ASYMMETRIC INFORMATION AND CORPORATE DERIVATIVES USE

PETER DADALT
GERALD D. GAY*
JOUAHN NAM

We investigate the relationship between derivatives use and the extent of asymmetric information faced by the firm. Using alternative analyst forecast proxies for asymmetric information, we find evidence that both the use of derivatives and the extent of derivatives usage is associated with lower asymmetric information. Specifically, for firms using derivatives (notably currency derivatives) we find that analysts' earnings forecasts have significantly greater accuracy and lower dispersion. These findings support the conjectures of DeMarzo and Duffie (1995) and Breeden and Viswanathan (1998) who argue that hedging reduces noise related to exogenous factors and hence decreases the level of asymmetric information regarding a firm's earnings. © 2002 John Wiley & Sons, Inc. Jrl Fut Mark 22: 241–267, 2002

We wish to thank the following individuals for their helpful comments and suggestions: Jayant Kale, John Knopf, Michael Rebello, Dan Rogers, Steve Smith, and John Thorton. We have further benefited from the comments of the anonymous reviewers. We also gratefully acknowledge the contribution of I/B/E/S Inc. in providing earnings per share forecast data as part of a broad program to encourage research on earnings expectations.

*Correspondence author, Department of Finance, J. Mack Robinson College of Business, Georgia State University, Atlanta, Georgia 30303-3083; e-mail: ggay@gsu.edu

Received October 2000; Accepted August 2001

- *Peter DaDalt is a Visiting Professor of Finance at Georgia State University in Atlanta, Georgia.*
- *Gerald D. Gay is a Professor of Finance at Georgia State University in Atlanta, Georgia.*
- *Jouahn Nam is an Assistant Professor of Finance at Pace University in New York, New York.*

The Journal of Futures Markets, Vol. 22, No. 3, 241–267 (2002)

INTRODUCTION AND OVERVIEW

The purpose of this study is to examine the effect of derivatives usage on the level of asymmetric information regarding a firm's earnings. Through hedging, managers can reduce the "noise" in earnings contributed by macroeconomic factors such as exchange rates and interest rates. Noise in this context refers to factors contributing to earnings that are believed to be outside of managerial control. Thus, by reducing the impact of these factors, hedging can present shareholders with a more informative picture of a firm's true earnings capacity and, hence, the quality of its managers. DeMarzo and Duffie (1995) and Breeden and Viswanathan (1998) explore this connection between hedging and asymmetric information using models in which shareholders learn about the quality of a firm's management by observing the firm's operating performance. In these models managers enhance the learning process by hedging those macroeconomic-related risks that are considered outside their control. Hedging, therefore, reduces the noise contained in earnings and thus increases their usefulness as indicators of managerial quality. Following this line of reasoning we hypothesize that the use of derivatives will be associated with lower levels of asymmetric information.[1]

An examination of this issue is important, as the mitigation of asymmetric information through hedging can increase firm value through a number of channels. By increasing the informativeness of earnings, managers can ameliorate the adverse selection problem that contributes to the costliness of external financing. As argued in Froot, Scharfstein, and Stein (1993), by reducing the dispersion of cash flows, hedging can reduce a firm's underinvestment problem by increasing the likelihood that the firm can fund projects through less expensive internally generated funds. While Froot et al. focus on this direct impact of hedging on the firm's underinvestment problem, hedging can also provide a less obvious benefit. In situations where the firm must still draw upon external financing, a lower level of information asymmetry increases the likelihood that the firm will obtain these funds at lower cost.

Similarly, the decreased cash flow volatility resulting from hedging can also have multiple effects on a firm's exposure to the costs associated

[1]Brown (2001) provides anecdotal evidence in support of the asymmetric information mitigation hypothesis. In a clinical examination of the risk practices of a large, multinational firm, he reports that its hedging decisions are motivated in part by attempts to lessen informational asymmetries.

with financial distress. Hedging lowers the expected cost of financial distress by reducing the number of states in which a firm may experience financial distress. In addition, a more accurate picture of the firm's true profitability provides creditors with better information, which may result in increased debt capacity and greater tax shields.

Our investigation adds to the extant research on derivatives usage by examining the effect of derivatives usage on information asymmetry.[2] In doing so, we utilize proxies that are both more directly related to information asymmetry and less likely to be confounded by other factors than those used in previous studies of corporate derivatives use. Drawing upon the analyst forecast literature, we utilize alternative measures to proxy for asymmetric information regarding a firm's earnings, including the accuracy and dispersion of analyst earnings forecasts.

Our principal empirical finding is that there is an inverse relationship between a firm's derivatives use and our measures of information asymmetry. This relationship is robust across different settings. In cross-sectional tests, both the use of derivatives and the extent of derivatives usage are associated with lower contemporaneous measures of asymmetric information. In addition, our measures of asymmetric information decrease (increase) across time as firms change status from being non-users (users) of derivatives to users (non-users). Our findings, however, appear driven primarily by currency derivatives usage and only weakly extend to usage of interest rate derivatives. We conjecture that there is inherently less information asymmetry regarding a firm's interest rate risk exposure than there is regarding its currency risk exposure due to accounting and reporting conventions.

The paper is organized as follows. In the next section we review and further develop the various linkages between hedging, firm value, and asymmetric information. In Section 3 we describe our data. In Section 4 we introduce and describe our proxies for information asymmetry. In Section 5 we report the empirical results of our examination of both the contemporaneous and intertemporal relationships between derivatives usage and asymmetric information. In Section 6 we provide concluding remarks.

[2]For analytical purposes, we assume that firms conduct their hedging through the use of derivatives. While we acknowledge that firms can and do use other techniques to manage risk, an analysis of these techniques is beyond the scope of this paper. The use of hedging substitutes is discussed in Nance, Smith, and Smithson (1993) and Géczy, Minton, and Schrand (1997).

HEDGING, INFORMATION AND FIRM VALUE

The financial economics literature offers a number of rationales for corporate hedging, typically falling into one of two categories. While not the primary focus of this paper, one category of investigation explores how hedging adds to firm value by reducing the dispersion of operating cash flows. By doing so, a firm can help alleviate the direct and indirect costs associated with financial distress, reduce its underinvestment problem associated with costly external financing, and lower expected tax liabilities.[3]

The second category emphasizes the effect of hedging on the information environment surrounding the firm. In a perfect market setting with full information, hedging at the firm level is irrelevant since shareholders may undertake this activity on their own. In practice, however, analysts, shareholders and others frequently rely on estimates of earnings and cash flows as inputs for valuation models. Also, earnings and firm cash flows are summary measures capturing the effects of both managerial decisions and ability and of exposures to macroeconomic factors of which shareholders may not be fully informed. Thus, by hedging, managers can reduce the noise in these measures contributed by factors outside of management's control, and in turn lessen the asymmetric information in the market regarding managerial ability and firm value.

In two studies utilizing this intuition, DeMarzo and Duffie (1995) and Breeden and Viswanathan (1998) consider settings where managers have superior knowledge (relative to shareholders) regarding the nature and extent of a firm's various market exposures, such as exposures to foreign exchange, interest rate and commodity price risks. In both studies, managerial choices regarding risk management strategies are useful in resolving informational frictions between managers and shareholders.

