# The Value to Shareholders of Hedging Operational Risk

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**Abstract**

While there is a good number of empirical studies that investigate the relationship between a firm's characteristics and its risk management practices, there are only four studies that directly investigate whether a firm's risk management practices actually generate profit for the firm. These studies are Allayanis and Weston (2001), Carter et al., (2003), Jin and Jorion, (2006) and Mackay and Moeller, (2007). These four studies use Tobin's q to measure the firm's profitability. There is disagreement among these studies as to strength of the relationship between hedging and q. Also, the choice of q as a measure of profitability creates ubiquity in the interpretation of results, especially since Tobin's q is also widely used as a measure of market power and as a measure of growth opportunities. This study measures wealth as the holding period return, as market value and as cash dividends and find that firms that hedge more of their core risk, on average pay higher dividends.

EFM classification codes: 210, 450, 740

## 1. Purpose

Economies have friction, and this friction creates costs. A properly designed corporate risk management program can reduce these frictional costs. Frictional costs stem from investment decisions that are not optimal in size and/or time, from costs associated with the probability of financial distress, from convex tax schedules and from information asymmetries. Aretz et al. (2007) provide a succinct literature review on how corporate risk management programs reduce frictional costs. The net benefits from reducing frictional costs can accrue to managers, to shareholders, or to both. If enough of the benefits of corporate risk management accrue to shareholders, then shareholders should enjoy higher value. While there is a good number of empirical studies that investigate the relationship between a firm's characteristics and its risk management practices, there are only four studies that directly investigate whether a firm's risk management practices actually generate profit for the firm. These studies are Allayanis and Weston (2001), Carter et al., (2003), Jin and Jorion, (2006) and Mackay and Moeller, (2007). These four studies, however, use Tobin's q to measure the firm's profitability. The choice of q as a measure of profitability creates ubiquity in the interpretation of results, especially since Tobin's q is also widely used as a measure of a firm's growth opportunities. This study contributes to the literature as it clarifies the relationships between hedging and shareholder value.

*1.1 Difficulty of interpreting existing results on the value of hedging*

Tobin (1969, p.21) introduces q as a theoretical construct for the "value of capital relative to its replacement cost" in his examination of the relationship between monetary policy and investment. Lindenberg and Ross (1981), the first to calculate q, employ it as a measure of a firm's market power while Smirlock et al. (1984) refine the use of q as a measure of a firm's ability to extract rents. Either a difficult-to-replicate competitive advantage or a protective regulation, creates barriers to entry which allow incumbent firms to extract rents. Efficient markets capitalize rents into the prices of the firm's outstanding securities. The existence of positive rents, therefore, results in a market value that is higher than the replacement cost of the firm's capital stock. Hence, q exceeds one. Stevens (1986), however, within the same literature stream argues that it is the use of current earnings for future growth that underlie high q rations, rather than market power. Meanwhile, Wernerfelt and Montgomery (1988) and McFarland (1988), within a different stream of literature, establish q as a measure of a firm's current profitability. So today, researchers are using q as a measure of a firm's market power, or as a measure of a firm's growth opportunities, or as a measure of a firm's current profitability. To confuse things further, authors have diverged in their measurement of q even though evidence suggests that empirical results are sensitive to how Tobin's q is constructed.[1]

The respective samples used in Mackay and Moeller, (2007), Allayanis and Weston (2001), Carter et al., (2003) and Jin and Jorion, (2006) have a progressively larger ratio of assets to growth opportunities. As the ratio of assets to growth opportunities increases from study to study, the studies find that the impact of hedging on q decreases.[2] This may be a coincidence. But is can also be that q is driven by the impact of hedging on the firm's systematic risk rather than on its profitability. Hedging changes the firm's total risk, which then changes the firm's systematic risk which in turn changes Tobin's q. Scordis et al. (2008) find that a firm's systematic risk decreases when total risk decreases if the firm has more assets in relation to growth opportunities, but the firm's systematic risk increases if the firm has fewer assets in relation to growth opportunities. And as systematic risk changes, q changes (Stevens, 1986; Nguyen and Bernier,1988). Thus, investigating the relationship between hedging and profitability, where q is the measure of profitability, may be capturing the impact of hedging on the firm's systematic risk rather than on its profitability. As an alternative, this study uses holding period return, market value and cash dividends as measures of value, rather than Tobin's q, to clarify the relationship between hedging and value.

