$ | 9.5% | 11.7% |

In column (2), we focus on the sub-sample of firms that use financial derivatives. Our test variable to measure the intensity of derivatives usage is the ratio of the net absolute fair value of derivatives divided by total assets (HEDGEINT). The coefficient HEDGEINT is positive and statistically significant at the 1% level. This result suggests that capital expenditure is positively associated with the intensity of derivative usage. In terms of economic significance, this result suggests that being an average hedger increases the firm's investment by about 13% relative to the sample mean of annual investments.

## VIII. DERIVATIVES AND COST OF DEBT

This section examines the association between derivatives usage and cost of debt. Table 7 presents the regression of cost of debt on derivative usage. The dependent variable is the cost of debt (COSTDEBT) which is computed as interest expense divided by long-term debt. The coefficient HEDGEINT is negative and statistically significant at the 1% level. In terms of economic significance, a one-standard deviation increase in the hedging intensity leads to a 1.4% reduction in interest expense. Relative to the average cost of debt of 6%, this represents a 18% reduction. Thus, hedging has a strong impact on cost of debt.

To gain additional insight into these effects, we also examine a sub-sample of firms with floating rate debt. If these firms do not hedge, an increase in borrowing rates will increase the interest expense on their floating rate debt, which eventually reduces net profit. Sensitivity analysis indicates that net profit can be reduced by up to 4 per cent for every 1 percentage point rise in interest rates. We find that about 33 per cent of the firms with substantial floating rate debt attempt to hedge interest rate risk by using an interest rate swap. By transforming their floating rate debt into fixed rate debt, they are shielded from future interest rate increases. Hence, effective usage of derivatives can have substantial first-order effect on lowering the cost of debt. The control variables are generally in the expected direction. Firms that are larger, those are more profitable and those are less leveraged, have lower cost of debt[7]. Our results on the effect of derivatives hedging on cost of debt are also consistent with Petersen and Thiagaran's (2000) findings on the mitigating effect of hedging on the cost of equity. Collectively, our results broadly suggest that hedging lowers the cost of external financing.

## IX. CONCLUSIONS

This paper examines the usage of financial derivatives by listed firms in Asia as a corporate risk management strategy. We find that about 48% of the listed firms use financial derivatives. In terms of type of financial risk hedged, among the derivatives users, we find that most firms tend to hedge foreign exchange risk, interest rate risk and commodity price risk. Furthermore, we find that forward contracts are the most widely used derivatives, followed by interest rate swaps and futures contract.

We examine the key determinants of the intensity of derivatives usage. Consistent with the usage of derivatives for hedging, we find that derivative users tend to have high foreign exchange exposure such as high foreign sales as a percentage of total sales and foreign assets as a percentage of total assets. Furthermore, we provide evidence that suggest firms with higher expected costs of financial distress (such as those with higher

**Table 7**
Regression of cost of debt on derivatives usage

This table presents the estimation results of the regression of cost of debt on derivative usage. The dependent variable is the interest expense divided by long term debt (COSTDEBT). HEDGEINT is hedging intensity defined as the absolute notional amount of derivatives divided by total assets. The control variables are as follows. LOGASSET is the natural logarithm of total assets. ROA is net income after tax divided by total assets. SALECHG is the annual sales growth. LTDEBT is total liabilities divided by total assets. In all models, we include country dummy variables to control for country effects, industry dummy variables to control for country effects, and year dummy variables to control for time effects. Standard errors are clustered by firm and year. $^{*}$, $^{**}$, and $^{***}$ denote statistical significance at the 10%, 5%, and 1% levels respectively. p-values are in parentheses.

| | |
|---|---|
| Intercept | 0.865 |
| | (3.71) $^{***}$ |
| HEDGEINT | -0.073 |
| | (-3.29) $^{***}$ |
| LOGASSET | -0.418 |
| | (-2.92) $^{***}$ |
| ROA | -0.277 |
| | (-3.56) $^{***}$ |
| SALECHG | 0.051 |
| | (1.19) |
| LTDEBT | 0.425 |
| | (3.88) $^{***}$ |
| NETPPE | -0.094 |
| | (-2.01) $^{**}$ |
| Country controls | Yes |
| Year controls | Yes |
| Industry controls | Yes |
| Adjusted $R^2$ | 7.9% |

long-term debt and low short-term liquidity) have higher intensity of derivatives usage. This result supports the benefit of hedging in terms of mitigating lower-tail cash flow realizations and reducing bankruptcy risks. Firm size is positively associated with the likelihood of using derivatives. We also find that firms with higher growth options and investment opportunities tend to be more intensive users of derivatives. This result supports the notion that by reducing the variation of cash flow realizations, hedging facilitates high growth firms to maintain sufficient funds to finance positive net present value projects. In essence, firms are more likely to hedge in response to financial distress costs, financial risk exposure, growth options, investment opportunities, and future cash flow needs.