DeMarzo and Duffie (henceforth "DD") model an environment similar to that in Holmstrom and Ricart i Costa (1986) wherein exists shareholder uncertainty regarding managerial quality. Superior managers wish to resolve this uncertainty in order to take advantage of competitive short-term labor markets. Shareholders learn about the quality of

[3]See, for example, the seminal articles of Mayers and Smith (1982), Smith and Stulz (1985), and Froot et al. (1993). Empirical evidence regarding these various rationales is reported in numerous studies, including Allayannis and Ofek (2000), Allayannis and Weston (1998), Berkman and Bradbury (1996), Dolde (1995), Gay and Nam (1998), Géczy et al. (1997), Graham and Rogers (1999), Howton and Perfect (1998), Tufano (1996), and Smith and Smithson (1993). For a thorough yet compact review of this literature and the accompanying empirical evidence, see Smithson (1998).

management and of the firm's projects by observing the firm's performance (as captured by its earnings). In one of their primary results, DD finds that "hedging reduces the amount of "noise" and increases the informational content in the firm's profits" (1995, p. 745). As a result, it increases the value of the shareholders' option to replace poorly performing or low quality managers.[4]

However, the results of DD vary under different disclosure regimes. Since hedging reduces the variability of profits (and hence of managerial wages), under a less than full disclosure regime (for example, one similar to hedge accounting), risk-averse managers choose full hedging as the equilibrium strategy. However, this result may not hold under a requirement of full disclosure of hedging positions (as with the reporting of separate accounts of hedging activity). In effect, since hedging reduces a source of noise in earnings and hence makes them a more informative signal of managerial quality, it could have the consequence of making managerial wages more variable. DD show that this second effect is to the detriment of managers and can destroy the equilibrium strategy of full hedging.

Breeden and Viswanathan (1998; henceforth "BV") model a similar setting. As in the DD model, there is uncertainty regarding managerial ability, and managers have superior information regarding the firm's exposure to various risks. Likewise, superior managers want to reveal their quality in order to take advantage of future increases in wages. However, in the absence of hedging, market participants are unable to determine whether the profits of the firm result from managerial ability or from factors outside management's control (such as changes in foreign exchange rates or factor prices). By hedging these factors, superior managers "lock in" firm profits by eliminating the contribution to profits resulting from extraneous risks. Hence, earnings become more informative of managerial ability, which is therefore more quickly revealed to the market.

In their model BV acknowledge that hedging can be costly to shareholders as it reduces the value of their implicit "equity option" arising from the presence of risky debt or loan guarantees. Since the implicit cost is lower for higher quality managers, BV use this intuition to limit the likelihood of equilibria where lower quality managers pool with higher quality ones. Given sufficient ability differences between the two groups, BV thus conclude that hedging costs will give rise to a

[4]In a related paper, DeMarzo and Duffie (1991) note that managers have proprietary information that may be costly to disclose because of strategic considerations or merely due to the costs of dissemination. They develop a model in which it can be therefore optimal for the firm to hedge on behalf of shareholders for purposes of eliminating noise in the firm's dividend stream.

separating equilibrium in which good managers hedge and poor managers do not.[5]

An additional setting where a reduction in asymmetric information can benefit firm value is found in Myers and Majluf (1984). Here the presence of asymmetric information contributes to externally raised funds being more expensive than internally generated funds.[6] That is, the presence of asymmetric information regarding the earnings capacity of assets in place induces an adverse selection problem that makes external financing more costly than internally generated funds. An underinvestment problem can then arise as the firm may forego otherwise profitable projects. As previously mentioned, Froot et al. (1993) demonstrate how risk management can increase firm value by reducing the firm's reliance on costly external financing, and hence mitigate the firm's underinvestment problem. However, despite risk management activities, there can be still be insufficient internally generated funds to fund all positive NPV projects. In these cases, hedging can have the additional benefit of lowering the cost of external funds.[7] By reducing the noisiness of earnings, hedging produces better information about the quality of the firm and hence reduces the information asymmetry between managers and investors. Since this reduces the adverse selection problem, hedging can therefore also result in lower costs associated with external financing when it is needed.[8]

SAMPLE DESCRIPTION

Our initial sample consists of all non-financial corporations included in the 1997 "Database of Users of Derivatives" (the last year of its publication) published by Swaps Monitor Publications.[9] The Database contains information regarding the incidence and extent of OTC and

[5]However, BV also show cases where pooling equilibria exist with neither group hedging.

[6]Asquith and Mullins (1986), for example, provide empirical support along these lines as they document negative share price reactions to industrial firms announcing equity issues.

[7]Evidence that mitigating information asymmetry can lead to less costly external capital has been documented in other research contexts. Krishnaswami and Subramaniam (1999) investigate the benefits that firms receive from the reduction of asymmetric information following spin-offs. Likewise, Dierkens (1991) finds that the costs associated with seasoned equity issues are positively associated with the level of asymmetric information.

[8]This point has been also made in Géczy et al. (1997).

[9]Swaps Monitor Publications, Inc. is a private company located at 401 Broadway, Suite 610, New York, NY 10013; telephone 212-625-9380. Though the firm no longer publishes its annual "Database of Users of Derivatives," the firm continues to serve as a leading industry vendor of derivatives data including quantitative information on the activities of derivatives dealers, dealer rankings, and estimates of the size of the global OTC and exchange-traded derivatives market. Further information regarding the services of Swaps Monitor Publications can be found at swapsmonitor.com.

exchange-traded derivatives usage by corporations, banks, thrifts, insurance companies, government agencies and other entities in the United States for fiscal years ending in 1992 through 1996. Swaps Monitor states that the information in the Database is derived largely from public sources including annual reports and regulatory filings. The coverage of corporations includes 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 their size. Among other information, Swaps Monitor reports for each firm the notional amount of interest rate, currency, and commodity derivatives, including swaps, forwards, futures, and options.

A firm was included in our initial sample if information regarding its interest rate or currency derivative usage was available in any of the years 1992 through 1996. Since we examine both the decision to use derivatives and the extent of derivative usage, we include in our sample all firms in the Database that can be clearly identified as either derivatives users or non-users, regardless of whether the notional amount of derivatives usage was available. To clarify, Swaps Monitor reports its information in a number of ways. First, for firms where information regarding the notional amount of derivatives usage is available, the database lists the notional dollar amount both by instrument (swaps, forwards, futures, or options) and by type (i.e., interest rate or foreign currency derivatives). Second, when the notional amounts are not available but a firm is identified as a known derivatives user, the database assigns a "−1." Third, the database identifies non-users by assigning either a "−2" or "0". A "−2" indicates that a firm clearly reported no use of any derivatives in either its proxy statement or 10-k. A "0" indicates that the firm is most likely a non-user based on the fact that no reported derivatives information could be found in public sources.

Table I presents information on the number of firms in our sample identified as either users or non-users of derivatives in each of the years 1992 through 1996. As shown in the table, our sample has a large number of firms with derivatives usage varying in both size and instrument type. Panel (a) reports on firms classified as users if they use any type of derivatives (either interest rate or currency derivatives), and as non-users if they use neither type of derivative. The number of users per year ranges from 333 to 440 firms, while the number of non-users varies from 227 to 356 firms. The panel also includes information on the derivatives usage for user firms for which actual notional dollar amounts were reported. The mean notional amount outstanding ranged from $535.5 million to $722 million with the median ranging from $85.6 million to $97.3

TABLE I
Descriptive Statistics of Derivative Users and Non-users

Panel (a): Derivatives Usage

	1992	*1993*	*1994*	*1995*	*1996*
Number of Non-users	236	227	237	356	322
Number of Users	333	409	440	372	430
Notional Amount					
No. Firms Reporting	301	368	412	325	397
Mean ($mil.)	535.5	603.2	615.5	722.0	717.7
Median ($mil.)	85.6	80.0	82.0	97.3	80.0

Panel (b): Firm Financial Characteristics

	Mean	*Median*	*Std. Dev.*	*Minimum*	*Maximum*
Users					
Total Assets ($mil.)	5,311	1,336	14,336	27.3	222,142
Sales ($mil.)	3,922	1,098	8,494	2.50	102,847
Debt Ratio	0.35	0.29	0.26	0.07	0.93
Number of Analysts	11.63	10.00	7.72	3.00	31.00
Number of Foreign Segments	3.68	3.00	0.81	3.00	5.00
Non-Users					
Total Assets ($mil.)	2,206	855	4,386	12.95	39,654
Sales ($mil.)	1,960	550	4,664	3.78	43,887
Debt Ratio	0.36	0.32	0.26	0.07	0.92
Number of Analysts	10.15	8.00	7.43	3.00	31.00
Number of Foreign Segments	3.46	3.00	0.68	2.00	5.00

Note. This table provides descriptive information for a sample of all non-financial firms reported in the Swaps Monitor database, which contains fiscal-year-end derivatives use information for the period 1992–1996. The number of users includes both firms reporting notional amounts of derivatives (currency and/or interest rate derivatives) and firms indicating the use of derivatives but reporting no information as to notional amounts. Mean and median notional amounts are in millions of dollars. Financial characteristics of firms reported in Panel (b) are as of fiscal year end 1996. Statistics for firms' total assets and sales are in millions of dollars.

million. Panel (b) of Table I presents selected characteristics (such as total sales, book value of total assets, debt ratios, the number of analysts following the firm, and the number of foreign sales segments) for users and non-users as of fiscal year-end 1996.