## 2. Specification and estimation of models

Empirical study of corporate risk management practice presents both an endogeneity and an exogeneity challenge. Daníelsson (2002) explains that when corporate risk becomes the focus

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[1] For example, Allayanis and Weston (2001), Carter et al., (2003), Jin and Jorion, (2006) and Mackay and Moeller, (2007) all use different ways to measure Tobin's q. Collectively these studies employee nine different ways to measure q, but only two of the studies share one common measure: (Market Value of Stock) ÷ (Book Value of Assets).

[2] Mackay and Moeller (2007) find that on average, hedging increases q by 3 percent. The average firm in their sample has the most assets in relation to growth opportunities. The average firm in this sample has assets of $12,088 million and a ratio of capital expenditures to assets (the study's measure of growth opportunities) of 0.05. Carter et al. (2003) find that on average, hedging increases q by 14%. The average firm in the Carter et al. sample has assets of $937 million and a ratio of capital expenditures to assets of 0.27. The findings of Allayanis and Weston (2001) fall between these two studies. They find that on average, hedging increase q by 5%; the average firm in this sample has assets of $7.701 million and a ratio of capital expenditures to assets of 0.10. Jin and Jorion (2006) find no relationship between hedging and q. The average firm in their sample seems to have the same amount of assets relative to growth opportunities with assets of $973 million and proven oil reserves of $935 million. Proven oil reserves is an indication of the future growth prospects of firms with a SIC code of 1311, from where Jin and Jorion draw their data.

of management, even if management takes no specific action, the dynamics between the corporation and its risk change. For example, a better understanding of the firm's risk can change the risk appetite of individuals, which in turn changes the firm's risk. Jin and Jorion (2006, p. 894) suggest that this "endogeneity problem should be alleviated by selecting firms within the same industry." The use of a single industry should also alleviate the exogeneity problem identified by Foot et al. (1993) as well as by Adam et al. (2007). These authors explain that the risk management strategy for a given firm further depends on the nature of competition in the firm's market and on the risk strategies of its competitors. Thus, this study uses publicly-traded firms from a single industry, the insurance industry.

Publicly-traded insurers are structured as holding firms of wholly owned subsidiaries licensed to sell life insurance products (SIC code of 6311) or property and casualty insurance products (SIC code of 6331). The study uses upstream insurance firms for two reasons. First, the diversity in business practices of these firms is reminiscent of the diversity in a cross-industry sample. Second, these firms hedge different proportions of their operational risk but when they do hedge they do so using the identical instrument. They purchase reinsurance. The use of the identical hedging instrument by all the firms in the study removes the need to control for the hedging effectiveness or for the optimality of the mix of the hedging instruments the firms are using as the work of Gay et al. (2003) and Mackay and Moeller (2007) would suggest. When insurers want to hedge their exposure from potential obligations to their policyholders they buy reinsurance, or cede insurance to a reinsurer; the buyer of reinsurance is the ceding insurer and the seller is the reinsurer. Simply put reinsurance is insurance for insurance firms.

*2.1 Specification and estimation of a returns model*

Practitioners and academic economists have long relied on the capital assets pricing model (CAPM) of Shapre (1964) to estimate a stock's return. There is considerable debate, however, on whether the CAPM and its use of just the stock's beta is a sufficient estimator of returns. The study does not take a stance on which asset pricing model best describes returns. It investigates whether the returns to shareholders are influenced by the usage of reinsurance as an operational hedge using the specification of Fama and French (1993) with additional variables for reinsurance usage and a variable for the net-of-reinsurance idiosyncratic risk of the firm. This is done because if in fact returns are explained by variables other than systematic risk, not including such variables in the model will bias its estimated coefficients. But there is no bias if the model erroneously includes additional explanatory variable. The model also includes a series of binary variables to denote all but one of the individual firms (firm effects) as a further control for firm-specific omitted variables. The model (for which Table 1 reports results) is estimated using a fixed effects estimator and a random effects estimator:

$$(HPR)_{it} = \gamma_o + \gamma_1 (OpHedge)_{it} + \gamma_2 (SRSK)_{it} + \gamma_3 (IRSK)_{it} + \gamma_4 (SMB)_t + \gamma_5 (HML)_t + \boldsymbol{B}_i + \varepsilon_{it} \qquad (1)$$

The subscripts (i) and (t) define the insurer and the year of the observation, (*HPR*) represents the annual holding period return the insurer generates for its shareholders, (*OpHedge*) measure the use of reinsurance to hedge an insurer's operational risk usage, (*SRSK*) measures the systematic risk of the insurer's stock, (*IRSK*) represents the idiosyncratic risk of the insurer not eliminated by reinsurance, (*SMB*) is the difference between a portfolio of small market capitalization stocks and a portfolio of large market capitalization stocks, (*HML*) is the difference between a portfolio of high market to book ratio stocks and a portfolio of low market to book ratio stocks, ($\boldsymbol{B_i}$) is a series of binary variable to denote all but one of the individual firms and ($\varepsilon$) is the error term. The binary variables control for additional factors that may influence (*HPR*).

