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BOARD COMPOSITION AND CORPORATE USE OF INTEREST RATE DERIVATIVES

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Abstract

We provide new evidence on the motives for corporate hedging by examining the relation between the quality of the firms' monitoring mechanisms and the quantity of interest rate derivatives employed. Because the capital structure decision and hedging decision are considered to be endogenous, the firm's capital structure and level of interest rate derivative use are modeled simultaneously. We show a positive relation between the relative influence of outside directors and the quantity of derivatives used. This evidence indicates that outside directors take an active role in derivatives usage and that firms employ hedging in the shareholders' best interests.

JEL Classifications: G3, G32, G39

I. Introduction

The losses incurred through the use of derivative securities by Procter and Gamble, Gibson Greetings, and other firms in the early part of the last decade brought calls for greater oversight of derivative use from several quarters. One such call, the 1993 Group of Thirty report, focused on the board of directors as a primary source for this oversight. In fact, the Group of Thirty report lists this as their first

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recommendation: the role of senior management. This recommendation stipulates that end-users of derivatives should use them in a manner consistent with the overall risk-management and capital policies approved by their boards of directors. It also stipulates that senior management should use approved procedures and controls to implement these policies, and management at all levels should enforce them.

Breeden (*Wall Street Journal,* March 7, 1994, p. A18) echoes this call for more responsible oversight of corporate derivatives policy. This call implies that management does not always employ derivatives in a manner that is in the best interests of shareholders. Articles in *Treasury and Risk Management* magazine present anecdotal evidence that many boards of directors responded to the call by creating oversight committees and comprehensive risk-management policies for their firms. This activity suggests that a firm's risk-management policies, specifically pertaining to the use of derivatives, should be strongly influenced by the policies of its board of directors. Furthermore, with the recent collapse of Enron, the importance of the board of directors in the proper monitoring of the firm is undeniable.

The policies of the board of directors vary based on the personal incentives of the directors. However, directors are not homogeneous; therefore, their incentives are expected to vary individually. In fact, director incentives are documented (e.g., Weisbach 1988; Byrd and Hickman 1992) to vary according to the director's affiliation with the firm. Directors who are also managers of the firm (inside directors) have incentives to make corporate decisions that maximize their own utility within the firm, whereas directors having no affiliation with the firm (outside directors) have incentives to make decisions that signal their abilities as efficient decision makers. Outside directors signal their abilities through the effective monitoring of management.

We examine the relation between the composition of a firm's board of directors and the firm's use of interest rate derivatives. If firms with outsider-dominated boards make greater use of interest rate derivative instruments, the evidence would be consistent with outside directors' taking an active role in the derivative decision. This outsider influence is expected to benefit shareholders. On the other hand, if boards dominated by insiders make greater use of interest rate derivatives, the evidence would be consistent with a derivative policy that benefits management.

Our study is the first to report evidence on the board of directors' influence on interest rate derivatives use by nonfinancial firms. Although Whidbee and Wohar (1999) examine this issue in the banking industry, their results are not easily generalized outside that industry because of the confounding presence of deposit insurance. Also, banks frequently use derivatives for more than simply hedging risk, further complicating the interpretation of the evidence from Whidbee and Wohar's study.

We employ several controls to minimize confounding effects. First, interest rate derivatives alone are examined because the factors influencing the use of other types of derivatives vary. Second, we control for firm size, performance, ownership,

executive option holdings, capital structure, and growth options. Although the decisions determining capital structure, risk-management position, ownership, and executive option holdings can all be assumed to be endogenous, a firm's capital structure and risk-management decisions are made jointly. Therefore, we assume the other policies are predetermined and model the debt and hedging decisions simultaneously.

We show a significant and positive relation between the quantity of interest rate derivatives used by firms and the proportion of outside directors on the firm's board. This evidence is consistent with boards of directors' taking an active role in monitoring derivative use as a component of risk-management policy. Additionally, the results suggest that, in aggregate, the use of interest rate derivatives in firms with boards dominated by outsiders is likely to be aligned with shareholders' interests.

II. Hypotheses

Researchers such as Smith and Stulz (1985) and Froot, Scharfstein, and Stein (1993) offer numerous theories to explain the incentives to manage risk within the firm, some of which suggest benefits to shareholders and others that suggest benefits to managers. The empirical evidence is mixed. Some evidence suggests shareholders benefit from derivative use and some suggests management benefits from its use. Because these theories are not mutually exclusive, this evidence potentially indicates that the beneficiaries differ depending on the circumstances.

Board of Directors

Fama and Jensen (1983) argue that outside directors have greater incentives to make decisions that benefit shareholders than do inside directors. The decisions made by outside directors are a signal to the labor market of their abilities as decision-control agents. Because most outside directors are major decision makers with other organizations, concern for their reputations in the labor market provides them with incentives to act in the interests of shareholders. Several studies, including Weisbach (1988), Byrd and Hickman (1992), and Borokhovich, Parrino, and Trapani (1996), report a more favorable reaction by the equity markets to decisions made by boards with higher proportions of outside directors. Weisbach finds that disciplinary turnovers of CEOs are more frequent in firms with higher proportions of outside directors. Byrd and Hickman find that the equity markets' reaction to takeover bids is positively related to the proportion of outsiders on the board. Finally, Borokhovich, Parrino, and Trapani show that equity markets react positively to the naming of an outsider as CEO, and that the probability of an outsider being named increases with the proportion of outside directors on the board.

