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Derivatives Use and the Cost of Equity

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Abstract

We investigate the effect of financial risk management, specifically derivatives use, on firms' cost of equity capital. Using a large sample of non-financial firms observed during 1992-1996 and 2002-2004, we compare the cost of equity of (1) derivatives using and non-using firms; and (2) a subset of firms who were non-users of derivatives and became users in a subsequent year. Using univariate and pooled regression methods, we find that derivatives users have a lower cost of equity, measured using the three-factor model of Fama and French, than non-users of approximately 20-90 basis points. Our further investigation finds that the reduction in the cost of equity is attributed to both lower market beta and SMB beta.

Derivatives Use and the Cost of Equity

I. Introduction

We examine whether firms engaged in financial risk management are rewarded with a lower cost of equity and, if so, what are the economic factors driving such reductions. Comparing firms that use derivatives with non-using firms, we find a significantly lower cost of equity ranging from 20 to 90 basis points annually. Within the context of the Fama French three-factor pricing model, we attribute the reduction in cost of equity to lower systematic (market) risk, and a lower SMB (small size minus big size) factor risk. This latter finding is consistent with the notion that derivatives use results in a lower degree of financial distress risk that is priced by the market as suggested by Chan, Chen, and Hsieh (1985), Fama and French (1996), and Vassalou and Xing (2004).

For risk management or hedging to increase firm value, it should either increase future expected cash flows or decrease the firm's cost of capital. In the classic Modigliani and Miller (1958) paradigm, risk management decisions should not affect a firm's value since investors can costlessly mimic a firm's financial decisions. However, the existence of imperfections related to financial distress (Smith and Stulz (1985)), tax shields (Stulz (1996) and Leland (1998)), and underinvestment (Bessembinder (1991) and Froot, Scharfstein, and Stein (1993)) lead some to argue that hedging can be a value-increasing activity.[1] While most of the financial literature has investigated cash flow or

[1] Several empirical studies find that hedging firms have a higher market valuation than non-hedgers (see Allayannis and Weston (2001), Allayannis, Lei, and Miller (2005), Bartram, Brown, and Fehle (2006), and Carter, Rogers, and Simkins (2006)); however, Jin and Jorion (2006) fail to find such evidence.

"numerator" effects of risk management, our focus is its affect on the cost of capital, specifically, whether derivatives use affects a firm's cost of equity.[2]

Smith and Stulz (1985) and Leland (1998) argue that hedging can potentially increase future expected cash flows by reducing expected costs associated with financial distress; however, whether a firm's financial exposures are diversifiable or represent risks that are priced remains an open question. The question is important in that a firm engaging in financial risk management could be rewarded by a lower cost of equity if, for example, financial distress risk has a systematic component. Empirical tests of asset returns conducted by Chan, Chen, and Hsieh (1985) find that the size effect can be explained by default risk premium. Fama and French (1992, 1996) find that a higher risk premium is associated with higher book-to-market and small-minus-big size effects, which are related to distress risk. However, Dichev (1998) finds that bankruptcy risk is not a systematic priced factor.

To investigate the relationship between derivatives use and the cost of equity, we use estimates of firms' ex post (average realized) cost of equity measured using the three-factor model of Fama and French (1993). We examine 1,541 non-financial firms in 1992-1996 and 1,384 non-financial firms in 2002-2004 using univariate as well as pooled regression methods to account for potential endogeneity related to a firm's hedging and capital structure decisions. Our results find strong support for the hypothesis that firms

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[2] Some studies argue that the cash flow effects of hedging might be small when placed in the context of overall firm size. Graham and Rogers (2002) estimate that the median tax benefits associated with hedging are $9.8 million. Guay and Kothari (2003) find that the potential median cash flow generated by a firm's derivatives portfolio is $15 million resulting from a hypothetical three standard deviation change in interest rates, currency exchange rate, and commodity prices.

engaged in financial risk management involving the use of derivatives have a lower cost of equity than do non-users. On average, we find that users of derivatives have a 20-80 basis points lower cost of equity. This finding is robust to specifications where we measure derivatives use as both a dummy variable as well as according to the notional extent of use. We further investigate the source of reduction in the cost of equity as relates to the various Fama-French factors and find evidence that the reduction in the cost of equity is attributable to decreases in market beta and the small-minus-big (SMB) beta.

Our investigation and findings compliment that of Bartram, Brown, and Conrad (2007) who examine how derivatives use affects firms' market betas using a CAPM framework. Analyzing more than 6,000 firms from 47 countries in the 2000-2001 period and dummy variables to capture firm's derivatives use, they report that beta coefficients for users are 0.042-0.181 lower than non-users, or 6-22% lower than non-users. Assuming by our estimates a market risk premium of say 6%, this translates into a 25 to 110 basis point reduction in a firm's cost of equity that uses derivatives.

Our final tests provide an alternative and arguably cleaner test for the effect of derivatives use on a firm's cost of equity. We identify those firms that during our sample period were historically, non-users of derivatives and subsequently became derivatives users. For these firms, we find that on average the cost of equity decreases by 20-90 basis points in the year of adoption of derivatives use as compared to the prior year.

II. Risk Management and the Cost of Equity

As noted previously, in a Modigliani and Miller (1958) framework, if capital markets are perfect, investors can mimic the risk management activities undertaken by a firm, and as a consequent, such activities should not be rewarded by investors. The existence of imperfections gives rise however to risk management having the potential to increase a firm's expected future cash flows. Among the channels through which financial risk management may increase expected cash flows relates to the potential benefits resulting from reducing a firm's financial distress risk. But whether such risk reduction is a diversifiable or priced risk is an open question.

