Does the Use of Financial Derivatives Affect Earnings Management Decisions?

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ABSTRACT: I examine the effects of derivatives use on earnings management behavior. I develop a self-selection simultaneous-equations model that captures managers' incentives to use derivatives and manage discretionary accruals. Empirical results from estimating the model on 1994-1996 data for a sample of 304 *Fortune 500* firms indicate that firms with larger derivatives portfolios have lower levels of discretionary accruals. Results also suggest that managers use discretionary accruals and derivatives as partial substitutes to smooth earnings so as to reduce agency costs, income taxes, and information asymmetry, and to increase personal wealth and utility.

Key Words: *Earnings management, Discretionary accruals, Financial derivatives, Hedging.*

Data Availability: *A list of sample firms is available from the author. All other data are available from public sources identified in the paper.*

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I. INTRODUCTION

The purpose of this study is to examine the relation between managers' use of derivative financial instruments and their earnings management decisions. Managers can use derivatives to reduce the volatilities of earnings and cash flows arising from changes in interest rates, foreign currency exchange rates, commodity prices, and other risk factors. Therefore, I hypothesize that managers' use of derivatives lessens their incentives to reduce earnings volatility through so-called "earnings management" devices, i.e., derivatives and discretionary accounting accruals serve as partial substitutes in reducing earnings volatility. I test this hypothesis on a sample of 304 nonfinancial, nonregulated *Fortune 500* firms and find that, consistent with my expectations, the magnitude of derivatives' notional amounts is negatively associated with the magnitude of discretionary accruals.

Managers of publicly traded firms face increasing pressure to report smooth earnings patterns. For example, the CEO of a *Fortune 500* firm was quoted recently as asserting that "[t]he No. 1 job of management is to smooth out earnings" (Loomis 1999). Recent media and regulatory focus has centered on managers' use of discretionary accounting choices to smooth earnings (see, e.g., Fox 1997; Loomis 1999). This emphasis has support in several academic studies that document that managers make discretionary accounting choices, in part, to reduce earnings volatility (e.g., Subramanyam 1996; Myers and Skinner 1998).

If markets were perfect, earnings volatility would not be costly to managers and their firms and, therefore, managers would have no incentives to smooth earnings. However, empirical and anecdotal evidence suggests that earnings management is pervasive. The literature proposes agency costs of debt and equity, income taxes, information asymmetries between firm insiders and outsiders, and managerial risk aversion as factors that make earnings volatility costly to the

firm and its stakeholders. However, a question remains largely unexplored by this literature: if managers have incentives to reduce earnings volatility, will they still elect to manage earnings through discretionary accounting decisions when they can reduce earnings volatility by smoothing cash flows through the use of derivatives? That is, earnings are the sum of accounting accruals and cash flows; hence, all else equal, reducing cash flow volatility will reduce earnings volatility.

Financial derivatives use is widespread, particularly among large publicly traded firms. For example, a survey by Bodnar et al. (1996) finds that over two-thirds of large U.S. firms use derivatives, and that almost half of the respondents consider their most important hedging goal to be the management of cash flow volatility, followed closely by the management of earnings volatility. Empirical and anecdotal evidence also suggests that earnings management through discretionary accounting practices is widespread (see, e.g., Hunt et al. 1996; Subramanyam 1996; Fox 1997; Myers and Skinner 1998; Loomis 1999). This suggests that managers may view derivatives and discretionary accounting choices as substitute mechanisms for reducing earnings volatility.

Providing evidence on the relation between derivatives use and earnings management through accruals is important because of recent FASB actions. In June 1998, the FASB issued SFAS No. 133, *Accounting for Derivative Instruments and Hedging Activities*, which becomes effective for fiscal years beginning after June 15, 2000. SFAS No. 133 is controversial because it requires managers to report all derivatives on the balance sheet at fair value with holding gains and losses included in earnings unless special hedge accounting rules and hedge effectiveness tests are met. Critics of SFAS No. 133 argue that the restrictive nature of these rules and tests imply that changes in the fair values of derivatives which are not fully offset by changes in the

values of the assets, liabilities, or cash flows being hedged will increase the volatilities of the firm's accruals and earnings. If managers currently use derivatives to reduce earnings volatility, the imposition of SFAS No. 133 could cause managers to reduce the use of derivatives as hedging instruments and increase earnings management through discretionary accounting choices.

To examine the substitution relation between derivatives and discretionary accruals, I develop a simultaneous-equations model that captures managers' incentives to use derivatives and manage discretionary accruals. I embed in the simultaneous equations a correction for self-selection because only about three-fourths of my sample firms use derivatives and evidence suggests that factors that drive the decision to use derivatives may have different effects on the decision of how much derivatives to use (see, e.g., Allayannis and Ofek 1997; Haushalter 1998; Graham and Rogers 1999). This approach allows me to examine the extent of ongoing substitution between discretionary accruals and derivatives after the initial costs to set up a derivatives program have been incurred. I measure discretionary accruals by abnormal accruals obtained from the Jones (1991) model as modified by Dechow et al. (1995) and derivatives use by the notional amount of contracts held at year-end. I estimate the model using 1994-1996 data for a sample of firms that are exposed ex ante to interest rate and foreign currency risks.

Consistent with my hypothesis, results from the simultaneous-equations model suggest that firms holding derivatives portfolios with large notional amounts tend to have lower levels of discretionary accruals, which I interpret as derivatives and discretionary accruals being used by managers as partial substitutes to affect earnings volatility. My results suggest that managers manage accruals and use derivatives to smooth earnings so as to reduce agency costs of debt and equity, income taxes, and information asymmetry, as well as to increase personal wealth and utility. Lastly, although I cannot rule out that the size of the derivatives position and the magni-

tude of accrual management are sequentially determined, I document that these variables are endogenous and, therefore, more likely the result of a joint decision to manage risks and earnings.

In supplemental tests, I also provide evidence that derivatives users tend to have significantly less volatile operating cash flows and total accruals than nonusers. This finding contrasts those reported in Hentschel and Kothari (1999) suggesting that measures of firm risk do not differ economically or statistically between users and nonusers of derivatives. In addition, using the earnings management prediction model proposed by Beneish (1999), I find that nonusers tend to be marginally more likely than users to violate GAAP by aggressively managing accruals. These findings complement the results obtained from MY regression analyses.

My paper contributes to the growing literature documenting that managers use derivatives in combination with assets and liabilities recognized in their firms' balance sheets to manage risk. For example, Petersen and Thiagarajan (1997) examine two gold mining firms with similar risk exposures but diametric risk management practices: one firm aggressively manages its risk with derivatives, whereas the other uses a combination of operating, financing, and accounting choices. In related research, Beatty and Bettinghaus (1998) report that bank managers jointly trade derivatives and investment securities to manage interest rate risk. Similarly, Schrand and Unal (1998) find that managers of savings and loans institutions combine derivatives and the composition of loan portfolios to manage overall risk. Lastly, Rajgopal and Pincus (1999) find that oil and gas producers are less likely to hedge with derivatives if they report exploration costs under the full cost method, which generally results in smoother earnings than the successful efforts method. My paper contributes to this growing literature by examining the interaction between derivatives and accrual accounting decisions for a large sample of firms in diverse industries.

The rest of the paper is structured as follows. Section II develops the hypothesis that derivatives and discretionary accruals are substitute mechanisms to reduce earnings volatility. Section III describes the sample and my measures of accrual management and derivatives use. Sections IV, V, and VI present the research design, empirical results, and sensitivity tests and extensions, respectively. Concluding remarks follow in section VII.

II. THE RELATION BETWEEN DERIVATIVES USE AND DISCRETIONARY ACCOUNTING CHOICES

This section describes the effects that managing accruals and using derivatives have on the time-series and cross-sectional patterns of earnings, cash flows, and accruals. It also describes the relation between discretionary accruals and derivatives' notional amounts when firms use these tools to smooth earnings.

Because the difference between earnings and cash flows is accruals, the volatilities of earnings and cash flows are linked as follows:

$$\begin{aligned}\text{Variance(Earnings)} = {} & \text{Variance(Cash flows)} + \text{Variance(Accruals)} \\ & + 2\text{Covariance(Accruals, Cash flows)}.\end{aligned}$$

Therefore, managers can manage earnings volatility by managing the volatilities of cash flows and accruals.

Consider a firm whose cash flows and earnings are exposed to a single, hedgeable source of risk. Assume all debt in the firm's capital structure consists of variable-rate debt. Therefore, the firm is exposed to interest rate risk: unexpected increases (decreases) in interest rates increase (decrease) the firm's interest expense and reduce (increase) its cash flows and earnings, thus increasing volatility in cash flows and earnings. Also assume that the firm's manager has two tools

to mitigate the effect of interest rate risk on earnings volatility: financial derivatives and discretionary accounting accruals.[1]

Suppose the manager chooses to enter into a pay-fixed/receive-variable interest rate swap on a portion of the outstanding debt. When interest rates fall below (rise above) the fixed rate stated in the derivative contract, the firm pays the shortfall to (collects the excess from) the counterparty to the derivative and adjusts its interest expense to reflect the payment (collection). Thus, the swap decreases the firm's cash flow variance by effectively converting a portion of the variable-rate debt to a fixed-rate debt. If the manager does not fully hedge the firm's exposure to interest rate risk, then the swap will reduce but not completely eliminate cash flow volatility.[2] The variance of the firm's nondiscretionary accruals will remain unchanged as long as the net interest expense is paid when incurred (or decrease if interest expense is accrued and paid in a subsequent period). Thus, the swap will reduce earnings volatility.