The evidence from these studies suggests there are at least two circumstances under which the composition of the board of directors potentially affects

the use of derivatives. First, in the event of a conflict between shareholder and management interests, the use of derivatives favors the interests of the group controlling the board. Second, the outside directors, as decision experts, may provide expertise in the use of derivatives that management lacks; this case requires on conflict of interest. The assumption is that management, although skilled in operating a firm in a particular industry, lacks the broader knowledge supplied by the outside directors. It is then reasonable to assume that the board of directors plays a significant role in the use of derivatives by a firm.

Shareholder Wealth Maximization Hypotheses

We address two hypotheses, concerning the costs of financial distress and the underinvestment problem, that have been proposed to explain how risk management maximizes shareholder wealth. A third hypothesis, concerning tax implications, is not examined. Tufano (1996), Géczy, Minton, and Schrand (1997), and Graham and Smith (1999), among others, examine the tax implications of derivative use but, at best, find only weak supporting evidence.

The first hypothesis is that derivatives reduce the costs of financial distress. A firm's probability of financial distress depends on the variability of cash flows and the extent of fixed claims against the firm, including interest payments associated with debt. Shapiro and Titman (1998) state that costs associated with financial distress include, for example, the loss or deterioration of the relations with customers and suppliers. Smith and Stulz (1985) propose that interest rate risk management reduces the probability of financial distress. Stulz (1996) describes the role of hedging in preventing financial distress, and Stulz (1996) and Leland (1998) suggest that hedging increases debt capacity. In other words, hedging reduces the volatility of income, thereby reducing the probability of financial distress. As a result, hedging potentially allows the firm to take on additional debt and increase the present value of the firm's tax shields, thus increasing firm value. The empirical evidence with respect to this hypothesis is mixed. Haushalter (2000), Graham and Rogers (2002), and Gay and Nam (1999) find that higher debt ratios are associated with greater hedging. In aggregate, these studies include a broad class of derivatives including interest rate and currency contracts, with the exception of Haushalter (2000), who studies the hedging of oil and gas prices. Tufano (1996) and Géczy, Minton, and Schrand (1997) fail to find any relation between hedging and a firm's leverage. However, Tufano investigates the use of commodity derivatives to hedge gold prices in the gold mining industry, whereas Géczy, Minton, and Schrand investigate motives for the use of currency derivatives.

A more direct test of the hypothesis that firms use derivatives to increase debt capacity while reducing financial distress is to study the relation between debt capacity and interest rate risk-management tools. Visvanathan (1998), Saunders (1999), and Simkins (2002) examine the use of interest rate derivatives by

nonfinancial firms and find evidence supporting financial distress motives for hedging. For example, Visvanathan examines the use of interest rate swaps and finds that firms with higher leverage are more likely to enter into interest rate swaps. Simkins finds that firms using interest rate swaps to create synthetic fixed-rate financing are more likely to undergo credit quality upgrades. The evidence in these studies is consistent with the use of risk management to reduce the probability of financial distress.

Derivatives are also hypothesized to reduce the underinvestment problem. Shapiro and Titman (1998), Bessembinder (1991), Stulz (1990), and Froot, Scharfstein, and Stein (1993) propose that a failure to manage risk can lead to a suboptimal investment policy for firms that depend on internal funding. The dependence is caused by information asymmetries that make external funding more costly. When cash flows are low, such firms have few internal funds to invest; therefore, they may not fund value-maximizing projects. Risk management reduces both the need for and the cost of external funds. The underinvestment problem is most critical for firms with valuable investment opportunities (growth options). Research and development (R&D) expense is a common proxy for a firm's growth options. Nance, Smith, and Smithson (1993), and Géczy, Minton, and Schrand (1997), among others, find that hedging increases with the level of R&D expenditures. Géczy, Minton, and Schrand find that firms with higher quick ratios make less use of currency derivatives. Because the quick ratio is a proxy for the availability of internal funds, this evidence is interpreted as being consistent with derivative use as a means to reduce the underinvestment problem. However, this interpretation should be tempered with the realization that some firms have higher demands for liquidity, which may result in both higher quick ratios and more extensive hedging. Therefore, the correlation across firms between quick ratios and hedging may not be exclusively the result of the underinvestment problem.

