Why Do Non-Financial Firms Select One Type of Derivatives Over Others?

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The increase in derivatives use over the past three decades has stimulated both theoretical and empirical research into the basis of such use. However, results from studies examining the financial characteristics of firms using each type of derivatives are not always easy to interpret and to make comparisons. This is due to the fact that it is not uncommon for firms to use more than one type of derivatives at the same time. We establish that differences exist, for each of the three types of derivatives (interest rate, foreign currency, and commodity price), between the results obtained with a sample of exclusive users and those obtained with a sample of non-exclusive users. Prominent among these differences is the effect of size: it disappears when we utilize only observations involving exclusive use of each type of derivatives.

INTRODUCTION

Understanding the nature of financial derivatives use by non-financial firms has been an important research area as these instruments have become routinely used by many such firms. Surveys and data from firms' financial reports show increasing use of derivatives over the past 30 years. Bartram, Brown, and Fehle (2009), using a sample of 7,319 non-financial firms from the Global Reports database for the period 2000-2001, found that 65 percent of these firms used derivatives. Our sample of S&P 500 and Fortune 500 non-financial firms shows a usage rate of 84 percent in 2001. Most of the research in this area has focused on studying behavior of users versus non-users. However, our sample shows that there is a great deal of variation among *users* of particular types of derivative instruments with respect to the factors affecting the derivatives use decision. An analysis of the differences among users would help us understand better why firms use any one of these three types of derivatives. However, prior research has not considered the fact that often firms used more than one type of derivatives. Accordingly, we investigate the characteristics of firms that use exclusively any one of these three types of derivatives as compared to other types of derivatives, and provide an analysis of differences among these users. Prior research, including Mian (1996), Allayannis and Mozumdar (2000), and Lin and Smith (2007), did not identify such exclusive users in their samples. Similar to past studies, the three types of derivatives we examine are interest rate, foreign currency, and commodity price derivatives.

Our analysis uses a sample of non-financial derivatives users and we ask why a firm chooses to use one type of derivatives over the other two types. There are two basic reasons why this adds to the current research on the use of derivatives by non-financial firms. First of all, the traditional comparison between users and non-users is beset with problems. This is because in the use vs. non-use situation, if a firm did not use, say, interest rate derivatives, it would be assumed that the firm did not use any other type of derivatives at all. As shown in our sample, more than half of firm-year observations (55 percent) are for firms that used more than one type of derivatives. This makes it difficult to compare the results from

different studies where each of the three types of derivatives was examined in order to obtain an understanding of the differences or similarities between different types of derivatives. Additionally, even in studies that consider all three types of derivatives, using either single-equation or multivariate regressions, the question is still about use of a particular type versus its non-use, rather than use of one type *instead of* another type. The multinomial approach, made possible by the use of our exclusive-use sample, is useful in that it would help sharpen our understanding of each type of derivatives in terms of the determinants of its choice over the others. Certain questions cannot be answered using the use versus non-use approach. For example, what makes a firm pick interest rate derivatives rather than foreign currency derivatives? If the firm experiences an increase in its operating cash flow, would it be less likely to pick interest rate derivatives than something else? The answer to such questions would bring into sharper focus the special nature of each type of derivatives in relation to its determinants. Additionally, since derivatives use has become so common, it is more interesting to ask how firms select one type of derivatives over others. What would be the profile of firms that use commodity price derivatives, as opposed to firms that use foreign currency derivatives or interest rate derivatives? These questions are rarely addressed in prior research.

We show in this paper that it matters for the results whether firms are classified as exclusive users or not. We find, for example, that the effect of firm size on the use of each type of derivatives disappears when we use a sample of exclusive users. As it turns out, the existence of this size effect on derivatives use is clearly dependent on firms using a multiplicity of derivative types. We have also found results that are consistent with the use of derivatives for hedging purposes. For example, as long-term debt increases, firms would be less likely to use foreign currency or commodity price derivatives, and more likely to use interest rate derivatives. This result is not surprising, given that firms in our sample that used derivatives of any type stated that these derivatives were used for hedging purposes.

The remainder of this paper is organized as follows. In Section 2 we provide the background and briefly review some relevant literature. Section 3 describes the sample and provides the descriptive statistics. In Section 4 we provide a model and explain its variables related to the use of derivatives. Section 5 explains the multinomial model and provides results for comparing between *users*. We conclude in Section 6.

BACKGROUND

The decision to use financial derivatives for hedging, like any other decision that a firm may make, involves a comparison between benefits and costs. The benefits are in mitigating the volatility in the firm's cash flow or in the market values of its assets or liabilities, which may adversely affect its investment plans. Cash flow hedging reduces the likelihood that the firm may be faced with costly external financing for their investment projects due to cash shortfalls, as argued in a seminal paper by Froot, Scharfstein, and Stein (1993). Myers and Majluf (1984) provided a theoretical basis for costly external finance related to information asymmetries between managers and outside investors. Other benefits from hedging in the form of higher firm valuation are attributed to the nature of the tax code (tax convexities) and to reduced financial distress costs (Stulz, 1984; Smith & Stulz, 1985). Managers may have their own incentives for using derivatives, these incentives being created by managers' risk aversion or by their compensation plans (Smith & Stulz, 1985).

These basic theories, along with the increasing use of derivatives over the past three decades, have provided an impetus for empirical studies that examine use versus non-use of derivatives by non-financial firms. Apart from issues of tax convexities and managerial incentives, the focus of these studies has been on determining (1) whether firms with costly external financing (characterized as financially constrained) are more likely to use derivatives; and (2) whether derivatives use makes a difference in terms of improving firms' market valuations or reducing their risk exposures. Some of these empirical studies analyze overall derivatives use, while others focus on particular types of derivatives. Research utilizing data on overall derivatives use includes Nance, Smith, Smithson (1993); Gay and Nam (1998); Guay (1999); Prevost, Rose, and Miller (2000); and Graham and Rogers (2002). Studies related to interest rate

derivatives include Visvanathan (1998); Saunders (1999); Borokhovich, Brunarski, Crutchley, and Simkins (2004); and Faulkender (2005). Foreign currency studies include Geczy, Minton, and Schrand (1997); Allayannis and Weston (2001); and Brown (2001). In general, these studies show an association between the use of financial derivatives and the mitigation of financial constraints. In addition, Allayannis and Weston (2001) showed that derivatives use increased firm value. Faulkender (2005) found that the use of interest rate derivatives has more to do with timing to lower borrowing costs than with hedging.