The study measures holding period return (*HPR*) as the change in market value of the firm during the year plus dividends paid to stockholders, all divided by the market value of the firm at the beginning of the year. Operational hedge is measured as the ratio of ceded premiums to gross premiums written (*OpHedge*) as this ratio is the most popular measure in the literature of the intensity with which reinsurance is used usage. Systematic risk (*SRSK*) is measured as the estimated coefficient ($\hat{â}$) of the ordinary least squares regression $(SRET)_{ij} = \alpha + \beta(MRET)_{ij} + \delta_{ij}$. The subscripts (i) and (j) define individual stocks and days, (*SRET*) is the daily stock return and (*MRET*) is the daily value-weighted market return. Idiosyncratic risk net of the operational hedge (*IRSK*) is measured as the error term in the regression model $\sigma(\delta_{ij})_{it} = \alpha + \theta(OpHedge)_{it} + \kappa_{it}$.

A Hausman test favors the use of the random effects estimator over the fixed effects estimator and as Table 1 shows, the p-value of the random effects estimated coefficient of (*OpHedge*) suggests a 90.1 percent probability that this estimated coefficient is significantly different from zero and positive. Although the statistical significance of this relationship is at the lower-end of what is traditionally viewed as significant, it is consistent with the findings of Mackay and Moeller, (2007), Allayanis and Weston (2001), Carter et al., (2003). Systematic risk and idiosyncratic risk are both positively related to holding period returns as the p-values of the random effects estimated coefficients (*SRSK*) and (*IRSK*) suggest at least a 95 percent probability that these estimated coefficients are significantly different from zero and positive. The positive relationship between idiosyncratic risk and return is consistent with an environment where shareholders are not well diversified so background risk creates risk aversion. The positive relationship between risk and return is also consistent with viewing stock as a combination of cash flow from assets-in-place and cash flow from real options. An increase in total risk will make the option component of a stock more valuable.

The holding period return (*HPR*) variable used in this section combines the cash dividends the insurer pays as well as its market value. If indeed the use of reinsurance confirms wealth benefits to stockholders, then one should also observe a positive relationship between the use of reinsurance and the payments of dividends or between the use of reinsurance and stock price. The following two sections investigate further how the reinsurance hedge impacts dividends and market value.

**Table 1**
**Fixed Effects and Random Effects Estimator of the Holding Period Returns Model**

The fixed effects estimator is a least squares procedure and assumes that the effect of omitted variables captured by the series of firm-specific and year-specific binary variables is constant across firms and years. The random effects estimator is a feasible generalized least squares procedure and assumes that the firm and year effects differ across firms and years.

| | Fixed Effects | | Random Effects | |
|---|---|---|---|---|
| | Estimated Coefficient | p-value | Estimated Coefficient | p-value |
| *Constant* | 0.066 | 0.353 | 0.040 | 0.261 |
| *OpHedge* | –0.265 | 0.146 | 0.202 | 0.099 |
| *SRSK* | 0.179 | 0.004 | 0.180 | 0.030 |
| *IRSK* | 3.109 | 0.079 | 3.333 | 0.002 |
| *SMB* | –0.330 | 0.023 | –0.095 | 0.264 |
| *HML* | 0.946 | 0.000 | 0.887 | 0.000 |

$$(HPR)_{it} = \gamma_o + \gamma_1 (OpHedge)_{it} + \gamma_2 (SRSK)_{it} + \gamma_3 (IRSK1)_{it} + \gamma_4 (SMB)_t + \gamma_5 (HML)_t + \boldsymbol{B}_i + \varepsilon_{it}$$

There are 403 degrees of freedom. The adjusted $R^2$ from the least squares estimator is 10.93 percent. The Hausman test value of 5.04 favors the **random effects** estimator over the fixed effects estimator.