ASYMMETRIC INFORMATION MEASURES

In this section we describe our proxies for asymmetric information. Prior studies have used variables such as the extent of analyst following, the percentage of institutional ownership, and firm size to proxy for the degree of asymmetric information. Analyst following and institutional ownership are typically justified as proxies on the basis of these groups'

privileged access to management information and their superior information processing and monitoring abilities. The general prediction of these studies is that the larger the amount of institutional ownership or analyst following, the smaller the degree of information asymmetry about the firm and, hence, the lower the incentive for these firms to hedge.[10] The empirical evidence provided in this literature has generally not been supportive of the asymmetric information hypothesis. For example, Géczy et al. (1997) report results inconsistent with the asymmetric information hypothesis, finding that users had both a greater percentage of institutional ownership and a higher level of analyst following. Graham and Rogers (1999) similarly report a positive relation between derivatives usage and institutional ownership. Finally, firm size has been used as a proxy for asymmetric information, as larger firms are likely to have less asymmetric information due to higher institutional ownership and greater analyst following (see Atiase, 1985).

In the following investigation, we employ two alternate measures to proxy for asymmetric information. While these measures have been used in other settings, to our knowledge they have not previously been used in the risk management literature. We acknowledge that there are other measures to proxy for asymmetric information such as trading volume, bid-ask spread and analyst following. However, we choose proxies that are earnings-related so as to be closer to the spirit of the models in DeMarzo and Duffie (1995) and Breeden and Vishwanathan (1998).

The first measure captures the ability of analysts to accurately forecast a firm's earnings per share. Consider the following simple model of earnings: $Y_t = X_t + \theta_{t-1} \cdot Z_t$ where Y_t represents the firm's actual earnings in period t, X_t is the firms earnings if the firm fully hedges, Z_t is the firm's hedgeable risk which is assumed to be uncorrelated with X_t, and θ_{t-1} measures the extent of the firm's hedged position.[11] We first assume that the firm's managers have superior knowledge of $\theta_{t-1} \cdot Z_t$ relative to market participants or outsiders. To the extent that analysts err in their forecasts of $\theta_{t-1} \cdot Z_t$ (and hence of Y_t), and these errors are not symmetrically distributed, then these errors will result in decreased accuracy in analysts' forecasts. Thus, to the extent that managers hedge to reduce the exposure of earnings to extraneous factors captured by Z_t, then the variance of Y_t will be lower and thus Y_t will be more reflective of managerial ability. Further, for these

[10] Géczy et al. (1997) also conjecture that firms with larger analyst followings have greater incentives to hedge as a way of minimizing earnings surprises.

[11] We thank an anonymous reviewer for suggesting this model.

hedging firms, analysts are now forecasting earnings drawn from a tighter distribution. As a result, forecasts of earnings of these firms should be more accurate.[12]

Along these lines, Elton, Gruber, and Gultekin (1984), Christie (1987), and Atiase and Bamber (1994) note that analyst forecast error could provide a useful proxy for information asymmetry. They argue that firms with higher levels of information asymmetry between managers and market participants regarding a firm's cash flows tend to have higher forecast errors. Following these authors, we calculate analyst forecast accuracy (denoted by *ACCUR*) as the absolute value of the average earnings forecast error, normalized by the firm's stock price as follows:[13]

$$ACCUR = \text{ABS}\left[\frac{\overline{EPS}_{FOR} - EPS_{ACT}}{Price}\right] \quad (1)$$

In equation (1), $\overline{EPS}_{FOR}$ is the mean analyst earnings forecast computed using all available annual earnings forecasts as of the last I/B/E/S (Institutional Brokers Estimate System) reporting month prior to the release of the firm's actual earnings per share. EPS_{ACT} is the actual annual earnings per share, and *Price* is the firm's share price as of the month prior to the forecast month. For a firm-year observation to be included in our sample, we require that it have a minimum of three analyst forecasts available. Also, since the revelation of earnings provides information that affects the share price, we use the share price as of one month prior to the I/B/E/S report date. For a firm-year observation to be included in our sample, we require that it have a minimum of three analyst forecasts available. We thus expect *ACCUR* to be positively related to the level of asymmetric information, that is, the greater the level of *ACCUR*, the higher the extent of asymmetric information.

We next introduce a second measure of information asymmetry that is based on the extent of disagreement in analysts' earnings forecasts. Krishnaswami and Subramaniam (1999) justify this second measure as a proxy for information asymmetry by noting that disagreement among analysts can be driven by the lack of available information about the firm. Similarly, Barry and Brown (1985) model a setting where

[12]It should be noted that while hedging results in both decreased information asymmetry and smoother or less variable earnings, we do not argue that earnings smoothness is associated with information asymmetry. For an analysis of the relation between earnings smoothness and derivatives usage, see Barton (2001).

[13]Since we are concerned with the issue of accuracy rather than "optimism" (e.g., whether the forecasts are high or low), we use the absolute value of the error instead of the signed forecast error. We have in addition normalized by both the actual earnings per share and by the mean forecast of earnings and found no substantive differences in the results to follow.

disagreement increases when there is more private rather than public information regarding the firm. We thus calculate analyst dispersion (denoted as *DISPERSE*) as the standard deviation of a firm's earnings per share estimates (EPS_i) as of the last I/B/E/S reporting month prior to the release of the actual earnings per share, normalized by the firm's share price as follows:

$$DISPERSE = \frac{\left[\Sigma_{i=1}^{n}(EPS_i - \overline{EPS}_{FOR})^2/N\right]^{0.5}}{Price} \quad (2)$$

where N is the number of reporting analysts. As in the case of the accuracy measure, we expect a positive relation between the dispersion measures *DISPERSE* and the level of asymmetric information.

EMPIRICAL TESTS AND RESULTS

We begin with univariate and multivariate tests of the contemporaneous association between derivatives usage and asymmetric information. In both settings we conduct separate examinations of firms' overall derivatives usage, their currency derivatives usage, and their interest rate derivatives usage. We also address the effects of both the decision to use derivatives and the extent of that usage. We follow this with an investigation of the intertemporal relationship between derivatives usage and asymmetric information. In doing so, we analyze the effects of a change in the status of derivatives usage on asymmetric information. That is, we look at firms that changed their status from either non-user to user or from user to non-user.

Contemporaneous Univariate Tests

Our central hypothesis is that hedging firms will have lower levels of information asymmetry than will those firms that do not. Table II presents the results of univariate tests of the differences between users and non-users of derivatives for our two measures of information asymmetry. Our sample includes all nonfinancial firms for which fiscal year-end derivatives usage is determinable from the Swaps Monitor database over the period 1992–1996. We hypothesize that users of derivatives will have lower earnings forecast error as well as a lower dispersion of earnings forecasts. To test these hypotheses we compute and report t-statistics for differences in means between the user and non-user groups for each of the measures *ACCUR* and *DISPERSE*.