Less common are studies dealing with commodity price derivatives, which often cover some particular industry, The use of these derivatives was found to increase firm values as shown in Adam and Fernando (2006) with respect to gold mining and in Carter, Rogers, and Simkins (2006) with respect to the airline industry; but not so in Jin and Jorion (2006) with respect to the oil and gas industry. With respect to oil and gas, Haushalter (2000) showed weak results with respect to financial variables that capture risk management, such as leverage. Tufano (1996), using data for the gold-mining industry, obtained results that indicate that managerial risk aversion rather than shareholder value maximization that drives the derivatives use decision.

Even less common than studies of commodity price derivatives use are studies that examine more than one type of derivatives. Guay and Kothari (2003) examined all three types of derivatives that are considered in this paper, and cast doubt on the significance of derivatives use in relation to standard risk management variables such as leverage. They also calculated the sensitivities of market values and cash flows to price changes, and found them to be quite small relative to total asset values. Mian (1996), studying the same three types of derivatives, found evidence that supports the external financing cost hypothesis of Froot, Scharfstein, and Stein (1993). A study by Bali, Hume, and Martell (2007) shows that derivatives use does not reduce risk exposures among firms hedging one or more risks. More recently, Bartram, Brown, and Fehle (2009) used extensive international data to conduct a comprehensive study of derivatives use. They found a positive firm size effect from a multivariate probit model that they used to estimate use or non-use of each of the three types of derivatives also considered in this paper. This is contrary to their expectation, but as we have stated earlier and will provide evidence later, this probably reflects the effect from multiplicity of use rather than the effect of firm size on the use of a particular type of derivatives. While it is possible to point out some differences in the results between studies for different types of derivatives (see, for example, Nguyen, Mensah, & Fan 2007), this aspect of multiplicity of use is not explicitly accounted for in any of the above studies.

Other aspects of derivatives use have been studied in the accounting literature. The role of derivatives use as a substitute for discretionary accruals in managing earnings was documented in Barton (2001), while Koonce, Lipe, and McAnally (2008) establish the importance of derivatives use as a signal to investors of "decision-making care" by management.

In the next section we describe the sample and provide a univariate analysis of its data.

SAMPLE AND DESCRIPTIVE STATISTICS

Sample Description

Our sample is based on the S&P 500 and Fortune 500 lists (taken as of 2001). The Fortune 500 list had 396 non-financial firms and the S&P 500 list had 415 non-financial firms. Then these firms were combined into a non-overlapping sample of 541 firms. Eliminated from the sample are companies that had mergers or acquisitions during the period from 1994 to 2001 (to allow for continuity and consistency in the data collected for 2000-2001). The final sample consists of 423 U.S. non-financial firms. The 10-K reports for fiscal years 2000 and 2001 of these firms were carefully read to collect use data on risk-specific instruments (interest rate, foreign currency, and commodity price derivatives). Below are some sample reported statements related to derivatives use.

From the 2001 10-K report of International Paper on interest rate derivatives:

> *"Interest rate swaps may be used to manage interest rate risks associated with International Paper's fixed rate debt. Some of these instruments qualify for hedge accounting in accordance with SFAS No. 133 and others do not."*

"… International Paper's interest rate swap agreements qualify as fully effective fair value hedges…To manage risks associated with future variability in cash flows attributable to certain commodity purchases, International Paper primarily uses natural gas swaps contracts…Foreign exchange contracts…are also used to hedge certain transactions, primarily trade receipts and payments denominated in foreign currencies…"

From the 2000 10-K report of International Flavors & Fragrances, Inc. on foreign currency derivatives:

"The Company enters into foreign currency forward contracts with the objective of reducing exposure to cash flow volatility arising from foreign payables and anticipated purchases of raw materials."

From Alcoa's 2001 10-K report on commodity price derivatives:

"Alcoa anticipates the continued requirement to purchase aluminum and other commodities such as natural gas, fuel oil and electricity for its operations. Alcoa enters into futures and options contracts to reduce volatility in the price of these commodities."

The data for 2000 show 81 percent of the sample firms used derivatives, while those for 2001 show a slight increase to 84 percent. Several studies in the past have used the S&P 500 or Fortune 500 list for selecting sample firms. They include Howton and Perfect (1998), Visvanathan (1998), Barton (2001), and Borokhovich, Brunarski, Crutchley, and Simkins (2004). In terms of examining differences among users, there may be an advantage in using firms from such lists as they are more likely to use derivatives.

We classify firm-year observations for 2000 and 2001 into three mutually exclusive groups: use of only interest rate derivatives or no derivatives at all; use of only foreign currency derivatives or no derivatives at all; and use of only commodity price derivatives or no derivatives at all. In addition to identifying use of a single-use (use of only one type of derivatives) versus non-use, we also identify multiple-type use, such as a firm that used interest rate as well as foreign currency derivatives. For comparisons among users, we classify firms based on their exclusive use of each of the three types of derivatives: interest rate, foreign currency, and commodity price.

TABLE 1
USAGE RATES FOR EACH PARTICULAR TYPE OF DERIVATIVES AND FOR MULTIPLE TYPES, 2000-2001

N (total sample size) = 698 firm-years	Usage (%)	Number of observations
FOREIGN CURRENCY ONLY	23.8	166
INTEREST RATE ONLY	16.3	114
COMMODITY PRICE ONLY	5.0	35
TWO OR MORE	54.9	383

Notes: Sample of 698 firm-years where derivatives were used. Some firms used more than one type of derivative. FOREIGN CURRENCY ONLY, INTEREST RATE ONLY, and COMMODITY PRICE ONLY refer to firm-year observations where the only derivative used was foreign currency, interest rate, or commodity price, respectively. Firm-year observations where more than one type of derivatives was used are listed as TWO OR MORE.