For a given level of derivatives, the manager would need to alter discretionary accruals to mitigate the effect of the unhedged interest rate exposure on earnings volatility. This will increase the variances of both discretionary and total accruals.[3] The smaller the portion of the firm's interest rate exposure that is hedged, the larger the magnitude of discretionary accruals the manager must use, which leads to the proposition that derivatives and discretionary accruals

[1] Depending on the source of risk, the manager may have several other tools available. For example, insurance contracts are available for casualty risks, derivatives and collateralization for counterparty failure or credit risk, and diversification (e.g., mergers and acquisitions, production location, broadening of product lines, corporate conglomerates) for overall business risk. Because of data limitations, I only control for diversification in my empirical analysis.

[2] Effectively, exposures are seldom hedged perfectly due to, for example, management's risk preferences, skills, and forecast errors; costly derivative contracts; and basis risk.

[3] McCulloch (1998) shows that the correlation between discretionary and nondiscretionary accruals for a firm smoothing earnings is likely negative, becoming weaker as earnings persistence and the ability to engage in earnings management increase. Therefore, its magnitude may not be sufficiently large to offset the increase in the variance of total accruals due to the increase in the variance of discretionary accruals. However, because the matching process embedded in accrual accounting creates a strong negative correlation between accruals and cash flows (e.g., Dechow 1994), increasing the variance of total accruals will make the covariance between total accruals and cash flows more negative. Because the manager's goal is to reduce overall earnings volatility, it must follow that twice the change in

serve as earnings-smoothing substitutes. If the use of derivatives and discretionary accrual management differ in their costs and/or their effectiveness in smoothing the firm's earnings, the manager is likely to consider these activities jointly. In other words, the decision of how much derivatives and discretionary accruals to use is likely endogenous.

The substitution relation between derivatives and discretionary accruals holds, however, if derivatives are used to reduce the firm's overall cash flow volatility. For example, if the firm's earnings and cash flows are exposed to a second source of risk, then the correlation between the magnitude of discretionary accruals and notional amounts will depend on the correlation between the two sources of risk. For instance, if the correlation between the two risks is negative, the risks will have opposite effects on earnings and cash flows (i.e., shocks due to one risk potentially offset shocks due to the other risk) and create a certain amount of natural hedge. By hedging away one of the risks, the manager will reduce or potentially eliminate the natural hedge and create additional volatility in the firm's cash flows and earnings. To smooth earnings, the manager will have to manage accruals to a greater extent the larger the amount of derivatives he uses. Thus, if managers' use of derivatives *increases overall cash flow volatility* (e.g., because of hedging ineffectiveness or speculation), the magnitude of discretionary accruals and derivatives will be *positively* correlated, i.e., discretionary accruals and derivatives will be *complements.*

As a second example, suppose instead that the interest rate on the firm's debt is fixed and the manager enters into a pay-variable/receive-fixed interest rate swap to hedge the debt's fair value.[4] As in the previous cash flow hedge scenario, the correlation between the magnitude of discretionary accruals and notional amounts will depend on the correlation between the interest

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the covariance between total accruals and cash flows must more than offset the increase in total accruals due to manipulation.

[4] One reason to hedge the debt's fair value rather than its cash flows is that the manager may expect to repurchase the debt in the near future and its fair value is highly sensitive to interest rate changes (see, e.g., Visvanathan 1998).

rate risk to which the firm becomes exposed through the swap and other sources of risk to which the firm is already exposed. For instance, if the correlation between the risks were positive, the effect of the swap would be to increase the firm's overall cash flow volatility. To smooth earnings, the manager would have to manage accruals to a greater extent as the level of derivatives use increases. This also suggests that, if the manager uses derivatives to *increase overall cash flow volatility*, the magnitude of discretionary accruals and derivatives will be *positively* correlated, i.e., discretionary accruals and derivatives will be *complements*.

In summary, if managers use derivatives to reduce overall cash flow volatility, they will likely view derivatives and discretionary accruals as substitute tools to smooth earnings. Whether the substitution relation holds empirically depends on unobservable firm characteristics (e.g., the correlations among the various sources of risk to which a firm is exposed, the relative benefits and costs of using derivatives vs. managing accruals) as well as on managerial preferences. For example, if cash flow volatility is costlier than earnings volatility, managers will have stronger incentives to reduce cash flow volatility than earnings volatility and, hence, use derivatives rather than discretionary accruals.[5] Under this scenario, the correlation between notional amounts and the magnitude of discretionary accruals could be negative or altogether insignificant. Moreover, it is still unclear whether managers use derivatives to reduce cash flow volatility. Although several papers provide evidence suggesting that derivatives use is consistent with incentives to hedge (e.g., Géczy et al. 1996; Tufano 1996; Allayannis and Ofek 1997; Haushalter 1998; Schrand and Unal 1998; Graham and Rogers 1999; Guay 1999), none of these papers directly tests whether the use of derivatives reduces earnings or cash flow volatilities.

[5] Unfortunately, the literature does not provide evidence as to whether, in general, cash flow volatility is costlier than earnings volatility.

Based on the above arguments, I test the following hypothesis (stated in alternative form):

H: The magnitude of derivatives' notional amounts and the magnitude of discretionary accruals are negatively associated.

I interpret rejection of the null as consistent with financial derivatives and discretionary accruals acting as substitutes to smooth earnings.

III. SAMPLE DESCRIPTION AND MEASUREMENT OF ACCRUAL MANAGEMENT AND DERIVATIVES USE

Sample Selection

My sample consists of nonfinancial, nonregulated *Fortune 500* firms during the 1993-1996 period. I eliminate firms that were merged or acquired, operated under Chapter 11, were owned privately or by foreign corporations, or had missing required data. The sample consists of three annual observations for each of 304 firms—218 derivatives users and 86 nonusers. Firms that use derivatives do so consistently throughout the sample period. The sample's composition is summarized in table 1.

This sample offers two important advantages. First, all years in the sample period are ones in which SFAS No. 119, *Disclosure about Derivative Financial Instruments and Fair Value of Financial Instruments,* was effective. SFAS No. 119 expanded the available disclosed data related to derivatives by requiring firms to distinguish derivatives held or issued for trading purposes (i.e., speculation) vs. other purposes (i.e., hedging), and restricting the aggregation and netting of the derivatives' notional amounts and fair values.[6] Second, *Fortune 500* firms tend to

[6] No firm in my sample reports holding derivatives for trading purposes. Therefore, I assume that my sample firms use derivatives for hedging.

have larger levels of assets, liabilities, cash flows, and foreign operations than other firms do. Thus, the selection procedure allows me to focus on firms most likely to have economically significant risk exposures and, hence, most likely to consider derivative instruments as potential means to smooth earnings. This should increase the power of my tests.

I obtain data on derivatives from the firms' 1994-1996 annual reports and 10K filings included in the Disclosure Select or the SEC's EDGAR databases, ownership and compensation data from the Standard & Poor's ExecuComp database, and the remaining data from the Standard & Poor's Compustat database.[7]

Measuring Accrual Management

A firm's discretionary accruals are unobservable and, therefore, must be proxied. For this purpose, I use the following Jones (1991) accruals expectation model as modified by Dechow et al. (1995):[8]

$$TAC_{it}/TA_{it-1} = \theta_1(1/TA_{it-1}) + \theta_2[(\Delta REV_{it} - \Delta REC_{it})/TA_{it-1}] + \theta_3(PPE_{it}/TA_{it-1}) + \upsilon_{it}, \qquad (1)$$

where TAC is total accruals measured as earnings before extraordinary items and discontinued operations less operating cash flows (see Collins and Hribar 1999),[9] TA is total assets, ΔREV is change in net revenue, ΔREC is change in accounts receivable, and PPE is gross property, plant

[7] I use *Fortune 500* lists for four years to select the initial sample of firms, but the final sample only includes three years of data per firm, because (1) cut-off year-ends for inclusion in a particular year's *Fortune 500* list and database differ for some firms, and (2) SFAS No. 119 disclosures are not required for some noncalendar year-end firms appearing in the 1993 *Fortune 500* list.

[8] While this model exhibits the most power in detecting earnings management among models proposed in the literature, it nevertheless estimates discretionary accruals with considerable imprecision (see, e.g., Dechow et al. 1995, 1998; Guay et al. 1996). With this caveat in mind, the results should be interpreted with caution. I assess the impact of measurement error in discretionary accruals on my results in section VI.

