

# Does Risk Management Add Value? A Survey of the Evidence

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In his March 8, 2003 letter to Berkshire Hathaway's shareholders, Warren Buffett described derivatives as "financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal." Mr. Buffett argued that derivatives "can exacerbate trouble that a corporation has run into for completely unrelated reasons. This pile-on effect occurs because many derivatives contracts require that a company suffering a credit downgrade immediately supply collateral to counterparties..."

Despite Buffett's warning, corporate managers appear to believe that derivatives are capable of adding value since they continue to make extensive use of them. When the International Swaps Dealers Association (ISDA) examined the annual reports and regulatory filings of the world's 500 largest companies in 2003, they found that 92% of the firms reported making some use of derivatives.<sup>1</sup> Of the users of derivatives, 92% reported using derivatives to manage interest rate risk, 85% reported using derivatives to manage currency risk, and 25% reported using derivatives to manage commodity price risk. Even Buffett himself, in that same March 2003 letter to shareholders, admitted to "engage[ing] in large-scale derivatives transactions in order to facilitate certain investment strategies."

Academics also seem to believe that the corporate use of derivatives generally works to increase shareholder wealth. In March 2004, ISDA surveyed finance professors at the top 50 business schools worldwide.<sup>2</sup> A total of 84 professors at 42 institutions provided responses. ISDA asked the professors whether they agreed with the statement, "Managing financial risk more effectively is a way for companies to build shareholder value." The results were as follows: 44% strongly agreed, 47% agreed, 7% somewhat agreed, and only 2% somewhat disagreed.<sup>3</sup>

So it appears that both corporate executives and academics believe that risk management can increase the value of the firm. But is there any *evidence* that it does?

In this article, we will investigate this question by examining four more specific questions:

- 1) Is financial price risk reflected in share price behavior?
- 2) Is the use of risk management tools (derivatives) associated with reduced risk?
- 3) Is cash flow volatility related to firm value?
- 4) Is there a relationship between the use of risk management and the value of the firm?

For each of these four questions, we searched for all of the academic empirical evidence (whether published in an academic journal or in working paper form). Although the research discussed below is not uniformly supportive of the corporate use of derivatives, the bulk of it reinforces the idea that risk management is a value-adding activity.

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## Question 1: Is Financial Price Risk Reflected in Stock Price Movements?

To answer this question, researchers need a model that tells them the rate of return an individual stock is expected to produce, *given the rate of return on the market as a whole*. The so-called "market" model does this by specifying a linear relationship between the rate of return on a particular equity,  $R_{i,t}$ , and that for the market portfolio,  $R_{m,t}$ :

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \gamma_b R_{b,t} + \epsilon_{i,t} \quad (1)$$

The market model can be viewed as a way of dividing the firm's risk into two different sources.<sup>5</sup> The parameter  $\beta_i$  measures the share of the total variation (or risk) in the share return that is attributable to changes in the broad market. The rest of the

1. International Swaps and Derivatives Association, 2003, "2003 Derivatives Usage Survey."

2. As ranked in *The Financial Times*, January 26, 2004.

3. International Swaps and Derivatives Association, 2004, "A Survey of Finance Professors' Views on Derivatives."

4. We restricted our search to studies that included U.S. companies or foreign firms with ADRs traded on U.S. exchanges as part of the sample. One reason for so doing was

to focus on an equity market that most would regard as efficient. The other reason is to keep the exhibits of manageable size.

5. The market model has been closely associated with the Capital Asset Pricing Model (CAPM). Note, however, that the market model is concerned only with the statistical relationship between returns to an individual stock and the market portfolio, while the CAPM makes additional assumptions about equilibrium pricing.

Exhibit 1 **Is Financial Price Risk Reflected in Share Price Behavior?**  
**Part 1 - Empirical Examination of Financial Institutions**

