Managerial Stock Options and the Hedging Premium

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Abstract

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JEL Classification: G32, F31

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Abstract

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1. Introduction

There is evidence that hedging increases firm value. Allayannis, Lel, and Miller (2003), Allayannis and Weston (2001), Carter, Rogers, and Simkins (2003), and Pramborg (2004) all find an economically large and statistically significant value premium associated with hedging. However, some recent papers have questioned the value of hedging. For example, Lookman (2004) uses a sample of oil and gas companies and finds that hedging per se does not increase firm value. He concludes that hedging is a noisy proxy for agency problems and management skills. Jin and Jorion (2005) also examine oil and gas producers and don’t find any impact of hedging on firm value and suggest that the correlation between hedging and firm value is likely due to endogeneity among the variables.

Despite the inconclusive evidence on the average value premium associated with hedging, there are some theoretically ‘good’ and ‘bad’ reasons for hedging. One good reason is that due to the convexity of the tax schedule hedging may reduce expected taxes (Mayers and Smith (1982) and Smith and Stulz (1985)). Graham and Rogers (2000), however, concluded that firms do not hedge in response to convexity because the incentive is small relative to other hedging incentives. Another hypothesis for why hedging may increase firm value is that hedging may mitigate the underinvestment problem. Gay and Nam (1998) provide empirical evidence that hedging reduces the costs associated with underinvestment. In addition, Mayers and Smith (1982) and Smith and Stulz (1985) theorize that by reducing the probability of financial distress, hedging reduces financial distress costs. Empirical support has been provided by Graham and Rogers (2000) and Nance, Smith, and Smithson (1993).

Smith and Stulz (1985) discuss how managerial exposure from their stock options may provide incentives for bad hedging. Managers’ stock options have two significant yet opposing effects on managerial incentives (Lambert, Larcker, and Verrecchia (1991) and Carpenter (2000)). First, stock options are sensitive to changes in the stock price (delta): as
the stock price increases (decreases) option values increase (decrease). Therefore, when risk-averse managers have a significant portion of their wealth in stock options, they are motivated to hedge firm risk. Second, stock options are sensitive to stock volatility (vega) because of the convex payoff structure of stock options. That is, increased stock volatility increases the value of stock options, thus giving an incentive for managers to hedge less. The first effect increases with the moneyness of the option, while the second decreases with the moneyness of the option. The net effect is that managers with options out of the money have incentive to hedge firm risk less, while managers with options in the money have incentives to hedge firm risk more. Therefore, options may induce managers into bad hedging, by over- or under-hedge, from the perspective of the typical diversified shareholder.

Knopf, Nam, and Thornton (2002) and Rajgopal and Shevlin (2000) find empirical evidence that managers sometimes use derivatives to hedge their own risk exposure from options. Although Knopf et al and Rajgopal and Shevlin show examples of bad hedging, they don’t examine whether bad hedging actually reduces firm value. Allayannis et al (2003) find that the hedging premium is lower in countries with poor corporate governance protections. However, they don’t attribute the lower value to any specific motivation on the part of the owners.

In this paper, we use a sample of Swedish firms to look at the impact on value of a specific incentive for bad hedging: managerial stock option plans. We use a method developed by Core and Guay (2002) to estimate the sensitivities of stock options to changes in the stock price (delta) and volatility (vega).

For our tests we initially run Ordinary Least Squares (OLS) regressions as a base case, and, because of the endogeneity problems suggested above, we also perform Treatment Effects and Two Stage Least Squares (2SLS) as robustness checks. We find statistically significant evidence that firms that hedge have higher valuations (using Tobin’s Q) than firms
that don’t hedge in our OLS and Treatment Effects regressions. This is consistent with some previous studies (e.g. Allayannis et al (2003)). However, for our simultaneous equations (2SLS) specification this relationship, although positive, is no longer statistically significant. This result is consistent with Lookman (2004) and Jin and Jorion (2005).

Interestingly, in the Treatment Effect and 2SLS specifications our main result holds: When managers hedge their stock options’ deltas (bad hedging) firm value significantly decreases. Therefore, we conclude that although the general relationship between hedging and firm value is not clear, hedging based upon managerial self-interest reduces shareholder value.

In Section 2, we describe our sample and define our variables. Section 3 reports our results. Section 4 concludes the paper.

2. Sample selection and variable definitions

2.1 Sample selection

Since public data are not available on Swedish firms’ foreign exchange (FX) exposures and hedging practices in tractable form, we employ three questionnaires to determine exposures and firms’ use of financial hedges. We sent the first questionnaire to 160 firms in October 1997; it contained questions concerning the respondents’ inherent exposures and hedging policies for 1997. We sent the second questionnaire to 275 firms in March 2000, followed by the third questionnaire, which we sent to 261 firms in September 2001. The questionnaires of 2000 and 2001 asked questions concerning 1998-1999 and 2000-2001, respectively.

We sent the questionnaires to firms that met the following three criteria: (i) the firm was listed at the Stockholm Stock Exchange, (ii) the firm was a non-financial firm, and (iii) the firm’s headquarter was located in Sweden. We excluded financial firms because the focus of the study is on end-users rather than producers of financial services. We also excluded
foreign firms (firms with headquarters located outside Sweden) to eliminate differences between firms arising from differences in accounting standards between countries.