[9] I do not adjust for accruals resulting from deferred gains and losses on derivatives holdings because such information is disclosed by only about one-half of the derivatives users in my sample. For these disclosing firms, the magnitude of these deferred items, either as a percent of total accruals or total notional amount, is not significantly different from zero at conventional levels. See panel A of table 2.

and equipment.[10] To avoid unnecessary sample attrition, I estimate the model cross-sectionally for each sample year and two-digit SIC code.

Following DeFond and Jiambalvo (1994) and Subramanyam (1996), I proxy for nondiscretionary or normal accruals (NDAC) by the fitted value of equation (1) and discretionary or abnormal accruals (DAC) by the regression residual. The literature interprets a positive (negative) value of DAC as income-increasing (-decreasing) discretionary accruals; hence, DAC reflects the direction of accrual management. To measure the magnitude of discretionary accruals, I construct the variable |DAC| as the absolute value of DAC.

Measuring Derivatives Use

The best measure of a firm's hedging is the ratio of the size of the position taken in derivatives to the size of the risk or exposure the firm is trying to hedge.[11] Unfortunately, the information needed to calculate this ratio is not disclosed publicly by most firms in my sample.[12] Instead, I use the disclosed notional amounts of derivatives holdings, scaled by lagged total as-

[10] The modified Jones model does not control for cross-sectional differences in operating performance, to which Dechow et al. (1995) find it susceptible, or for asset restructurings, which several firms in my sample undertook during the sample period. Therefore, for sensitivity purposes, I also include as additional regressors in equation (1) operating cash flows and an indicator variable coded 1 for firms reporting special items during the sample period, 0 otherwise. The Spearman rank correlation between discretionary accruals estimated with this alternative specification and those estimated with equation (1) is 0.93 and their medians do not differ significantly at conventional levels. Therefore, I conduct the remaining analyses using the discretionary accruals estimated with equation (1).

[11] For example, ignoring basis risk, a firm trying to hedge interest rate risk on a $1 million debt security with a $1 million interest rate swap would have a ratio of 1, indicating that the risk is 100% hedged. Similarly, if the firm were to use a $500,000 swap to hedge the security, the ratio would be 0.5, indicating that only 50% of the risk is being hedged. See Tufano (1996), Haushalter (1998), and Rajgopal and Pincus (1999) for hedge ratio calculations in the gold and oil/gas industries.

[12] Most firms in my sample meet the requirements of SFAS No. 119 by stating that carrying amounts approximate fair values without disclosing the amount of either. Moreover, information is not required to be disclosed for contracts that either require the exchange of a financial instrument for a nonfinancial commodity or permit the settlement of an obligation by delivery of a nonfinancial commodity. Therefore, most firms do not tend to disclose fair values, carrying amounts, or notional amounts for their commodity derivatives. Consequently, my measure of derivatives use only includes the notional amounts of interest rate and foreign currency derivatives.

sets, as a proxy for the firm's derivatives use, DERIV.[13] While the notional amount of a derivative is usually much larger than the contract's fair value, it provides a viable measure of a firm's involvement in derivatives because it represents the amount exposed to changes in the value of the underlying asset and the basis for calculating the amounts exchanged by the parties to the contract.[14] Notional amounts have been used regularly in prior research (e.g., Allayannis and Ofek 1997; Haushalter 1998; Guay 1999).

Panel A of table 2 reports sample descriptive statistics, including derivatives positions held by firms. Seventy-two percent of the firms use derivatives, with mean and median notional amounts of $2.5 billion and $0.5 billion. Only 14% of users hold commodity contracts. Reported fair values and carrying amounts are substantially lower than notional amounts, averaging about six percent or less of the latter.

To assess whether notional amounts capture basic attributes of hedging, I correlate this variable with some simple albeit very crude measures of hedge ratios: the ratios of foreign exchange notional to foreign sales, interest rate notional to total debt, and commodity notional to total sales. Significant positive Spearman rank correlations reported in panel B of table 2 suggest that DERIV does in fact appear to capture basic attributes of hedging. Moreover, DERIV also is highly correlated with derivatives' fair values and carrying amounts for those firms disclosing these amounts.

[13] I use this scale to be consistent with that of |DAC|. Scaling by other measures of firm size, such as sales and market capitalization, does not alter my conclusions.

[14] In contrast, the fair value of the derivative contract is the amount that would have to be exchanged among the parties to the contract as of the reporting date and, therefore, also reflects counterparty default risk.

Effect of Derivatives Use and Accrual Management on Volatilities

Table 3 summarizes univariate tests of the effects of derivatives use and accrual management on the volatilities of net income, operating cash flows, and total accruals. I measure each variable's volatility by its coefficient of variation (i.e., the ratio of the variable's standard deviation to the absolute value of its mean over the sample period), which is a unitless metric of variation used in previous research (see, e.g., Minton and Schrand 1999). I report differences in median coefficients of variation between users and nonusers of derivatives and between aggressive and modest accrual manipulators. I define firm-years with |DAC| larger (less) than the contemporaneous industry median |DAC| as aggressive (modest) manipulators.

Results indicate that net income volatility does not differ significantly between users and nonusers of derivatives or between aggressive and modest manipulators. However, consistent with the arguments presented in section II, derivatives users tend to have less volatile operating cash flows and total accruals than nonusers. In contrast, aggressive manipulators tend to have more volatile operating cash flows and total accruals than modest manipulators.

IV. EMPIRICAL DESIGN

To investigate whether accrual management and derivatives use are substitute mechanisms to smooth earnings, I use the following simultaneous-equations model:

$$DERIV_{it} = \alpha_0 + \alpha_1 |DAC|_{it} + \boldsymbol{a}' \mathbf{CONTROLS}_{it} + \zeta_{it}, \quad (2)$$

and

$$|DAC|_{it} = \beta_0 + \beta_1 DERIV_{it} + \boldsymbol{b}' \mathbf{CONTROLS}_{it} + \xi_{it} \quad (3)$$

where DERIV and |DAC| are as defined in section III and **CONTROLS** is a vector of variables which I describe shortly.

While evidence suggests that accrual management is pervasive (e.g., Hunt et al. 1996; Subramanyam 1996), the use of derivatives is not as widespread. For example, survey evidence indicates that only about two-thirds of large firms and one-eighth of small firms use derivative contracts (see, e.g., Bodnar et al. 1996). Thus, DERIV is a left-censored variable that takes the value of zero in years in which the firm does not hold derivatives. That is, I observe managers' desired level of derivatives if the benefits of using this level exceed its costs; otherwise, I observe zero.[15] Because the effects of factors determining whether managers use any derivatives at all may differ from those of factors determining the magnitude of derivatives used, I model these decisions as sequential (see, e.g., Cragg 1971; Allayannis and Ofek 1997; Haushalter 1998; Graham and Rogers 1999). I first estimate the following self-selection model to explain managers' decision of whether or not to use derivatives:

$$USER_{it} = \gamma_0 + \boldsymbol{\gamma}'\mathbf{CONTROLS}_{it} + \nu_{it}, \quad (4)$$

where USER is coded 1 if the firm uses derivatives, 0 otherwise. I use probit regression on the full sample of 912 firm-years to estimate equation (4), the USER equation. I then obtain z_{it}, the prediction of each firm-year's probit regression index function, and calculate inverse Mills ratios (MILLS), i.e., $\phi(z_{it})/\Phi(z_{it})$, where ϕ is the standard normal density and Φ is the normal cumulative probability. I include MILLS as an additional control variable to correct for potential self-selection bias in both simultaneous equations (2) and (3), which I estimate only for the sample of derivatives users.

I assume that managers' discretionary accruals and derivatives are chosen to maintain an optimal (albeit unobservable) level of earnings volatility. Therefore, if managers view discre-

[15] In principle, DERIV captures both nonobservability and firm choice. For example, DERIV can take the value of zero if the firm uses derivatives but does not disclose this fact in its annual report (e.g., when the firm does not comply with reporting requirements under SFAS No. 119 or it uses derivatives such as commodity contracts for which

tionary accruals and derivatives as substitute mechanisms to manage earnings volatility, I predict that, all else equal, firms with larger derivatives portfolios will have lower levels of discretionary accruals and vice versa. Empirically, I expect the coefficients of |DAC| and DERIV to be negative and significant. Because these and the remaining coefficients of the simultaneous equations are conditional on firms using derivatives, they should be interpreted as capturing the ongoing relation between accrual management and derivatives use after the initial set-up costs of the firm's risk management program have been incurred.

The vector **CONTROLS** includes two sets of variables, one set common to all equations and the other intended to help identify the system of simultaneous equations.

Variables Common to All Equations

The decision to use derivatives and manage accruals is likely driven by how strong managers' incentives are to report low-volatility earnings and cash flows. The literature suggests four market imperfections likely to give rise to these incentives: agency costs of debt and equity, corporate income taxes, information asymmetries between firm insiders and outsiders, and managerial risk aversion. Empirical evidence provides differing levels of support for these motives to manage accruals and use derivatives.[16]

I include LEVERAGE and DISTRESS to capture financial distress and debt-related costs. Reducing earnings volatility may increase the firm's debt capacity (e.g., Leland 1998; Graham and Rogers 1999) and reduce its debt cost (e.g., Smith and Stulz 1985; Minton and Schrand

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no disclosures about notional and fair values are required), the firm's use of derivatives is immaterial, or the firm chooses not to use derivatives.