Authors	What was examined? (Time period)	Findings
Lloyd & Shick (1977)	Sensitivity of equity returns of 60 large banks to Salomon Brothers High-Grade Long-Term Corporate Bond Index (1969-72)	Only 8.3% of bank stocks exhibited significant sensitivity to the long-term corporate bond index. [Authors noted that (1) bank stocks should be sensitive to short-term interest rates, rather than the long-term bond index they used; and (2) during the 1969-72 period, returns on bonds were higher than those for equity – the average monthly return on a bond portfolio was 0.5% and the average return on an equity portfolio was 0.2%.]
Lyngé & Zumwalt (1980)	Sensitivity of equity returns of 57 banks and all DJIA companies to short- and long-term interest rates (1969-75)	Approximately 80% of banks and half of industrial companies are sensitive to interest rates. Magnitude of bank exposures are larger than for industrial companies.
Chance & Lane (1980)	Sensitivity of bank equity returns to short-, intermediate-, and long-term interest rates (1972-76)	For the period 1972-76, the interest rate factor was not significant in a two-factor model.
Flannery & James (1984)	Interest rate sensitivity of 67 actively traded commercial banks and S&Ls (1976-1981)	Direct relation between estimated interest-rate-risk parameter and the degree of maturity mismatch in assets and liabilities.
Booth & Officer (1985)	Interest rate sensitivity of 66 banks and a control group of 66 nonfinancials (1966-80)	Bank stocks are sensitive to actual, anticipated, and unanticipated changes in short-term interest rates, a result not found for the control group of nonfinancials.
Scott & Peterson (1986)	Interest rate risk of portfolios of 78 bank stocks, 8 S&L stocks, and 25 insurance company stocks (1977-84)	All portfolios exhibited significant sensitivity to interest rates. Interest rate sensitivity of S&L portfolio twice as great as for commercial banks or insurance companies portfolios.
Kane & Unal (1988)	Interest rate sensitivity of 31 banks and 8 S&Ls using a two-factor model that estimated time-varying coefficients (1975-85)	Interest-sensitivity varied significantly over time period. Bank equity returns were sensitive to interest rates only for 1979-82, while S&L returns were sensitive to interest rates over most of sample period.
Kwan (1991)	Interest rate sensitivity of 51 bank stock returns, using a two-factor model that controls for time-varying interest rate sensitivity (1976-82)	Bank stock returns are related to unanticipated interest rate changes, and the magnitude of the effect can be explained by the maturity composition of assets and liabilities.
Choi, Elyasiani, & Kopecky (1992)	Interest rate and exchange rate risks of 48 largest U.S. banks (1975-87)	Bank equity returns were significantly negatively related to interest rates only for the post-Oct. 1979 period. Money center bank returns were sensitive to FX rates – negative relation prior to Oct. 1979 and positive relation thereafter.

variation, which is reflected in the “error term,”  $\epsilon_{i,t}$ , is so-called “idiosyncratic” or firm-specific risk—risk that can be managed by investors simply by holding diversified portfolios.

Most researchers who have investigated Question 1 have done so by taking the market model and adding elements to it. For example, to detect the interest-rate exposure of a company’s market value—an exposure that is presumably reflected in the sensitivity of its stock price to changes in interest rates—researchers have added the rate of return from holding a constant-maturity, default-free bond,  $R_{b,t}$ , as in the following equation:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \gamma_b R_{b,t} + \epsilon_{i,t} \quad (2)$$

Or they have added the rate of change in interest rates,  $\Delta r_t / r_t$ :

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \gamma_r \frac{\Delta r_t}{r_t} + \epsilon_{i,t} \quad (3)$$

6. Note that only one of the nine studies of financial institutions also investigated foreign exchange risk and only one of the 12 studies of industrial corporations investigated interest rate exposure. Clearly, as supported by the empirical evidence, academic

In Equations (2) and (3), interest rate exposure is measured by  $\gamma_b$  (bond price exposure) or  $\gamma_r$ .

To examine the exchange rate exposure reflected in equity returns, researchers add the rate of change in a foreign exchange rate,  $\Delta P_{FX,t} / P_{FX,t}$ :

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \gamma_{FX} \frac{\Delta P_{FX,t}}{P_{FX,t}} + \epsilon_{i,t} \quad (4)$$

where the firm’s exposure to foreign exchange rates is measured by  $\gamma_{FX}$ .

Having made such additions to the market model, Question 1 is then rephrased as follows: Are  $\gamma_b$ ,  $\gamma_r$ , and  $\gamma_{FX}$  different from zero?

We found 21 published studies and working papers that attempted to answer Question 1. Nine of the studies looked at the interest rate sensitivity of financial institutions and 12 studies examined either the foreign exchange exposure or the interest rate exposures of industrial corporations.<sup>6</sup> The

research considers interest rate exposure a greater risk for financial institutions and exchange rate exposure a greater risk for industrial corporations.