TABLE II
Univariate Results Comparing Information Asymmetry Measures

	Users			*Non-users*			*Difference Tests*
Variables	*No.*	*Mean*	*Median*	*No.*	*Mean*	*Median*	*t-statistic*
Panel (a): Currency and/or Interest Rate Derivatives							
ACCUR	1982	0.0041	0.0014	1371	0.0049	0.0018	−3.17***
DISPERSE	1984	0.0029	0.0015	1378	0.0034	0.0017	−3.78***
Panel (b): Currency Derivatives							
ACCUR	1165	0.0034	0.0011	2094	0.0051	0.0019	−7.25***
DISPERSE	1166	0.0025	0.0012	2102	0.0035	0.0019	−8.34***
Panel (c): Interest Rate Derivatives							
ACCUR	1348	0.0042	0.0015	2094	0.0045	0.0016	−1.17
DISPERSE	1350	0.0030	0.0016	2101	0.0032	0.0016	−1.62*

Note. This table provides comparisons of measures of information asymmetry for users and non-users of derivatives. The sample includes non-financial firms taken from the Swaps Monitor database for the fiscal-year-end period of 1992–1996. For a firm-year observation to be included in our sample, we require that a firm's fiscal-year end usage of derivatives be indicated in the Swaps Monitor database and that I/B/E/S reports a minimum of three analyst forecasts of the firm's annual earnings per share for the fiscal year. *ACCUR* is a measure of analyst forecast accuracy computed as the absolute value of the analyst forecast error scaled by the firm's stock price as of one month prior to the forecast where analyst forecast error is computed as the difference between the average analyst forecast of fiscal year end earnings per share and actual earnings per share. *DISPERSE* is a measure of the dispersion of analyst forecasts computed as the standard deviation of forecast of earnings per share scaled by the firm's stock price as of one month prior to the forecast. Statistics reported include the number of firm-year observations, mean values, median values, and *t*-statistics for differences in means. Statistical significance for all test statistics is based on a one-tailed test.
*Significant at the 10% level; and ***significant at the 1% level.

In panel (a) of Table II, firms are classified as users if they use either interest rate or currency derivatives (or both), and as non-users if they use neither. The results provide strong support for our hypotheses as the earnings forecasts for user firms are both more accurate and less dispersed than those for non-user firms. The differences in the mean levels of both measures are statistically significant at the 1% significance level (one-tailed test).[14]

Panels (b) and (c) of Table II repeat the tests of panel (a), with the only difference being that the user/non-user classification is based solely on either currency derivatives usage or interest rate derivatives usage, respectively. The results for currency derivatives users in panel (b) are consistent with those of panel (a), and in fact appear to be even more pronounced, with the differences in the mean levels of the two measures again statistically significant at the 1% significance level.

[14]To control for outliers possibly affecting our findings reported in Table II, we also conducted tests of differences in median values by computing Wilcoxon signed-rank z-statistics. The results are qualitatively similar and are available upon request.

In contrast, the results for interest rate users in panel (c) are much weaker than are those of currency derivative users. While the mean levels of the two measures appear to be smaller for users than for nonusers, the differences are statistically significant only for the difference in means for *DISPERSE* (10% significance level).

In summary, while the univariate results for both overall derivatives use and the use of currency derivatives are strongly supportive of our hypothesis that hedging through the use of derivatives is associated with lower levels of information asymmetry, the results for interest rate derivatives are less compelling. The conflicting results may simply be due to there being inherently less information asymmetry to be resolved pertaining to a firm's exposure to interest rate risk than to its currency risk.[15] For example, although disclosure rules are somewhat similar for interest rate and currency derivatives, there can be large differences in the disclosure of firms' interest rate and currency exposures. Much of firms' interest rate exposures can be inferred through publicly reported financial statements and other regulatory filings. In contrast, firms' currency exposures are often difficult to fully ascertain using publicly available information. Geographic segment reporting requirements for public U.S. multinational firms (see SFAS 14) typically apply to only those segments contributing 10% or more to consolidated revenues or income. The usefulness of this data in ascertaining specific currency exposures is further lessened by the fact that individual country data are often aggregated and reported on a regional basis (for example, Europe or Asia).

Contemporaneous Multivariate Tests

The univariate results in the previous section demonstrate an association between derivatives usage and decreased levels of information asymmetry. However, derivative usage may simply be capturing systematic variations in the firms' financial characteristics (such as firm size or the level of growth opportunities) that are the true drivers of the level of information asymmetry faced by the firm. We address this possibility by extending the analysis of the previous section to a multivariate framework. Therefore, by including control variables for these characteristics we attempt to ensure that we are capturing the true marginal effect of derivatives usage on information asymmetry. In the following analysis,

[15]Along these lines, we note that Allayannis and Ofek (2000) find a strong, negative association between firms' exchange-rate exposure and their currency derivatives usage, and interpret this result to suggest that firms use currency derivatives to hedge rather than to speculate.

we examine two related issues. First, we examine whether the *decision* to use derivatives is associated with decreased levels of information asymmetry. Second, we investigate whether (conditional on the firm using derivatives) the *extent* of derivatives usage has further effects on the level of a firm's informational asymmetry.

Effects of the Decision to Use Derivatives

In this section we examine whether derivatives users have less information asymmetry on average than do non-users, without regard to the amount of derivatives used. The common structure of the ordinary least squares regressions that we employ is as follows:

$$IA_i = f(\text{Derivatives User, Year Dummies, Control Variables}) \quad (3)$$

In the above specification, IA_i refers to one of the firm's two information asymmetry measures (i.e., *ACCUR* or *DISPERSE*). Regressions are estimated separately for each of the two measures and utilize all firm-year observations having complete data available. "Derivatives User" in the above specification is a dummy variable used to denote whether a firm is a derivatives user. The variable is assigned a value of one if the firm reports the use of a specified type of derivatives, and zero otherwise. Separate analyses are conducted for firms using (i) currency and/or interest rate derivatives, (ii) currency derivatives, and (iii) interest rate derivatives.

Control Variables: In each regression specification we include a common set of control variables. We control for firm size as it can affect the level of information asymmetry of the firm but may also be correlated with derivatives usage because of scale economies in the initiation and conduct of a hedging program.[16] Larger firms are likely to be more closely followed by the news media in general and the analyst community in particular. Thus, as a proxy for firm size, we use ASSET, defined as the firm's book value of total assets.[17]

In addition, we control for the variance of a firm's earnings. While our two analyst-based proxies are intended to capture the extent of asymmetric information between insiders and outsiders, they are also affected by the variance in firm's earnings. It is inherently more difficult for analysts to make forecasts of highly variable earnings, and these forecasts are also more likely to vary from analyst to analyst. To control for this

[16]Most prior studies report a report a positive relation between firm size and derivatives usage (see, e.g., the summary presented in Smithson, 1998). Notable exceptions include studies by Tufano (1996), Gay and Nam (1998), and Haushalter (2000) that report a negative relation.

[17]All tests below were repeated using instead the natural logarithm of ASSET, with essentially identical results.

effect we include a measure of a firm's earnings stability, EARNSTAB, calculated by I/B/E/S as the coefficient of variation of the firm's annual earnings relative to a five-year earnings trend line.[18]

As previously discussed, a number of firm characteristics are associated with derivatives usage, including tax structure, leverage and growth opportunities. While our focus is not on the determinants of derivatives usage, but rather on one if its consequences, i.e., the mitigation of information asymmetry, two of these factors may be germane to our analysis. First, firms that are highly leveraged may be more mature firms having high levels of assets in place and thus more predictable earnings. Alternatively, these firms could have more variable earnings as a result of their increased financial leverage. Second, firms whose values are derived largely from future growth opportunities could have earnings that are less predictable than firms whose earnings derive primarily from well established and more predictable lines of business. Alternatively, high-growth firms could have greater pressures to smooth earnings. To control for these two factors we include the variables DEBT and MKTBK. DEBT is defined to be the ratio of a firm's book value of total debt to the market value of total assets (defined as the market value of equity plus the book value of debt and preferred) measured as of fiscal year-end. MKTBK is defined as the ratio of a firm's market value of total assets to their book value measured as of fiscal year-end.

All financial statement information was obtained from the Standard and Poor's Compustat databases. Earnings forecast information including earnings stability, actual earnings, and stocks prices used for normalizing measures were obtained from the I/B/E/S database. Individual firm and market index returns were obtained from CRSP. Each of the tests reported below is conducted using all firms having complete data required for the particular test and again includes all non-financial firms for which fiscal year-end derivatives usage is determinable from the Swaps Monitor database over the period 1992–1996.