Empirical results as to whether bankruptcy risk is systematic are mixed. Chan, Chen, and Hsieh (1985) find that the default risk premium between corporate and government bonds can explain the negative relation between size and stock returns. Chan and Chen (1991) further report that small firms are riskier because they tend to operate inefficiently and have higher financial leverage. Fama and French (1992) find that the average stock returns can be explained by size and book-to-market effects and in their 1996 paper they argue that those two effects are proxies for financial distress risk. Vassalou and Xing (2004) also find that size and book-to-market effects are default effects and default risk is systematic. This is consistent with the scenario that more-distressed firms are more sensitive to economy-wide recessions and investors will ask for a higher required rate of return for bearing the risk. Cochrane (1999) also states: "financial markets offer rewards in the form of average returns for holding risks related to recessions and financial distress, in addition to the risks represented by overall market movements" (page 36). However, Dichev (1998) finds firms with high bankruptcy risk have not earned higher than average returns since 1980 and concludes that bankruptcy risk is not systematic risk.

Empirical tests find results generally support that hedging reduces cash flow variability and lower variability results in lower cost of capital. Deshmukh and Vogt (2005) find hedging can smooth the cash flows of the firm and thus reduce the sensitivity of investment to cash flows. Empirical tests conducted by Minton and Schrand (1999) find that lower earnings variability is associated with a lower cost of debt and weighted average cost of capital. However, Hentschel and Kothari (2001) find that the reduction of volatility associated with equity returns is significant but economically small.

Empirical tests also find results that generally support derivatives use reducing other risk exposures. Allayannis and Ofek (2001) document users have lower exchange-rate exposure. Guay (1999) find declines in interest-rate exposure, exchange rate-exposure, and stock return volatility following the initiation of derivatives. The reduction in the market risk exposures may also lead a lower cost of equity. Stulz (1996, page 12) states that "although well-diversified shareholders may not be concerned about the cash flow variability caused by swings in FX (foreign exchange) rates or commodity prices, they will become concerned if such variability materially raised the probability of financial distress."

While our investigation is predicated on firms' derivatives use being for the primary purpose of reducing various risk exposures, we recognize incentives for firms to increase risk through their use. Smith and Stulz (1985) argue that managers have less incentive to hedge if their compensation has option-like features. Tufano (1996) provides evidence that managers who hold mostly options have incentives to increase risk in the gold mining industry. However, Geczy, Minton, and Schrand (1997) and Haushalter (2000) do not find shares or options owned by managers are related to hedging decisions.

Markets surveys also show that firms use derivatives take directional views on market prices. Bodnar, Hayt, and Marston (1998) report that 32% of the derivatives users indicate they actively take derivatives positions based on their views, and about 59% of the firms sometimes or frequently let their own view of market prices alter the timing of hedging.

III. Data description

Our data is taken from two periods: 1992-1996 and 2002-2004. We constructed our 1992-1996 sample of non-financial firms from the Swaps Monitor database. Swap Monitor reports derivatives use information for all Fortune 500 and Business Week 1000 firms, all other industrial firms with revenues greater than $500 million or assets greater than $500 million, and other known derivatives users regardless of firm size. For the 1992-1996 period, we have 1,541 firms with 3,440 firm-year observations that are users and 3,057 firm-year observations that are non-users.

Since 1996 is the last year reported in the swap Monitor, to test whether our hypothesis still holds in the most recent years, we collected the derivatives use information for S&P 1500 firms from the annual 10-K filings. We identified the union of all firms comprising the S&P 1500 during the 2000-2004 period; and collected data for these firms for each of the years 2002-2004. Since we focused on the practices of non-financial firms, we excluded banks, financial service firms, and insurance companies. Firms that experienced corporate events such as mergers and bankruptcies were subsequently excluded when they did not file 10-Ks. We finally have 1,341 firms with

2,489 firm-year observations that are users and 2,196 firm-year observations that are non-users.

We obtained financial data from the Standard and Poor's Compustat database. Information on foreign sales, the number of segments, and segment sales came from Compustat's Segment File. The number of analysts following the firms was collected from the I/B/E/S. We collected the stock returns from CRSP. The data for estimating the three-factor model was from French's website at mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

IV. Methods

IV.1 Measuring Firms' Cost of Equity

There are several alternative approaches to estimate the cost of equity. One approach is to use CAPM, which predicts that expected returns are a linear function of market beta. However, a couple of researchers indicate that beta alone cannot explain the cross-sectional variation in average stock returns. For example, Chan, Chen, and Hsieh (1985) find that size captures the default risk that is compensated in returns. Fama and French (1992, 1993) demonstrate that three factors: beta, book-to-market ratio, and size, explain the cross-section of returns much better than the beta alone. These studies basically show that size and book-to-market risk factors may capture the financial distress risk that may not completely captured by beta alone. Cochrane (1999) also argues that after quarter-century of studies, what we know is "multifactor extensions of the CAPM dominate the description, performance attribution, and explanation of average returns" (page 37). We use the Fama and French three-factor model (1993) to estimate the cost of equity.