Exhibit 1 **Is Financial Price Risk Reflected in Share Price Behavior?**  
**Part 2 - Empirical Examination of Industrial Corporations**

Authors	What was examined? (Time period)	Findings
Sweeney & Warga (1986)	Interest rate sensitivity of industry portfolios focusing primarily on utilities (1960-79)	Utilities exhibited significant negative sensitivity to interest rates. No other industry portfolios exhibited significant interest rate sensitivity.
Jorion (1990)	FX sensitivity of 287 U.S. multinationals (1971-87)	Only 5% of firms exhibited significant FX exposure – estimated FX sensitivity increased as the firm's foreign involvement (as measured by foreign sales) increased.
Amihud (1994)	Foreign exchange rate risk of 32 largest U.S. exporters (1979-88)	Strongest significance of FX risk parameter is detected with a lag of up to two quarters.
Bartov, Bodnar, & Kaul (1996)	Relation between volatility in share price returns and volatility in foreign exchange rates before and after the switch from fixed to floating exchange rates (1973)	Increased FX rate volatility associated with increased volatility in share price returns.
Choi & Prasad (1995)	FX sensitivity of 409 multinational firms and 20 industry portfolios (1978-89)	More firms exhibit significant FX sensitivity during weak-dollar periods than during strong-dollar periods. Cross-sectional differences in FX sensitivity are related to foreign operating profits, sales, and assets.
Chow, Lee, & Solt (1997)	FX sensitivity of 213 multinational firms and 4 diversified stock portfolios (1977-91)	FX exposure increases with return horizon and is significantly related to firm size but not to foreign sales.
Martin, Madura, & Akhigbe (1999)	FX sensitivity of 168 U.S. multinational firms with foreign operations primarily in Europe (1979-95)	16% of firms exhibit FX sensitivity (reinforces Jorion's (1990) finding that FX sensitivity increases as the firm's foreign involvement increases). FX sensitivity is determined by the degree of imbalance in foreign cash inflows and outflows and the proportion of export sales.
Allayannis & Ihrig (2001)	FX sensitivity of returns of 18 U.S. manufacturing industry groups (1979-95)	Four of 18 industry groups exhibited significant FX sensitivity. Significant relation between FX sensitivity and industry markups – as industry markups fall (rise), exposure increases (decreases).
Pantzalis, Simkins, & Laux (2001)	FX sensitivity of returns of the 220 multinational firms in the Fortune 500 (1989-93)	Operational hedges can reduce FX sensitivity – firms with foreign subsidiaries spread across several foreign countries exhibited smaller FX sensitivity than those with more highly concentrated networks.
Williamson (2001)	FX sensitivity of automotive firms in the U.S. and Japan (1973-95)	Automotive firms face exposure to FX shocks. FX sensitivity determined by foreign sales and by operational hedging in the form of foreign production.
Bodnar & Wong (2003)	FX sensitivity of large U.S. firms (1977-96)	FX exposures are more significant at longer horizons. There is an inverse relation between firm size and exposure.
Pritamani, Shome, & Singal (2004)	FX sensitivity of subgroups of S&P 500: 28 “importer” firms and 67 “exporter” firms (1975-97)	Significant positive (negative) FX exposures for importers (exporters).

findings of these studies are summarized in Exhibit 1.

In the case of financial institutions, the answer to Question 1 is: “Yes.” All of the studies that examined stock returns following the increase in interest rate volatility at the end of the 1970s<sup>7</sup> (as well as some of the studies of earlier periods) found that the stock returns of financial institutions were sensitive to interest rate changes. Several of the studies also showed that the degree of the interest rate sensitivity of equity returns was related to the interest rate “riskiness” of the institution, as reflected in operating as opposed to stock market measures. For example, a 1984 study by Flannery and James found that interest rate sensitivity was directly

related to the extent of the maturity mismatch between assets and liabilities (a finding reinforced by Kwan (1991)). And a 1986 study by Scott and Peterson found that S&Ls, whose business model was based on an extreme mismatch between the durations of assets and liabilities, were more sensitive to interest rates than commercial banks or insurance companies (a finding confirmed by Kane and Unal (1988)).

In the case of industrial corporations, the answer to Question 1 is: “It depends.” All but one of the 12 studies of industrial companies’ stock returns focused on foreign exchange rate risk. The one study that investigated interest rate risk—Sweeney and Warga (1986)—reported that the

7. This increase in interest rate volatility is contemporaneous with the Federal Reserve's change in monetary policy (from targeting interest rates to targeting money supply) in 1979.