Yearly Dummies: Because we are pooling firm observations across multiple years, we include a set of yearly dummy variables to control for time varying effects. For example, the number and percentage of firms that are classified as derivatives users varies on a year by year basis through the time period covered in our investigation. In addition, the disclosure environment may have changed over time causing a structural

[18]To calculate EARNSTAB for each firm, I/B/E/S first computes the standard error from an ordinary least squares regression of annual earnings on time based on five years of earnings data. The standard error is then scaled by the five-year mean of the annual earnings. This procedure is similar to that used in Kale, Noe, and Ramirez (1991).

change in the way analysts interpret derivatives information. As one example, the increased requirements for derivatives disclosure following the enactment of SFAS 119 may have affected the characteristics of analysts forecasts. In October 1994, The Financial Accounting Standards Board (FASB) issued Statement of Financial Accounting Standards (SFAS) No. 119, "Disclosure about Derivative Financial Instruments and Fair Value of Financial Instruments." SFAS No. 119 enhanced requirements regarding disclosures of derivative financial instruments and became effective for financial statements issued for fiscal years ending after December 15, 1994. Failure to control for these potential effects could result in spurious relationships between derivatives usage and information asymmetry measures. Thus, we include a set of four dummy variables where each is assigned a value of one if a set of observations is from 1993, 1994, 1995, or 1996 (respectively), and zero otherwise.[19]

Tables IIIa, IIIb, and IIIc report regression results conducted according to the model in equation (3) corresponding to each of the three definitions of derivatives users. Within each table, results are reported from two ordinary least squares regressions corresponding to the two information asymmetry measures that are employed as dependent variables (*ACCUR* and *DISPERSE*). We hypothesize that the regression coefficient on each of the user indicator variables will be negative. In Table IIIa, where firms are classified as users based on any type of derivatives usage, the coefficients on the dummy variable USER in both regressions 1 and 2 are negative as hypothesized and significant (at the 1% level, one-tailed test).[20] This finding thus provides additional evidence that derivatives usage is associated with lower levels of information asymmetry.

In Tables IIIb and IIIc, we re-estimate the two models with the only modification being that the usage dummy variable is denoted CURUSER (for firms using currency derivatives) and as INTUSER (for firms using interest rate derivatives), respectively. The results in Table IIIb are qualitatively similar to those reported in Table IIIa. The coefficients on the dummy variable CURUSER in regressions 1 and 2 are both negative and significant at the 1% significance level. In addition, in Table IIIc, the results for users of interest rate derivatives also provide support for our basic hypothesis with the coefficients on the dummy variable INTUSER significant at the 5% and 1% levels, respectively. Taken as a whole, the

[19]As a robustness test for our results reported below, we also re-estimated all regressions for each year separately without the yearly dummy variables. The results were qualitatively unchanged.

[20]Significance levels were determined using heteroskedasticity-consistent standard errors following procedures described in White (1980).

TABLE IIIa

Regression Results Relating Information Asymmetry Measures to Status of Interest Rate and Foreign Currency Derivatives Use

Variables	*(Regression 1)* *Dep. Var. = ACCUR*	*(Regression 2)* *Dep. Var. = DISPERSE*
Intercept	6.366	3.789
	(8.068)***	(9.085)***
USER	−0.774	−0.581
	(−2.386)***	(−3.333)***
D93	−0.214	−0.045
	(−0.424)	(−0.163)
D94	−0.107	−0.307
	(−0.217)	(−1.176)
D95	−0.108	−0.713
	(−2.336)**	(−2.919)***
D96	−0.102	0.625
	(−2.742)***	(2.474)**
DEBT	4.793	2.612
	(5.423)***	(5.423)***
MKTBK	−0.149	−0.088
	(−1.474)	(−1.562)
EARNSTAB	0.055	0.037
	(5.963)***	(7.779)***
ASSET	−0.231	−0.231
	(−2.743)***	(−4.700)***
F-statistic	21.676	26.893
Adj. R^2	0.082	0.101

Note. For a sample of non-financial firms, this table presents results from ordinary least squares regressions of measures of information asymmetry on firm-specific financial characteristics and the use of interest rate and/or currency derivatives. The sample size for the two regressions is 2,086 firm-year observations from the 1992–1996 period. For a firm-year observation to be included in our sample, we require that a firm's fiscal-year-end usage of derivatives be indicated in the Swaps Monitor database, that I/B/E/S report a minimum of three analyst forecasts of the firm's annual earnings per share for the fiscal year, and that the firm have available complete financial information for the fiscal year as described below.

The dependent variables are *ACCUR* (Regression 1) and *DISPERSE* (Regression 2). *ACCUR* is a measure of analyst forecast accuracy computed as the absolute value of the analyst forecast error scaled by the firm's stock price as of one month prior to the forecast where analyst forecast error is computed as the difference between the average analyst forecast of fiscal year end earnings per share and actual earnings per share. *DISPERSE* is a measure of the dispersion of analyst forecasts computed as the standard deviation of forecasts of earnings per share scaled by the firm's stock price as of one month prior to the forecast. *ASSET* is the book value of the firm's total assets as of fiscal year end. *DEBT* is the ratio of a firm's book value of total debt to the market value of its total assets as of fiscal year end. Market value of total assets is defined as the sum of the book value of total debt, book value of preferred stock, and market value of equity. *MKTBK* is the ratio of the firm's market value of total assets to book value of its total assets as of fiscal year end. *EARNSTAB* is the firm's earning stability measure, defined as the coefficient of variation of the firm's annual earnings relative to a 5-year earnings trend line. *D93*, *D94*, *D95*, and *D96* are dichotomous variables, which take the value 1 if a firm-year observation is from fiscal year (respectively) 1993, 1994, 1995, or 1996, and 0 otherwise. *USER* is a dichotomous variable taking the value 1 if a firm uses any type of interest rate or foreign currency derivatives and 0 otherwise.

All coefficients are multiplied by 1,000. *t*-statistics are calculated based on White (1980) heteroskedasticity-consistent standard errors and are reported in parentheses. Statistical significance for all test statistics is based on a two-tailed test with the exception of that for *USER*, which is based on a one-tailed test.

**Significant at the 5% level; and ***significant at the 1% level.

TABLE IIIb

Regression Results Relating Information Asymmetry Measures to Status of Currency Derivatives Use

Variables	*(Regression 1)* *Dep. Var. = ACCUR*	*(Regression 2)* *Dep. Var. = DISPERSE*
Intercept	6.186	3.767
	(7.517)***	(8.719)***
CURUSER	−0.932	−0.699
	(−3.040)***	(−4.403)***
D93	−0.309	−0.026
	(−0.589)	(−0.092)
D94	−0.147	−0.262
	(−0.287)	(−0.980)
D95	−1.090	−0.679
	(−2.278)**	(−2.718)***
D96	−1.137	−0.644
	(−2.391)**	(−2.508)**
DEBT	4.549	2.385
	(5.044)***	(4.924)***
MKTBK	−0.143	−0.084
	(−1.378)	(−1.462)
EARNSTAB	0.057	0.037
	(5.963)***	(7.372)***
ASSET	−0.515	−0.223
	(−5.732)***	(−4.288)***
F-statistic	20.876	25.396
Adj. R^2	0.082	0.098

Note. For a sample of non-financial firms, this table presents results from ordinary least squares regressions of measures of information asymmetry on firm-specific financial characteristics and the use of currency derivatives. The sample size for the two regressions is 2,086 firm-year observations from the 1992–1996 period. For a firm-year observation to be included in our sample, we require that a firm's fiscal-year-end usage of derivatives be indicated in the Swaps Monitor database, that I/B/E/S report a minimum of three analyst forecasts of the firm's annual earnings per share for the fiscal year, and that the firm have available complete financial information for the fiscal year as described below.