Managerial Incentives Hypothesis

The preceding hypotheses indicate that shareholder wealth maximization is an incentive for risk management. Smith and Stulz (1985) provide an alternative hypothesis based on managerial incentives. They propose that risk-averse managers want the firm to manage risk to maximize their personal utility. The greater the managers' human capital investment or equity investment in the firm, the greater is their incentive to reduce risk. However, if managers have large option components in their compensation structure, the convex payoff structure provides an incentive to minimize risk management. Consistent with this hypothesis, Tufano (1996) finds that managers holding higher percentages of a firm's equity are more likely to use derivative securities to manage the risk of changes in gold prices, whereas managers with more stock options tend to use fewer derivatives. However, Géczy, Minton, and Schrand (1997) and Haushalter (2000), employing similar variables, find no

relation when examining currency derivatives usage in nonfinancial Fortune 500 firms, and oil and gas producers, respectively.

III. Data

The initial sample consists of the 370 nonfinancial firms in the S&P 500 in 1995. The focus is on nonfinancial firms because financial firms use derivatives both to trade and to hedge. We collect data on derivatives from the *Corporate Risk Management Handbook* (1996), which reports details on the notional principal amounts for each type of derivative at fiscal year-end 1994. In accordance with Statement of Financial Accounting Standards (SFAS) No. 119, firms report detailed information on the types and purpose of derivative holdings, as well as whether the contracts are for hedging or trading purposes. Six nonfinancial firms disclose that derivatives are held for trading purposes (speculative strategies) and are excluded from this analysis. We refer to all interest rate swaps, options, swaptions, and forward contracts in aggregate as interest rate derivatives.

To be included in the final sample, we require that a firm be listed on Compustat and have proxy statements for 1994. We obtain proxy statements from either the Security and Exchange Commission's (SEC) EDGAR or Q-file proxy database. Compustat provides data on firm size, performance, investment, and growth opportunities. Proxy statements provide data on equity ownership structure and board composition. We use the S&P ExecuComp database and proxy statements to obtain managerial compensation data. The final sample consists of 284 firms.

Sample Firm Use of Interest Rate Derivatives

Table 1 presents the sample firms' reported use of interest rate derivatives both overall and by industry. As shown in Panel A, 72.7% of the 284 firms use interest rate, currency, commodity, or equity derivatives, or some combination of the four. Only 49.3% of all sample firms use interest rate derivatives. Consistent with other studies, such as Mian (1996) and Géczy, Minton, and Schrand (1997), the percentage of firms using derivative contracts increases with firm size. However, even some of the largest firms report no derivative usage.

Panel B of Table 1 shows the extent of derivatives use by industry. The percentage of firms employing derivatives varies across industries, suggesting industry characteristics play a role in determining derivatives usage. However, derivatives are not employed in 100% of the firms in any of the industries. Because all firms have some manageable risk, this evidence suggests that the decision to use derivatives is not automatic.

We report the distribution of the notional principal of interest rate derivatives by instrument type for sample firms in Table 2. Unlike earlier studies that

TABLE 1. Frequency of Use of Derivative Instruments by Size and Industry.

Panel A. By Firm Size (by 1994 Sales)

All Firms	*N*	Interest Rate Derivatives Users (%)	Any Derivatives Usage (%)
All firms	284	49.3%	72.7%
4th quartile	71	67.1	85.1
3rd quartile	71	63.4	84.3
2nd quartile	71	35.2	60.9
1st quartile	71	31.4	60.9

Panel B. By Standard Industrial Classification (SIC) Code

Industry	SIC Code	*N*	Interest Rate Derivatives Users (%)	Any Derivatives Usage (%)
Food and tobacco	0100 & 2000-2199	19	55.6	94.4
Mining	1000-1499	9	44.4	77.8
Construction	1500-1999	4	50.0	75.0
Manufacturing	2200-3999	194	51.8	78.8
Communication	4800-4899	5	60.0	60.0
Wholesale	5000-5199	7	42.9	42.9
Retail	5200-5999	31	35.5	43.3
Service	7000-9999	15	40.0	42.9
Total		284	49.3%	72.7%

Note: This table reports the frequency of use of derivative instruments by 284 nonfinancial firms in the S&P 500 for fiscal year-end 1994. Frequencies are expressed as a percentage of firms in each quartile or industry. Usage is expressed as a percentage of total sample firms. Interest rate derivatives users include firms that disclose the use of interest rate swaps, interest rate swaptions, interest rate options, forward rate agreements, and other interest rate derivatives instruments. Usage of any derivatives includes firms that disclose the use of interest rate, currency, commodity or equity derivatives. Panel A describes the extent of usage based on quartiles determined by firm sales. The first quartile includes the smallest firms based on 1994 total net sales and the fourth quartile includes the largest firms based on sales. Panel B describes the extent of usage by major Standard Industrial Classification (SIC) divisions.

use a binary variable to reflect derivative use, such as Nance, Smith, and Smithson (1993) and Géczy, Minton, and Schrand (1997), we use the notional principal as a proxy for the extent of hedging. This measure is analogous to the one used in Carter and Sinkey (1998), Hentschel and Kothari (2001), and Knopf, Nam, and Thornton (2002).