Table 1 above provides the basic characteristics of our sample using these classifications. Importantly, it shows that more than 50 percent of the sample observations involve multiplicity of derivatives use, that is, use of more than one type of derivatives. As we have argued previously, this multiplicity needs to be considered and accounted for in any empirical study in order to accurately capture the nature of use of each type of derivatives and to make valid comparisons among users.

Descriptive Statistics

In this section we will review the data for the variables used in this paper. These variables are defined in Table 2 and their correlations are provided in Table 3.

TABLE 2
VARIABLE DEFINITIONS

Variable	Definition
ATR	real total assets, in millions of 2000 dollars
CAPXATL	ratio of capital expenses to lagged total assets
COMONLY	an indicator variable equal to 1 if a firm-year observation shows use of only commodity price derivatives; 0 if no derivatives of any type were used
CURRENCYONLY	an indicator variable equal to 1 if a firm-year observation shows use of only foreign currency derivatives; 0 if no derivatives of any type were used
DUMAGMINE	an indicator variable with 1 for firms in agriculture or mining; 0 otherwise
DUMOTHERS	an indicator variable with 1 for firms in sectors other than agriculture, mining, or utilities; 0 otherwise
DUMUTILITY	an indicator variable with 1 for firms in utilities; 0 otherwise
INST1	an indicator variable with 1 if a firm-year observation shows use of one or more instruments; 0 otherwise
INST2	an indicator variable with 1 if a firm-year observation shows use of any one instrument; 2 if use of two or more instruments; and 0 otherwise
INST3	an indicator variable with 1 if a firm-year observation shows use of only interest rate derivatives; 2 for use of only foreign currency derivatives; and 3 for use of only commodity price derivatives
INTERESTONLY	an indicator variable equal to 1 if a firm-year observation shows use of only interest rate derivatives; 0 if no derivatives of any type were used
LNATR	natural logarithm of real total assets (2000 dollars)
LTDAT	ratio of long-term debt to total assets
MATAT	ratio of market value to book value of total assets
OANCFATL	ratio of operating cash flow to lagged total assets
QR	quick ratio, the ratio of total current assets minus inventories to total current liabilities
SALERGR	growth of inflation-adjusted sales
TFSALEP	percentage of firm's net sales attributed to foreign sales (in percent)

Of interest is the lack of a positive correlation, frequently found in the literature, between size and use of any one of the three types of derivatives (INTERESTONLY, CURRENCYONLY, or COMONLY). However, a significantly positive correlation between size and derivatives use is found when we allow for use of more than one type of derivatives (shown in the correlation between total assets, ATR, and use of multiple types of derivatives, INST2).

Table 4 (Panel A) below shows how financial characteristics vary between categories of derivatives use. Consistent with the correlation results, the differences with respect to firm size (as measured by total assets) between use and non-use firms are clearly related to the use of two or more types of derivatives, rather than with the use of any one type of derivatives. Specifically, the mean total assets for users of two or more types are about twice as large as for non-users, and more than twice as large as for users of just any one type of derivatives. Thus, the positive size effect seems to be associated with firms using multiple types of derivatives rather than with derivatives use as such.

TABLE 3
CORRELATIONS

	INST1	INST2	ATR	OANCFATL	QR	LTDAT	MATAT	TFSALEP	CAPXATL
INST1	1.000	**0.793**	0.050	-0.059	**-0.213**	0.085	**-0.140**	**0.135**	-0.029
	(846)	(846)	(846)	(846)	(812)	(846)	(827)	(585)	(830)
INST2		1.000	**0.131**	-0.083	**-0.234**	**0.118**	**-0.168**	0.069	-0.082
		(846)	(846)	(846)	(812)	(846)	(827)	(585)	(830)
INTERESTONLY			0.007	**-0.217**	**-0.266**	**0.296**	**-0.177**	-0.058	-0.043
			(262)	(262)	(244)	(262)	(251)	(116)	(258)
CURRENCYONLY			-0.059	0.073	-0.050	-0.137	0.006	**0.364**	0.009
			(314)	(314)	(305)	(314)	(299)	(215)	(303)
COMONLY			0.006	-0.013	**-0.231**	0.106	-0.160	-0.165	**0.198**
			(183)	(183)	(178)	(183)	(175)	(88)	(177)
ATR			1.000	-0.059	**-0.157**	0.023	-0.048	-0.009	0.051
			(846)	(846)	(812)	(846)	(827)	(585)	(830)
OANCFATL				1.000	**0.311**	**-0.292**	**0.449**	0.034	**0.299**
				(846)	(812)	(846)	(827)	(585)	(830)
QR					1.000	**-0.326**	**0.494**	0.250	0.023
					(812)	(812)	(793)	(562)	(796)
LTDAT						1.000	**-0.291**	**-0.223**	-0.089
						(846)	(827)	(585)	(830)
MATAT							1.000	**0.111**	**0.157**
							(827)	(572)	(812)
TFSALEP								1.000	-0.002
								(585)	(573)
CAPXATL									1.000
									(830)

Notes: All of the variables are as defined in Table 2. Bolded numbers refer to statistical significance at the 1 % level. The numbers in parentheses refer to the sample size.

As indicated by test results in Panel B of Table 4, this and other differences with respect to many other firm characteristics, such as long-term debt (LTDAT), are related to differences between non-use and use of more than one type of derivatives, or between use of any one type of derivatives and use of two or more types of derivatives, rather than between use and non-use. Specifically, Table 4 shows that, relative to multiple-type users, non-users have greater operating cash flow (OANCFATL), greater quick ratio (QR), and lower leverage (LTDAT), similar to the results found in Lin and Smith (2007). Non-users also have greater market-to-book ratio (MATAT), also found in Baker and Wurgler (2002). In addition, non-users have a higher investment rate (CAPXATL), consistent with the results of Adam (2002) and of Bartram, Brown, and Fehle (2009). In short, it is the multiplicity of use, rather than simply use of any one derivative type, such as interest rate derivatives, that gives us the results in terms of differences in firm characteristics between use and non-use.