The dependent variables are *ACCUR* (Regression 1) and *DISPERSE* (Regression 2). *ACCUR* is a measure of analyst forecast accuracy computed as the absolute value of the analyst forecast error scaled by the firm's stock price as of one month prior to the forecast where analyst forecast error is computed as the difference between the average analyst forecast of fiscal year end earnings per share and actual earnings per share. *DISPERSE* is a measure of the dispersion of analyst forecasts computed as the standard deviation of forecasts of earnings per share scaled by the firm's stock price as of one month prior to the forecast. *ASSET* is the book value of the firm's total assets as of fiscal year end. *DEBT* is the ratio of a firm's book value of total debt to the market value of its total assets as of fiscal year end. Market value of total assets is defined as the sum of the book value of total debt, book value of preferred stock, and market value of equity. *MKTBK* is the ratio of the firm's market value of total assets to book value of its total assets as of fiscal year end. *EARNSTAB* is the firm's earning stability measure, defined as the coefficient of variation of the firm's annual earnings relative to a five-year earnings trend line. *D93*, *D94*, *D95*, and *D96* are dichotomous variables, which take the value 1 if a firm-year observation is from fiscal year (respectively) 1993, 1994, 1995, or 1996, and 0 otherwise. *CURUSER* is a dichotomous variable taking the value 1 if a firm uses any type of foreign currency derivative and 0 otherwise.

All coefficients are multiplied by 1,000. *t*-statistics are calculated based on White (1980) heteroskedasticity-consistent standard errors and are reported in parentheses. Statistical significance for all test statistics is based on a two-tailed test with the exception of that for *CURUSER*, which is based on a one-tailed test.

**Significant at the 5% level; and ***significant at the 1% level.

TABLE IIIc

Regression Results Relating Information Asymmetry Measures to Status of Interest Rate Derivatives Use

Variables	*(Regression 1)* *Dep. Var. = ACCUR*	*(Regression 2)* *Dep. Var. = DISPERSE*
Intercept	6.101	3.548
	(7.804)***	(8.668)***
INTUSER	−0.513	−0.379
	(−1.695)**	(−2.366)***
D93	−0.161	−0.060
	(−0.326)	(−0.226)
D94	−0.145	−0.363
	(−0.304)	(−1.447)
D95	−0.988	−0.639
	(−2.178)**	(−2.680)***
D96	−0.921	−0.557
	(−2.208)**	(−2.253)**
DEBT	4.945	2.764
	(5.637)***	(5.847)***
MKTBK	−0.150	−0.089
	(−1.526)	(−1.555)
EARNSTAB	0.055	0.037
	(6.094)***	(7.803)***
ASSET	−0.570	−0.244
	(−6.741)***	(−4.919)***
F-statistic	22.256	27.048
Adj. R^2	0.082	0.099

Note. For a sample of non-financial firms, this table presents results from ordinary least squares regressions of measures of information asymmetry on firm-specific financial characteristics and the use of interest rate derivatives. The sample size for the two regressions is 2,086 firm-year observations from the 1992–1996 period. For a firm-year observation to be included in our sample, we require that a firm's fiscal-year-end usage of derivatives be indicated in the Swaps Monitor database, that I/B/E/S report a minimum of three analyst forecasts of the firm's annual earnings per share for the fiscal year, and that the firm have available complete financial information for the fiscal year as described below.

The dependent variables are *ACCUR* (Regression 1) and *DISPERSE* (Regression 2). *ACCUR* is a measure of analyst forecast accuracy computed as the absolute value of the analyst forecast error scaled by the firm's stock price as of one month prior to the forecast where analyst forecast error is computed as the difference between the average analyst forecast of fiscal year end earnings per share and actual earnings per share. *DISPERSE* is a measure of the dispersion of analyst forecasts computed as the standard deviation of forecasts of earnings per share scaled by the firm's stock price as of one month prior to the forecast. *ASSET* is the book value of the firm's total assets as of fiscal year end. *DEBT* is the ratio of a firm's book value of total debt to the market value of its total assets as of fiscal year end. Market value of total assets is defined as the sum of the book value of total debt, book value of preferred stock, and market value of equity. *MKTBK* is the ratio of the firm's market value of total assets to book value of its total assets as of fiscal year end. *EARNSTAB* is the firm's earning stability measure, defined as the coefficient of variation of the firm's annual earnings relative to a five-year earnings trend line. *D93*, *D94*, *D95*, and *D96* are dichotomous variables, which take the value 1 if a firm-year observation is from fiscal year (respectively) 1993, 1994, 1995, or 1996, and 0 otherwise. *INTUSER* is a dichotomous variable taking the value 1 if a firm uses any type of interest rate derivative and 0 otherwise.

All coefficients are multiplied by 1,000. *t*-statistics are calculated based on White (1980) heteroskedasticity-consistent standard errors and are reported in parentheses. Statistical significance for all test statistics is based on a two-tailed test with the exception of that for *INTUSER*, which is based on a one-tailed test.

**Significant at the 5% level; and ***significant at the 1% level.

above regression results indicate that derivatives usage is associated with a lower level of information asymmetry.

The results for the control variables were consistent in all specifications.[21] The coefficient on DEBT is positive and significant at the 1% level in each table, indicating both decreased accuracy and less consensus in forecasts for more highly levered firms. The coefficients on MKTBK are statistically insignificant. The coefficients on EARNSTAB are positive and significant (1% level) consistent with the intuition that analysts have both greater difficulty in forecasting earnings and less consensus in their forecasts for firms having greater volatility of earnings. Finally, the coefficient on firm size (ASSET) is strongly significant (1% level) in each regression of each table.

Effects of the Extent of Derivatives Usage

To this point, we have focused on the relationship between the level of information asymmetry surrounding the firm and its decision to engage in hedging activities. We now address a related issue: whether, conditional on the firm hedging, the extent of derivatives usage has a further marginal impact on the firm's information environment. Consistent with the intuition developed in the analysis of the firm's decision to hedge, we expect that greater hedging leads to greater reduction in the level of the firm's information asymmetry.

To capture the extent of a firm's derivatives usage, we introduce two additional continuous variables: CURDERIV and INTDERIV. CURDERIV is defined as the notional dollar amount of the firm's currency derivatives holdings as of its fiscal year-end scaled by total foreign sales for the year. Likewise, INTDERIV is defined as the notional dollar amount of the firm's interest rate derivatives scaled by its total debt.[22] These two measures proxy for the proportion the firm chooses to hedge of its exposure to either currency or interest rate risk.

The form of the regression model we utilize is similar to that shown earlier in equation (3), with the exception that the dichotomous usage variables are replaced with their continuous extent counterparts. We hypothesize a negative relationship between each of these variables and our asymmetric information measures.

[21]All regressions were examined for possible multicollinearity using variance inflation factors calculated as the inverse of $(1 - R^2)$ in a regression of a given independent variable on all remaining variables. None of the variables exhibited evidence of significant multicollinearity, with all variance inflation factors less than 3. For a description of the test, see Neter, Wasserman, and Kutner (1990).

[22]As a robustness check, the regression models were re-estimated with INTDERIV calculated using (alternatively) short-term and long-term debt in the denominator. The results were qualitatively unchanged.

The results are qualitatively similar whether we estimate our regressions with CURDERIV or INTDERIV included individually as independent variables or simultaneously. Hence, for brevity, we report only one set of regression results in which both CURDERIV and INTDERIV are simultaneously included as independent variables. These results are presented in Table IV and provide further support for the asymmetric information hypothesis, but mainly as it applies to the usage of currency derivatives. For usage of interest rate derivatives, though the coefficients on INTDERIV are negative as hypothesized, statistical significance is found only in regression 2 and at the 10% level (one-tailed test). However, there is a strong and statistically significant negative relationship between the extent of foreign exchange risk hedged and both the accuracy (*ACCUR*) and dispersion (*DISPERSE*) of analysts' forecasts. The coefficients on CURDERIV in the two regressions are negative and statistically significant at the 5% and 1% levels (one-tailed test), respectively. Therefore, it appears that a firm's level of information asymmetry is affected not only by the decision to engage in the management of currency risk, but also by the extent of its currency hedging activity. As for interest rate derivatives usage, a firm's level of information asymmetry appears also affected by the decision to use interest rate derivatives, but is not strongly affected by the extent of usage.