Note that the notional principal of the derivatives position gives only a rough indication of the extent of hedging. As Smith (1995) points out, comparing firms with different sized options contracts and different exercise prices is difficult. Similarly, two firms using swaps with identical notional principals but different maturities have different levels of hedging, yet the notional values indicate the same level. Consequently, reported notional principal amounts should be interpreted with care. However, we believe that notional principal values still serve as useful proxies for derivatives use, as suggested by recent published studies such as Wong (1997),

TABLE 2. Notional Values of Interest Rate Derivatives by Instrument Type.

Interest Rate Derivative Type	*N* (% of users)	Mean	Median	Std. Dev.	Minimum	Maximum
Total positions (scaled by total sales)	141 (100.0)	0.0991	0.0594	0.1170	0.0013	0.5556
Total positions (scaled by long-term debt)	141 (100.0)	0.1857	0.1193	0.2168	0.0024	1.6744
Total positions (scaled by total assets)	141 (100.0)	0.0924	0.0566	0.1034	0.0011	0.5668
Total positions (million $)	141 (100.0)	1178.1	269.5	5080.1	9.4	53,800.0
Interest rate swaps (million $)	125 (88.7)	1130.6	236.9	5254.3	9.4	53,800.0
Forward rate agreements (million $)	6 (4.3)	392.7	500.0	253.9	3.0	628.0
Interest rate options (million $)	26 (18.4)	763.1	141.0	2730.2	15.8	14,080.0
Interest rate swaptions (million $)	5 (3.6)	173.8	100.0	182.3	70.0	499.0
Other interest rate derivatives (million $)	3 (2.1)	474.2	200.0	636.6	20.6	1202.0

Note: This table reports the use of interest rate derivatives by type of instrument for 141 of the 284 sample firms (49.7%) that disclose the use of interest rate derivatives. Contract notional values are for positions held at fiscal year-end 1994. *N* represents the number of sample firms that use the type of interest rate derivative. Total positions are calculated as the total notional principal amounts of interest rate swaps, interest rate options and swaptions, and other interest rate derivatives.

Knopf, Nam, and Thornton (2002), Hentschel and Kothari (2001), and Graham and Rogers (2002).

The mean (median) level of the total notional principal of interest rate derivative positions scaled by total sales is 0.0991 (0.0594) with a minimum of 0.0013 and a maximum of 0.5556. The range is similar when we scale total interest rate derivative positions by total assets. The range for total positions when scaled by long-term debt is 0.0024 to 1.6744. Total dollar values of derivatives positions range from $9.4 million to $53,800 million with a mean (median) value of $1178.1 ($269.5) million. Interest rate swaps, by far the most common instrument, are used by 88.7% of the firms that use interest rate derivatives. The next most frequently used contract is interest rate options, used by only 18.4% of the firms that use interest rate derivatives. Less than 5% of the firms that use interest rate derivatives use either forward rate agreements or interest rate swaptions.

Variables

We provide the data source and definitions for all variables used in the tests in Table 3. These variables are equity ownership; executive options holdings;

TABLE 3. Description of Variables.

Independent Variable	Definition (Source)
Panel A. Equity Ownership Characteristics (Percentage of Total Voting Rights)	
Total insider ownership	Total beneficial inside ownership of the executives and board of directors (expressed as a percentage of total voting rights). (1994 proxy statement)
Outside director blockholdings	Total blockholdings of outside directors (expressed as a percentage of total voting rights). Must exceed 5% for a given individual. (1994 proxy statement)
Inside director blockholdings	Total blockholdings for all inside directors (expressed as a percentage of total voting rights). Must exceed 5% for any given individual. This includes the CEO (if a blockholder). (1994 proxy statement)
Total blockholdings	Total blockholdings. Must exceed 5% for any given individual or firm. (1994 proxy statement)
Bank blockholdings	Total blockholdings for all banks (expressed as a percentage of total voting rights). Must exceed 5% for any given bank. (1994 proxy statement)
Panel B. Executive Characteristics	
CEO ownership (%)	Total CEO ownership expressed as a percentage of total voting rights. (1994 proxy statement)
Options holdings/(total salary + bonus) for top 5 executives	Total executive options holdings (including exercisable and unexercisable options)/(total salary plus bonus). These values are calculated for the top five highest paid executives of the firm, based on salary. (1994 proxy statement and S&P ExecuComp database)
Panel C. Board of Directors Characteristics (Percentage of Total Board of Directors)	
Managers and former managers on board (inside directors)	Managers, former managers, and spouses and children of managers on the board of directors. Calculated as a percentage of total board of directors. (1994 proxy statement)
Outside directors	All directors that are not affiliated with the firm. Excludes bank executives, insurance company executives, consultants in the same line of business as the firm, and lawyers, and includes executives of other unaffiliated firms, politicians, investors, and philanthropists. Calculated as a percentage of total board of directors. (1994 proxy statement)
Grey directors	Directors that are bank executives, lawyers, consultants, and insurance company executives (based on Weisbach, 1988). Calculated as a percentage of total board of directors. (1994 proxy statement)
Bank executives	Directors that are bank executives. Calculated as a percentage of total board of directors. (1994 Proxy Statement)
Outside directors less inside directors (*DIFDIR*)	Difference in outside directors minus inside directors, calculated as a percentage of total board size. (1994 proxy statement)
Total number of directors on board	Total number of directors on the board in 1994. (1994 proxy statement)

(Continued)

board of directors' composition; capital structure; firm risk characteristics; and firm performance, growth opportunities, underinvestment, and size.