Table 5 is different from Table 4 in showing use of each particular type of derivatives and the associated financial characteristics. As Panel B of this table shows, most of the differences in these characteristics, such as the quick ratio (QR), are found between foreign currency users on the one hand, and users of interest rate and commodity price derivatives, on the other hand. We find that, relative to users of other types of derivatives and also to non-users, foreign currency derivatives users invested more, a result similar to that of Allayannis and Mozumdar (2000). The results with respect to industry nature of derivatives use are not surprising. For example, commodity price derivatives users were more likely to be in agricultural and mining than users of other types of derivatives.

TABLE 4
FINANCIAL AND OPERATING CHARACTERISTICS OF SAMPLE FIRMS WITH RESPECT TO USE OR NON-USE OF DERIVATIVES

Panel A. Means and Medians (in parentheses)

Variable	INST1 = 0 (No Use)	INST1 = 1 (Use of 1 or more types)	INST2 = 0 (No Use)	INST2 = 1 (Use of any one type)	INST2 = 2 (Use of 2 or more types)
ATR (millions)	$9,158 ($2,906)	$13,229 ($5,450)	$9,158 ($2,906)	$7,657 ($3,497)	$17,811 ($8,101)
OANCFATL	0.139 (0.123)	0.123 (0.112)	0.139 (0.123)	0.130 (0.116)	0.117 (0.104)
QR	1.570 (0.986)	0.980 (0.723)	1.570 (0.986)	1.118 (0.835)	0.868 (0.677)
LTDAT	0.195 (0.165)	0.231 (0.225)	0.195 (0.165)	0.215 (0.196)	0.245 (0.245)
MATAT	4.406 (2.313)	2.784 (1.691)	4.406 (2.313)	3.284 (1.936)	2.384 (1.604)
SALEGR	0.213 (0.147)	0.154 (0.073)	0.213 (0.147)	0.177 (0.087)	0.135 (0.056)
TFSALEP (%)	24.984 (22.512)	33.072 (33.320)	24.984 (22.512)	34.439 (35.099)	32.197 (32.691)
CAPXATL	0.073 (0.056)	0.069 (0.055)	0.073 (0.056)	0.076 (0.061)	0.064 (0.052)

Panel B. P-values for Pearson chi-squared tests of difference in medians between uses of non-users

Variable	INST1=0 & 1 (Between No Use and Use)	INST2=0 &2 (Between No Use and Use of two or more)	INST2=1 & 2 (Between Use of Any One and Use of two or more)
ATR	0.444	0.000***	0.000***
OANCFATL	0.817	0.167	0.196
QR	0.343	0.000***	0.002***
LTDAT	0.173	0.001***	0.000***
MATAT	0.292	0.002***	0.035**
SALEGR	0.026**	0.002***	0.008***
TFSALEP	0.010**	0.014**	0.365
CAPXATL	0.225	0.434	0.021**

Notes: *, **, *** indicate statistical significance at the 10%, 5%, or 1 % levels, respectively. All variables are as defined in Table 2.

In summary, the discussion in this section shows that it is necessary to classify derivatives use correctly, especially if the objective of the research is to compare among users of different types of derivatives. In the next section we estimate the standard multivariate model of derivatives use to demonstrate that the results obtained depend on how data on derivatives use are classified. In Section 5 we will compare among users of different types of derivatives by using our exclusive-use sample.

TABLE 5
FINANCIAL AND OPERATING CHARACTERISTICS OF USERS OF EXCLUSIVELY EACH TYPE OF DERIVATIVES

Panel A. Interest rate (INTERESTONLY), Foreign Currency (CURRENCYONLY), and Commodity Price (COMONLY)

Variable	Means (Medians)		
	INTERESTONLY	CURRENCYONLY	COMONLY
ATR	$9,618	$5,883	$9,684
	($4,275)	($2,816)	($5,557)
OANCFATL	0.092	0.156	0.135
	(0.100)	(0.139)	(0.127)
QR	0.784	1.432	0.630
	(0.597)	(1.103)	(0.579)
LTDAT	0.308	0.145	0.240
	(0.316)	(0.110)	(0.255)
MATAT	2.169	4.725	1.417
	(1.500)	(2.990)	(1.319)
SALERGR	0.141	0.122	0.229
	(0.053)	(0.047)	(0.070)
TFSALEP (%)	22.7	39.8	17.2
	(18.7)	(40.8)	(18.0)
CAPXATL	0.068	0.074	0.106
	(0.055)	(0.059)	(0.089)
DUMAGMINE (%)	7.7	15.4	30.8
DUMUTILITY (%)	11.6	0.0	15.9
DUMOTHERS (%)	17.5	27.1	2.0
N	114	166	35

Panel B. P-values for Pearson chi-squared tests of difference in medians

Variable	INTERESTONLY & CURRENCYONLY	INTERESTONLY & COMONLY	CURRENCYONLY & COMONLY
ATR	0.015**	0.312	0.014**
OANCFATL	0.001***	0.532	0.599
QR	0.000***	0.626	0.000***
LTDAT	0.000***	0.004***	0.000***
MATAT1	0.000***	0.175	0.000***
SALEGR	0.808	0.312	0.336
ZSCORE	0.000***	0.959	0.000***
TFSALEP	0.000***	0.764	0.000***
CAPXATL	0.493	0.009***	0.181

Notes: *, **, *** indicates statistical significance at the 10%, 5%, or 1 % levels, respectively. The numbers in parentheses are medians. All variables are as defined in Table 2.