We obtained 101, 130, and 128 usable responses from the first, second, and third questionnaire, representing response rates of 63, 47, and 49 percent, respectively. The three surveys rendered a total of 617 firm year observations. This number was reduced to 308 firm year observations when we collected accounting data and data on managerial stock options. Any firms without complete data were deleted. To check for potential non-response bias, we compared the sample firms with firms that did not return the questionnaires; this comparison indicated no response bias.

2.2 Variables

2.2.1 Measure of hedging activity

To measure hedging activity of firms in our sample, we use a dummy variable (HEDGE) which is set to one if a firm hedges committed transaction FX exposure during the year and zero otherwise. The rationale for using committed transaction FX exposure hedging as our proxy for risk management activity is that (i) FX exposure is the most common source for hedging among Swedish firms and (ii) committed transaction exposure is the predominant source for hedging among FX exposures, according to our questionnaires. We also use this variable as an independent variable in the regressions on firm market value. In addition, as robustness test we use the fraction of committed transaction FX exposure hedged (%HEDGE).

We obtained information on this variable from the questionnaires. One advantage of using questionnaire data is that it controls for the possibility that financial instruments are not used for hedging. This may be important, given Leland’s (1998) results indicating that firms may use risk management tools for speculative purposes.
2.2.2 Measure of firm market value

We follow Bodnar, Tang, and Weintrop (1999) and Allayannis and Weston (2001) and others, and use the logarithm of Tobin’s Q, as a proxy for firms’ market values. Our variable, TOBINSQ, is defined as the logarithm of the ratio of market value to replacement cost of assets, evaluated at the end of the fiscal year for each firm, using year-end values. We use book value of total assets minus book value of equity plus market value of equity as proxy for market value, and book value of total assets as proxy for replacement cost of assets. While most previous researchers have used book value as a proxy for replacement cost (e.g. Fama and French (1998) and Bodnar et al (1999)), Allayannis and Weston (2001) followed the procedure outlined in Lewellen and Badrinath (1997) and in Perfect and Wiles (1994), which enabled them to calculate an improved measure of Tobin’s Q. However, they also used simple book values to calculate Tobin’s Q, and their results were not affected by the choice of measure. We collected the data required to calculate this variable from Dextel Findata TRUST database and the stock market guide Nordbanken Aktieguide Sommar 2001.

2.2.3 Measures of managerial wealth sensitivities

We follow Knopf et al (2002) and approximate the manager’s incentive to hedge her personal wealth by three different variables. Knopf et al use the market value of the manager’s stockholdings in the firm. However, both Tobin’s Q and the market value of the manager’s stockholdings in the firm are functions of the market value of equity; this may cause spurious correlation in the regressions on Tobin’s Q. Therefore, as our first measure of managerial incentive to hedge, we use CEO CONTROL, a dummy variable that equals one if the manager is the controlling (largest) shareholder and zero otherwise.9
One way to mitigate the manager’s incentive to reduce corporate risk is to set up a managerial stock option program. However, stock options have two opposing effects on managerial incentives. One effect comes from the sensitivity of options to stock return volatility. Since options have a convex payoffs structure, the value of the stock option increases with the volatility of the firm’s stock returns. Hence, our second measure of the manager’s incentive to hedge her personal wealth is the sensitivity of the stock options to changes in the volatility of the firm’s stock return. We define this variable as the SEK change in the value of the managerial stock options to a one percent change in the volatility of the underlying stock (Core and Guay (2002)). The variable is labelled OPTION VEGA.

Since the payoff of the stock option is directly linked to the value of the underlying stock price, another effect of managerial stock options on managerial incentives is its sensitivity to stock price. In this respect, managerial stock options tie the manager’s wealth to the stock price in a similar way as stock holdings, thereby decreasing a risk-averse manager’s incentives to bear risk. Our third measure of the manager’s incentive to hedge her personal wealth is, therefore, the sensitivity of the stock options to changes in the price of the underlying stock. We define this variable as the SEK change in the value of the managerial stock option to a one percent change in the price of the underlying stock (Core and Guay (2002)). This variable is labelled OPTION DELTA.

Core and Guay (2002) show how (i) an option’s sensitivity to changes in volatility (vega) decreases with the moneyness of an option while (ii) an option’s sensitivity to stock price changes (delta) increases with moneyness. Figure 1 illustrates these effects for an option with characteristics equal to median values in our sample of managerial options. For options in the money, the negative effect on the manager’s willingness to bear risk, stemming from the sensitivity to the stock price changes, dominates the positive effect, stemming from the sensitivity to volatility changes.
Information about the number of shares and stock options held by the CEO is collected from annual reports. We collect the option characteristics (strike price and time to maturity) from Sundqvist and Sundin (1997-2001). This source is published in January each year and contains ownership information for all listed Swedish firms. The managerial stock option information in the book is based on a questionnaire sent to all listed firms. There is no information about the response rate. Eighty-two firms in our sample have managerial stock options according to Sundqvist and Sundin (1997-2001). In 62 of these observations the CEO holds stock options. In the remaining 20 observations, other managers hold the stock options. We have performed all tests with and without these 20 observations: the results are essentially unchanged. All variables concerning managers’ equity and stock option ownership are estimated at the beginning of the year.