*2.2 Specification and estimation of a dividends model.*

The literature advances several reasons as to why firms pay dividends. Unfortunately, there is not a single generally accepted model for the dividend decision of firms as the reviews by Frankfurter and Wood (2002) as well as Baker, Powell and Veit (2002) reveal. In fact, Benartzi, Michaely and Thaler (1997, p.1032), conclude that ... *Lintner's model of dividends remains the best description of the dividend setting process available*. The Lintner (1956) model is an inductive model where the dividends a firm pays are a function of the firm's current earnings and past dividends. Lee and Forbes (1982) extend Lintner's dividend model to insurance firms.

The study estimates the Lee and Forbes (1982) model with an added term for the reinsurance hedge as well as firm- and year-effects to provide further control for omitted variables:

$$(DIV)_{it} = \gamma_o + \gamma_1 (OpHedge)_{it} + \gamma_2 (NI)_{it} + \gamma_3 (DIV)_{it-1} + \gamma_4 (CR)_{it} + \boldsymbol{B}_i + \boldsymbol{B}_t + \varepsilon_{it} \quad (2)$$

The subscripts (*i*) and (*t*) define the insurer and the year of the observation, (*DIV*) is the firm's cash dividends, (*OpHedge*) measures the reinsurance hedge, (*NI*) is the net income of the insurers, (*CR*) represents the capacity ratio of the insurer, ($\boldsymbol{B_i}$) is a series of binary variables to denote all but one of the individual firms and ($\boldsymbol{B_t}$) is a series of binary variables to denote all but one of the individual years and (ε) is the error term. Table 2 reports estimated results for this model.

A Hausman test favors the use of the fixed effects estimator over the random effects estimator. The p-value for the fixed effects estimator suggests a 96.6 percent probability that the estimated coefficient of (*OpHedge*) is significantly different from zero and positive, a finding that is again consistent with Mackay and Moeller, (2007), Allayanis and Weston (2001), Carter et al., (2003). Lagged dividends and net income are positively related to cash dividends as their p-values suggest at least a 99.8 percent probability that the estimated fixed effects coefficients of ($DIV_{t-1}$) and (*NI*) are significantly different from zero and positive. The capacity ratio of the insurer is also positively related to cash dividends as its p-value suggest a 89.6 percent probability that the estimated fixed effects coefficient of (*CR*) is significantly different from zero and positive. The positive relationship between lagged dividends, net income, capacity ratio and cash dividends is consistent with the findings of Lee and Forbes (1982).

**Table 2**
**Fixed Effects and Random Effects Estimator of the Dividends Model**

The fixed effects estimator is a least squares procedure and assumes that the effect of omitted variables captured by the series of firm-specific and year-specific binary variables is constant across firms and years. The random effects estimator is a feasible generalized least squares procedure and assumes that the firm and year effects differ across firms and years.

$$(DIV))_{it} = \gamma_o + \gamma_1 (OpHedge)_{it} + \gamma_2 (NI)_{it} + \gamma_3 (DIV)_{it-1} + \gamma_4 (CR)_{it} + \boldsymbol{B}_i + \boldsymbol{B}_t + \varepsilon_{it}$$

There are 391 degrees of freedom. The adjusted $R^2$ from the least squares estimator is 98.61 percent. The Hausman test value of 16.15 favors the **fixed effects** estimator over the random effects estimator.

| | Fixed Effects | | Random Effects | |
|---|---|---|---|---|
| | Estimated Coefficient | p-value | Estimated Coefficient | p-value |
| *Constant* | 25.969 | 0.012 | –2.549 | 0.265 |
| *OpHedge* | 17.927 | 0.034 | 8.872 | 0.102 |
| $DIV_{t-1}$ | 0.991 | 0.000 | 1.019 | 0.000 |
| *NI* | $0.519 \times 10^{-5}$ | 0.002 | $0.864 \times 10^{-5}$ | 0.230 |
| *CR* | 20.758 | 0.104 | 10.409 | 0.186 |

*2.3 Specification and estimation of a market value model.*

There are several broad drivers to insurance firm value. These drivers are the current cash flow to stockholders, the growth opportunities of the firm (which hopefully will translate to more future cash flow for stockholders), and the relative size of the firm's liabilities to policyholders and bondholders (see for example Cummins and Lamm-Tennant, 1994; Babbel and Merrill, 2005, *Sigma* 3/2005). The following model uses variables that capture these value drivers as a function of the firm's market value:

$$(MV)_{it} = \gamma_o + \gamma_1 (eOpHedge)_{it} + \gamma_2 (CFO)_{it} + \gamma_3 (CFI)_{it} + \gamma_4 (DIV)_{it} + \gamma_5 (REP)_{it} + \gamma_6 (TDRA)_{it} + \boldsymbol{B}_i + \boldsymbol{B}_t + \varepsilon_{it} \qquad (3)$$