We run the following regression by using daily returns to obtain the slopes: b_i, s_i, h_i.

$$R_{i,t} - R_{f,t} = a_i + \sum_{k=-1}^{k=1} b_{i,k}(R_{M,t+k} - R_{f,t+k}) + \sum_{k=-1}^{k=1} s_{i,k} SMB_{t+k} + \sum_{k=-1}^{k=1} h_{i,k} HML_{t+k} + e_i \qquad (1)$$

where R_i = the return for firm i

R_f = the return on one-month Treasury bill

R_m = the return of value-weight market portfolio on all NYSE, AMEX, and NASDAQ stocks

SMB = the difference in returns between small-stock and large-stock portfolios

HML = the difference in returns between high book-to-market and low book-to-market portfolios

Since we use daily returns, we include one lead and lag return in addition to the contemporaneous return in the regression to account for potentially biased betas when estimated in the presence of non-synchronous trading (see methods proposed by Dimson (1979) and modified by Fowler and Rorke (1983)). We obtain each beta (market, SMB, and HML beta) by summing the coefficient estimates on the contemporaneous, lead, and lagged value of the corresponding risk premiums. We obtain the cost of equity (CE) by substituting the regression slopes and arithmetic average daily, $R_m - R_f$, *SMB*, and *HML* returns from July 1963 until the year-end date into equation (1), as suggested in Fama and French (1997) and D'Mello and Shroff (2000), and then multiplying by 252 days[3].

IV.2 Empirical tests of hypotheses

[3] Fama and French (1997) use monthly data to estimate betas and thus obtain an annualized cost of equity by multiplying by 12.

We regress the cost of equity on derivatives use and correct firm and year clustering as suggested by Petersen (2007). In a pooled regression, standard errors can be biased downward when the residuals are correlated. In a panel data-set the residuals may be correlated across firms and years and lead to false inference of the relation between the cost of equity and derivatives use. We thus adjust the standard errors by simultaneously clustering by firm and year.

Following Botosan (1997) and Gebhardt, Lee, and Swaminathan (2001) we specify the relation between derivatives and the cost of equity as follows:

$$CE_{i,t} = f\,(Derivatives_{i,t}, Leverage_{i,t}, Book\text{-}to\text{-}Market\ Ratio_{i,t}, Number\ of\ Analysts_{i,t}, Size_{i,t}, Number\ of\ Segments_{i,t}, \%\ Segment\ Sales_{i,t}) \qquad (2)$$

We use a derivatives dummy variable and the notional amount of derivatives holding to measure a firm's derivatives activities. The derivatives dummy variable is defined to equal one if a firm reports the use of any type of interest rate, foreign currency, or commodity derivatives, and 0 otherwise. A firm's total notional amounts of derivatives is scaled by its total assets.

Leverage, a proxy for default risk, is defined as long-term debt plus current portion of long-term debt over total assets. Leverage is expected to be positively correlated with the cost of equity. However, Gebhardt Lee, and Swaminathan (2001) find that leverage is positively or negatively related to the ex ante measure of cost of equity, depending on different model specifications. Book-to-Market Ratio, a proxy for growth opportunities, is measured by the ratio of market value of equity to book value of equity. Book-to-Market ratio is expected to have a positive relation with the cost of equity.

We use analyst following to proxy for asymmetric information. Myers and Majluf (1984) argue that the problem of asymmetric information between managers and shareholders leads firms to obtain external finance at a premium to compensate investors for the potential “lemons” problem. We expect a negative relation between the number of analysts and the cost of equity as firms with a greater analysts following have less asymmetric information.

Size is measured by the natural logarithm of total assets and is expected to be negatively related to the cost of equity. The number of segments, a proxy for industrial diversification, is the number of segments that a firm operates. Diversification reduces a firm’s risk and is expected to be negatively related to the cost of equity. We also include the percentage of segment sales to total sales to measure a firm’s exposure to segment sales as well as industry effect and year dummy variables to control for time effect.

In addition to the pooled regression models, we also investigate our hypothesis in a simultaneous equation framework. The regression specification can be criticized because it assumes the derivatives use decision is exogenous. The derivatives use decision is more likely to be endogenous in reality. The debt capacity argument, raised by Stulz (1996), Ross (1996), and Leland (1998), suggests that by reducing risk, hedging enables the firm to increase debt capacity and to reduce tax liabilities due to leverage increases, which is different from the argument of Smith and Stulz (1985) (i.e. given fixed leverage hedging reduces the expected costs of financial distress). Consistent with the debt capacity hypothesis, Graham and Rogers (2002) find that firms with higher leverage are more likely to hedge and hedging also leads to higher leverage. So, a firm with relatively high leverage is more likely to hedge, hedging can lead to a lower level of risk, and thus affect the level of the debt ratio and the cost of equity. We, therefore, investigate the cost of equity, derivatives use, and leverage decisions within a system that allows us to avoid false inferences of causality among these decisions that are due to spurious correlations.

We specify the model of derivatives use following Geczy, Minton, and Schrand (1997).

$$Derivatives_{,i,t} = f\ (Leverage_{i,t},\ Book\text{-}to\text{-}Market\ Ratio_{i,t},\ Number\ of\ Analysts_{i,t},\ Size_{i,t},\ Number\ of\ Segments_{i,t},\ Quick\ Ratio_{i,t},\ Investment\ Tax\ Credit\ to\ Total\ Assets_{i,t},\ Foreign\ Sales\ to\ Total\ Sales_{i,t},\ \%\ Segment\ Sales_{i,t},\ Year\ Dummies) \quad (3)$$

We expect leverage to be positively related to the use of derivatives since Smith and Stulz (1985) predict that firms with higher probability of incurring financial distress are more likely to hedge. The inclusion of book-to-market ratio is based on the argument of Bessembinder (1991) and Froot, Scharfstein, and Stein (1993) that hedging can alleviate the underinvestment problem. So firms with higher growth opportunities, and thus lower book-to-market-ratio are more likely to hedge. We include the number of analysts as an asymmetric information measure in the model because DeMarzo and Duffie (1991, 1995) argue that if managers have private information that is not made available to shareholders, managers and shareholders will support hedging policies to eliminate the noise in the firm’s dividend stream. The asymmetric information argument predicts that firms with a higher level of asymmetric information are more likely to hedge. We also expect that large firms are more likely to hedge given there are economies in scale to participate in risk management.