[16] For discretionary accounting choices, see, e.g., Healy (1985), Watts and Zimmerman (1986), Baber et al. (1991), DeFond and Jiambalvo (1994), Gaver et al. (1995), Hunt et al. (1996), Subramanyam (1996), and DeFond and Park (1997). For derivatives use, see, e.g., Géczy et al. (1996), Tufano (1996), Allayannis and Ofek (1997), Haushalter (1998), Graham and Rogers (1999), and Guay (1999).

1998). Moreover, because debt covenants generally are defined in terms of accounting numbers, reducing earnings volatility can free up potentially binding covenants (Smith and Stulz 1985; Watts and Zimmerman 1986; Shapiro and Titman 1992). Consistent with previous studies, I measure LEVERAGE as total debt divided by total assets and DISTRESS as the probability of financial distress based on Ohlson's (1980) model 1. I expect the coefficients of both variables to be positive in all regressions.

Two variables are intended to capture incentives related to the firm's investment opportunity set: RD and the interaction between RD and LEVERAGE. By hedging with derivatives, managers can generate a steady stream of internally generated cash flows and, thus, reduce their reliance on more costly external capital for investment funding (see, e.g., Froot et al. 1996). To the extent that managers need to rely on external funding, reducing earnings and cash flow volatilities can prevent underinvestment by lowering the costs of debt and equity financing (see, e.g., Minton and Schrand 1999). Consistent with previous research, I measure RD as research and development expense, scaled by sales, and expect it and the interaction term to have positive coefficients in all regressions.

I include the variable CONVEXITY to capture tax-induced incentives to mitigate earnings and cash flow volatility. If the firm's income tax costs are a convex function of taxable income (i.e., the firm faces a marginal tax rate in excess of its average tax rate), then managers have incentives to reduce the volatility of their firm's taxable income since lower variance in taxable income leads to lower expected tax costs and higher firm value (Smith and Stulz 1985; Graham and Rogers 1999; Graham and Smith 1999).[17] Although taxable income generally differs

[17] Convexity in the tax function results from progressive statutory tax rates and tax preference items or tax shields such as net operating loss carryforwards, tax credits, and other permanent or temporary differences between financial and tax accounting. Firms without convex tax functions have either linear or concave functions. Firms facing linear functions would not benefit from altering taxable income volatility, whereas firms facing concave tax func-

from (financial accounting) earnings, it includes both accrual basis components—generally measured under GAAP—and cash basis components. Therefore, taxable income volatility can be altered by managing accrued revenues and expenses that do not create book/tax differences and by managing cash receipts and disbursements that do create book/tax differences. I measure CONVEXITY as the excess of the marginal tax rate (calculated as in Graham 1996) over the average tax rate (i.e., tax expense divided by pretax earnings) and expect its coefficient to be positive in all regressions.

By smoothing earnings and cash flows, managers can signal information about the degree of persistence of future cash flows and earnings (see, e.g., Smith and Stulz 1985; Watts and Zimmerman 1986; Chaney and Lewis 1995; Subramanyam 1996). Smooth, predictable earnings and cash flows likely increase analyst following, in turn leading to reduced informational asymmetries and cost of capital (see, e.g., Minton and Schrand 1999). I proxy informational asymmetries by ANALYST, the natural logarithm of the number of analysts following the firm's equity and fixed income securities during the year; I expect its coefficient to be positive in all regressions.

Stock holdings, bonuses, and stock options also may provide managers with incentives to alter earnings and cash flow volatility. For example, managers are likely to smooth earnings so that they fall within the prescribed range in which managers will be granted bonuses (see, e.g., Healy 1985, Gaver et al. 1995). Evidence suggests that firms with smoother earnings are valued more highly by the market (see, e.g., Myers and Skinner 1998; Barth et al. 1999) and, thus, managers with large stock holdings may be more inclined to smooth earnings. The incentives to smooth earnings from stock options, however, are less clear. Under standard option pricing mod-

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tions would benefit from increasing taxable income volatility. Graham and Smith (1999) show that the tax benefits for firms with concave functions are rather immaterial.

els, the value of a call option is an increasing function of both the level and volatility of the firm's stock price. Thus, if volatile earnings translate into volatile stock prices and managers' stock options are more sensitive to stock volatility than to the level of stock prices, then these managers are more likely to increase earnings volatility. In contrast, if stock options are more sensitive to the level of stock prices, managers may be inclined to reduce earnings volatility. Consistent with prior research, I measure stock holdings (SHARES), bonuses (BONUS) and stock option holdings (OPTIONS) relative to the firm's CEO as the fair value of shares owned, salary and bonus compensation, and the number of options outstanding, respectively. All variables are scaled by lagged total assets; I expect positive coefficients for SHARES and BONUS, whereas I make no prediction for the coefficient of OPTIONS.

Increased diversification (DIVERS) in the firm's business creates a natural reduction in the variance of earnings and cash flows (Smith and Stulz 1985), which suggests that highly diversified firms are less likely to benefit from earnings and risk management. However, firms diversifying internationally are exposed to foreign exchange rate risk and, consequently, are more likely to use exchange rate derivatives (see, e.g., Géczy et al. 1996; Allayannis and Ofek 1997) or discretionary accruals. I measure diversification (DIVERS) by the entropy index proposed in Palepu (1985) and foreign exchange rate exposure (FRGSALES) by the ratio of foreign to total sales.[18] I expect DIVERS (FRGSALES) to have a negative (positive) coefficient in all regressions.

Finally, I include in all regressions indicator variables for year and industry membership in order to control for potential variation in derivatives use and accrual management attributable

[18] The entropy index is zero in the case of an undiversified firm, i.e., a firm with all its revenues in a single four-digit SIC industry. While the index has no upper limit, a firm with a score over 3 is considered highly diversified.

to unobserved industry-specific and time-varying economy-wide factors, such as market fluctuations that can alter a firm's risk exposure.

Variables to Identify the Simultaneous-Equations Model

I identify the simultaneous equations by excluding certain variables from the **CONTROLS** vector in either equation (2) or (3). Both economic theory and extraneous information can be used to place these zero-coefficient restrictions (see, e.g., Kennedy 1998). Unfortunately, existing theories of risk management and earnings management overlap substantially, making it difficult to use economic theory to justify the restrictions. While I provide economic intuition for selecting the identifying variables discussed below to be excluded from a particular equation, I recognize that an argument against exclusion can be made for each variable. Therefore, I also rely on extraneous information in placing restrictions. Specifically, I pretest each identifying variable by calculating its Spearman rank correlation with DERIV and |DAC| to ensure that it is significantly correlated only with the dependent variable of the equation it is intended to identify. Because this procedure is ad hoc, I also overidentify the system to reduce reliance on a single identifying variable.

To identify equation (2), the DERIV equation, I use the following variables: SIZE, YIELD, TRDCYCLE, and STDEBT. Because these variables are expected to explain variation in the level of derivatives use, I also include them in equation (4), the USER equation. I expect SIZE, measured as the natural logarithm of total liabilities plus preferred stock plus market capitalization of common stock, to be positively associated with derivatives use because setting up and monitoring a hedging program can be quite costly and, therefore, larger firms with economies of scale in information, technology, and transaction costs are more likely to benefit

from using derivatives (e.g., Géczy et al. 1996; Tufano 1996; Allayannis and Ofek 1997).[19] I expect YIELD, the dividend yield, to be positively associated with derivatives use because Graham and Rogers (1999) and others argue that dividend restrictions might allow firms to retain sufficient liquidity to make hedging unnecessary. I expect STDEBT, the ratio of short-term to total debt, to be positively associated with derivatives use because firms with shorter debt maturity structures are more likely to use interest rate swaps (see, e.g., Visvanathan 1998). Lastly, the shorter is a firm's trading or cash cycle, TRDCYCLE, the more efficient is its cash management and, therefore, the less likely it is to use derivatives. However, longer trading cycles may be associated with unrecognized firm commitments or forecasted transactions, which potentially expose the firm to risks and make it more likely to benefit from hedging. Therefore, I expect the coefficient of TRDCYCLE to be positive.

To identify equation (3), the |DAC| equation, I use the following variables: PRIORDAC, INDFLEX, OCF, LIFORES, and PAYOUT. I expect PRIORDAC, the lagged value of |DAC|, to be positively associated with earnings management. I include this variable because, due to the reversing nature of accruals, managers managing accruals in one period will have to manage accruals in subsequent periods to achieve the same level of earnings, all else equal (see, e.g., Hunt et al. 1996).[20] I expect INDFLEX, the root mean squared error of the cross-sectional accrual expectations regression used to estimate the firm-year's |DAC|, to be positively associated with earnings management. I include this variable to capture managers' flexibility to manage earn-

[19] As an example of using extraneous information, the variable SIZE can also proxy for political costs and informational asymmetries and, therefore, should be correlated with |DAC|. However, in empirical pretests, I find no such correlation perhaps because my sample consists of the largest firms in their respective industries. Therefore, I exclude SIZE from the |DAC| equation as a means to help identify that equation.