EFFECTS OF DERIVATIVES USE CLASSIFICATION: A MULTIVARIATE ANALYSIS

Model

We employ this standard model of derivatives use:

Derivatives Use = f (SIZE, FINANCIAL and OPERATING CHARACTERISTICS, TAX and MANAGERIAL INCENTIVES, INDUSTRY)

where *Derivatives Use* is an indicator variable. This traditional model has been used to compare between firms that used derivatives and those that did not. The theoretical basis for such a model can be found in Stulz (1984); Smith and Stulz (1985); and also in Froot, Scharfstein, and Stein (1993), who stated (p. 1631) "[A] firm's optimal hedging strategy – in terms of both the amount of hedging and the instruments used - depends on the nature of its investment and financing opportunities." Firm size and financial characteristics are included to reflect financial constraints in the form of costly external finance that shape a firm's derivatives use decision.

The estimating model is the following:

$$USE = \beta_0 + \beta_1*LNATR + \beta_2*OANCFATL + \beta_3*QR + \beta_4*LTDAT + \beta_5*MATAT + \beta_6*CAPXATL + \beta_7*TFSALEP + \beta_8*INDUSTRY + \varepsilon \quad (1)$$

where:

USE	= 1 if use of a type of derivatives, and 0 otherwise;
LNATR	= the natural log of real total assets;
OANCFATL	= the ratio of operating cash flow to lagged total assets;
QR	= the quick ratio;
LTDAT	= the ratio of long-term debt to total assets;
MATAT	= the ratio of market value to book value of total assets;
CAPXATL	= the ratio of capital expenses to lagged total assets;
TFSALEP	= the ratio of foreign sales to total sales;
INDUSTRY	= industry dummy (agriculture and mining, utilities, or others); and
ε	= random-disturbance term.

Other than classifying use to reflect use of exclusively any one type of derivatives, the estimation model is similar to that used by other researchers, including Gay and Nam (1995), Guay (1999), and Barton (2001), where tax-related variables or managerial incentive variables were not included. Another justification for not including these variables is that when they are included, often they are found not to be significant, as shown in Borokhovich, Brunarski, Crutchley, and Simkins (2004) with respect to the effect of managerial incentives on the use of interest rate derivatives; or in Graham and Rogers (2002) with respect to the effect of tax variables on general derivatives use; or in Mian (1996) with respect to the effect of tax variables on the use of foreign currency derivatives and on the use of interest rate derivatives.

Discussion of Model Variables

Size (LNATR)

Concerning the effect of size, there are two opposing effects. Some economies of scale may exist with respect to derivatives use, so larger firm size would mean greater likelihood of derivatives use. On the other hand, larger firms are better known and may thus have lower external costs of finance, as one may argue from the perspective of Myers and Majluf (1984); also, larger firms may not benefit as much from reduced financial distress costs associated with hedging as smaller firms (Smith & Stulz, 1985) as these costs do not increase proportionately with firm size (Warner, 1977). Thus, we would expect larger firms to be less likely to use derivatives. The frequent finding in the empirical literature is that larger firms are more likely to use derivatives (see, for example, Mian, 1996; Guay & Kothari, 2003; Bartram, Brown, & Fehle, 2009). Rarely would one find a negative effect, and even then it would not be statistically significant (Gay & Nam, 1998; Haushalter, 2000). However, as we have seen above, the positive effect of size on derivatives use seems to be limited to firms that used more than one type of derivatives. Given these opposing effects, we hypothesize that size has no effect on the use of any one particular type of derivatives.

Cash Flow (OANCFATL)

We expect the effect of operating cash flow (OANCFATL) to be negative. A larger cash flow would cushion any impact from a price risk, making it less necessary to hedge in order to have enough cash for investment purposes, as suggested in Froot, Scharfstein, and Stein (1993).

Quick ratio (QR)

The strength of a firm's overall balance sheet in the short term may be measured by its quick ratio (QR). We thus expect the quick ratio to have a negative effect on the use of any one particular type of derivatives. Studies that have used the quick ratio include Borokhovich, Brunarski, Crutchley, and Simkins (2004); and Bartram, Brown, and Fehle (2009).

Long-Term Debt (LTDAT)

This variable, the ratio of long-term debt to total assets, is a measure of leverage. Its effect is expected to be positive with respect to the use of interest rate derivatives. Smith and Stulz (1985) show that a levered firm may be more likely to hedge if the costs of financial distress from leverage diminish with firm value. Empirical support for the effect of leverage on hedging can be found in Block and Gallagher (1986); Wall and Pringle (1989); and Nance, Smith, and Smithson (1993). On the other hand, we expect the effect of leverage to be zero or negative for users of foreign exchange or commodity price derivatives. The negative effect is possible since an increase in debt would make it more likely for a firm to use interest rate derivatives and thus less likely to use other types of derivatives, if it were to use only one type.

Market-to-Book Ratio (MATAT)

With respect to the market-to-book ratio, its effect is ambiguous. As a measure of investment opportunities, better market valuation is expected to increase derivatives use, as suggested in Froot, Scharfstein, and Stein (1993). On the other hand, better market valuation may reflect investors' more favorable views of the firm's future, allowing it to borrow at lower costs (Baker & Wurgler, 2002), a timing element that has been found in Faulkender (2005) with respect to the use of interest rate derivatives. This would have the opposite effect in reducing the use of derivatives. In a study using the gold-mining industry, Adam (2002) found a negative effect for this variable.

Foreign Trade Exposure (TFSALEP)

Foreign trade exposure, as measured by the percentage of total sales attributed to foreign sales (TFSALEP), is expected to have a positive effect on foreign currency derivatives use, but non-existent for use of the other two types of derivatives. The evidence for this positive effect can be found in Bartram, Brown, and Fehle (2009).

Capital Investment (CAPXATL)

Firms may hedge in order to avoid having their investment plans disrupted due to cash shortfalls, especially so for firms that are financially constrained (Froot, Scharfstein, & Stein, 1993). In an empirical study using the gold-mining industry, Adam (2002) finds that hedging is positively related to investment expenditures. We thus hypothesize that the effect of investment on derivatives use is positive.