The number of segments and quick ratio are measured the substitute of derivatives use. More diversified firms have less needs of derivatives use. The quick ratio is measured as cash and short-term investments over current liabilities.[4] The quick ratio is expected to be negatively correlated with hedging as more liquid firms have less needs of using derivatives. We use investment tax credit to total assets to proxy for tax function convexity. Smith and Stulz (1985) show that the structure of the tax code allows some firms to benefit from hedging. We include the ratio of foreign sales to total sales to measure foreign risk exposure and expect a positive relation between foreign sales and hedging. We also include year dummies to control for time effect.[5]

We follow Titman and Wessels (1988) for the independent variables in the leverage specification.

$$Leverage_{i,t} = f\,(Derivatives_{,i,t},\ Book\text{-}to\text{-}Market\ Ratio_{i,t},\ ,\ Size_{i,t}\ Investment\ Tax\ Credit\ to\ Total\ Assets_{i,t,t},\ Marginal\ Tax\ Rate_{i,t},\ Inventories,\ Plant\ \&\ Equipment\ to\ Total\ Assts_{i,t},\ Return\ on\ Assets_{i,t},\ \%\ Segment\ Sales_{i,t},\ Year\ Dummies) \quad (4)$$

Consistent with the debt capacity arguments raised by Ross (1996) and Leland (1998), we expect the use of derivatives increase the level of leverage. We expect a positive relation between book-to-market ratio and leverage as Myers (1977) argues that firms with good investment opportunities are more likely to have less debt. We expect larger firms have a higher level of leverage.

We use investment tax credit to total assets and marginal tax rate to control for tax-related motivations for firm's to utilize debt financing. DeAngelo and Masulis

[4]Following Geczy, Minton, and Schrand (1997), the numerator of the quick ratio does not include accounts receivable as those authors argue that the conversion of the latter into cash may "create information costs similar to those related to debt financing" (page 1329).

(1980) argue that non-debt tax shields can act as substitutes for the tax benefits of debt and therefore firms that can shelter large portions of their revenue through tax deductions should have lower demand for debt financing. The marginal tax rates are computed by John Graham and are collected from his website.[6]

Inventories, plant & equipment to total assts, the measure of collateral value, is the ratio of inventory plus plant and equipment to total assets. A positive relationship is expected between leverage and inventories, plant & equipment to total assts. Return on assets, a proxy for profitability, is calculated as the ratio of net income before dividends and taxes relative to the total assets of the firm and is expected to be negatively related leverage.

V. Empirical Results

V.1 Univariate Tests

Table 1 reports the results of univariate tests of the cost of equity and Fama and French three betas focusing on the difference between derivative users and non-users. In addition to the mean difference tests, we also conduct the Wilcoxon signed-rank median difference test to avoid the potential influence of outliers.

We find that users have a significant lower cost of equity than non-users for the period 1992-1996. In particular, users have on average 80 basis points lower cost of equity than non-users. The lower cost of equity is driven by lower market beta and SMB beta. The reduction in SMB beta indicates that derivatives use can reduce the financial

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[5] Our main results remain the same when we exclude year dummies.

[6] http://faculty.fuqua.duke.edu/~jgraham/taxform.html. The details of the simulation procedure used to estimate the corporate marginal tax rate can be found in Graham (1996a) and Graham (1996b).

distress risk. For years 2002-2004, we find users have 20 basis points lower cost of equity than non-users but which is statistically marginally significant (p-value of 0.16 for median test). Users have significantly lower market beta and SMB beta as in 1992-1996 while users have higher HML beta than non-users. Our findings suggest that users have market betas lower than non-users by 3-9%, which is close to 6-22% reported by Bartram, Brown, and Conrad (2007).

V.2 Multivariate tests

In a univariate setting, we find a negative association between the estimate of the cost of equity and derivatives use. However, without controlling for other variables that have an effect on the cost of equity, it is difficult to examine the relationship between derivatives use and the cost of equity. We turn now to test our hypothesis in a multivariate framework.

V.2.1 Regressions

Since our data is a panel data-set, we use pooled regression models and correct firm and time clustering as suggested by Petersen (2007).[7] Table 2, Panel A reports regression results for examining the relation between the cost of equity and derivatives use for years 1992-1996 and Panel B reports the relation for years 2002-2004. Model 1 reports the results of the relation between the cost of equity and derivatives users versus non-users, measured by derivatives usage indicator variable, and Model 2 examines the relation between the cost of equity and the extent use of the derivatives, measured by derivatives notional amounts to total assets.

[7] Our main results remain quantitatively similar when we just adjust the standard errors for either firm or year clustering alone. Also, our results remain unchanged when we use a fixed-effect model that includes year dummies.