[20] PRIORDAC, the lagged value of |DAC|, was determined (perhaps endogenously) at some earlier time period and, therefore, may be regarded as predetermined or exogenous with respect to the current values of |DAC| and DERIV.

ings.[21] I expect the coefficient of OCF, operating cash flows scaled by lagged total assets, to be positive given evidence reported in Dechow (1994) and Dechow et al. (1995). I expect a positive coefficient for LIFORES, beginning LIFO reserve scaled by lagged total assets, because Hunt et al. (1996) argue that the larger is the beginning LIFO reserve, the greater is management's ability to increase income by liquidating LIFO layers. Lastly, I expect a negative coefficient for PAYOUT, the dividend payout rate, if managers manage earnings to achieve expected payout rates.

Table 4 shows Spearman rank correlations between dependent and independent variables in equations (2)-(4). In general, the correlations are consistent with expectations in that most variables capturing incentives to use derivatives and manage accruals are significantly correlated with USER, DERIV, or |DAC|. Moreover, the identifying variables are not significantly correlated with the dependent variables of the equations they do not identify.

V. EMPIRICAL RESULTS

Table 5 reports summary statistics for the estimated regressions. Recall that equation (4), the USER equation, describes managers' decision of whether or not to use derivatives, whereas equations (2) and (3), the DERIV and |DAC| equations, describe managers' decision of how much derivatives to use and accruals to manage given that they chose to use derivatives to begin with. I first present probit maximum likelihood regression results for the USER equation estimated on the entire sample. Next, I present two-stage least squares (2SLS) regression results for

[21] The root mean squared error is the square root of the sum of the squared residuals from the regression of equation (1) for each two-digit SIC industry, scaled by the appropriate number of degrees of freedom. Because the residuals proxy for discretionary accruals, industries in which firms have larger residuals also have larger values of INDFLEX. Therefore, INDFLEX serves as a proxy for the extent of discretion exercised by firms in a particular industry. To the extent that the regression residuals proxy for discretionary accruals with error, INDFLEX also can be viewed as a control for such measurement error.

the simultaneous equations estimated only for the sample of derivatives users. I estimate the simultaneous equations by 2SLS because the system is overidentified. To help interpret the relative importance of the right-hand-side (RHS) variables in explaining variation in the dependent variables, I report marginal probabilities for the USER equation and standardized coefficients for the DERIV and |DAC| equations. I also down-weight the effects of influential observations using the procedures described in Huber (1964), Beaton and Tukey (1974), and Li (1985).[22] Test statistics for all coefficients are heteroscedasticity consistent and adjusted to allow for the three time-series observations for each firm to be correlated.

Consistent with my hypothesis, the coefficients of |DAC| and DERIV are both negative and highly significant. A 95% confidence interval around the (standardized) coefficient estimate of |DAC| indicates that increasing |DAC| by one standard deviation results in a decrease of 0.276 to 0.418 standard deviations in DERIV. Similarly, increasing DERIV by one standard deviation results in a decrease of 0.265 to 0.425 standard deviations in |DAC|. Furthermore, Hausman (1978) tests indicate that the null hypotheses that |DAC| and DERIV are exogenous can be rejected safely at conventional levels. Taken together, the results suggest that discretionary accruals and derivatives use are partial substitutes and that the magnitude of discretionary accruals and derivatives' notionals are determined jointly.

Comparison of the regression results for the USER and DERIV equations indicates that the RHS variables have different effects on the decision of whether to use derivatives and the decision of how much to use, which justifies modeling these two decisions separately.[23] For example, managerial stock and option holdings do not appear to affect the decision to use deriva-

[22] Closer inspection of observations deemed influential under diagnostics described in Belsley et al. (1980) confirms they are not a result of miscoding. Therefore, I follow the recommendation of Belsley et al. of not deleting these observations, but rather minimizing their effects using bounded influence estimators.

tives but, once managers have decided to initiate a derivatives portfolio for other reasons, both stock and option holdings influence the size of the portfolio.

Results reported in table 5 provide further insights into how managers of firms using derivatives combine earnings and risk management strategies to achieve their goals. The most important factor (as measured by the magnitude of standardized coefficients) directly affecting the magnitude of derivatives use besides discretionary accruals is exposure to foreign exchange risk. In contrast, the most important factor directly affecting the magnitude of discretionary accruals besides the size of the derivatives portfolio is the extent of previous discretionary accrual management, followed closely by managers' cash-based compensation.

In terms of financial distress and debt-related costs, the coefficient of LEVERAGE is significant in the DERIV equation only, whereas the coefficient of DISTRESS is significant only in the USER and |DAC| equations. Taken together, these findings suggest that managers are more likely to use derivatives to increase debt capacity and prevent binding debt covenants, whereas they combine both derivatives and discretionary accounting choices to reduce the perceived probability of financial distress.

Although the coefficient of RD is significant only in the |DAC| equation and the coefficient of the interaction between RD and LEVERAGE is significant only in the USER and DERIV equations, the results are consistent with managers using both derivatives and discretionary accruals to secure the ability to exploit their firms' investment opportunities. Further, the coefficient of CONVEXITY is significant only in the |DAC| equation, which suggests that managers are more likely to manage accruals than use derivatives for tax purposes. Moreover, the coefficient of ANALYST is significant only in the USER and DERIV equations. If ANALYST prop-

[23] An unreported Lagrange multiplier test proposed by Lin and Schmidt (1984) provides additional support for modeling these two decisions as sequential.

erly proxies for information asymmetry, its insignificant coefficient in the |DAC| equation could be traced to the fact that my sample firms are *Fortune 500* firms and, thus, have superior information environments than other firms in their industries.

In terms of managerial risk preferences, the coefficients of SHARES and OPTIONS are significant only in the DERIV equation, whereas the coefficient of BONUS in significant only in the |DAC| equation. These findings suggest that managers are more likely to use derivatives to hedge the value of their stock and option holdings and to manage accruals to increase their cash-based compensation. This interpretation is further supported by the coefficient of BONUS being significant but of the wrong sign in the USER equation.

Results reported in Table 5 also suggest that managers are more likely to use derivatives to hedge interest rate and foreign exchange rate risks as evidenced by the significant coefficients of FRGSALES in the USER and DERIV equations and STDEBT in the DERIV regression. Further, the coefficient of DIVERS is significant only in the |DAC| regression, which suggests that managers are more likely to mitigate the effects of lack of diversification on earnings volatility by managing accruals rather than using derivatives.

Lastly, with the exception of SIZE and LIFORES, the coefficients of the identifying variables are all significant. These results, together with the Spearman rank correlations reported in table 4, indicate that the identifying variables are successful in helping identify the simultaneous equations.

VI. SENSITIVITY ANALYSES AND EXTENSIONS

Sensitivity tests and extensions suggest that the significant negative association between DERIV and |DAC| is not driven by unrealistic assumptions, measurement error, model misspecification, or alternative definitions of the control variables.

Joint vs. Sequential Decisions to Use Derivatives and Manage Accruals

As the Hausman (1978) tests indicate, when treated as RHS variables in the simultaneous-equations regressions, the variables proxying for discretionary accruals and derivatives use, |DAC| and DERIV, are correlated with the regressions' residuals. This indicates that both variables are endogenous in the system, which suggests that managers may simultaneously or jointly choose the extent of derivatives use and accrual management. This interpretation assumes that managers select risk and earnings management policies jointly and carry them out throughout the year. An alternative argument is that managers select these policies sequentially (see, e.g., Rajgopal and Pincus 1999). For example, managers may choose and implement a hedging policy at the beginning of the year and wait until the end of the year to assess the effect of the policy on earnings volatility. At that point in time, managers could further affect earnings volatility by managing accruals.[24]

To assess whether my results are sensitive to the joint vs. sequential assumptions, I repeat the estimation of the |DAC| equation by replacing the right-hand-side variables DERIV and MILLS by their lagged values. By using these lagged values, I lose one year of data. As ordinary

[24] The sequential decision process assumes that, for example, managers do not rebalance their firm's derivatives portfolio throughout the year, they manage accruals only at year-end, or their earnings management policies are intertemporaly independent. These assumptions are rather strong given that careful reading of financial reports indicates that many firms engage in derivatives transactions throughout the year. Moreover, because of increased pressure to meet quarterly earnings expectations, managers likely manage earnings in the interim. Lastly, the results reported in table 5 and in other papers (see, e.g., Hunt et al. 1996; DeFond and Park 1997) are consistent with earnings management being a multiperiod behavior.

least squares results reported in table 6 show, the coefficient of lagged DERIV is negative and significant, which is consistent with a sequential decision to use derivatives and discretionary accruals as tools to smooth earnings. However, this coefficient is much smaller in absolute terms than that reported in table 5 for the current value of DERIV (i.e., -0.070 vs. –0.345, respectively), which suggests that the current level of derivatives use has a stronger effect on discretionary accruals than lagged levels. Therefore, while I cannot rule out that the extent of derivatives use and accrual management are sequentially determined, my overall results are more consistent with risk management and earnings management policies being jointly determined.