Intertemporal Tests

In the previous tests we found evidence that derivatives usage is contemporaneously associated with lower levels of information asymmetry. However, our results could merely be reflective of the endogeneity problem discussed in Guay (1999). We address this possibility in two ways. First, we have repeated each of the cross-sectional regressions using lagged values of the independent variables. The results are qualitatively similar to those reported and are available from the authors upon request.[23] However, since a firm's decision to use derivatives is likely to be stable across time, the derivatives right-hand side indicator variable is potentially highly autocorrelated. Hence we conduct an additional test in which we examine the relationship between changes in derivatives usage status and asymmetric information over time. Specifically, we analyze a

[23]As an additional test we examine the relationship between derivatives usage and information asymmetry in a structural equation framework in which we simultaneously model derivatives usage as a function of information asymmetry and vice versa [see Géczy et al. (1997) and Graham and Rogers (1999)]. In each specifications the coefficients on the asymmetric information variables were generally negative and typically statistically insignificant. Results are available upon request.

TABLE IV

Regression Results Relating Information Asymmetry to the Extent of Interest Rate and Currency Derivative Usage

Variables	*(Regression 1)* *Dep. Var. = ACCUR*	*(Regression 2)* *Dep. Var. = DISPERSE*
Intercept	5.967	3.984
	(6.512)***	(8.089)***
INTDERIV	−0.273	−0.118
	(−0.492)	(−1.844)*
CURDERIV	−0.359	−0.487
	(−2.011)**	(−3.755)***
D93	−0.167	−0.465
	(−0.269)	(−1.450)
D94	−0.414	−0.678
	(−0.720)	(−2.213)**
D95	−0.693	−0.934
	(−1.228)	(−3.261)***
D96	−0.905	−0.919
	(−1.677)*	(−3.109)***
DEBT	3.122	1.458
	(2.715)***	(2.410)**
MKTBK	−0.176	−0.131
	(−1.537)	(−2.074)**
EARNSTAB	0.062	0.041
	(5.188)***	(6.956)***
ASSET	−0.502	−0.223
	(−4.994)***	(−4.015)***
F-statistic	11.226	17.525
Adj. R^2	0.074	0.115

Note. For a sample of non-financial firms, this table presents results from ordinary least squares regressions of measures of information asymmetry on firm-specific financial characteristics and the extent of their interest rate and currency derivatives usage. The sample size for both regressions is 1,273 firm-year observations taken from the 1992–1996 period. For a firm-year observation to be included in our sample, we require that the extent of a firm's fiscal-year-end usage of derivatives be indicated in the Swaps Monitor database, that I/B/E/S report a minimum of three analyst forecasts of the firm's annual earnings per share for the fiscal year, and that the firm have available complete financial information for the fiscal year as described below. The dependent variables are *ACCUR* (Regression 1) and *DISPERSE* (Regression 2). *ACCUR* is a measure of analyst forecast accuracy computed as the absolute value of the analyst forecast error scaled by the firm's stock price as of one month prior to the forecast where analyst forecast error is computed as the difference between the average analyst forecast of fiscal year end earnings per share and actual earnings per share. *DISPERSE* is a measure of the dispersion of analyst forecasts computed as the standard deviation of forecasts of earnings per share scaled by the firm's stock price as of one month prior to the forecast. *ASSET* is the book value of the firm's total assets as of fiscal year end. *DEBT* is the ratio of a firm's book value of total debt to the market value of its total assets as of fiscal year end. Market value of total assets is defined as the sum of the book value of total debt, book value of preferred stock, and market value of equity. *MKTBK* is the ratio of the firm's market value of total assets to book value of its total assets as of fiscal year end. *EARNSTAB* is the firm's earning stability measure, defined as the coefficient of variation of the firm's annual earnings relative to a five-year earnings trend line. *D93*, *D94*, *D95*, and *D96* are dichotomous variables, which take the value 1 if a firm-year observation is from fiscal year 1993, 1994, 1995, or 1996, respectively and 0 otherwise. *CURDERIV* is the ratio of a firm's notional amount of foreign currency derivatives to the firm's total foreign sales. *INTDERIV* is the ratio of a firm's notional amount of interest rate derivatives to the firm's total debt.
All coefficients are multiplied by 1,000. *t*-statistics are calculated based on White (1980) heteroskedasticity-consistent standard errors and are reported in parentheses. Statistical significance for all test statistics is based on a two-tailed test with the exception of that for *INTDERIV and CURDERIV*, which are based on a one-tailed test.
*Significant at the 10% level; **significant at the 5% level; and ***significant at the 1% level.

sample of firms that changed their status from a non-user of derivatives in a given year to a user in the subsequent year. We similarly identify a sample of firms that switched from a user to non-user status in successive years. If derivatives usage is inversely related to information asymmetry, we hypothesize that a change in status from non-user to user (user to non-user) will be associated with a decrease (increase) in both the analyst accuracy and dispersion measures.

Table V reports the results of our analysis again performed for each of our three classes of derivatives type. Viewed as a whole, the results are highly supportive of the hypothesis that derivatives usage is associated with lower levels of information asymmetry. In panel (a), we see that for firms switching from user to non-user status, there is, as predicted, a significant increase in the analyst-forecast error (*DACCUR*) as well as a

TABLE V

Means Tests of the Effect of a Change in Derivatives Use Status on the Change in Asymmetric Information

	Change in Status						*Difference in Means*
	User to Non-User			*Non-User to User*			
Variables	*No.*	*Mean*	*t-stat.*	*No.*	*Mean*	*t-stat.*	*t-statistic*
Panel (a): Currency and/or Interest Rate Derivatives							
DACCUR	351	0.00081	1.556*	362	−0.00098	−2.038**	2.527***
DDISPERSE	354	0.00059	2.355***	364	−0.00075	−3.006***	3.791***
Panel (b): Currency Derivatives							
DACCUR	246	0.00138	2.111**	246	−0.00070	−1.151	2.328***
DDISPERSE	248	0.00101	3.202***	248	−0.00070	−2.138**	3.759***
Panel (c): Interest Rate Derivatives							
DACCUR	327	0.00106	1.948**	329	−0.00160	−0.308	1.626*
DDISPERSE	329	0.00067	2.420***	330	−0.00019	−0.751	2.288**

Note. This table reports changes in the means of various measures of information asymmetry resulting from firms changing their derivatives use status from either user to non-user or non-user to user. The sample includes all non-financial firms listed in the Swaps Monitor database for fiscal year-ends 1992 through 1996 that changed status from one year to the next. *DACCUR* is the change in analyst forecast accuracy computed as the year-to-year change in the absolute value of the analyst forecast error (computed as the difference between the average analyst forecast of fiscal year end earnings per share and actual earnings per share), all scaled by the firm's stock price as of one month prior to the forecast. Firms were required to have a minimum of three analyst forecasts of annual earnings per share for the fiscal year as reported by I/B/E/S. *DDISPERSE* is the change in the dispersion of analyst forecasts, defined as the year-to-year change in the absolute value of the analyst forecast error (computed as the difference between the average analyst forecast of fiscal year end earnings and actual earnings) scaled by the firm's stock price as of one month prior to the forecast.

Statistics reported include the number of observations, mean values, *t*-statistics based on the null hypothesis that the mean change for a sub-group equals zero, and *t*-statistics based on the null hypothesis that the mean changes between sub-groups are equal. Statistical significance for all test statistics is based on a one-tailed test.

*Significant at the 10% level; **significant at the 5% level; and ***significant at the 1% level.

significant increase in the dispersion measure (*DDISPRESE*) at the 10% and 1% levels, respectively (one-tailed test).[24] Also, firms switching from a non-user to user status exhibit a significant drop in both the analyst forecast error and dispersion measures (5% and 1% significance levels, respectively, one-tailed test).