Exhibit 2 **Is the Use of Risk Management Tools Associated with Lower Levels of Risk?**  
**Part 1 - Empirical Examination of Financial Institutions**

Authors	What was examined? (Time period)	Findings
Choi & Elyasiani (1997)	Impact of interest rate and FX risk management activities of 59 large U.S. banks (1975-92)	Relation exists between the scale of interest rate and FX derivatives contracts and the corresponding sensitivity measures.
Chamberlain, Howe, & Popper (1997)	FX risk management activities of 30 largest U.S. bank holding companies (1986-92)	Negative relation between use of FX derivatives and FX sensitivity of share price.
Carter & Sinkey (1998)	Impact of use of interest rate derivatives on a sample of large U.S. banks (1991-94)	Use of interest rate derivatives associated with a reduction in interest rate sensitivity of bank stock returns.
Schrand (1997)	Interest rate sensitivity of 57 S&Ls (1984-88)	Derivatives usage associated with lower stock price sensitivity.
Hirtle (1997)	Relation between equity returns and use of interest rate swaps for 139 bank holding companies (1986-94)	Increased use of interest rate swaps associated with higher interest rate sensitivity for 1991-94 (no significant relation for earlier years).
Brewer, Jackson, & Moser (2001)	Effects of interest rate derivatives use on commercial and industrial lending activity by 154 bank holding companies (1986-94)	Derivatives users tend to have less exposure to interest rate risk than nonusers.

**Part 2 - Empirical Examination of Industrial Corporations**

Tufano (1998)	Impact of hedging on sensitivity of equity value to price of gold for North American gold producers (1990-97)	Negative relation between degree of hedging and sensitivity of equity value to price of gold.
Guay (1999)	Impact of interest rate and FX derivatives on equity returns of new users of derivatives - i.e., firms who previously had not reported using derivatives (1990-94)	Both interest rate and FX sensitivities of equity returns declined.
Petersen & Thiagarajan (2000)	Impact of gold hedging on risk exposures of two firms at opposite ends of derivatives-use spectrum (1976-94)	American Barrick's (hedger) gold exposure was only slightly smaller than Homestake Mining (nonhedger). Operational hedging and leverage are also important to exposure.
Allayannis & Ofek (2001)	Impact of use of FX derivatives on sensitivity of equity returns to FX for 378 nonfinancial firms (1992-94)	Strong negative relation between use of FX derivatives and FX sensitivity of equity returns.
Hentschel & Kothari (2001)	Impact of interest rate and FX derivatives use on equity returns of 325 U.S. nonfinancials (1990-93)	Sensitivities of equity returns to interest rates and FX not related to derivatives positions.
Allayannis, Ihrig, & Weston (2001)	Impact of financial (and operational) risk management on FX sensitivity of U.S. multinational firms (1996-98)	Financial risk management is related to lower FX sensitivity.
Carter, Pantzalis, & Simkins (2004)	Impact of financial (and operational) risk management on FX sensitivity of 208 U.S. multinational firms (1994-98)	Financial risk management is related to lower FX sensitivity.
Kim, Mathur, & Nam (2004)	Impact of financial (and operational) risk management on FX exposure of 424 firms (1996-2000)	Financial risk management is related to lower FX sensitivity.
Jin & Jorion (2005)	Risk management activities of 119 U.S. oil and gas producers (1998-2001)	Use of risk management reduces sensitivity of equity returns to oil and gas prices.

interest rate sensitivity of industrial companies was concentrated mainly in the utility industry, though industries like banking, finance, and real estate also showed some sensitivity during certain periods.<sup>8</sup> The studies of FX risk in industrial companies reported that only a small percentage of individual firms exhibited (statistically) significant exposure. Moreover, a number of the studies found that significant FX exposures were associated with certain firm characteristics. For example,

as one would expect, most of the studies reported that the FX sensitivity of a company's stock increases with the extent of the firm's foreign involvement.<sup>9</sup> As we would also expect, the sensitivity of equity returns to FX movements was shown to be negatively related to the degree of "operational hedging" done by the firm. Pantzalis, Simkins, and Laux (2001) found that companies with highly concentrated foreign networks (operating with a small number of foreign subs) had greater

8. A number of other industries—notably banking, finance, real estate, and "stone, clay, and glass"—showed significant negative exposures over certain time periods. Sweeney and Warga also investigated whether the interest factor is priced within the framework of APT and found strong evidence for this effect in the utility industry (i.e., interest rate risk is priced in that it is recognized by market participants who expect a premium for bearing this risk).