Measurement Error and Model Misspecification

A competing interpretation of the Hausman (1978) test results reported in table 5 is that the correlation between the regressions' residuals and the variables |DAC| and DERIV is a result of measurement error in these variables rather than endogeneity. The potential for measurement error is particularly severe for |DAC|, which is constructed from the residuals of the modified Jones model. While this model exhibits the most power in detecting earnings management among accruals expectation models proposed in the literature, it nevertheless estimates discretionary accruals with considerable imprecision (see, e.g., Dechow et al. 1995, 1998; Guay et al. 1996).

The 2SLS procedure that I apply to estimate the simultaneous equations is appropriate under endogeneity and measurement error in |DAC| and DERIV since it produces consistent and unbiased estimates under both conditions and is robust to the presence of other estimation problems such as multicollinearity and specification error (see, e.g., Kennedy 1998). However, to determine whether omitted variables that may contribute to potential measurement error in |DAC|

and DERIV are driving my results, I re-estimate the simultaneous equations using three-stage least squares (3SLS) regression techniques, which take into consideration the covariance between the residuals of the two equations in the simultaneous system. The advantage of 3SLS over 2SLS is that, if the residuals are correlated (perhaps due to omitted variables contributing to measurement error in the included variables), it produces asymptotically more efficient estimates by considering all available information. The chief disadvantage, however, is that if the system is misspecified, all coefficient estimates would be affected. Results based on 3SLS (not tabulated) support the conclusions previously drawn based on 2SLS about the relation between derivatives use and discretionary accruals, which suggests that model misspecification is not driving my results.

McNichols and Wilson (1988) argue that two conditions can lead to misleading results in studies of accrual management. The first condition occurs when nondiscretionary accruals are correlated with the variable used to partition the sample into groups expected to show different patterns of discretionary accrual management. This condition gives rise to bias due to the inability of tests to distinguish whether the results are driven by accrual management or by omitted factors causing the correlation between misclassified nondiscretionary accruals and the partitioning variable. In my study, DERIV acts as a (continuous) partitioning variable. Therefore, the correlation between NDAC and DERIV should provide evidence of the degree of potential bias inherent in my results. For derivatives users in my sample, the Spearman rank correlation between NDAC and DERIV is an insignificant –0.023, suggesting that bias is not driving my results.

The second condition described by McNichols and Wilson (1988) occurs when measurement error in discretionary accruals is large. Under this condition, my tests would be com-

promised by lack of power, which would translate into an inability to detect an association between |DAC| and DERIV. However, as results reported in table 5 show, not only do I find a significant negative association between these two variables, but also large t-statistics for their coefficients. This relation would be statistically and economically stronger if |DAC| and DERIV were measured without error.

Xie (1998) finds that discretionary accruals estimated using the modified Jones model are more volatile and less persistent than the model's estimates of nondiscretionary accruals, which leads him to conclude that, despite potential specification problems, the model successfully captures basic attributes of the behavior of discretionary accruals. Untabulated analyses in my study suggest that, relative to modest manipulators, aggressive manipulators tend to have larger levels (in terms of absolute value) of special items, net gains from asset dispositions, and net income effects due to accounting changes. In contrast, total accruals, nondiscretionary accruals, and (signed) discretionary accruals do not differ between the two groups. These findings are consistent with those reported by Xie.

Finally, table 7 summarizes univariate tests of differences in three alternative earnings management variables between users and nonusers of derivatives and between aggressive and modest manipulators. The first variable, similar to the smoothing ratio used by Rajgopal and Pincus (1999), is the coefficient of variation of premanaged earnings to the coefficient of variation of reported earnings, where premanaged earnings is defined as net income minus discretionary accruals. Large values for this ratio suggest that smoother earnings have been attained through discretionary accruals, assuming the latter are not measured with considerable error. Consistent with my hypothesis, I expect derivatives users to manage accruals to a lesser extent and, therefore, to have a smaller median smoothing ratio than nonusers. On the other hand, because I as-

sume that accruals are managed to smooth earnings, I expect aggressive manipulators to have a larger median smoothing ratio than modest manipulators. The results are consistent with these expectations.

The second variable is calculated using the Beneish (1999) model of earnings management prediction. Specifically, the model estimated by Beneish is based on a sample of firms known to have violated GAAP and which have been subject to SEC enforcement actions. Higher values of the score imply a greater probability that the firm is managing accruals. The third variable, the M probability, is the probability of management, calculated as the normal cumulative probability evaluated at the respective M score. Consistent with my hypothesis, I expect derivatives users to have smaller median M scores and probabilities than nonusers, whereas I expect aggressive manipulators to have larger median M scores and probabilities than modest manipulators. The results confirm my expectations. However, they should be interpreted with caution because the sample used by Beneish to estimate the model differs markedly from mine. For example, firms in my sample have sales and assets over 100 times larger than those of GAAP violators reported in Beneish (1999). The relatively low values of the M probabilities reported in table 7 are potentially attributable to these sample differences.

Alternative Definitions of Control Variables

Results supporting my hypothesis are largely invariant to alternative measures of the control variables. Alternative measures examined include: for LEVERAGE, the ratio of total debt to market value of assets, the latter proxied by the sum of total liabilities, preferred stock, and market capitalization of common stock; for RD, R&D expense scaled by total assets, market to book value of equity, capital expenditures scaled by total assets, and the sum of capital expen-

ditures, advertising expense and R&D expense scaled by either sales or total assets; for CONVEXITY, an indicator coded 1 if marginal tax rate exceeds the average tax rate, 0 otherwise, and an indicator coded 1 if the firm had NOL carryforwards or an average tax rate lower than 35%, 0 otherwise; for ANALYST, number of analysts, unscaled and scaled by SIZE; for FRGSALES, an indicator coded 1 if the firm has foreign pretax earnings, 0 otherwise; for DIVERS, related and unrelated diversification entropy indexes; and for OPTIONS, the fair value of exercisable in-the-money stock options held by the CEO, scaled by lagged total assets.

VII. SUMMARY

Using a simultaneous-equations framework, I model managers' incentives to use derivatives and manage discretionary accruals. I measure discretionary accruals as abnormal accruals obtained from the modified Jones (1991) model and derivatives use as the notional amount of contracts held at year-end, and estimate the simultaneous-equations model using 1994-1996 data for 304 nonfinancial, nonregulated *Fortune 500* firms. Consistent with expectations, test results indicate that firms with larger derivatives positions have lower levels of discretionary accruals. This evidence suggests that discretionary accruals and derivatives are used by managers as partial substitutes to affect earnings volatility. Sensitivity tests and extensions suggest that these results are robust and not driven by measurement error or model misspecification.

My study provides direct evidence that managers manage their firms' earnings volatility by managing the volatilities of cash flows and accruals. It also offers some insight into the possible effects that newly issued SFAS No. 133 may have on firms' earnings management and hedging strategies. One often cited criticism of SFAS No. 133 is its potential to increase earnings volatility. Thus, the imposition of SFAS No. 133 may increase the costs of using derivatives

relative to discretionary accounting choices. If managers view earnings management and hedging as substitute mechanisms to reduce earnings volatility, then managers may curtail hedging with derivatives and increase earnings management through discretionary accounting choices. Because SFAS No. 133 becomes effective for fiscal years beginning after June 15, 2000, data are not available currently to document its effects on firms' earnings management and hedging strategies. I leave this task for future research.

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TABLE 1
Sample Composition

Panel A: Sample Selection

Total firms in each *Fortune 500* list for the years 1993-1996	2,000
Firms appearing in more than one list	(1,407)
Firms not making the list at least once during 1993-1996 (e.g., dropped in ranking, merged, were acquired, etc.)	(104)
Firms consistently included in list during 1993-1996	489
Foreign-owned or with missing information	(82)
Firms in financial services industries	(103)
Total firms in sample	304
Firms not using financial derivatives	(86)
Firms using financial derivatives	218

Panel B: Sample Composition by Industry

Industry	*Firms*	*Percent*
Consumer Goods	33	10.9
Electronics, Electricals, Semiconductors	35	11.5
Energy	18	5.9
Metals	14	4.6
Nondurable Consumer Products	10	3.3
Paper and Related	19	6.3
Production and Construction Materials	21	6.9
Transportation	49	16.1
Merchandising, Retail, Wholesale	57	18.8
Services	48	15.8
Total Firms in Sample	304	100.0

TABLE 2
Sample Descriptive Statistics

Panel A: Descriptive Statistics for Sample Firm-Years[a]