For the corresponding analysis of currency derivative users in panel (b), the results are similar to those in panel (a). Firms switching from user to non-user status experienced a significant increase in both their earnings forecast error and dispersion, while those switching from non-user to user experienced a decline. However, the decline was only significant for the dispersion measure. Finally, in panel (c) for interest rate derivatives, we find some evidence supportive of the basic hypothesis, at least for firms switching from user to non-user status.

CONCLUSION

The literature on corporate hedging has shown that mitigation of a firm's underinvestment problem and reduction of the expected costs of financial distress are potentially important rationales for a firm's risk management activities. Using insights taken from DeMarzo and Duffie (1995) and Breeden and Viswanathan (1998), we have explored an additional benefit of hedging—its impact on asymmetric information regarding a firm's earnings. Through hedging, managers can reduce the noisiness of earnings contributed by macroeconomic factors such as exchange rates and interest rates. Thus, market participants are presented with a more informative picture of both a firm's true earnings capacity and the abilities of its managers.

We investigate this hypothesis by examining the effect of the use of currency and interest rate derivatives on the extent of information asymmetry facing the firm. Our results are supportive of the hypothesis that derivatives usage is associated with reductions in the level of information asymmetry between managers of the firm and outsiders. Specifically, both the accuracy and consensus in analysts' earnings forecasts are higher for firms that use derivatives than for those that do not. These reductions in information asymmetry are related not only to the decision to use derivatives, but also to the extent of the firm's exposure to currency and interest rate risk that it chooses to hedge. The effects appear to be driven mainly by currency derivatives usage and, to a much lessor extent, by the use of interest rate derivatives.

[24]In addition to the means tests reported in Table V, we also conducted tests of differences in median values by computing Wilcoxon signed-rank z-statistics and found similar results.

Finally, we conjecture that while derivatives usage is associated with lower information asymmetry, it is unlikely that managers would view derivatives as a primary tool for managing information asymmetry. Managers have a variety of other options for doing so that come without the costs or risks associated with engaging in a program of derivatives usage. Examples include changing the firm's financial disclosure policy, placing increased emphasis on the firm's investor relations department and more aggressively engaging the financial analyst community. Given these alternative means of managing information asymmetry, it is questionable whether derivatives usage would be driven mainly by the desire to manage asymmetric information. Still, our results are consistent with the notion that regardless of the reasons for a firm to use derivatives, this usage will have the effect of lowering the firm's information asymmetry.

BIBLIOGRAPHY

Allayannis, G., & Ofek, E. (2001, April). Exchange rate exposure, hedging, and the use of foreign currency derivatives. Journal of International Money and Finance, 20, 273–296.

Allayannis, G., & Weston, J. (1998). The use of foreign currency derivatives and firm market value. Working paper, Darden School of Business, University of Virginia.

Asquith, P., & Mullins, D. W. (1986, January/February). Equity issues and offering dilution. Journal of Financial Economics, 15, 61–89.

Atiase, R. (1986, Spring). Predisclosure information, firm capitalization, and security price behavior around earnings announcements. Journal of Accounting Research, 24, 21–36.

Atiase, R., & Bamber, L. (1994, May). Trading volume reactions to annual accounting earnings announcements: The incremental role of predisclosure information asymmetry. Journal of Accounting and Economics, 18, 309–329.

Barry, C., & Brown, S. (1985, December). Differential information and security market equilibrium. Journal of Financial and Quantitative Analysis, 20, 407–422.

Barton, J. (2001, January). Does the use of financial derivatives affect earnings management decisions? The Accounting Review, 76, 1–26.

Berkman, H., & Bradbury, M. E. (1996, Summer). Empirical evidence on the corporate use of derivatives. Financial Management, 25, 5–13.

Bhushan, R. (1989, July). Firm characteristics and analyst following. Journal of Accounting and Economics, 11, 255–274.

Breeden, D., & Viswanathan, S. (1998). Why do firms hedge? An asymmetric information model. Working Paper, Fuqua School of Business, Duke University.

Brown, G. W. (2001, May/June). Managing foreign exchange risk with derivatives. Journal of Financial Economics, 60, 401–448.

Brown, S. J., & Warner, J. B. (1980, September). Measuring security price performance. Journal of Financial Economics, 8, 205–258.

Christie, A. (1987, December). On cross-sectional analysis in accounting research. Journal of Accounting and Economics, 9, 231–258.

DeMarzo, P. M., & Duffie, D. (1991, April). Corporate financial hedging with proprietary information. Journal of Economic Theory, 53, 261–286.

DeMarzo, P. M., & Duffie, D. (1995, Fall). Corporate incentives for hedging and hedge accounting. Review of Financial Studies, 8, 743–771.

Dierkens, N. (1991, June). Information asymmetry and equity issues. Journal of Financial and Quantitative Analysis, 26, 181–199.

Doherty, N., & Sinclair, S. (2000). Risk management and the information content of earnings surprises. Working Paper, Department of Insurance and Risk Management, The Wharton School, University of Pennsylvania.

Dolde, W. (1995, June). Hedging, leverage, and primitive risk. Journal of Financial Engineering, 4, 187–216.

Elton, E., Gruber, M., & Gultekin, M. (1984, December). Professional expectations: Accuracy and diagnosis or errors. Journal of Financial and Quantitative Analysis, 19, 351–363.

Froot, K. A., Scharfstein, D. S., & Stein, J. C. (1993, December). Risk management: Coordinating corporate investment and financing policies. Journal of Finance, 48, 1629–1658.

Gay, G. D., & Nam, J. (1998, Winter). The underinvestment problem and corporate derivatives use. Financial Management, 27, 53–69.

Géczy, C., Minton, B. A., & Schrand, C. (1997, September). Why firms use currency derivatives. Journal of Finance, 52, 1323–1354.

Graham, J. R., & Rogers, D. A. (1999). Is corporate hedging consistent with value maximization? An empirical analysis. Working Paper, Fuqua School of Business, Duke University.

Guay, W. (1999, January). The impact of derivatives on firm risk: An empirical examination of new derivatives users. Journal of Accounting and Economics, 26, 319–351.

Haushalter, G. D. (2000, February). Financing policy, basis risk, and corporate hedging: Evidence from oil and gas producers. Journal of Finance, 55, 107–152.

Holmstrom, B., & Ricart i Costa, J. (1986, November). Managerial incentives and capital management. Quarterly Journal of Economics, 101, 835–860.

Howton, S. D., & Perfect, S. B. (1998, Winter). Currency and interest-rate derivatives use in US firms. Financial Management, 27, 111–121.

Kale, J., Noe, T., & Ramirez, G. (1991, December). The effect of business risk on corporate capital structure: Theory and evidence. Journal of Finance, 46, 1693–1715.

Krishnaswami, S., & Subramaniam, V. (1999, July). Information asymmetry, valuation, and the corporate spin-off decision. Journal of Financial Economics, 53, 73–112.

Mayers, D., & Smith, C. W., Jr. (1982, April). On the corporate demand for insurance. Journal of Business, 55, 281–296.

Myers, S. C., & Majluf, N. S. (1984, June). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13, 187–221.

Nance, D. R., Smith, C. W., Jr., & Smithson, C. W. (1993, March). On the determinants of corporate hedging. Journal of Finance, 48, 267–284.

Neter, J., Wasserman, W., & Kutner, M. (1990). Applied linear statistical models (3rd ed.). Boston: Richard D. Irwin, Inc.

Smith, C. W., Jr., & Stulz, R. M. (1985, December). The determinants of firms' hedging policies. Journal of Financial and Quantitative Analysis, 20, 391–405.

Smithson, C. W. (1998). Questions regarding the use of financial price risk management by industrial corporations. Working Paper, CIBC World Markets.

Tufano, P. (1996, September). Who manages risk? An empirical examination of risk management practices in the gold mining industry. Journal of Finance, 51, 1097–1137.

White, H. (1980, May). A heteroscedasticity-consistent covariance matrix estimator and a direct test for heteroscedasticity. Econometrica, 48, 817–838.