2.2.4 Control variables

Our control variables are expected to explain cross sectional differences in hedging activity and firm market value among our sample firms. Below we define the variables and explain why we include them.

a) **Firm size** (SIZE): Empirical research supports the perception that starting and managing a hedging program is associated with significant economies of scale (see e.g. Géczy, Minton, and Schrand (1997)). Also, Allayannis and Weston (2001) found differences in Tobin’s Qs for large firms as compared to small firms, where large firms were associated with lower Tobin’s Q. To control for this, we use the log of the book value of total assets in million SEK as a proxy for size.

b) **Liquidity** (LIQ): Hedging can increase the value of the firm by lowering the expected costs of financial distress (see Smith and Stulz (1985)). Nance et al (1993) argue that
the probability of encountering financial distress can be reduced by maintaining more liquid assets, and thereby reducing the need for hedging. We use the ratio of current assets to current liabilities as a proxy for liquidity.

c) **Leverage** (LEV): Hedging can reduce the variance of firm value and thereby the expected cost of financial distress (see Smith and Stulz (1985)). Hence, we expect leverage to be positively related to hedging. In addition, we expect a negative relationship between leverage and Tobin’s Q (see Fama and French (1998) and Allayannis and Weston (2001)). We use the book value of debt divided by the book value of equity as a proxy for leverage.

d) **Dividend dummy** (DIV): Nance et al (1993) predict that firms that pay dividends are more likely to hedge. Also, Fama and French (1998) inferred from their empirical results that dividends convey information about future profitability (expected net cash flows). Therefore, we expect that firms that pay dividends have higher Tobin’s Qs. To control for this, we use a dummy that is set to one if the firm pays dividend and zero otherwise.

e) **Profitability** (PROF): A profitable firm is likely to trade at a premium relative to a less profitable one. Therefore, we expect profitability to be positively associated with Tobin’s Q. As a proxy for profitability, we use the return on capital employed for the current year.

f) **Growth opportunities** (INVEST): Firms with more valuable growth opportunities are likely to invest more. We therefore expect investment level to be positively associated with Tobin’s Q. As a measure of investment level, we use the ratio of capital expenditure to total assets.

g) **Foreign activity** (FORACT): Given the fixed costs associated with a derivatives program, the decision to initiate one is not only determined by whether FX exposure
exists or not, but also by its level. We define our proxy for foreign activity, as the average of the proportion of revenues and the proportion of costs denominated in foreign currency.

h) \textit{Absolute net exposure} (ABSNETEXP): The decision to hedge is not only based on the level of foreign activity. If foreign revenues are equal to foreign costs and the distribution of revenues and costs among different currencies are about the same, the net exposure is roughly zero (see Marston (2001)). We define the absolute net exposure (ABSNETEXP) as the absolute value of the difference between the fraction of revenues and costs denominated in foreign currency.

i) \textit{Family control dummy} (FAMILY): When the largest shareholder is a family (or a group of individuals), one or several of the family members usually take an active part in the management of the firm as CEO and/or members of the board. In such cases, there is no separation of ownership from control. Furthermore, the family most likely hold a poorly diversified portfolio. This has implications for the incentive to reduce firm risk through e.g. hedging and possibly on firm performance (Anderson and Reeb (2002 and 2003)). We estimate the effect of family control by a dummy variable set equal to one if the largest vote holder is a family, an individual or a group of individuals; it is zero otherwise.

j) \textit{Outside blockholder dummy} (BLOCK10%): An outside blockholder may serve as an additional monitor of managers’ hedging decisions. As a proxy for outside monitoring, we use a dummy variable equal to one when there is an outsider with a block of 10% of the votes or more, and zero otherwise.

The accounting data required to calculate the explanatory variables a) – f) are collected from \textit{Dextel Findata TRUST database}, the stock market guide \textit{Nordbanken Aktieguide Sommar
2001 and annual reports. We obtain data for creating the explanatory variables g) and h) from the questionnaires and variables i) and j) are collected from Sundin and Sundqvist (1997-2001). Firm size, liquidity, leverage, family control and outside block-ownership are defined as the beginning of the year values. The flow variables, i.e. dividend, profitability, investments, and FX exposure are the totals for each year.

2.3 Descriptive statistics

In Table 1 we report descriptive statistics for our sample. Panels A and B report the statistics for the continuous variables and dichotomous variables, respectively. The sample is split according to whether the firm hedges currency exposure or not. The average (median) firm has foreign activity (FORACT) of 37.1 (36.6) percent. Firms with greater foreign activity are more likely to hedge. The average (median) firm that hedges has FORACT equal to 51.5 (50) percent while non-hedgers have FORACT equal to 24.6 (12.7) percent. Hedgers also have significantly higher absolute net exposure, are significantly larger, have lower leverage, and hold significantly more liquid assets. CEO ownership (both capital and excess votes) in hedging firms is significantly smaller. The value of CEO equity (VAL CEO EQUITY) does however not differ between the sub samples. There are no significant differences between hedgers and non-hedgers in terms of INVEST, PROF, and TOBINSQ.