Variable	*N*	*Mean*	*Standard Deviation*	*First Quartile*	*Median*	*Third Quartile*
Market Capitalization	912	10,976	17,594	2,087	4,534	11,029
Total Assets	912	11,730	24,925	2,702	5,200	12,346
Sales	912	11,256	16,989	3,651	6,391	12,219
Net Income	912	576	1,049	98	248	646
Total Accruals	912	-621	1,429	-634	-221	-69
Derivatives:						
Total Notional	654	2,452	9,138	178	530	1,688
Foreign Exchange	461	1,541	3,781	112	390	1,200
Interest Rate	462	1,758	7,282	171	390	1,219
Commodities	88	220	392	9	53	180
Carrying Amount	270	25	55	0	3	21
Carrying Amount/Notional	270	2.8%	6.6%	0.0%	0.6%	2.3%
Fair Value	346	125	331	1	18	75
Fair Value/Notional	346	6.3%	22.3%	0.9%	2.3%	6.1%
Deferred Gain (Loss)	357	-2	25	0	0	0
Deferred Gain (Loss)/Notional	357	0.0%	0.9%	0.0%	0.0%	0.0%
Deferred Gain (Loss)/ Total Accruals	357	0.7%	2.3%	0.0%	0.0%	0.0%

Panel B: Spearman Rank Correlations between DERIV and Other Derivatives Variables

	Sample of Firm-Years Used to Estimate Correlation			
Variable	*All Users*	*Foreign Exchange Derivatives Users Only*	*Interest Rate Derivatives Users Only*	*Commodity Derivatives Users Only*
Foreign Exchange Derivatives' Notional Amount/ Foreign Sales		0.507 *** (n=461)		
Interest Rate Derivatives' Notional Amount/ Total Debt			0.746 *** (n=462)	
Commodity Derivatives' Notional Amount/ Total Sales				0.192 ** (n=83)
Derivatives' Fair Value/ Lagged Total Assets	0.625 *** (n=346)	0.440 *** (n=254)	0.600 *** (n=245)	0.703 *** (n=48)
Derivatives' Carrying Amount/ Lagged Total Assets	0.591 *** (n=270)	0.486 *** (n=183)	0.524 *** (n=192)	0.627 *** (n=36)

[a] Amounts other than percentages and firm-years are in $ million.
** and *** denote significance at the 0.05 and 0.01 levels, respectively, based on two-tailed tests.

TABLE 3
Summary Statistics of Effect of Derivatives Use and Accrual Management on Volatilities

		Users – Nonusers of Derivatives				*Aggressive – Modest Manipulators*[a]			
Coefficient of Variation[b]	*Median for All Firms*	*Difference in Medians*	*Expected Sign*	*T-statistic*		*Difference in Medians*	*Expected Sign*	*T-statistic*	
Net Income	0.613	0.108	?	1.637		-0.014	?	0.861	
Operating Cash Flows	0.773	-0.079	–	-2.555	***	0.054	+	2.793	***
Total Accruals	0.985	-0.089	–	-2.314	**	0.089	+	2.822	***

** and *** denote significance at the 0.05 and 0.01 levels, respectively, based on one-tailed Mann-Whitney-Wilcoxon rank-sum tests for signed predictions, two-tailed tests otherwise.

[a] Firm-years with |DAC| > (|DAC ≤) contemporaneous industry median |DAC| are classified as aggressive (modest) manipulators.

[b] The coefficient of variation is defined as the standard deviation of the variable divided by the absolute value of its mean over the sample period.

TABLE 4
Spearman Rank Correlations between Dependent and Independent Variables

		Dependent Variable		
Independent Variable	*Expected Sign*	*USER*	*DERIV*	*|DAC|*
N		912	654	654
Financial Distress and Debt-Related Costs				
LEVERAGE	+	0.158 ***	0.122 ***	-0.047
DISTRESS	+	0.025	-0.097	0.055 *
Investment Opportunities				
RD	+	0.346 ***	0.412 ***	0.078 **
RD×LEVERAGE	+	0.383 ***	0.408 ***	0.066 *
Taxes				
CONVEXITY	+	0.080 **	0.171 ***	0.083 **
Information Asymmetry				
ANALYST	+	0.343 ***	0.119 ***	-0.070
Managerial Risk Aversion				
SHARES	+	-0.319	-0.017	0.067 *
BONUS	+	-0.324	0.107 ***	0.207 ***
OPTIONS	?	0.051	0.202 ***	0.029
Other Factors				
FRGSALES	+	0.351 ***	0.382 ***	0.038
DIVERS	–	0.183	0.096	-0.142 ***
YIELD	+	0.106 ***	-0.132	0.032 ✓
SIZE	+	0.386 ***	0.166 ***	0.028 ✓
TRDCYCLE	+	0.156 ***	0.237 ***	0.001 ✓
STDEBT	+	0.160 ***	0.265 ***	-0.054 ✓
PRIORDAC	+	-0.034 ✓	-0.040 ✓	0.295 ***
INDFLEX	+	-0.043 ✓	-0.002 ✓	0.228 ***
OCF	+	0.007 ✓	0.057 ✓	0.085 **
LIFORES	+	0.025 ✓	-0.035 ✓	-0.009
PAYOUT	–	-0.049 ✓	-0.034 ✓	-0.243 ***

*, **, *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively, based on two-tailed tests.
✓ denotes that lack of statistical significance at conventional levels supports the use of these variables as identifying variables in the simultaneous-equations model.

TABLE 5
Summary Statistics for Simultaneous-Equations Regressions

Model: $USER = \gamma_0 + \gamma_1 LEVERAGE_{it} + \gamma_2 DISTRESS_{it} + \gamma_3 RD_{it} + \gamma_4 (RD \times LEVERAGE)_{it} + \gamma_5 CONVEXITY_{it} + \gamma_6 ANALYST_{it} + \gamma_7 SHARES_{it} + \gamma_8 BONUS_{it} + \gamma_9 OPTIONS_{it} + \gamma_{10} FRGSALES_{it} + \gamma_{11} DIVERS_{it} + \gamma_{12} YIELD_{it} + \gamma_{13} SIZE_{it} + \gamma_{14} TRDCYCLE_{it} + \gamma_{15} STDEBT_{it} + \boldsymbol{\gamma_I' INDUSTRY}_{it} + \boldsymbol{\gamma_Y' YEAR}_{it} + \varepsilon_{it}$ (4)

$DERIV = \alpha_0 + \alpha_1 |DAC|_{it} + \alpha_2 LEVERAGE_{it} + \alpha_3 DISTRESS_{it} + \alpha_4 RD_{it} + \alpha_5 (RD \times LEVERAGE)_{it} + \alpha_6 CONVEXITY_{it} + \alpha_7 ANALYST_{it} + \alpha_8 SHARES_{it} + \alpha_9 BONUS_{it} + \alpha_{10} OPTIONS_{it} + \alpha_{11} FRGSALES_{it} + \alpha_{12} DIVERS_{it} + \alpha_{13} YIELD_{it} + \alpha_{14} SIZE_{it} + \alpha_{15} TRDCYCLE_{it} + \alpha_{16} STDEBT_{it} + \alpha_{17} MILLS_{it} + \boldsymbol{\alpha_I' INDUSTRY}_{it} + \boldsymbol{\alpha_Y' YEAR}_{it} + \zeta_{it}$ (2)

$|DAC| = \beta_0 + \beta_1 DERIV_{it} + \beta_2 LEVERAGE_{it} + \beta_3 DISTRESS_{it} + \beta_4 RD_{it} + \beta_5 (RD \times LEVERAGE)_{it} + \beta_6 CONVEXITY_{it} + \beta_7 ANALYST_{it} + \beta_8 SHARES_{it} + \beta_9 BONUS_{it} + \beta_{10} OPTIONS_{it} + \beta_{11} FRGSALES_{it} + \beta_{12} DIVERS_{it} + \beta_{13} PRIORDAC_{it} + \beta_{14} INDFLEX_{it} + \beta_{15} OCF_{it} + \beta_{16} LIFORES_{it} + \beta_{17} PAYOUT_{it} + \beta_{18} MILLS_{it} + \boldsymbol{\beta_I' INDUSTRY}_{it} + \boldsymbol{\beta_Y' YEAR}_{it} + \chi_{it}$ (3)

		Left-Hand-Side Variable								
		USER[a]			*DERIV*[b]			*|DAC|*[b]		
Right-Hand-Side Variable	*Expected Sign*	*Marginal Probability*	*z-stat.*		*Standardized Coefficient*	*t-stat.*		*Standardized Coefficient*	*t-stat.*	
Endogenous Variable										
|DAC|	–				-0.347	-9.634	***			
DERIV	–							-0.345	-8.487	***
Financial Distress and Debt-Related Costs										
LEVERAGE	+	-0.068	-0.870		0.076	2.056	**	0.089	1.208	
DISTRESS	+	0.308	2.370	***	-0.046	-0.867		0.098	1.460	*
Investment Opportunities										
RD	+	0.327	0.210		-0.085	-1.252		0.148	1.568	*
RD × LEVERAGE	+	15.141	3.680	***	0.097	1.446	*	0.048	0.599	
Taxes										
CONVEXITY	+	-0.383	-1.820		0.044	0.837		0.098	2.247	**
Information Asymmetry										
ANALYST	+	0.043	2.180	**	0.080	1.823	**	0.061	1.077	
Managerial Risk Aversion										
SHARES	+	0.003	0.310		0.104	2.302	**	0.047	0.756	
BONUS	+	-0.121	-2.470		-0.027	-0.445		0.247	4.422	***
OPTIONS	?	-0.008	-0.330		0.113	2.812	***	0.017	0.573	