Empirical Results

Correlations

In Table 6 we provide the correlations for various variables used in estimating Equation (1) above. In terms of differences in the correlations among users, we notice the especially strong correlation between investment (CAPXATL) and operating cash flow (OANCFATL), and between investment and the ratio of market-to-book value of assets (MATAT), for users of commodity price derivatives. The negative correlation between long-term debt and operating cash flow is strongest for users of foreign currency derivatives. The correlation between the quick ratio (QR) and cash flows (OANCFATL) is significant

(and positive) for only users of foreign currency derivatives.

Estimation Results

We estimate Equation (1) using the logit method for each of the three types of derivatives. The results are reported in Table 7. We report two sets of results: one for using the traditionally classified data (NON-EXCLUSIVE); and one for using the exclusive-use classification (EXCLUSIVE), that is, where the observations show use of any one, but only one, of the three types of derivatives.

TABLE 6
CORRELATIONS FOR USERS OF EXCLUSIVELY EACH TYPE OF DERIVATIVES

Panel A. INTERESTONLY = 1

	ATR	OANCFATL	QR	LTDAT	MATAT	TFSALEP	CAPXATL
ATR	1.000	-0.091	-0.105	0.071	-0.064	-0.200	0.293***
	(114)	(114)	(101)	(114)	(111)	(43)	(114)
OANCFATL		1.000	-0.034	-0.205**	0.246***	0.146	0.117
		(114)	(101)	(114)	(111)	(43)	(114)
QR			1.000	-0.379***	0.592***	0.266*	0.040
			(101)	(101)	(98)	(41)	(101)
LTDAT				1.000	-0.333***	-0.099	0.110
				(114)	(111)	(43)	(114)
MATAT					1.000	0.322**	0.145
					(111)	(43)	(111)
TFSALEP						1.000	0.272*
						(43)	(43)
CAPXATL							1.000
							(114)

Panel B. CURRENCYONLY = 1

	ATR	OANCFATL	QR	LTDAT	MATAT	TFSALEP	CAPXATL
ATR	1.000	-0.205***	-0.121	-0.026	0.006	0.045	-0.034
	(166)	(166)	(162)	(166)	(159)	(142)	(159)
OANCFATL		1.000	0.332***	-0.378***	0.539***	-0.067	0.404***
		(166)	(162)	(166)	(159)	(142)	(159)
QR			1.000	-0.189**	0.476***	0.122	0.117
			(162)	(162)	(155)	(138)	(155)
LTDAT				1.000	-0.266***	-0.169**	-0.246***
				(166)	(159)	(142)	(159)
MATAT					1.000	0.032	0.244***
					(159)	(135)	(153)
TFSALEP						1.000	-0.022
						(142)	(135)
CAPXATL							1.000
							(159)

(continued on next page)

Panel C. COMONLY = 1

	ATR	OANCFATL	QR	LTDAT	MATAT	TFSALEP	CAPXATL
ATR	1.000	0.255	-0.316*	-0.102	0.095	-0.233	0.331*
	(35)	(35)	(35)	(35)	(35)	(15)	(33)
OANCFATL		1.000	-0.009	-0.062	0.546***	-0.138	0.823***
		(35)	(35)	(35)	(35)	(15)	(33)
QR			1.000	-0.110	0.128	0.187	-0.135
			(35)	(35)	(35)	(15)	(33)
LTDAT				1.000	-0.343**	0.007	-0.114
				(35)	(35)	(15)	(33)
MATAT					1.000	0.146	0.477***
					(35)	(15)	(33)
TFSALEP						1.000	-0.200
						(15)	(13)
CAPXATL							1.000
							(33)

Notes: *, **, *** indicate statistical significance at the 10%, 5%, or 1 % levels, respectively. Numbers in parentheses refer to the number of observations. All variables are as defined in Table 2.

TABLE 7
LOGIT REGRESSIONS OF DERIVATIVES USE ON FIRM CHARACTERISTICS FOR EACH OF THE THREE TYPES OF DERIVATIVES BASED ON EXCLUSIVE AND NON-EXCLUSIVE SAMPLES (EXCLUSIVE AND NON-EXCLUSIVE): INTEREST RATE, FOREIGN CURRENCY, AND COMMODITY PRICE DERIVATIVES

Panel A: Interest rate users (1 if use; 0 otherwise)

Explanatory variable	Exclusive		Non-Exclusive	
LNATR	0.122	0.105	0.519***	0.546***
	(0.371)	(0.452)	(0.000)	(0.000)
OANCFATL	-3.104*	-3.020*	-0.372	0.513
	(0.077)	(0.084)	(0.698)	(0.612)
QR	-0.466**	-0.480**	-0.194*	-0.216**
	(0.028)	(0.023)	(0.066)	(0.042)
LTDAT	2.509***	2.442***	1.767***	1.640***
	(0.005)	(0.007)	(0.001)	(0.003)
MATAT	-0.001	0.000	-0.050	-0.048
	(0.983)	(0.996)	(0.170)	(0.193)
CAPXATL		0.152		-4.580***
		(0.954)		(0.004)
Constant	-1.095	-0.909	-4.226***	-4.178***
	(0.368)	(0.458)	(0.000)	(0.000)
Pseudo-R-squared	0.124	0.124	0.111	0.116
N	233	229	793	778

(continued on next page)

Panel B: Foreign currency users (1 if use; 0 otherwise)

Explanatory variable	Exclusive		Non-Exclusive	
LNATR	-0.139	-0.153	0.257**	0.314**
	(0.466)	(0.431)	(0.015)	(0.004)
OANCFATL	2.288	2.714	1.847	3.228**
	(0.190)	(0.141)	(0.123)	(0.014)
QR	-0.483***	-0.499***	-0.333***	-0.370***
	(0.003)	(0.002)	(0.006)	(0.003)
LTDAT	-2.371*	-2.319*	-1.452*	-1.759**
	(0.059)	(0.077)	(0.070)	(0.035)
MATAT	-0.030	-0.028	-0.033	-0.031
	(0.390)	(0.413)	(0.281)	(0.280)
TFSALEP	0.053***	0.053***	0.048***	0.048***
	(0.000)	(0.000)	(0.000)	(0.000)
CAPXATL		-1.886		-6.289***
		(0.507)		(0.001)
Constant	1.049	1.229	-1.954**	-2.059**
	(0.532)	(0.467)	(0.050)	(0.045)
Pseudo R-squared	0.183	0.178	0.129	0.147
N	194	188	549	538