From Panel B, it is evident that hedging firms are more likely to pay dividends, have an outside blockholder with more than 10 percent of the votes, and have employee (managerial) stock option plans. However, hedging firms are less likely to be controlled by the CEO or by a family.

In Panel C we report the descriptive statistics for the 82 stock option plans in our sample. On average, the options have three years to maturity and an underlying yearly VOLATILITY of 40 percent. The median option is out of the money. The median
MONEYNESS, defined as the current price divided by the strike price, is 0.869. The median stock option will increase by SEK 0.775 if the stock price increases by one percent (OPTION DELTA). The median option will increase by SEK 0.485 if the underlying volatility increases by one percent (OPTION VEGA).

Consistent with Knopf et al (2002), sorting the firms with option plans according to whether they hedge currency exposure indicates that the option plans in the hedging firms have significantly higher MONEYNESS and higher OPTION DELTA. Also, hedgers have significantly lower VOLATILITY; but this may of course be a result of the hedging.

### 3. Tests

In this section we perform two sets of tests. First, we examine whether managerial incentives influence firm hedging activity. Second, we test the impact of hedging on firm value. For the second set of tests, we pay particular attention to whether firm value decreases when hedging benefits managers, but not necessarily institutional shareholders or the typical diversified shareholder.

#### 3.1 Econometric Issues

For our tests we have some significant econometric issues. First, we have 308 firm year observations drawn from 152 different firms. Therefore, since we draw some of our observations twice or more from the same firm in different years, the observations may not be independent. This causes inflated standard errors. The Huber-White estimator asymptotically relaxes the assumption of independent observations. In all of our models we use the Huber-White estimator to calculate robust variance estimates. The Huber-White estimator also corrects for heteroskedasticity.
Another way to correct for correlated observations is a fixed effect model. However, very few firms changed hedging policy during our sample period. In fact, 139 firms (261 observations) did not change hedging policy at all. Of the 13 firms (47 observations) that changed hedging policy, they began hedging 10 times and quit hedging 11 times. Thus, there is too little within firm variation for a fixed effect procedure to find a significant relation even if one exists (see Zhou (2001)).

Second, a positive relationship between hedging and Tobin’s Q doesn’t necessarily imply that hedging increases value. Hedging may be correlated with some unknown factor that is also correlated with value. For example, Lookman (2004) finds that although hedging per se doesn’t have a significant impact on value; hedging is inversely correlated with agency costs, resulting in a positive correlation with Tobin’s Q. We use a Treatment Effects procedure to correct for this type of potential bias in our estimates. Treatment effects are estimated by Maximum Likelihood. Heckman 2-stage procedure generates similar but generally weaker results.

Finally, we have potential endogeneity problems among some of our variables, for example, firm value, and CEO equity, family control, and the decision to hedge (see e.g. Froot, Scharfstein, and Stein (1993)). To correct for biases caused by endogeneity, we have estimated simultaneous equations with firm value and these other variables. In all of the specifications our main results were not materially affected. Since the central question of our research concerns the relationship between the decision to hedge and Tobin’s Q we only report the results generated from the estimation of the two second stage simultaneous equations given below:
\[ HEDGE = \beta_0 + \beta_1 \text{TOBINSQ\_HAT} + \beta_2 \text{OPTION DELTA} + \beta_3 \text{OPTION VEGA} + \beta_4 \text{FORACT} + \beta_5 \text{ABSNETEXP} + \beta_6 \text{LIQ} + \mathbf{\beta C} + \varepsilon \] (1)

\[ \text{TOBINSQ} = \alpha_0 + \alpha_1 \text{HEDGE\_HAT} + \alpha_2 \text{PROF} + \alpha_3 \text{INVEST} + \mathbf{\alpha C} + \varepsilon \] (2)

Equation (1) is estimated using a Probit regression, where hedging is the dependent variable and Tobin’s Q (TOBINSQ\_HAT) is the estimated Tobin’s Q from a first stage OLS regression. We include OPTION DELTA and OPTION VEGA to test whether managerial incentives caused by stock options affect the hedging decision (see Knopf et al (2002)). We include our measures of inherent FX exposure (FORACT, ABSNETEXP), and liquidity (LIQ) as instruments to control for the firm’s general incentive to hedge. We also include a number of control variables (C) in the estimation. The control variables are CEO CONTROL, the FAMILY firm dummy, leverage (LEV), the dividend dummy (DIV), firm size (SIZE), the existence of an outside block holder with at least 10 percent of the votes (BLOCK10\%), four year dummies and nine industry dummies.