TABLE 5 (Cont'd)

		Left-Hand-Side Variable								
		USER[a]			*DERIV*[b]			*|DAC|*[b]		
Right-Hand-Side Variable	*Expected Sign*	*Marginal Probability*	*z-stat.*		*Standardized Coefficient*	*t-stat.*		*Standardized Coefficient*	*t-stat.*	
Other Factors										
FRGSALES	+	0.436	5.240	***	0.142	3.982	***	0.027	0.521	
DIVERS	–	0.028	1.010		0.029	0.931		-0.067	-1.787	**
YIELD	+	-0.139	-0.200		0.051	2.111	**			
SIZE	+	0.080	3.500	***	-0.072	-0.687				
TRDCYCLE	+	0.001	0.460		0.057	2.222	**			
STDEBT	+	-0.031	-0.550		0.068	1.334	*			
PRIORDAC	+							0.265	5.378	***
INDFLEX	+							0.206	3.683	***
OCF	+							0.153	2.117	**
LIFORES	+							0.036	0.922	
PAYOUT	–							-0.122	-3.860	***
MILLS	?				-0.103	-1.641	**	-0.069	-0.733	
INDUSTRY indicators		yes			yes			yes		
YEAR indicators		yes			yes			yes		
Number of Firm-Years		912			654			654		
Pseudo/Adjusted R^2		32.5%			20.8%			27.0%		
Percent Correctly Classified		80.7%								
Hausman t-statistic					-1.917 *			-2.876 ***		

*, **, *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively, based on one-tailed tests for signed predictions, two-tailed tests otherwise. Tests are based on robust (i.e., heteroscedasticity-consistent) standard errors.

[a] Regression is estimated on entire sample of firm-years using probit maximum likelihood procedures. Marginal probabilities are calculated by multiplying each probit coefficient by $\phi(\mathbf{xg})$, where ϕ is the normal density, **x** is a vector containing the means of the right-hand-side variables, and **g** is a vector containing the estimated probit coefficients.

[b] Regression is estimated on sample of derivatives users only using 2SLS procedures. Standardized coefficients are calculated by multiplying the regression coefficient by the ratio of the standard deviation of the associated right-hand-side variable to the standard deviation of the left-hand-side variable.

TABLE 5 (Cont'd)

Variables are defined as follows:

ANALYST	=	natural logarithm of number of analysts following the firm's equity and fixed income securities during the year.
BONUS	=	salary and bonus compensation of CEO, scaled by lagged total assets.
CONVEXITY	=	excess of marginal tax rate (calculated as in Graham 1996) over average tax rate (i.e., tax expense divided by pretax earnings).
|DAC|	=	absolute value of discretionary accruals, i.e., regression residuals from equation (1).
DERIV	=	notional amount of foreign currency and interest rate derivative instruments, scaled by lagged total assets.
DISTRESS	=	probability of bankruptcy obtained from Ohlson's (1980) model 1.
DIVERS	=	entropy index calculated following Palepu (1985).
FRGSALES	=	percentage of foreign sales to total sales.
INDFLEX	=	Root mean squared error of cross-sectional accrual expectations regression used to estimate the firm-year's |DAC|.
INDUSTRY	=	vector of indicator variables for each industry group identified in panel A of table 1, except for the consumer goods and energy groups which serve as benchmarks.
LEVERAGE	=	total debt divided by total assets.
LIFORES	=	beginning balance LIFO reserve, scaled by lagged total assets.
MILLS	=	inverse Mills ratio obtained from model (4).
OCF	=	operating cash flows, scaled by lagged total assets.
OPTIONS	=	number of options outstanding held by CEO, scaled by lagged total assets.
PAYOUT	=	Cash dividends divided by premanaged earnings, defined as net income minus discretionary accruals.
PRIORDAC	=	lagged value of |DAC|.
RD	=	research and development expense, scaled by sales.
SHARES	=	fair value of shares owned by CEO, scaled by lagged total assets.
SIZE	=	natural logarithm of the sum of total liabilities, preferred stock, and market capitalization of common stock.
STDEBT	=	short-term debt divided by total debt.
TRDCYCLE	=	trade or cash cycle, calculated as days receivables outstanding plus days inventory in stock minus days payables outstanding.
USER	=	indicator variable coded 1 if the firm uses financial derivative instruments, 0 otherwise.
YEAR	=	vector of indicator variables for years 1995 and 1996.
YIELD	=	cash dividends divided by market capitalization of common stock.

TABLE 6
Summary Statistics for |DAC| Regression Assuming Derivatives Use and Accrual Management Are Sequential Decisions

Model 1:[a] $|DAC| = \omega_0 + \omega_1 DERIV_{it-1} + \omega_2 LEVERAGE_{it} + \omega_3 DISTRESS_{it} + \omega_4 RD_{it} + \omega_5 (RD \times LEVERAGE)_{it} + \omega_6 CONVEXITY_{it} + \omega_7 ANALYST_{it} + \omega_8 SHARES_{it} + \omega_9 BONUS_{it} + \omega_{10} OPTIONS_{it} + \omega_{11} FRGSALES_{it} + \omega_{12} DIVERS_{it} + \omega_{13} PRIORDAC_{it} + \omega_{14} INDFLEX_{it} + \omega_{15} OCF_{it} + \omega_{16} LIFORES_{it} + \omega_{17} PAYOUT_{it} + \omega_{18} MILLS_{it-1} + \omega_{19} YEAR95_{it} + \boldsymbol{\omega}_1' \boldsymbol{INDUSTRY}_{it} + \eta_{it}$

Independent Variable[b]	*Expected Sign*	*Standardized Coefficient*	*t-statistic*	
Derivatives Use				
DERIV	–	-0.070	-1.345	*
Financial Distress and Debt-Related Costs				
LEVERAGE	+	0.036	0.483	
DISTRESS	+	0.122	1.661	**
Investment Opportunities				
RD	+	-0.079	-0.757	
RD×LEVERAGE	+	0.070	0.784	
Taxes				
CONVEXITY	+	0.069	1.302	*
Information Asymmetry				
ANALYST	+	0.043	0.708	
Managerial Risk Aversion				
SHARES	+	-0.049	-0.659	
BONUS	+	0.136	2.236	**
OPTIONS	?	0.007	0.176	
Other Factors				
FRGSALES	+	-0.025	-0.463	
DIVERS	–	-0.076	-1.927	**
PRIORDAC	+	0.294	5.272	***
INDFLEX	+	0.044	0.663	
OCF	+	0.289	4.043	***
LIFORES	+	0.042	0.906	
PAYOUT	–	-0.075	-2.026	**
MILLS	?	0.039	0.525	
INDUSTRY indicators		yes		
YEAR95 indicator		yes		
Number of Firm-Years		436		
Adjusted R^2		27.5%		

*, **, *** denote significance at the 0.10, 0.05, and 0.01 levels, respectively, based on one-sided tests for signed predictions, two-tailed tests otherwise. Tests are based on robust (i.e., heteroscedasticity-consistent) standard errors.

[a] Regressions are estimated on 1995-1996 data for the sample of derivatives users only using ordinary least squares. Standardized coefficients are calculated by multiplying the regression coefficient by the ratio of the standard deviation of the associated independent variable to the standard deviation of the dependent variable.

[b] YEAR95 is an indicator variable coded 1 for year 1995 observations, 0 otherwise. All other variables are defined as in table 5.

TABLE 7
Summary Statistics of Differences in Earnings Management Variables by Derivatives Use and Magnitude of Discretionary Accruals

		Users – Nonusers of Derivatives				*Aggressive – Modest Manipulators*[a]			
Variable	*Median for All Firms*	*Difference in Medians*	*Expected Sign*	*T-statistic*		*Difference in Medians*	*Expected Sign*	*T-statistic*	
Smoothing ratio	1.389	-0.046	–	-1.735	**	0.282	+	1.874	**
M score	-3.005	-0.086	–	-2.883	***	0.032	+	0.915	
M probability	0.001	-0.001	–	-2.883	***	0.006	+	1.946	**

** and *** denote significance at the 0.05 and 0.01 levels, respectively, based on one-tailed Mann-Whitney-Wilcoxon rank-sum tests.

[a] Firm-years with |DAC| > (|DAC ≤) contemporaneous industry median |DAC| are classified as aggressive (modest) manipulators.

Variables are defined as follows:

Smoothing ratio = coefficient of variation of premanaged earnings divided by coefficient of variation of reported earnings. The coefficient of variation is measured as the standard deviation of the variable divided by the absolute value of its mean throughout the sample period. Premanaged earnings is net income minus discretionary accruals.

M score = score calculated using the weighted exogenous sample maximum likelihood results reported in Beneish (1999). Using the unweighted probit results yields essentially similar scores.

M probability = normal cumulative probability evaluated at the respective M score.