Panel C: Commodity price users (1 if use; 0 otherwise)

Explanatory variable	Exclusive		Non-Exclusive	
LNATR	0.145	-0.078	0.436***	0.410***
	(0.534)	(0.765)	(0.000)	(0.000)
OANCFATL	8.508***	4.768	4.900***	4.389***
	(0.006)	(0.187)	(0.001)	(0.007)
QR	-0.986*	-0.805	-1.287***	-1.285***
	(0.070)	(0.139)	(0.000)	(0.000)
LTDAT	-0.508	-0.649	1.166*	1.073
	(0.802)	(0.773)	(0.098)	(0.131)
MATAT	-1.304***	-1.759***	-0.685***	-0.669***
	(0.002)	(0.001)	(0.000)	(0.000)
CAPXATL		14.516***		0.941
		(0.003)		(0.634)
Constant	-0.290	1.425	-3.332***	-3.120***
	(0.883)	(0.513)	(0.000)	(0.000)
Pseudo R-squared	0.260	0.319	0.217	0.211
N	170	164	793	778

Notes: *, **, *** indicate statistical significance at the 10%, 5%, or 1% level, respectively. All of the variables are as defined in Table 2. Coefficients estimates are from logit estimation, using the 2000-2001 sample. P-values are given in parentheses. "Exclusive" refers to users of only one type of derivatives, while "Non-Exclusive" means the user of a given type of derivatives, such as interest rate derivatives, may also use other types.

In the model, we also control for industry membership. However, the effect of this variable is not significant for each of the three types of derivatives, and is excluded from the estimation. This is consistent with the finding in a study of foreign currency derivatives use by Geczy, Minton, and Schrand (1997) that all except for one industry variable (ENERGY) were not significant. The variable reflecting foreign exposure, TFSALEP, is included only in the equation for foreign currency derivatives use since it is not significant for the other two types of derivatives, and since including this variable would reduce the sample size for each of the two types of derivatives other than foreign currency derivatives.

With the exclusive-use classification, the positive effect of SIZE on the use of each of the three types of derivatives disappears. This is a significant result in two ways: first, it is contrary to those found in many prior studies (such as Mian, 1996; and Bartram, Brown, & Fehle, 2009); second and more importantly, it suggests that there is no size advantage with respect to the use of any one type of derivatives. Below we discuss other results for users of each type of derivatives versus non-users, and show that many of these results change significantly as one goes from using a sample of non-exclusive users to using a sample of exclusive users.

Interest rate derivatives users

Panel A of Table 7 shows that, for interest rate derivatives users, the effects of the three financial variables, OANCFATL (operating cash flow), QR (quick ratio), and LTDAT (leverage) are larger in absolute value, compared to results from using the non-exclusive sample. Specifically, the coefficient on QR more than doubles in absolute value, from 0.216 using the "Non-Exclusive" sample to 0.480 using the "Exclusive" sample. The effect of cash flow changes from positive to negative and becomes significant when the exclusive sample is used. Prior studies on interest rate derivatives use that used non-exclusive samples, such as those of Borokhovich, Brunarski, Crutchley, and Simkins (2004), and Saunders (1999), did not find a significant effect of liquidity variables. While variables that measure leverage have been found in previous studies to have a positive effect on the use of interest rate derivatives (Visvanathan, 1998; Bartram, Brown, & Fehle, 2009), the estimated effect of leverage for firms obtained from using the exclusive sample rather than the non-exclusive sample is about 50 percent greater, which would strengthen one's view that firms choose a type of derivatives that fits their exposure profile. With respect to investment, its effect on interest rate derivatives use is no longer negative when estimated using the exclusive-use sample, a result more consistent with theory. No prior study of interest rate derivatives use has considered either capital investment in general, or R&D in particular, so it is not possible to make a judgment as to how the results here with the exclusive-use sample may be different from past studies. While not related to the use of interest rate derivatives, it is worth noting that Adam (2002) found a positive effect of investment on derivatives use in the gold-mining industry.

Foreign currency derivatives users

The results for users of foreign currency derivatives from using the exclusive use sample are more in accordance with theory in that the positive effect of operating cash flow and the negative effect of investment, found with the non-exclusive use sample, are no longer significant. Since these two variables are often not included in many past studies of foreign currency derivatives use, it is not possible to make a comparison in terms of how the results may have been changed had they classified their samples based on exclusive use of these derivatives. One notes that the coefficient on the long-term debt ratio (LTDAT) is more negative with the exclusive-use sample than with the non-exclusive use sample. Surprisingly this estimated coefficient from the non-exclusive sample is very close to what was obtained by Geczy, Minton, and Schrand (1997), which is -1.416, as compared with the value of -1.452 as shown in Table 7.

Commodity price derivatives users

Here we also find that some results are different when obtained with the exclusive-use sample. For example, the estimated coefficient of the market-to-book ratio (MATAT) is significantly negative, consistent with what has previously been found in Adam (2002) and in Bartram, Brown, and Fehle (2009). We, however, find that the effect of this variable is even more negative (about twice as large in

absolute value) with the exclusive classification than with the non-exclusive classification. The positive and significant effect of operating cash flow on derivatives use disappears when its coefficient estimate is obtained with the exclusive-use sample, which result is consistent with what is found for the oil and gas industry by Haushalter (2000). One may note in this connection that there is a strong correlation between operating cash flow and investment (0.823, as shown in Table 6). Looking at Panel C of Table 7, one can say that with the exclusive-use sample results, it is not short-term liquidity, but investment expenditures and also market-to-book ratio that drive the derivatives use decision in the case of commodity price derivatives users.