In equation (2), we reverse our primary variables of interest: the Tobin’s Q is the dependent variable. We estimate equation (2) using a two stage procedure where equation (2) is estimated with Least Squares and HEDGE\_HAT is the estimated hedge variable from a first stage Probit regression. We include profitability (PROF) and our proxy for growth opportunities (INVEST) as instruments for the Tobin’s Q. The control variables (C) are the same as in equation (1). The system satisfies the rank and order conditions for model identification since each equation has its own predetermined variables: OPTION DELTA, OPTION VEGA, FORACT, ABSNETEXP and LIQ in the hedge regression and PROF and INVEST in the q-regression. Our final tests also include OPTION DELTA, OPTION VEGA, and interaction terms between HEDGE and the independent variables (including OPTION DELTA and OPTION VEGA) in the q-regression. In the second stage of the simultaneous equations the independent variables have been interacted with HEDGE HAT.
In the following sections we report the results of our test using Treatment Effects and Simultaneous Equations. We also report results from simple Probit and Ordinary Least Squares for comparison purposes. For ease of comparison we estimate the simple Probit and Ordinary Least Squares models with the same independent variables as in the simultaneous system.

3.1 Managerial wealth sensitivities and hedging activity

In this part, we investigate how options influence managerial incentives for hedging using a Probit Model. We report, in Table 2, the results of the determinants of hedging activity for our three Probit Model specifications: Basic (M1), Treatment Effects (M2) and Two-Stage Probit (M3). For all of the specifications, the delta value of the managerial stock options, OPTION DELTA, is positive and significant at the 10% (or higher) level. This result shows that there is a positive relationship between the price sensitivity of managerial options and hedging activity. The coefficient on OPTION VEGA is negative for all three models, but is only significant for the treatment effects procedure. This provides weak evidence that as the sensitivity of employee stock options to stock return volatility increases, the firm tends to conduct less hedging. In sum, our results are roughly consistent with the results of Knopf et al (2002) and Rajgopal and Shevlin (2000), and the theoretical predictions of Smith and Stulz (1985).13

A risk-averse manager’s decision whether to hedge currency exposure may also be influenced by her shareholdings in the firm. The CEO Control variable, our proxy for management entrenchment, is positive in the basic and treatment effects models and negative
in the two-stage model. In all three cases the variable is far from any conventional level of significance. Although we have not reported the results, we tested various other proxies for managerial entrenchment such as CEO ownership and votes. In all cases the results for OPTION DELTA and OPTION VEGA were not materially affected. We decided to report the results for our CEO Control variable because we believe it suffers the least from endogeneity problems of all of the proxies.

The coefficients for the control variables are generally as expected. In all of our models, the FAMILY firm dummy is negative, but only significant (5% level) in the basic probit model. This provides very weak evidence that family control affects the decision to hedge. The coefficients on SIZE, ABSNETEXP, and FORACT are always positive and highly significant (1% or 5% level), suggesting that economies of scale are important in hedging decisions. There is no support for the argument that costs related to financial distress influence firms’ hedging decision given the insignificant negative sign for the liquidity variable. There is a negative and significant relation between leverage and hedging, suggesting that Swedish firms do not hedge to increase their debt capacity and interest tax deductions as suggested by Leland (1998). This is in contrast with the empirical findings of Graham and Rogers (2002) but in line with the findings of Géczy et al (1997) and Allayannis and Ofek (2001). The dividend dummy and BLOCK10% dummy are not significant in any of the models.

In sum, our main results in this section suggest that managerial incentives influence hedging activity. Specifically, we find that managerial stock option delta is positively related to hedging activity.
In this section, we explore the interaction between managerial stock options, hedging activity and firm value. First, we check whether firm value increases with hedging for our sample as some previous studies have found. Second, we are specifically interested in whether firm value decreases when managers hedge their individual risk exposure from their options, rather than hedging for other reasons that have been found to increase firm value.

In Table 3, models M1 to M3, we report our results without cross-terms to check the consistency of our results with other papers. The dependent variable for all of the models is our proxy for Tobin’s Q, TOBINSQ, the natural logarithm of the sum of market value of equity and book value divided by book value of total assets.

For our OLS (M1) and Treatment Effects (M2) models the coefficient for HEDGE is positive and significant at the 10% and 5% levels, respectively. Allayannis et al, who also use Treatment Effects, get similar results of an economically large and significant effect. However, for our 2SLS model (M3), HEDGE\textsuperscript{14} is still positive but no longer significant at conventional levels. This result is consistent with Lookman (2004) and Jin and Jorion (2005).

In Table 3, models M4 to M6, we include option DELTA, VEGA, and interaction terms between HEDGE and all of the other variables. Although the HEDGE coefficient remains positive in M4 to M6, it is insignificant in all three models. These results support the theory that although hedging may be positively correlated with firm value it doesn’t cause an increase in firm value.

In M4 (OLS) the OPTION DELTA is positive but insignificant. However, it is positive and significant for the Treatment Effects and 2SLS Models (5% and 10% levels, respectively). There are a number of possible explanations for this result. Firms having managerial options may be valued at a premium. Also, increasing stock prices may translate into high TOBINSQ and more stock options in the money. Or, managers may be more likely
to award themselves stock options when firms have superior performance. OPTION VEGA is negative but not significant in any of the models.