Model 1 in Table 2, Panel A shows that the derivatives use dummy variable is significantly negatively related to the cost of equity. The coefficient values indicate that derivatives users have a lower cost of equity than non-users by 40 basis points. Model 2 shows the cost of equity decreases as the derivatives notional amounts increase. In particular, the cost of equity reduces by 2.4 basis points as the ratio of notional amounts to total assets increases by 1%. The average percentage of notional amounts to total assets is 13.5% in our sample, so on average users have lower cost of equity than non-users by 32.4 basis points (2.4*13.5), which is close to 40 basis points reported in Model 1. The results are consistent with our hypothesis that derivatives use can lower the cost of equity.

We find similar results for years 2002-2004. Model 1 in Table 2, Panel B shows that the coefficient on derivatives indicator variable is negative and significant at the 1% level. The magnitude of the derivative usage premium is bigger than that in years 1992-1996, and suggests that users have on average 70 basis points lower cost of equity than non-users. Model 2 indicates that the notional amount to total assets is inversely related to the cost of equity.

With respect to the other explanatory variables, in both periods, as expected we find leverage are significant and positive related to the cost of equity, which is consistent with the findings of Botosan (1997). Consistent with our expectation, we find in years 2002-2004 book-to-market ratios are significantly positive related to the cost of equity and a negative relation between the number of analysts and the cost of equity, while we find the signs for both variables are reverse in years 1992-1996. We also find large firms have a lower cost of cost in 2002-2004 while the relation is insignificant in 1992-1996.

We fail to find any relation between the number of segments and the cost of equity for both periods.

V.2.2 Simultaneous Regressions

Table 3 reports the results of estimating the cost of equity, derivatives use and leverage within a simultaneous equation framework. We use a two-stage estimation method to estimate the parameters. In the first stage, separate OLS regressions are run for the cost of equity and leverage decisions and Probit (Tobit) regression for the derivatives use versus non-use (notional amounts) decision. In the second stage, structural equations are estimated by replacing the explanatory variables with the predicted values from the first-stage regressions.

Table 3, Panel A presents the results of simultaneous equations estimation when using cost of equity, derivatives use, and leverage as the endogenous variables for years 1992-1996 and Panel B reports the results for years 2002-2004. Consistent with our findings in Table 2, our main results still hold after control for the endogeneity. Table 3 indicates a significant negative relationship between the cost of equity and derivatives usage dummy variable as well as notional amounts to total assets for both periods. The results for the other control variables are very similar to those reported in Table 2 except that in years 1992-1996 size and the number of analysts lose their significance.

From the derivatives equation reported in Panel A Model 2, we find that firms with higher leverage are more like to hedge, which is consistent with the financial distress argument and consistent with the empirical findings of Berkman and Bradbury (1996), Haushalter (2000), Gay and Nam (1998). In the leverage equation, we find hedging can increase the level of leverage, which supports the debt capacity argument and consistent with the findings of Graham and Rogers (2002).

Consistent with the underinvestment hypothesis and the empirical findings of Gay and Nam (1998), from the derivatives equation reported in Panel A Model 2 we find firms with higher book-to-market ratios, or lower growth opportunities, hedge less when notional amounts to total assets are used in the derivatives equations, while consistent with Nance, Smith, and Smithson (1993) and Geczy, Minton, and Schrand (1997), we do not find the same the relation when derivatives usage indicator variable (Panel A Model 1). We also find that firm size is positively correlated with the hedging decision and more liquid firms hedge less as expected. Consistent with Allayannis and Ofek (2001), we find firms with more exposure to risk, measured by foreign sales to total sales, hedge more. The results for years 2002-2004 are similar to those just discussed except that we do not find a significant and positive relation between leverage and derivatives in the derivative equation.

From the leverage equation reported in Panel A Model 2, we find large firms carry less debt. We also find that estimated coefficients of investment tax credits to total assets are significant and negative for years 1992-1996, which indicates investment tax credits serve as a substitute for the benefits of interest deductions. However, we do not find significant relation between the marginal tax rate and leverage. Consistent with our expectation, we find a positive and significant relation between the inventories, plant & equipment to total assets and leverage, which is consistent the argument that firms with more collateral assets borrow more. Finally, we find the estimated coefficients on the return on assets variable are negative and significant, which consistent with the hypothesis that more profitable firms carry less debt. We basically find similar results for years 2002-2004.

V.3 Changes in the Cost of Equity for New Derivatives Users

In this section, we further investigate the changes in the cost of equity before and after the initiation of derivatives programs. By investigating changes in the cost of equity before and after the initiation of derivatives, we can alleviate the concern that non-users may not be an appropriate control group for users due to different firm characteristics. Following Guay (1999), for years 1992-1996, a firm is defined as a new derivatives user if it reports derivatives use in year t, but does not report a position in derivatives in any years prior to year t during the sample period. Firms that report derivatives use in the year 1992 are not identified as new users since the data on derivatives usage for 1991 is unavailable. The initial sample contains 641 firms that are identified as new users.

For years 2002-2004, since we have only three years of derivatives use data, we look at years 2003 and 2004 and identify a firm as a new user if a firm reports the use of derivatives in year t, but does not use derivatives for two consecutive years prior to year t. The initial sample contains 98 firms that are identified as new users for years 2003 and 2004.

The results in Table 4 Panel A show that for the period of 1992-1996, new users are associated with lower estimates of cost of equity (based on the mean difference test). The average magnitude of the reduction in the cost of equity is 90 basis points, which is very similar to the difference of 80 basis points between users and non-users as reported in Table 2 Panel A. We further test which three betas drive the changes in the cost of equity. We find news users have significant lower market betas (based on the median difference test), SMB beta and marginally significant HML beta (p-value of 11% for mean difference test). The decreases in SMB and HML betas indicate new users experience a decrease in the cost of financial distress risk. However, for years 2002-2004 as shown in Table 4 Panel B, we only find new users experience a significant decrease in market beta.