We classify directors as insiders, outsiders, or greys in a manner similar to Weisbach (1988). Inside directors are defined as managers of the firm. We define outside directors as directors who have no business ties to the firm other than the

TABLE 3. Continued.

Independent Variable	Definition (Source)
Panel D. Capital Structure and Risk Characteristics	
Industry-adjusted debt	Long-term debt/(market value of equity plus book value of debt) minus the industry median ratio value. Industry adjustments are at the two-digit Standard Industrial Classification (SIC) level and are for fiscal year-end 1994. (Compustat)
Industry-adjusted tangible assets/total assets	Tangible assets/total assets minus the industry median ratio value. Tangible assets are calculated as total assets less intangible assets. Industry adjustments are at the two-digit SIC level and are for fiscal year-end 1994. (Compustat)
Panel E. Measures of Firm Performance, Growth Opportunities, Underinvestment, and Size	
Industry-adjusted book equity/market equity	Book value of equity/market value of equity minus the industry median ratio value. Industry adjustments are at the two-digit SIC level and are for fiscal year-end 1994. Proxy for growth options. (Compustat)
R&D/total assets	Research and development expenses/total assets for fiscal year-end 1994. Proxy for growth options. (Compustat)
Quick ratio	(Current assets minus inventory)/current liabilities at fiscal year-end 1994. Proxy for underinvestment problem. (Compustat)
ln(market value of equity + book value of debt)	Natural logarithm of (market value of equity plus book value of debt at fiscal year end 1994). Proxy for firm size. (Compustat)
ln(total sales)	Natural logarithm of total sales in 1994. Proxy for firm size. (Compustat)
Panel F. Additional Variables Used in Simultaneous Equations Analysis	
Operating income/sales	Ratio of operating income before interest and taxes to total sales. Values are for fiscal year-end 1994. (Compustat)
SGA/sales	Ratio of selling, general, and administrative expenses to total sales. Values are for fiscal year-end 1994. (Compustat)

Note: This table presents the independent variables for the analysis of interest rate derivatives usage by sample firms, providing variable definitions and data source.

directorship and who are not officers of an organization that has potential business ties to the firm. Directors who are not members of management but have potential business ties to the firm are defined as greys.[1] We also include a variable defined as the difference between the proportion of outside directors and the proportion of inside directors (*DIFDIR*) as a measure of the relative influence of outside directors.

We define blockholders as owners of at least 5% of a firm's equity. When there is more than one class of stock, blockholdings are calculated as a percentage of voting rights, not a percentage of shares outstanding.

[1]The directors classified as greys include those currently employed as consultants, bank executives, and insurance company executives. These directors may have or could form business relations with the firm. Therefore, they may have incentives, as suggested by Brickley, Lease, and Smith (1988), to act with management to preserve the business ties.

Glaum (2002) finds that bank-controlled firms tend to engage in more selective hedging than do other firms. To control for the possibility that this relation extends to the use of interest rate derivatives, we include bank blockholdings in the tests. We also include total blockholdings. Although directors have a fiduciary duty to work in the best interests of shareholders, blockholders have their own personal wealth at stake. Because their incentives as directors may come into conflict with their incentives as shareholders, the director blockholdings are also included.

As shown in Table 1, there are differences in the use of interest rate derivatives across industries. Therefore, we adjust the variables measuring leverage, book-equity-to-market-equity ratio, and tangible-assets-to-total-assets ratio by subtracting the median industry values, calculated at the two-digit Standard Industrial Classification (SIC) level, from each firm's ratio. We measure leverage as the industry-adjusted long-term debt ratio (long-term debt/market value of equity). Other studies such as Nance, Smith, and Smithson (1993) and Géczy, Minton, and Schrand (1997) employ these variables.

Similar to Géczy, Minton, and Schrand (1997), we use the quick ratio as a proxy for the underinvestment problem. The book-to-market value of equity measures the growth opportunities for the firm. Because arguments can be made that either variance from the industry norm or unadjusted values are the better measure, we employ both industry-adjusted and unadjusted measures of book-to-market equity.

In Table 4 we report descriptive statistics for independent variables used in the simultaneous regressions. As shown, board composition varies substantially. *DIFDIR,* which is the percentage of outside directors less the percentage of inside directors on the board, ranges from 0% to 83.3% outside directors and has a mean value of 31.92%. Board size ranges from 4 directors to 20 directors with a mean value of 11.2. See Table 4 for other descriptive statistics on the independent variables.