The main contribution of our study is shown in the interaction terms between HEDGE and OPTION DELTA and OPTION VEGA, which are included to capture the valuation effect of hedging related to managerial self-interest, respectively, i.e. managers hedging their option portfolios. Interestingly, the coefficient for the interaction term HEDGE*OPTION DELTA, is negative in all models and significant at the 5% level for the more econometrically robust Treatment Effects (M5) and 2SLS (M6). We interpret this as evidence that although some previous authors find that a positive value premium may exist, when hedges are used to reduce the stock price sensitivity of managerial stock options, the hedging premium is smaller and in some cases even negative.

We have included a number of control variables. The only control variable that is consistently significant in all three specifications is the proxy for profitability (PROF). Not unexpectedly, more profitable firms have higher TOBINSQ. The CEO CONTROL variable is negative, but only significant in the M6 (2SLS). There are numerous other proxies used in the literature for managerial entrenchment, but we chose the CEO CONTROL variable to minimize endogeneity problems. Although we don’t report the results for other proxies for CEO entrenchment, none of them had a material affect on our main results. INVEST is positively significant and HEDGE*INVEST is negatively significant in the OLS regression. However, in the Treatment Effects and 2SLS models both coefficients are insignificant. Therefore, it is likely that there is an endogeneity problem between INVEST and TOBINSQ.

The coefficients for the control variables are generally consistent with previous studies. The proxy for leverage (LEV) is negative and insignificant. This is consistent with other studies e.g. Allayannis and Weston (2001). The Family Firm dummy is positive and significant at the 5% level in the 2SLS model, roughly consistent with Anderson and Reeb.
(2002). The SIZE coefficient is negative but only significant in the Treatment Effects Model. The remaining control variables, LIQ, DIV, and BLOCK10%, are all statistically insignificant across all the models.

3.3 Additional Robustness Tests

In this section we perform additional robustness checks to affirm the validity of our results. We have examined the yes/ no hedging decision like many other cross-sectional hedging studies (e.g. Nance et al (1993), Mian (1996), and Géczy el al (1997)). However, some studies use a continuous hedge variable (e.g. Graham and Rogers (2002) and Knopf et al (2002)). We therefore perform Tobit analysis with the fraction of currency exposure hedged as dependent variable. The results from Table 2 are essentially unchanged (unreported). We also run the simultaneous equation system using the continuous variable. The results presented in Table 2 tests whether the probability of hedging is related to firm value (Tobin’s Q) while the simultaneous system, with a continuous hedge variable, tests whether the extent of hedging is related to firm value. In unreported simultaneous equation systems with the continuous variable we find that the extent of hedging is not related to firm value. However, the interaction of the extent of hedging and OPTION DELTA is negatively significant. This indicates that the interaction of OPTION DELTA of managerial stock options and the yes/ no decision of whether to hedge and the extent of hedging is related to firm value in a similar way.

Another possible problem with our tests is that there may be some managers who wish to hedge their options’ risks but don’t have a FX hedging program in place. We have assumed, up till now, that managers would automatically hedge their OPTION DELTA if it was in their interests. Above we have reported results for Treatment Effect and 2 SLS models to control for the self-selection problem. As an alternative robustness check of this problem,
we look at the influence of managerial options on hedging and firm value for firms that to some extent hedge FX exposure (144 firm years). The tests are performed by means of Tobit analysis (unreported) on the extent of hedging. Our main result is similar to what we found for the entire sample. OPTION DELTA is positive and significant at the 10 percent level in the HEDGE regression. For firms that hedge, the extent of hedging is correlated with managerial options risk. Unreported simultaneous equations also corroborate the results for the whole sample in terms of the relation between the extent of hedging, its interaction with OPTION DELTA, respectively, and firm value.

Finally, we make two additional robustness tests. First, to investigate whether our results are driven by outliers, we estimate bootstrapped confidence intervals for all reported models. Our main results are robust to bootstrapping, suggesting that our results not are driven by a few outliers. Our final robustness test involves the use of alternative proxies for managerial incentives to hedge the exposure from managerial stock options. Instead of the OPTION DELTA and OPTION VEGA variables we have defined a dummy variable for the existence of managerial options and a dummy variable for managerial options in-the-money. The in-the-money variable generates similar results (unreported) as the OPTION DELTA variable both in ordinary regressions and in the simultaneous regression framework. This suggests that our findings not are driven by our definition of OPTION DELTA.

4. Conclusion

Previous empirical work has shown mixed evidence on whether firms that hedge have a higher value compared to their non-hedging counterparts. However, there is evidence that managers sometimes hedge not to aid the typical shareholder but to reduce the exposure of their managerial stock options. To reconcile these two finding, we investigate the impact on firm value of managers hedging their stock options. We find that such managerial self-
interested hedging reduces firm value. We conclude that whether or not hedging in general is good for shareholders, hedging to reduce the risk exposure of managerial options doesn’t necessarily benefits shareholders.
References