We further examine the relationship between hedging and the cost of equity for new users by regressing changes in the cost of equity on the changes of notional amounts of derivatives and control variables. Changes are measured from year t-1 to year t. The results are reported in Table 5. We find for years 1992-1996, the coefficient of intercept is negative but insignificant and the coefficient of changes in notional amounts is negative and significant. The coefficient of intercept indicates that a new user experiences a reduction of 170 basis points when it initiates derivatives use. We do not find the coefficient of notional amounts is significant for years 2002-2004 as reported in Table 5 Panel B.

VI. Conclusions

This paper investigates the relation between derivatives use and the cost of equity. Consistent with our hypothesis, empirical tests conducted by univariate and pooled regression models with standard errors corrected for firm and year clustering as well as simultaneous equations methods indicate that on average derivatives users have a lower cost of equity estimated by the three-factor model. Specifically, we find that, on average, users have a lower cost of equity than non-users by 20 to 80 basis points.

We further investigate the changes in the risk and characteristics of firms initiating derivatives programs. Consistent with our cross-sectional results, we find that new users experience reductions in the cost of equity and probability of bankruptcy. These findings are consistent with the idea that firms use derivatives to reduce their risk exposures.

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Table 1

Statistical Comparision of Derivative Users and Non-Users

This table provides the results of a t-test of the difference in mean and Wilcoxon rank-sum tests of the difference in median between derivative users and non-users. Cost of equity is measured by risk premiums, which are computed as the expected returns - risk-free rate in three-factor cost of equity. Market Beta is the beta related to market risk premium. SMB Beta is the beta related to SMB risk factor. HML Beta is the beta related to HML risk factor. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Years 1992-1996

	Users			Non-Users			Difference Test			
							Means		Median	
Variable	Mean	Median	Std Dev	Mean	Median	Std Dev	T-test		Wilcoxon Test	
Cost of Equity	0.075	0.065	0.070	0.083	0.069	0.079	-0.008	***	-0.003	***
Maket Beta	1.039	0.951	0.706	1.073	0.936	0.850	-0.034	*	0.014	
SMB Beta	0.553	0.441	0.910	0.874	0.703	1.131	-0.321	***	-0.262	***
HML Beta	0.338	0.318	0.854	0.360	0.278	1.007	-0.022		0.040	

Note: The sample contains 3,440 firm-year observations that report using any type of interest rate, foreign currency, or commodity derivatives and 2,837 firm-year obervations that do not use derivatives .

Panel B. Years 2002-2004

	Users			Non-Users			Difference Test			
							Means		Median	
Variable	Mean	Median	Std Dev	Mean	Median	Std Dev	T-test		Wilcoxon Test	
Cost of Equity	0.074	0.067	0.054	0.076	0.071	0.058	-0.002		-0.003	
Maket Beta	1.115	1.020	0.535	1.232	1.149	0.600	-0.117	***	-0.130	***
SMB Beta	0.470	0.323	0.832	0.866	0.762	0.945	-0.396	***	-0.439	***
HML Beta	0.201	0.209	0.910	0.012	0.044	0.980	0.189	***	0.165	***

Note: The sample contains 2,489 firm-year observations that report using any type of interest rate, foreign currency, or commodity derivatives and 1,413 firm-year obervations that do not use derivatives .

Table 2
Pooled Regression of the Cost of Equity on Derivatives Use

This table presents results for regression estimation of the cost of equity on the use of derivatives and corrected standard errors for firm and year clustering. The dependent variable is cost of equity, measured by risk premiums (the expected returns - risk-free rate) in three-factor cost of equity. Derivatives Usage Indicator is equal to 1 if a firm reports the use of any type of interest rate, foreign currency, or commodity derivatives and zero otherwise. Derivatives Notional Amounts to Total Assets is the ratio of derivatives notional amounts to total assets. Leverage is measured by (long-term debt + current portion of long-term debt)/total assets. Book-to-Market Ratio is the ratio of book value of equity to market value of equity. Number of Analysts is the number of analysts following the firm. Size is the natural logarithm of total assets. Number of Segments is the number of segments the firm operates. The regressions also include the ratio of each segment sales to total sales. Standard errors are reported in parentheses. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Years 1992-1996

	Model 1		**Model 2**	
Intercept	0.103	***	0.101	***
	(0.021)		(0.022)	
Derivatives Usage Indicator	-0.004	*		
	(0.003)			
Derivatives Notional Amount to Total Assets			-0.024	**
			(0.010)	
Leverage	0.037	***	0.039	***
	(0.013)		(0.013)	
Book-to-Market Ratio	-0.009	**	-0.009	**
	(0.004)		(0.004)	
Number of Analysts	0.000	*	0.000	
	(0.000)		(0.000)	
Size: Natural Logarithm of Total Assets	-0.002		-0.003	
	(0.002)		(0.002)	
Number of Segments	0.000		0.000	
	(0.001)		(0.001)	
Number of Observations	5,043		4,762	
Number of Users	2,800		2,519	
Number of Non-users	2,243		2,243	
R^{2+}	0.090		0.091	