IV. Empirical Evidence

Models of the Simultaneous Debt-Derivatives Decision

As explained by Géczy, Minton, and Schrand (1997), the decision to use derivatives may be endogenous to the capital structure decision. Furthermore, Bhagat and Jefferis (2002) argue that corporate governance hypotheses must be tested within a simultaneous equations framework. Therefore, it is necessary to model the capital structure decision and derivative decision simultaneously. Following the procedure proposed by Maddala (1983) and employed by Titman and Wessels (1988), and following Géczy, Minton, and Schrand in the selection of

TABLE 4. Descriptive Statistics for Sample Firms.

Variable	Mean	Median	Standard Deviation	Minimum	Maximum	*N*
Total inside ownership (%)	7.250	2.230	12.800	0.000	72.90	240
Option holdings/(total salary + bonus) for top 5 executives (%)	37.80	27.38	50.09	0.000	583.76	240
ln(options holdings for top 5 executives)	−10.800	−4.660	99.430	−354.040	237.81	240
Total blockholdings (%)	12.780	8.760	12.980	0.0000	65.250	240
Bank blockholdings (%)	1.200	0.0000	3.640	0.0000	21.450	240
Book equity/market equity	0.5463	0.3431	1.2105	−1.1353	12.3969	240
Outside directors less inside directors (%) (*DIFDIR*)	31.920	36.360	30.550	−100.000	83.333	240
Total number of directors on board	11.2167	11.0000	2.5944	4.0000	20.0000	240
Bank executive director dummy (1 if at least one, 0 otherwise)	0.3583	0.0000	0.4805	0.0000	1.0000	240
Quick ratio	1.1792	0.9900	0.9313	0.0800	10.2000	240
ln(market value of equity)	8.4741	8.4326	1.0381	5.5461	11.5439	240
Operating income/sales	0.1524	0.1310	0.0909	−0.0089	0.5467	240
Industry-adjusted book equity/market equity	−0.8028	−0.0860	0.2513	−1.5112	1.1111	240
R&D/total assets	0.0394	0.0241	0.0418	0.0000	0.2056	183
Industry-adjusted tangible assets/total assets	−0.0651	−0.0201	0.0985	−0.3914	0.1792	240
SGA/sales	0.2247	0.1951	0.1271	0.0056	0.6247	240
ln(total sales)	8.1520	8.1572	1.0587	5.3929	11.1148	240

Note: This table reports descriptive statistics for independent variables used in the simultaneous equations analysis. The sample consists of the 240 nonfinancial firms used in the study. Table 3 provides a description of the variables used in the study. The holdings of directors, insiders, CEOs, and blockholders are computed based on the percentage of the voting stock held by these parties. The CEO is defined as the top paid executive with the firm holding the title of either CEO, president, or chairman of the board.

variables, the structural equations are as follows. First, the capital structure decision is:

$$DEBT = \delta_0 + \delta_1(IRDERIV^*) + \delta_2(OI/\text{sales}) + \delta_3(IABK/MK) + \delta_4(RD/TA) + \delta_5(IATANGS) + \delta_6(SGA/\text{sales}) + \delta_7 \ln(\text{sales}) + \varepsilon. \quad (1)$$

The interest rate derivatives usage decision is:

$$\begin{aligned} IRDERIV = {} & \lambda_0 + \lambda_1(DEBT^*) + \lambda_2(\text{total insider ownership}) \\ & + \lambda_3(\text{options holdings}) + \lambda_4(\text{total blockholdings}) \\ & + \lambda_5(\text{bank blockholdings}) + \lambda_6(DIFDIR) \\ & + \lambda_7(\text{total no. of directors on board}) + \lambda_8 \ln(\text{mv equity}) \\ & + \lambda_9(\text{banker}) + \lambda_{10}(\text{quick ratio}) + \lambda_{11}(\text{BK/MK equity}) + \omega. \end{aligned} \quad (2)$$

In equation (1), *IRDERIV** is the predicted level of interest rate derivatives use divided by total sales obtained from the first-stage estimation of the interest rate derivatives usage decision equation. *OI*/sales is the ratio of operating income to total sales, as a leverage-free measure of the firm's profitability. *IABK/MK* is the industry-adjusted ratio of the book value of equity to the market value of equity, and it proxies for the firm's investment opportunity set as does *RD/TA,* the ratio of R&D expenses to total sales. *IATANGS* is the industry-adjusted ratio of tangible assets (total assets less intangible assets) as a proportion of total assets. *SGA*/sales is the ratio of selling, general, and administrative expenses to sales, a measure of the firm's fixed operating costs. Ln(sales) is the natural logarithm of total sales.

In equation (2), *DEBT** is the predicted value of the industry-adjusted long-term debt ratio obtained from the first-stage estimation of the capital structure decision equation. For robustness, the options holdings variable takes two forms: percentage of options held as described in Table 3 or the natural logarithm of the number of options held by the top five executives. Banker is a dummy variable that equals 1 if at least one director is currently employed as a bank executive, and 0 otherwise. This variable is a proxy for the firm's potential to obtain external financing sources in times of financial distress. As suggested by articles in *Treasury and Risk Management* magazine, bankers provide expertise in the use of derivatives that might otherwise be lacking. *BK/MK* equity is the book value of equity divided by the market value of equity without the industry adjustment found in the first equation. This variation prevents potential multicolinearity problems with the *DEBT* variable estimated in equation (1). *DIFDIR,* as discussed earlier, is the percentage of outside directors less the percentage of inside directors on the board. Other equation (2) independent variables are as described in Table 3.