Table 1
Summary Statistics

This table presents summary statistics for our sample. The sample consists of 308 firm year observations 1997-2001, of which 82 firm years contain managerial stock options and 144 firm years hedge FX exposure. Managerial stock option data are collected from annual reports and Sundin and Sundqvist (1997-2001). Ownership data are collected in the beginning of the year from Sundin and Sundqvist (1997-2001). Hedging data relates to the hedging policy during the year and are collected by means of surveys. %HEDGE is equal to zero for firms that do not hedge FX exposure and equal to the percentage of committed transaction exposure hedged for firms that do hedge. FORACT is equal to the average of the proportion of revenues and proportion of costs in foreign currency (in percent). ABSNETEXP is the absolute value of the difference between the fraction of revenues and costs denominated in foreign currency (in percent). LEV is equal to the book value of total debt divided by the book value of Equity. INVEST is equal to capital expenditure divided by total sales. PROF is equal to the Return on Capital Employed (ROCE). LIQ is equal to current assets divided by current liabilities. SIZE is equal to the natural logarithm of total assets in M SEK. CEO EQUITY is equal to the percentage of firm equity held by the CEO. CEO VOTE is equal to the percentage of firm votes held by the CEO. CEO EXCESS VOTE is equal to the percentage of votes held by the CEO minus the percentage of firm equity held by the CEO. VAL CEO EQUITY is equal to the value (in M SEK) of the equity held by the CEO. TOBINSQ is defined as the sum of the market value of equity and total debt divided by the book value of total assets. CEO CONTROL is equal to one if the CEO is the largest shareholder or if the CEO comes from the family who is the largest shareholder in the firm, and zero otherwise. FAMILY is equal to one if the controlling shareholder is a family, an individual or a group of individuals, and zero otherwise. DIV is a dummy which equals one if the firm pays dividend, and zero otherwise. BLOCK10% is equal to one if the second largest shareholder holds more than 10 percent of the voting rights, and zero otherwise. MANAGERIAL STOCK OPTION dummy is equal to one if the firm has managerial stock options, and zero otherwise. MATURITY is equal to number of years until the exercise day of the option. VOLATILITY is equal to the yearly standard deviation of daily stock returns. OPTION DELTA is equal to the sensitivity of the option to a 1% change in the stock price (Core and Guay (2002)). OPTION VEGA is equal to the sensitivity of the option to a 1% change in the stock volatility (Core and Guay (2002)). Median differences tested by means of Wilcoxon rank-sum test. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A: Summary Statistics continuous variables

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<tr>
<th>Variable</th>
<th>All, N=308</th>
<th>Mean</th>
<th>Median</th>
<th>Non-hedgers, N=164</th>
<th>Mean</th>
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<th>Hedgers, N=144</th>
<th>Mean</th>
<th>Median</th>
<th>Difference Tests</th>
<th>Mean</th>
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1 Mean differences tested on the natural logarithm of these variables

Panel B: Summary Statistics dichotomous variables

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<th>Prop</th>
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Panel C: Summary Statistics Managerial Stock Options

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<td>OPTION VEGA</td>
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Table 2
Probit, Treatment Effect and 2 Stage Probit Regressions with HEDGE as dependent variable

The sample consists of 308 firm year observations 1997-2001, of which 82 firm years contain managerial stock option plans and 144 firm years hedge FX exposure. Hedging data relates to the hedging policy during the year and are collected by means of surveys. Managerial stock option data are collected from annual reports and Sundin and Sundqvist (1997-2001). Ownership data are collected in the beginning of the year from Sundin and Sundqvist (1997-2001). HEDGE is equal to one if the firm hedges FX transaction exposure, and zero otherwise. TOBINSQ_HAT is equal to the predicted value of TOBINSQ from the first stage OLS regression. OPTION DELTA is equal to the sensitivity of the option to a 1% change in the stock price (Core and Guay (2002)). OPTION VEGA is equal to the sensitivity of the option to a 1% change in the stock volatility (Core and Guay (2002)). CEO CONTROL is equal to one if the CEO is the largest shareholder or if the CEO comes from the family who is the largest shareholder in the firm, and zero otherwise. FAMILY is equal to one if the controlling shareholder is a family, an individual or a group of individuals, and zero otherwise. FORACT is equal to the sum of revenues and costs in foreign currency divided by total revenues multiplied by two. ABSNETEXP is the absolute value of the difference between the fraction of revenues and costs denominated in foreign currency. LIQ is equal to current assets divided by current liabilities. LEV is equal to the book value of total debt divided by the book value of Equity. DIV equals one if the firm pays dividend, and zero otherwise. BLOCK10% is equal to one if the second largest shareholder holds more than 10 percent of the voting rights, and zero otherwise. SIZE is equal to the natural logarithm of total assets in M SEK. Marginal effects are reported with heteroskedasticity and within firm correlation robust z-values in parentheses. The treatment effect regression is estimated using Maximum Likelihood. Marginal effects are reported with z-values in parentheses. z-values are corrected for heteroskedasticity and within firm correlation using the Huber-White estimator. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

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<th>M1 Probit Dep. Var: HEDGE</th>
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<th>M3 2 stage Probit Dep var: HEDGE</th>
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<td>0.0055 (2.65)*****</td>
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<td>-0.1136 (-2.33)** **</td>
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</table>
## Table 3