Panel B. Years 2002-2004

	Model 1		**Model 2**	
Intercept	0.091	***	0.084	***
	(0.007)		(0.005)	
Derivatives Usage Indicator	-0.007	***		
	(0.001)			
Derivatives Notional Amount to Total Assets			-0.024	*
			(0.013)	
Leverage	0.053	***	0.053	***
	(0.008)		(0.008)	
Book-to-Market Ratio	0.028	***	0.026	***
	(0.007)		(0.007)	
Number of Analysts	-0.001	***	-0.001	***
	(0.000)		(0.000)	
Natural Logarithm of Total Assets	-0.002	*	-0.003	**
	(0.001)		(0.001)	
Number of Segments	0.000		0.001	
	(0.001)		(0.001)	
Number of Observations	3,293		3,102	
Number of Users	2,074		1,883	
Number of Non-users	1,219		1,219	
R^{2+}	0.227		0.214	

Table 3

Simultaneous Equation Analysis of the Cost of Equity, Derivatives Use, and Leverage

This table presents results where the cost of equity, measured by risk premiums (the expected returns - risk-free rate) in three-factor model, derivatives use, and leverage are estimated within a simultaneous equations framework. Derivatives Usage Indicator is equal to 1 if a firm reports the use of any type of interest rate, foreign currency, or commodity derivatives and zero otherwise. Derivatives Notional Amounts to Total Assets is the ratio of derivatives notional amounts to total assets. Leverage is measured by (long-term debt + current portion of long-term debt)/total assets. Market-to-Book Ratio is the ratio of market value of equity to book value of equity. Number of Analysts is the number of analysts following the firm. Size is the natural logarithm of total assets. Number of Segments is the number of segments the firm operates. Quick Ratio is calculated as cash and short-term investments over current liabilities. Investment Tax Credits to Total Assets are investment tax credits divided by total assets. Foreign Sales to Total sales is the percentage of foreign sales to total sales. Inventories, Plant & Equipment to Total Assets is the ratio of inventory plus plant and equipment to total assets. Return on Assets is the ratio of net income before dividends and taxes to total assets. Marginal Tax Rate is the simulated marginal tax rates computed by Graham (1996a and 1996b). The regressions also include year dummies and the ratio of each segment sales to total sales. Standard errors are reported in parentheses. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Years 1992-1996

	Model 1			Model 2		
Dependent Variable:	**Cost of Equity**	**Derivatives**	**Leverage**	**Cost of Equity**	**Derivatives**	**Leverage**
Variable \ Estimation Methodology:	**OLS**	**Probit**	**OLS**	**OLS**	**Tobit**	**OLS**
Intercept	0.094 ***	-2.397 ***	0.284 ***	0.082 ***	-0.318 ***	0.419 ***
	(0.013)	(0.241)	(0.028)	(0.017)	(0.042)	(0.034)
Endogenous Variables						
Derivatives Usage Indicator	-0.024		0.023			
	(0.015)		(0.035)			
Derivatives Notional Amount to Total Assets				-0.072 **		0.485 ***
				(0.032)		(0.071)
Leverage	0.095 ***	0.936 **		0.106 ***	0.168 **	
	(0.016)	(0.392)		(0.018)	(0.067)	
Exogenous Variables						
Book-to-Market Ratio	-0.007 *	0.049	-0.075 ***	-0.008 **	-0.022 *	-0.056 ***
	(0.003)	(0.068)	(0.007)	(0.004)	(0.011)	(0.008)
Number of Analysts	0.000	0.011 ***		0.000	0.000	
	(0.000)	(0.004)		(0.000)	(0.001)	
Size: Natural Logarithm of Total Assets	-0.002	0.255 ***	0.005	-0.002	0.033 ***	-0.012 ***
	(0.002)	(0.026)	(0.004)	(0.002)	(0.004)	(0.003)
Number of Segments	0.000	0.072 ***		0.000	0.002	
	(0.001)	(0.020)		(0.001)	(0.003)	
Quick Ratio		-0.052			-0.020 ***	
		(0.036)			(0.006)	
Investment Tax Credits to Total Assets		19.734	-26.612 ***		-4.421	-22.045 ***
		(34.580)	(3.648)		(5.708)	(3.747)
Foreign Sales to Total Sales		0.785 ***			0.143 ***	
		(0.124)			(0.019)	
Marginal Tax Rate			0.028			-0.027
			(0.019)			(0.019)
Inventories, Plant & Equipment to Total Assets			0.103 ***			0.114 ***
			(0.015)			(0.015)
Return on Assets			-0.009 ***			-0.008 ***
			(0.000)			(0.000)
Number of Observations	4,612			4,346		
Number of Users	2,558			2,292		
Number of Non-users	2,054			2,054		
R^{2+}	0.089		0.326	0.091		0.336
Log Likelihood		-2,618.455			-685.651	