The association between derivatives usage and firm valuation depends on whether management use derivatives to address capital market imperfections (such as financial distress costs, external financing constraints, and information asymmetries) versus management's usage of derivatives for speculation and managerial self-interest. We find that firm valuation is positively associated with the intensity of derivatives usage. In terms of economic significance, we find that derivatives usage increases shareholder value, between US$ 26 million and US$ 74 million, representing about 2% to 5% of

equity valuation. Thus, on average, derivatives usage is associated with substantial increase in firm valuation.

The association between firm valuation and derivatives usage is also conditional on corporate governance structures. Specifically, we find that in firms with stronger corporate governance structures (such as those with higher board independence), the positive association between firm valuation and derivatives usage is greater. In well-governed firms, agency costs and monitoring problems tend to be lower. Thus, managers are more effectively monitored and this curtails the usage of usage of derivatives for value-destroying speculative purposes or personal self-interest. Additional analysis indicates that hedging mitigates the negative association between firm valuation and periods of economic downturn. This result supports the role of financial risk management in attenuating the expected financial distress costs and bankruptcy risks, especially during the periods of economic downturn.

Next, we investigate the channels in which derivatives can improve firm valuation. Using various measures for firm risk, we provide evidence that firm risk is negatively associated with derivatives usage. We find that firms with higher intensity of derivatives usage are more likely to have lower cash volatility, operating profitability volatility and stock return volatility than those with lower derivatives usage. Thus, higher hedging with derivatives is associated with lower firm risk.

We provide evidence that hedging has considerable effect on the firm's capital expenditure investments. The results indicate that hedging with derivatives can increase capital expenditure investments. Holding constant other factors, such as firm size, profitability and industry membership, a firm with "high derivative usage" has a capital expenditure investment intensity that is about substantially higher than a "low derivative usage" firm. By reducing the probability of negative cash flow scenarios, hedging with derivatives enables firms to direct more internal funds into future positive net present value projects. The benefit of hedging in promoting capital expenditure intensity is more pronounced in firms with high growth options and those that lack flexibility to obtain additional debt capacity. Without hedging, unexpected shocks to the cash flow may force firms to rely on costly external financing to support their capital expenditure investments. In the worst case scenario, firms may be forced to reject value-increasing profitable projects.

We also examine the association between cost of debt and derivatives usage. We find that hedging with derivatives can reduce the cost of debt. Thus, hedging eases access to external financing by mitigating costs of financial distress.

## ENDNOTES

1. The sample size takes into account the prohibitively high costs of manual data collection of derivatives data from the annual report and considerations to cover a broad spectrum of firms across the countries.
2. For comparison, as a benchmark, approximately 63% of the listed firms in United States use financial derivatives to hedge. Moreover, the percentage of derivative users in United Kingdom and Australia are 64% and 67% respectively.
3. Examples of tax shields are interest expense, tax losses, tax depreciation and investment allowances.

4. Using the ratio of interest-bearing long term debt to total assets as another measure of interest rate exposure, the results are qualitatively similar.
5. Operationally, strong corporate governance measures include implementing strong risk management policies and procedures, stringent approval processes to ensure trading limits are followed, and frequent and timely monitoring of risk exposure undertaken by the firm's executives.
6. We obtain data for corporate governance from Lee and Lee (2014). We construct a corporate governance index (CG) based on a principal components analysis of various attributes of the board of directors such as percentage of independent directors on the board, the separation of CEO and chairman position and board size. For parsimony, we standardize our corporate index to range from one to ten with higher corporate governance index (CG) denoting stronger corporate governance structure.
7. As a robustness test, we also include various country-level investor protection and enforcement variables that can affect corporate financing policies (see Lee, Lee and Yeo (2009) for details). Our results are qualitatively similar.

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