We present estimation results in Table 5. There are four columns, each with two regressions. The first regression is a Tobit estimating the parameters of the variables for the interest rate derivatives decision. The second regression is an ordinary least squares (OLS) estimation of the variables for the capital structure decision. As in Géczy, Minton, and Schrand (1997), we perform two sets of tests. The first includes the entire sample (columns 1 and 2). The second includes observations only for firms reporting zero or positive R&D expenses (columns 3 and 4). As in Géczy, Minton, and Schrand (1997), R&D is a proxy for growth opportunities. Although some firms voluntarily report zero R&D expenses, they are not required to do so. Only firms with material costs are required to report these data.

The interest rate derivative variable is significant at the 1% level in all of the capital structure decision regressions, and the leverage variable is also significant at the 1% level in all of the interest rate derivative usage regressions. It appears that managers make the capital structure decision and the interest rate derivative decision simultaneously. The positive relation between these variables is consistent

TABLE 5. Simultaneous Equations Analysis of Capital Structure Decisions and Interest Rate Hedging Decisions.

	Dependent Variable							
	Column 1		Column 2		Column 3		Column 4	
	IRDERIV/ Total Sales	*DEBT* (Industry Adjusted)	*IRDERIV*/ Total Sales	*DEBT* (Industry Adjusted)	*IRDERIV*/ Total Sales	*DEBT* (Industry Adjusted)	*IRDERIV*/ Total Sales	*DEBT* (Industry Adjusted)
Variable	Tobit (*p*-value)	OLS (*p*-value)	Tobit (*p*-value)	OLS (*p*-value)	Tobit (*p*-value)	OLS (*p*-value)	Tobit (*p*-value)	OLS (*p*-value)
Intercept	−0.3493		−0.3332		−0.2950		−0.3039	
	(.0005)		(.0004)		(.0026)		(.0011)	
Total insider ownership (%)	−0.0025		0.0073		−0.0763		−0.0902	
	(.9712)		(.9133)		(.4290)		(.3435)	
Option holdings/(total salary + bonus) for top 5 executives (%)			0.0124				−0.0051	
			(.4284)				(.8192)	
ln(options holdings for top 5 executives)	−0.0061				−0.0040			
	(.5139)				(.6606)			
Total blockholdings (%)	−0.0044		0.0157		−0.0273		−0.0029	
	(.9521)		(.8360)		(.7091)		(.9692)	
Bank blockholdings (%)			−0.2473				−0.2616	
			(.3608)				(.3119)	
Expected [long-term debt/(market equity + bank debt)] (*DEBT**)	0.2885		0.2790		0.2966		0.2953	
	(.0000)		(.0000)		(.0000)		(.0000)	
Book equity/market equity	−0.0193		−0.0183		−0.0102		−0.0091	
	(.0698)		(.1006)		(.2008)		(.2787)	
Outside directors less inside directors (%) (*DIFDIR*)	0.0465		0.0492		0.0698		0.0659	
	(.1115)		(.0950)		(.0127)		(.0172)	
Total number of directors on board	−0.0013		−0.0009		0.0023		0.0026	
	(.7441)		(.8176)		(0.5312)		(.4678)	
Bank executive director dummy (1 if at least one, 0 otherwise)	−0.0018		−0.0010		0.0129			
	(.9211)		(.9568)		(.4669)			
Quick ratio	−0.0171		−0.0189		−0.0180		−0.0118	
	(.3032)		(.2540)		(.2924)		(.4827)	

(Continued)

TABLE 5. Continued.

	Dependent Variable							
	Column 1		Column 2		Column 3		Column 4	
	IRDERIV/ Total Sales	*DEBT* (Industry Adjusted)	*IRDERIV*/ Total Sales	*DEBT* (Industry Adjusted)	*IRDERIV*/ Total Sales	*DEBT* (Industry Adjusted)	*IRDERIV*/ Total Sales	*DEBT* (Industry Adjusted)
Variable	Tobit (*p*-value)	OLS (*p*-value)	Tobit (*p*-value)	OLS (*p*-value)	Tobit (*p*-value)	OLS (*p*-value)	Tobit (*p*-value)	OLS (*p*-value)
ln(market value of equity)	0.0394 (.0004)		0.0367 (.0004)		0.0288 (.0076)		0.0296 (.0028)	
Intercept		0.4939 (.1590)		0.4068 (.1989)		0.5812 (.0530)		0.5133 (.0866)
Predicted interest rate derivatives/sales (*IRDERIV**)		6.2503 (.0031)		5.1149 (.0013)		8.5212 (.0000)		6.7422 (.0004)
Operating income/sales		−1.0311 (.0342)		−1.0681 (.0286)		−0.9588 (.0088)		−1.0112 (.0060)
Industry-adjusted book equity/market equity		0.7763 (.0219)		0.7471 (.0259)		0.8937 (.0002)		0.8644 (.0004)
R&D/total assets						0.8184 (.2572)		0.7543 (.2906)
Industry-adjusted tangible assets/total assets		−0.3044 (.3413)		−0.3682 (.2314)		−0.2262 (.4618)		−0.2783 (.3708)
SGA/sales		−0.4505 (.0757)		−0.4038 (.1103)		−0.3784 (.1191)		−0.3065 (.2105)
ln(total sales)		−0.0505 (.3032)		−0.0343 (.3963)		−0.0807 (.0242)		−0.0634 (.0689)
Log likelihood	37.70		38.21		50.22		50.12	
Number of observations		240		240		183		183
Adjusted R^2		0.167		0.172		0.252		0.249