Table 3 (continued)
Panel B. Years 2002-2004

	Model 1						**Model 2**					
Dependent Variable:	**Cost of Equity**		**Derivatives**		**Leverage**		**Cost of Equity**		**Derivatives**		**Leverage**	
Variable \ Estimation Methodology:	**OLS**		**Probit**		**OLS**		**OLS**		**Tobit**		**OLS**	
Intercept	0.095	***	-2.681	***	0.148	***	0.087	***	-1.989	***	0.233	***
	(0.007)		(0.230)		(0.023)		(0.012)		(0.206)		(0.035)	
Endogenous Variables												
Derivatives Usage Indicator	-0.024	***			0.256	***						
	(0.008)				(0.023)							
Derivatives Notional Amount to Total Assets							-0.009	**			0.098	***
							(0.004)				(0.011)	
Leverage	0.245	***	-0.412				0.245	***	0.264			
	(0.020)		(0.677)				(0.021)		(0.642)			
Exogenous Variables												
Book-to-Market Ratio	0.032	***	-0.086		-0.027	***	0.031	***	-0.063		-0.023	***
	(0.003)		(0.081)		(0.007)		(0.003)		(0.071)		(0.007)	
Number of Analysts	0.000		-0.007	**			0.000		-0.004			
	(0.000)		(0.004)				(0.000)		(0.003)			
Size: Natural Logarithm of Total Assets	-0.008	***	0.468	***	-0.006	*	-0.010	***	0.181	0.000	0.010	***
	(0.002)		(0.042)		(0.004)		(0.002)		(0.038)		(0.003)	
Number of Segments	0.001		0.014				(0.001)		-0.009			
	(0.001)		(0.018)				(0.001)		(0.016)			
Quick Ratio			-0.157	***					-0.092	***		
			(0.024)						(0.023)			
Investment Tax Credits to Total Assets			-53.619	**	4.622	**			-43.212	*	5.098	**
			(22.540)		(2.101)				(22.835)		(2.217)	
Foreign Sales to Total Sales			1.075	***					0.811	***		
			(0.140)						(0.124)			
Marginal Tax Rate					0.020						0.017	
					(0.017)						(0.018)	
Inventories, Plant & Equipment to Total Assets					-0.016	*					0.013	
					(0.009)						(0.009)	
Return on Assets					-0.004	***					-0.003	***
					(0.000)						(0.000)	
Number of Observations	3,188						3,009					
Number of Users	1,995						1,816					
Number of Non-users	1,193						1,193					
R^{2+}	0.2262				0.398		0.213				0.392	
Log Likelihood			-1517.217						-2854.183			

Table 4

Changes in the Cost of Equity When New Users Start to Use Derivatives

This table presents changes in the cost of equity and three-factor betas when new users begin using derivatives. For years 1992-1996, a firm is categorized as a new user if a firm reports the use of derivatives in year t, but does not use derivatives prior to year t. For years 2002-2004, a firm is categorized as a new user if a firm reports the use of derivatives in year t, but does not use derivatives for two consecutive years prior to year t. Cost of equity is measured by risk premiums, which are computed as the expected returns - risk-free rate in three-factor cost of equity. Market Beta is the beta related to market risk premium. SMB Beta is the beta related to SMB risk factor. HML Beta is the beta related to HML risk factor. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Years 1992-1996

Variable	**Mean Change**		**Median Change**		**Std Dev**
Cost of Equity	-0.009	**	-0.001		0.114
Maket Beta	-0.062		-0.056	*	1.045
SMB Beta	-0.109	***	-0.092	**	1.400
HML Beta	-0.089		-0.020		1.430

Note: The sample contains 641 new derivatives users.

Panel B. Years 2002-2004

Variable	**Mean Change**		**Median Change**		**Std Dev**
Cost of Equity	-0.002		-0.001		0.062
Maket Beta	-0.112	**	-0.067	*	0.536
SMB Beta	0.082		0.075		0.774
HML Beta	-0.054		-0.012		1.017

Note: The sample contains 98 new derivatives users.

Table 5
Pooled Regression of Changes in the Cost of Equity on Changes in Derivatives Use for New Users of Derivatives

This table presents results for rgression estimation of changes in the cost of equity on changes in the use of derivatives for new users of derivatives and corrected standard errors for firm and year clustering. For years 1992-1996, a firm is categorized as a new user if a firm reports the use of derivatives in year t, but does not use derivatives prior to year t. For years 2002-2004, a firm is categorized as a new user if a firm reports the use of derivatives in year t, but does not use derivatives for two consecutive years prior to year t. Changes in the cost of equity is changes in risk premiums measured by the expected returns - risk-free rate in three-factor cost of equity from year t-1 to year t. Changes in Derivatives Notional Amounts to Total Assets is changes in the ratio of derivatives notional amounts to total assets from year t-1 to year t. Changes in Leverage is changes in (long-term debt + current portion of long-term debt)/total assets from year t-1 to year t. Market-to-Book Ratio is changes in the ratio of market value of equity to book value of equity from year t-1 to year t. Changes in Number of Analysts is changes in the number of analysts following the firm from year t-1 to year t. Changes in size is changes in the natural logarithm of total assets from year t-1 to year t. Changes in Number of Segments is changes in the number of segments the firm operates from year t-1 to year t. The regressions also include changes in the ratio of each segment sales to total sales. Standard errors are reported in parentheses. The symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Years 1992-1996

Intercept	-0.017	
	(0.016)	
Changes in Derivatives Notional Amount to Total Assets	-0.007	**
	(0.003)	
Changes in Leverage	-0.028	
	(0.022)	
Changes in Book-to-Market Ratio	-0.051	
	(0.043)	
Changes in Number of Analysts	-0.001	
	(0.002)	
Changes in Natural Logarithm of Total Assets	0.001	
	(0.011)	
Changes in Number of Segments	0.012	
	(0.032)	
Number of Observations	433	
R^{2+}	0.064	

Panel B. Years 2002-2004

Intercept	-0.028	
	(0.020)	
Changes in Derivatives Notional Amount to Total Assets	0.180	
	(0.161)	
Changes in Leverage	-0.325	**
	(0.141)	
Changes in Book-to-Market Ratio	-0.079	***
	(0.028)	
Changes in Number of Analysts	0.000	
	(0.001)	
Changes in Size, Natural Logarithm of Total Assets	0.082	
	(0.060)	
Changes in Number of Segments	-0.010	
	(0.018)	
Number of Observations	71	
R^{2+}	0.282	