The subscripts (*i*) and (*t*) define the insurer and the year of the observation, (*MV*) represents the firm's market, (*OpHedge*) measures the reinsurance hedge, (*CFO*) represents the net cash flow from operating activities, (*CFI*) represents the cash flow from investing activities, (*DIV*) measures the cash paid to stockholders in the form of dividends, (*REP*) measures the cash paid to stockholders in the form of stock repurchases, (*TDRA*) measures the total debt of the insurer relative to its assets, (***B***) is a binary variable to denote individual firms and individual years and (ε) is the traditional error term. The binary firm specific binary variables control for additional factors that may influence (*MV*) including growth opportunites. Table 3 reports estimated results for this model.

In this model specification the estimate coefficient of (*OpHedge*) is not statistically significant. A Hausman test favors the use of the fixed effects estimator over the random effects estimator. For the fixed effects estimator, the estimated coefficients of (*CFO*), (*DIV*) and (*REP*) are significantly different from zero and positively related to market value as their respective p-values are at least a 93.4 percent. The liabilities of the insurer relative to its assets are negatively related to market value as its p-value suggests a 99.9 percent probability that the estimated fixed effects coefficients of (*TDRA*) is significantly different from zero and negative. These results are consistent with the findings in the literature that higher actual or anticipated cash flow to stockholders results in higher market valuations. The negative estimated coefficient of (*TDRA*) is consistent with the residual nature of stock. As the liabilities of the insurer to its policyholders and bondholders increase in relation to its assets, the stockholders who are residual claimants of the firm see their share of the cash flow generated by the assets of the firm decline.

**Table 3**
**Fixed Effects and Random Effects Estimator of the Market Value Model**

The fixed effects estimator is a least squares procedure and assumes that the effect of omitted variables captured by the series of firm-specific and year-specific binary variables is constant across firms and years. The random effects estimator is a feasible generalized least squares procedure and assumes that the firm and year effects differ across firms and years.

$$(MV)_{it} = \gamma_o + \gamma_1(OpHedge)_{it} + \gamma_2(CFO)_{it} + \gamma_3(CFI)_{it} + \gamma_4(DIV)_{it} + \gamma_5(REP)_{it} + \gamma_6\,(TDRA)_{it} + \boldsymbol{B}_i + \boldsymbol{B}_t + \varepsilon_{it}$$

There are 392 degrees of freedom. The adjusted $R^2$ from the least squares estimator is 93.40 percent. The Hausman test value of 42.35 favors the **fixed effects** estimator over the random effects estimator.

| | Fixed Effects | | Random Effects | |
|---|---|---|---|---|
| | Estimated Coefficient | p-value | Estimated Coefficient | p-value |
| *Constant* | 1769.658 | 0.000 | 1654.623 | 0.002 |
| *OpHedge* | 775.204 | 0.192 | 101.927 | 0.452 |
| *CFO* | 1.349 | 0.000 | 1.446 | 0.000 |
| *CFI* | 0.013 | 0.461 | 0.027 | 0.418 |
| *DIV* | 1.819 | 0.066 | 3.352 | 0.002 |
| *REP* | 4.723 | 0.000 | 5.214 | 0.000 |
| *TDRA* | −1111.123 | 0.000 | −1127.254 | 0.002 |

## Conclusion

There are only four studies that directly investigate whether a firm's risk management practices generate profit for the firm. These studies are Allayanis and Weston (2001), Carter et al., (2003), Jin and Jorion, (2006) and Mackay and Moeller, (2007). These four studies, however, use Tobin's q to measure the firm's profitability. The choice of q as a measure of profitability creates ubiquity in the interpretation of results, especially since Tobin's q is also widely used as a measure of a firm's growth opportunities. As an alternative, this study uses holding period return, market value and cash dividends as measures of value, rather than Tobin's q, to clarify the relationship between hedging and value. While the study does not find a statistically significant relationship between hedging operating risk through the use of reinsurance and market value, the study does find a significantly positive relationship between hedging and holding period return and between hedging and the payment of dividends. The statistically strongest finding of this study is that insurance firms that hedge more of their operating risk using reinsurance, on average pay higher dividends.

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