Note: This table reports results of two-stage regression models linking the extent of derivatives hedging with the capital structure decision. The first regression in each column is a Tobit estimation of interest rate derivatives (*IRDERIV)* notional principal scaled by total sales on predicted values of the long-term debt-to-market value equity ratio and other variables explaining interest rate hedging levels. The second regression in each column is an ordinary least squares (OLS) estimation of the debt-to-asset ratios on predicted values of *IRDERIV* notional principal scaled by total sales and other variables proposed to explain debt levels. The *p*-values (in parentheses) for the OLS regression coefficient estimates are computed with heteroskedastic-consistent standard errors.

with firms' choosing interest rate derivatives to balance their debt position, and choosing higher debt when they access derivatives markets.

The coefficient for the variable measuring the difference in proportions of outside and inside board members indicates that interest rate derivative use increases as outside directors gain influence. Although this result is only marginally significant (10% level) for the overall sample, it is significant (5% level) in the tests controlling for R&D expenses. However, the relation for the overall sample is not significantly different from the relation for the R&D reporting firms. In tests not reported here for the sake of brevity, we include an interactive dummy variable in the regressions in columns 1 through 4 of Table 5. We define the R&D dummy variable as equal to 1 if the firm reported nonzero R&D expenditures, and 0 otherwise. We also include an interaction term defined as the product of the R&D dummy variable and the variable measuring the difference between outside and inside directors. The coefficient of the interaction term is not significantly different from zero. There is no evidence that the relation between board composition and the use of derivatives to hedge interest rate risk is confined to firms with growth options as proxied by R&D expenses. These results suggest that the boards of directors are actively involved in firms' decisions to use interest rate derivatives. Additionally, if outside directors monitor effectively, this result is consistent with corporate derivative use in the interests of the shareholders.

The other results fail to provide evidence that firms use derivatives to benefit managers at shareholder expense. The size of the board is not significantly related to the quantity of corporate derivatives used. The evidence reported in Table 5 is also inconsistent with the use of interest rate derivatives to reduce manager's risk. Neither management's option positions nor its equity holdings are significantly related to the derivative usage of the firm. The composition of the board of directors is the only significant corporate control measure in these tests of the determination of derivative use in hedging interest rate risk.[2]

[2]Although firms simultaneously decide on capital structure and derivative use, the methods we use in this section do not differentiate between the two-step nature of the derivative use decision. The first step is to decide whether interest rate derivatives will be used and the second step is to decide the extent of the usage. If the relations of the dependent variables differ across the two decision steps, it could have a confounding effect on the results of the regressions reported in Table 5. For robustness, we examine that possibility. The tests we employ are based on procedures proposed by Heckman (1979) and employed by Haushalter (2000) and Carter and Sinkey (1998). The procedure that eliminates this potential sample-selection bias consists of two sequential models. We capture the decision to manage interest rate risk with interest rate derivatives in a probit regression (participation equation), whereas we examine the magnitude of the derivatives use through an OLS regression (level equation). Overall, we find no evidence of sample-selection bias. This result suggests that the probit-OLS model is not an appropriate means to estimate the derivative use decision. For the sake of brevity, we do not report these results, but they are available from the authors.

V. Conclusions

After several prominent firms suffered large losses from their derivative investments in the early 1990s, the Group of Thirty, among others, issued directives calling for greater risk-management oversight by firms. In this article we provide evidence on the relation between the board of directors and the firm's decision to use interest rate derivatives. Because the capital structure decision and hedging decision are considered to be endogenous, we model the firm's capital structure and its interest rate derivative decisions simultaneously. If differences exist between the incentives of management and those of shareholders to manage risk in the firm, conflict can arise. In the event of conflict, the outside members of the board of directors are expected to work in the best interests of the shareholders.

The evidence indicates that boards of directors influence the decision to use interest rate derivatives and that the decision varies with the composition of the board. There is a significant and positive relation between the quantity of interest rate derivative use and the relative influence of outside directors. This evidence also suggests that corporate interest rate derivative use, on average, benefits shareholders. There is no evidence to suggest that managers benefit from corporate interest rate derivative use at shareholder expense.

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