9. This finding was first reported by Jorion (1990), who looked at U.S. multinationals over the period 1971-87. The finding was then reinforced by Choi and Prasad (1995), who looked at foreign operating profits, sales, and assets; and by Martin, Madura, and Akhigbe (1999), who looked at foreign cash inflows and outflows and export sales as a percentage of the firm's total sales. At the same time, Chow, Lee, and Solt (1997) found no relationship between FX sensitivity and foreign sales.

### Exhibit 3 Is Cash Flow Volatility Related to Firm Value?

Authors	What was examined? (Time period)	Findings
Minton & Schrand (1999)	Financial statements of approximately 1,000 nonfinancial firms (1988-95)	(1) Negative relation between cash flow volatility and investment: firms with higher levels of cash flow volatility had lower capital expenditures, R&D expenditures, and advertising expenditures; and (2) Positive relation between volatility and cost of debt and equity financing.
Shin & Stultz (2000)	Firms available on COMPUSTAT database and CRSP for the period 1962-99	Negative relation between cash flow volatility and shareholder wealth. Result stronger for firms that are financially weak and have poorer growth opportunities.
Allayannis & Weston (2003)	Earnings and cash flow volatility impact on firm value for COMPUSTAT/CRSP firms with few missing observations (1986-2000); 3,390 firm-year observations	Negative relation between earnings and cash flow volatility on shareholder wealth. Value effect of earnings volatility greater than that of cash flow volatility.

FX sensitivities than firms with more network “breadth.” And Williamson (2001) reported that the FX sensitivity of U.S. and Japanese automotive companies was affected by the degree of foreign production—and, more specifically, that foreign sales were associated with increased FX exposure and foreign operations with reduced exposure. Finally, Chow, Lee, and Solt (1997) and Bodnar and Wong (2003) both reported an inverse relationship between FX exposure and the size of the firm. The intuition here is that although larger companies tend to be more multinational, the greater size and diversity of their overseas operations tend to function as natural hedges.<sup>10</sup>

#### Question 2: Is the Use of Risk Management Tools (Derivatives) Associated with Reduced Risk?

If companies are exposed to financial price risk (that is, if the firm’s equity returns are sensitive to changes in interest rates, foreign exchange rates, or commodity prices) and if they use derivatives to manage one or more of those exposures, a change in the sensitivity of their stock returns to those risks would be evidence that the market reacts to risk management activities. In the context of Equations (2), (3), and (4), Question 2 can be rephrased as: Does the use of derivatives affect the size of  $\gamma_b$ ,  $\gamma_r$ , and/or  $\gamma_{FX}$ ?

We found 15 studies that examined this question, six that focused on financial institutions and nine on industrial companies. The findings reported in these studies are summarized in Exhibit 2. In the case of financial institu-

tions, the answer to Question 2 is: “Yes.” All six of the studies reported that the use of derivatives reduced the sensitivity of the equity returns to interest rates. And three other studies provided indirect supporting evidence: Ahmed, Beatty, and Takeda (1997) concluded that the use of derivatives reduced the volatility of net income for banks; Venkatachalam (1996) reported that derivatives disclosures affect share returns;<sup>11</sup> and Brewer, Jackson, and Moser (1996) found that, in addition to reducing the volatility of their stock returns, the use of derivatives by S&Ls was also associated with greater growth in their mortgage portfolios. Moreover, this last finding was reinforced by a later study of commercial banks (Brewer, Jackson, and Moser (2001)) that demonstrated a positive relationship between their derivatives use and the growth of their C&I loan portfolios.<sup>12</sup>

In the case of industrial companies, while the studies are not unanimous, the weight of the evidence suggests that the answer to Question 2 is “Yes.” Eight of the nine studies reported that the use of (mainly FX) derivatives by nonfinancial firms reduced the sensitivity of their equity returns to financial (mainly currency) risks.<sup>13</sup>

#### Question 3: Is Cash Flow Volatility Related to Firm Value?

Finance theory suggests that risk management can increase the value of the firm by addressing the so-called corporate “underinvestment problem.” The basic idea is that, by hedging financial risks with derivatives, companies reduce the

10. The overall evidence of FX exposure for nonfinancial firms is mixed. Possible explanations are as follows: the difficulty in obtaining stable measures of FX exposure; the long-term nature of FX risk (i.e., economic exposure), which is difficult to ascertain and not captured using the short-term return measures of most studies; the use of broad exchange rate indexes when firms have unique FX exposures; and the use of stock returns instead of cash flows to measure FX exposures. Also important is the fact that such studies don’t take account of corporate risk management practices that work to reduce exposures.