Summary

The above results for users of each type of derivatives and non-users indicate that it matters as to how users are classified: whether or not firms used exclusively one type of derivatives. They also suggest that a valid comparison among different types of derivatives with respect to their use requires using samples of exclusive-use classification.

For commodity price derivatives, it is the market-to-book ratio and capital investment that are the major determinants of their use. For users of interest rate derivatives, it is both operating cash flow and current assets that have a negative effect on derivatives use, while only current assets matter for foreign currency derivatives users (in addition to foreign exposure as measured by foreign sales). Long-term debt has a positive effect on the use of interest rate derivatives, but a negative effect for foreign currency derivatives. Capital investment affects derivatives use only in the case of commodity price derivatives.

A motivation for using a sample of users based on their exclusive use of each type of derivatives is to try to understand the differences (or similarities) between these different types of derivatives with respect to the financial characteristics of the firms that used them. In this, we go beyond the traditional analysis of use and non-use. Below, we estimate a multinomial logit model for *users* of each of the three types of derivatives.

COMPARISONS AMONG USERS OF EACH OF THE THREE TYPES OF DERIVATIVES

While the preceding analysis is concerned with use versus non-use, this section examines only firms that used derivatives. We compare their behavior with respect to the financial characteristics that determine firms' use of derivatives. A multinominal logit model is used with the same right-hand side variables as before. The model assumes mutually exclusive choices concerning the use of each of the three types of derivatives, which is possible with the exclusive-use classification. This sort of comparison has never been done before. For example, Bartram, Brown, and Fehle (2009) use a multivariate model to compare among users of derivatives, but the decision for each derivative is still between use and non-use, and more significantly, users of one type of derivatives could also be users of other types. The question that we want to ask, which is how one type of derivatives is different from other types, can be best answered within the multinomial rather than multivariate framework.

The coefficient estimates for the multinomial model are provided in Table 8, while Table 9 shows the average marginal effects, each of which refers to the change in the probability of derivatives use per each one-unit change in an independent variable, holding the other independent variables constant.

Consistent with previous results, a change in firm size (LNATR) does not affect the likelihood of using any one of the three types of derivative instruments. If a firm is a derivatives user, an increase in its size does not make it more or less likely to use any one type of derivatives relative to the other two types; that is, size does not favor using one type of derivatives over another. The effect of an increase in operating cash flow is to make a firm less likely to use interest rate derivatives relative to the other two types. On the other hand, a firm that experiences an increase in long-term debt would be more likely to use interest rate derivatives relative to the other two, which is consistent with hedging interest rate risk. An improvement in a firm's market-to-book ratio makes it less likely to use commodity price derivatives, but more likely to use interest rate derivatives, each relative to the other two. It suggests that an increase in the market-to-book ratio indicates an improvement in the investment opportunities of interest rate

derivatives users, and an improvement in the ability to borrow funds in the external market for commodity price derivatives users. Relative to foreign currency derivatives and interest rate derivatives, an increase in capital investment raises the likelihood of using commodity price derivatives.

TABLE 8
LOGIT REGRESSION COMPARING USERS OF PARTICULAR TYPES OF DERIVATIVES (BASE OUTCOME IS INTERESTONLY)

Explanatory variable	INST3	
	INST3 = CURRENCYONLY	INST3 = COMONLY
LNATR	-0.074	0.063
	(0.740)	(0.864)
OANCFATL	4.578*	4.284
	(0.061)	(0.465)
QR	0.528	-0.222
	(0.135)	(0.769)
LTDAT	-5.150***	-2.074
	(0.001)	(0.459)
MATAT	-0.054	-1.146**
	(0.490)	(0.028)
TFSALEP	0.040***	-0.015
	(0.001)	(0.525)
CAPXATL	-4.639	9.310
	(0.188)	(0.155)
Constant	0.703	0.070
	(0.740)	(0.985)
Pseudo R-squared = 0.2726		
N = 179		

Notes: *, **, *** indicate statistical significance at the 10%, 5%, or 1% levels, respectively. The numbers in parentheses are p-values. All of the variables are as defined in Table 2.

CONCLUSIONS

The purpose of this paper has been to compare among users of different types of derivatives within a consistent framework with respect to how samples of users of derivatives are selected. This is important if one wants to understand the determinants of use of each type of derivatives, and also to make comparisons among these users, due to the fact that users of derivatives often use more than one type of derivatives. We show that the results from our exclusive-use sample are different from those obtained from the non-exclusive sample, and this applies to each of the three types of derivatives examined in this paper. One robust result is that the use of a particular type of derivatives is not dependent on size, leading us to conclude that the finding of a size effect from previous studies was probably the result of including firms that used a multiplicity of derivatives.

TABLE 9
MARGINAL EFFECTS CALCULATED FROM LOGIT REGRESSION RESULTS

Explanatory variable	INST3 = INTERESTONLY	INST3 = CURRENCYONLY	INST3 = COMONLY
LNATR	0.007	-0.012	0.005
	(0.817)	(0.691)	(0.780)
OANCFATL	-0.642*	0.536	0.106
	(0.060)	(0.108)	(0.717)
QR	-0.055	0.080*	-0.025
	(0.269)	(0.086)	(0.505)
LTDAT	0.650***	-0.672***	0.022
	(0.001)	(0.000)	(0.868)
MATAT	0.036**	0.021	-0.057**
	(0.029)	(0.205)	(0.027)
TFSALEP	-0.004***	0.006***	-0.002
	(0.005)	(0.000)	(0.112)
CAPXATL	0.291	-0.883*	0.592*
	(0.533)	(0.055)	(0.056)
N = 179			

Notes: *, **, *** indicate statistical significance at the 10%, 5%, or 1 % level, respectively. The numbers in parentheses are p-values. All of the variables are as defined in Table 2.

We have also found results that are consistent with the use of derivatives for hedging purposes. For example, as long-term debt increases, firms become less likely to use instruments other than interest rate derivatives. Our framework also helps us understand the differences between users of different types of derivatives. For example, an improvement in market-to-book ratio reduces the use of commodity price derivatives, while it increases the use of interest rate derivatives.

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