11. The findings suggest that the fair values of off-balance-sheet derivatives are correlated with equity values beyond the notional values for such derivatives. Across firms,

the fair value gains and losses for on-balance-sheet derivatives were negatively correlated with fair value gains and losses on derivatives. However, for over 50% of the banks, changes in the fair values of derivatives were positively correlated with the fair values of net on-balance-sheet items—suggesting that some banks may be using derivatives to increase, rather than to reduce, risk.

12. They interpreted this to mean that derivatives usage reduces systematic risk, thereby increasing lending ability.

13. In addition, one study (Guay (1999)) found that the use of risk management was associated with a reduction in beta or market risk.

Exhibit 4 **Is There a Relationship between Risk Management and the Value of the Firm?**  
**Part 1 - Empirical Examination of Impact of Interest Rate and/or FX Risk Management by Financial Institutions**

Authors	What was examined? (Time period)	Findings
Cyree & Huang (2004)	Impact of interest rate and FX derivatives use by publicly traded banks or holding companies (1993-96)	Banks using derivatives have higher value (Tobin's Q) than non-users.

**Part 2 - Empirical Examination of Impact of Interest Rate and/or FX Risk Management by Industrial Corporations**

Allayannis & Weston (2001)	Impact of FX derivatives use on 720 large nonfinancial firms (1990-95)	Positive relation between use of FX derivatives and firm value (Tobin's Q).
Bartram, Brown, & Fehle (2004)	Impact of interest rate and FX derivatives use for 7,292 companies in U.S. and 47 other countries (2000-2001)	Use of derivatives associated with higher firm value (more significant for interest rates than FX).
Nain (2004)	U.S. firms (548 derivatives users and 2,711 non-derivative users) with ex ante FX exposure (1997-99)	FX risk management increases (does not affect) firm value as measured by Tobin's Q if many (few or zero) competitors hedge.
Kim, Mathur, & Nam (2004)	Impact of financial (and operational) risk management on FX exposure of 424 firms (1996-2000)	Financial risk management is associated with higher firm value.
Allayannis, Lel, & Miller (2005)	Impact of use of FX derivatives on firm value (Tobin's Q) for 379 firms (1990-99)	Significant positive premium for users of derivatives with FX exposures (positive but insignificant for firms with no exposure).

**Part 3 - Empirical Examination of Impact of Commodity Price Risk Management by Users of Commodities**

Carter, Rogers, & Simkins (2004)	Impact of fuel hedging on 26 U.S. airlines (1994-2000)	Positive relation between use of fuel price risk derivatives and firm value (Tobin's Q).
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**Part 4 - Empirical Examination of Impact of Commodity Price Risk Management by Producers of Commodities**

Callahan (2002)	Impact of gold hedging on 20 North American gold mining firms (1996-2000)	Negative correlation between extent of gold hedging and performance of firm stock price.
Lookman (2004)	Exploration and production (E&P) firms that hedge commodity price risk; unbalanced panel set of 125 firms (364 firm-year observations) (1992-94 and 1999-2000)	For undiversified E&P firms where commodity price risk is a primary risk, hedging is associated with lower firm value. For diversified firms with an E&P segment, hedging is associated with higher firm value. In aggregate, no association with hedging and firm value is detected.
Jin & Jorion (2005)	Risk management activities of 119 U.S. oil and gas producers (1998-2001)	Risk management not related to firm value (Tobin's Q).

variability of their cash flow, thereby ensuring they will have sufficient funds to undertake all promising projects.<sup>14</sup>

We found only three studies (summarized in Exhibit 3) that bear on this issue. In their study of about 1,000 nonfinancial companies over the period 1988-1995, Minton and Schrand (1999) found that companies with higher cash flow volatility had lower capital expenditures, R&D, and advertising expenditures, thereby establishing the tie

between volatility and lower investment. The link between volatility and lower value is furnished in two working papers. Looking at over 2,000 companies during the period 1986-2000, Allayannis and Weston (2003) found a negative relationship between earnings and cash flow volatility and shareholder value (as measured by price-to-book ratios). And Shin and Stulz (2000) reported much the same result in their study of companies from 1962-1999.

14. This idea is supported by a leading theoretical paper, Froot, Scharfstein, and Stein (1993), which demonstrated that when the costs of external capital include deadweight costs, companies that require outside financing will underinvest when internal operating

cash flows are low. They also show that hedging can be designed to generate additional cash in these situations, thus providing a solution to the underinvestment problem.

#### Question 4: Is There a Relationship between the Use of Derivatives and Firm Value?

Now to the question we started with: Does the use of risk management add value? Empirical research on this question is relatively recent. In all, we found ten studies, the first of which was published in 2001. To proxy for a firm's value, nine of the studies used Tobin's Q, which is the ratio of a company's market value to the replacement value of its assets. In Exhibit 4, we have arranged these studies into four groups:

- 1) One study of interest rate and FX risk management by financial institutions
- 2) Five studies of interest rate and FX risk management by industrial corporations
- 3) One study of commodity price risk management by commodity users
- 4) Three studies of commodity risk management by commodity producers

In the case of interest rate and FX risk management (Parts 1 and 2 of Exhibit 4), the evidence shows a positive relationship between risk management and the value of the firm. The study of banks' use of interest rate and FX derivatives concludes that such activities are associated with higher firm value (as measured by Tobin's Q). Furthermore, all five studies of industrial companies' use of FX derivatives (including one study that also included interest rate derivatives) found evidence that risk management adds value.

The most-cited study (and one of the few published papers) in this line of research is Allayannis and Weston (2001) on the use of foreign currency derivatives by large nonfinancial firms between 1990 and 1995. Again using Tobin's Q as an approximation of firm value, they found that FX hedging is associated with a 4.8% premium for companies with FX exposure (as measured by foreign sales). But this finding presents the problem of distinguishing between correlation and causality: Could the corporate use of derivatives alone account for this almost 5% premium, or does a sophisticated risk management program presuppose some degree of corporate success? Another published study (Guay and Kothari (2003)) concluded that corporate derivatives positions in general are far too small to account for the valuation premium reported by Allayannis and Weston,<sup>15</sup> and that the positive association between derivatives and value is more a reflection of the tendency of successful companies to use derivatives.

Nevertheless, there are a number of other studies of FX and interest rate risk management that shed a more direct light on this question of causality. An important published study by Graham and Rogers (2002) examined a broad cross section of 442 companies and concluded that hedging FX and/or interest rates increases firm value by 1.1% through increased debt capacity and tax benefits.<sup>16</sup> Perhaps even more suggestive, Nain (2004) reported that companies that choose not to hedge FX risk in industries where the use of FX derivatives is common had 5% lower Tobin's Q than their hedged competitors.<sup>17</sup> The novel approach of this study may be the most effective way of addressing the question: What difference does hedging really make?

Now, let's turn to the case of commodity price risk management. As summarized in parts 3 and 4 of Exhibit 4, the evidence suggests that whether or not risk management adds value depends on whether the company is a user or producer of the commodity. Taking an approach similar to that of the Nain study just mentioned, the single study of commodity risk management by commodity users (Carter, Rogers, and Simkins (2005)) found that fuel price hedging by airlines was associated with significantly higher firm values. More specifically, the study examined 29 U.S. airlines over the period 1992-2003 and found that 1) the stock prices of all the airlines were highly sensitive to fuel prices and 2) the prices of the airlines that hedged traded at a 12-16% premium over those that did not.<sup>18</sup> Such results do not seem unreasonable, especially when one considers that the annualized volatility of jet fuel prices is around 30% (as compared to, say, 11% for major currencies). Consider the recent hedging results for two major airlines, American Airlines and Southwest Airlines. At the end of 2004, AMR (parent company of American Airlines) had hedged roughly 5% of its 2005 fuel requirements and, as a result, expected to pay \$1.3 billion *more* for jet fuel in 2005 than in 2004 (a considerable amount, considering that 2004 revenues were \$18.6 billion and the net loss for that year was \$761 million). By contrast, Southwest Airlines' aggressive hedging program (which involved hedging over 80% of its 2005 fuel requirements, with some contracts extending up to six years) has saved the firm over \$1 billion on fuel since 2000, allowing it to make important capital investments when strategic opportunities arise.<sup>19</sup>

15. Guay and Kothari reported that, for the median firm in their sample of 234 firms, a simultaneous three-standard-deviation change in interest rates, FX rates, and commodity prices would result in a cash inflow of only \$15 million and would increase the value of the firm's derivatives portfolio by only \$31 million.

16. They found that hedging increases the mean (median) firm's debt ratio by 2.03% (2.46%), consistent with increased debt capacity resulting from lower income volatility. The higher debt ratios lead to tax deductions equal to about 1.1% of firm value.

17. While not included in the exhibit, additional support for this conclusion was provided by another study: Lin, Pantzalis, and Park (2005) found that the use of risk management by nonfinancial firms was associated with lower levels of equity undervaluation (measured as the deviation of a firm's equity value from its intrinsic or fundamental value using six different proxies of value including abnormal returns and analysts' forecasts). Other studies worth noting in this context are Lin and Smith (2003) and Dadalt, Gay, and

Nam (2002). In their study of companies over the period 1992-96, Lin and Smith found that companies that hedge have a lower cost of equity than non-hedgers (in the range of 0.4-2.9%) using both ex post (average realized) and ex ante (expected) cost of equity measures. Dadalt, Gay, and Nam revealed that both the use of derivatives and the extent of derivatives usage were associated with lower asymmetric information in that analysts' earnings forecasts were more accurate and less dispersed.

18. They also note that analysts' forecasts for hedging airlines tended to be more accurate, an indirect benefit of hedging also mentioned by Guay and Kothari (2003).

19. For example, their hedging program has helped give them the financial capability to make capital expenditures to increase their market position in weaker competitors' markets, aggressively expand new routes, and make energy-saving improvements, including the addition of blended winglets to 177 of their Boeing 737-700 aircraft (as of December 31, 2004).

But what about the three studies of commodity producers? Two studies of oil and gas firms and a study of gold mining companies all found that commodity risk management had either no effect or a negative effect on equity values. The most important paper of the three, Jin and Jorion (2005), studied the hedging activities of 119 U.S. oil and gas producers from 1998-2001 and concluded that, while hedging reduced the firm's stock price sensitivity to oil and gas prices, it did not appear to increase value. As the authors conclude, "...one might even argue that investors take positions in oil producers precisely to gain exposure to oil prices. If so, an oil firm should not necessarily benefit from hedging oil price risk."<sup>20</sup>

## Conclusions

Contrary to the implications of the Capital Asset Pricing Model, the findings of academic studies suggest that financial price risks can affect the expected returns on stocks and hence stock prices themselves. For example, there is clear evidence that the equity returns of financial institutions are sensitive to interest rate changes. And industrial companies with foreign sales and cash flows (though not large-scale foreign operations) exhibit greater sensitivity to foreign exchange rate changes than most wholly domestic firms. What's more, the evidence also suggests that the corporate uses of derivatives to manage certain "diversifiable" risks reduces the sensitivity of their stock returns to those risks.

But how does reduced sensitivity to price risks translate into added value—and if so, how? The main argument offered by finance academics is that the resulting reduction in cash flow volatility reduces the likelihood that the company will become financially distressed or be forced to pass up valuable investment opportunities. And what little evidence we now have on this issue—which shows positive associations between higher cash flow volatility and both lower corporate investment and lower share values—is consistent with this argument.

Is there any direct evidence that risk management increases firm value? The answer is yes, but the evidence is fairly limited as yet. A number of more recent studies show a clearly positive correlation between higher share values and the use of derivatives to manage foreign exchange rate risk and interest rate risk. And one study provides fairly compelling evidence that the use of commodity price derivatives by commodity users increases share values. But studies of hedging by commodity producers provide no clear support for the argument that risk management adds value. At a minimum, whether hedging adds value appears to depend on the types of risk to which a firm is exposed.

For those of us who have spent much of our careers promoting the use of derivatives to manage financial price risk, the results of the research to date are reassuring. But it also raises questions that deserve more attention:

- The available evidence indicates that although the management of interest rate and foreign exchange rate risks does indeed add value, the effect is larger than would be expected. Is the observed effect the market's reaction to the risk management activity itself; or are we observing some kind of "self-selection" process in which successful firms are more likely to have the capital and other resources needed to run a derivatives program? How do shareholders react to a change in the scale of risk management activities; is more derivatives trading preferred to less? And are there other ways in which the use of derivatives might be adding value?
- Some of the studies suggest that the use of risk management reduces the sensitivity of the share price not only to the financial price being managed but to general market risk ( $\beta$ ). How "robust" is this result? Can determinants of the size of this effect be identified?
- How is information on risk management being acquired by shareholders? Do security analysts provide more favorable ratings to companies that actively manage risk? If so, why?

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20. One published paper, while indirectly related to our question, provides evidence for a positive effect. Adam and Fernando (2005) found that firms in the gold mining industry have consistently realized positive cash flows from their derivatives transactions for gold.

The authors documented that a key source of this cash flow is realized from gold producers trading on a persistent positive risk premium in the forward markets.



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