**OLS, Treatment Effect and 2SLS Regressions with TOBINSQ as dependent variable**

The sample consists of 308 firm year observations 1997-2001, of which 82 firm years contain managerial stock option plans and 144 firm years hedge FX exposure. Hedging data relates to the hedging policy during the year and are collected by means of surveys. Managerial stock option data are collected from annual reports and Sundin and Sundqvist (1997-2001). Ownership data are collected in the beginning of the year from Sundin and Sundqvist (1997-2001). HEDGE is equal to one if the firm hedges FX transaction exposure, and zero otherwise. **OPTION DELTA** is equal to the sensitivity of the option to a 1% change in the stock price (Core and Guay (2002)). **OPTION VEGA** is equal to the sensitivity of the option to a 1% change in the stock volatility (Core and Guay (2002)). CEO CONTROL is equal to one if the CEO is the largest shareholder or if the CEO comes from the family who is the largest shareholder in the firm, and zero otherwise. **FAMILY** is equal to one if the controlling shareholder is a family, an individual or a group of individuals, and zero otherwise. **LEV** is equal to the book value of total assets divided by the book value of Equity. DIV equals one if the firm pays dividend, and zero otherwise. **SIZE** is equal to the natural logarithm of total assets in MSEK. **PROF** is equal to the Return on Capital Employed.

The sample consists of 308 firm year observations 1997-2001, of which 82 firm years contain managerial stock option plans and 144 firm years hedge FX exposure. Hedging data relates to the hedging policy during the year and are collected by means of surveys. Managerial stock option data are collected from annual reports and Sundin and Sundqvist (1997-2001). Ownership data are collected in the beginning of the year from Sundin and Sundqvist (1997-2001). HEDGE is equal to one if the firm hedges FX transaction exposure, and zero otherwise. **OPTION DELTA** is equal to the sensitivity of the option to a 1% change in the stock price (Core and Guay (2002)). **OPTION VEGA** is equal to the sensitivity of the option to a 1% change in the stock volatility (Core and Guay (2002)). CEO CONTROL is equal to one if the CEO is the largest shareholder or if the CEO comes from the family who is the largest shareholder in the firm, and zero otherwise. **FAMILY** is equal to one if the controlling shareholder is a family, an individual or a group of individuals, and zero otherwise. **LEV** is equal to the book value of total assets divided by the book value of Equity. DIV equals one if the firm pays dividend, and zero otherwise. **SIZE** is equal to the natural logarithm of total assets in MSEK. **PROF** is equal to the Return on Capital Employed (ROCE). **INVEST** is equal to capital expenditure divided by total sales. The treatment effect regressions are estimated using Maximum Likelihood. Coefficients are reported with t-values (z-values) in parentheses. t-values (z-values) are corrected for heteroskedasticity and within firm correlation using the Huber-White estimator. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

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<th>M1 OLS</th>
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<td>Dep var: TOBINSQ</td>
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<td>OPTION DELTA</td>
<td>0.3037 (1.43)</td>
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<td>0.1949 (1.67)**</td>
<td>0.1563 (0.62)</td>
<td>-0.0997 (0.98)</td>
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<td>FAMILY</td>
<td>0.2002 (2.07)**</td>
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<td>SIZE</td>
<td>-0.0264 (-0.56)</td>
<td>-0.0645 (-1.28)</td>
<td>-0.0816 (-0.89)</td>
<td>-0.0651 (-1.01)</td>
<td>-0.0922 (-2.46)**</td>
<td>-0.0768 (-0.86)</td>
</tr>
<tr>
<td>PROF</td>
<td>0.0091 (2.90)**</td>
<td>0.0091 (3.15)**</td>
<td>0.0109 (4.19)**</td>
<td>0.0076 (1.94)</td>
<td>0.0076 (0.84)</td>
<td>0.0100 (0.14)</td>
</tr>
<tr>
<td>INVEST</td>
<td>0.0122 (0.52)</td>
<td>0.0066 (0.30)</td>
<td>0.0255 (1.24)</td>
<td>0.0521 (1.24)</td>
<td>0.0455 (1.16)</td>
<td>0.0121 (0.46)</td>
</tr>
<tr>
<td></td>
<td>(2.65)**</td>
<td>(1.16)</td>
<td>(0.46)</td>
<td>(2.65)**</td>
<td>(1.16)</td>
<td>(0.46)</td>
</tr>
<tr>
<td>HEDGE*DELTA1</td>
<td>-0.2833 (-1.50)</td>
<td>-0.2579 (-2.16)**</td>
<td>-0.2579 (-1.99)**</td>
<td>-0.0195 (-0.25)</td>
<td>-0.0004 (-0.16)</td>
<td>-0.0942 (-0.88)</td>
</tr>
<tr>
<td>HEDGE*VEGA1</td>
<td>0.0631 (0.25)</td>
<td>0.0865 (0.46)</td>
<td>0.0501 (0.68)</td>
<td>0.0631 (0.25)</td>
<td>0.0865 (0.46)</td>
<td>0.0501 (0.68)</td>
</tr>
<tr>
<td>HEDGE*CEO CONTROL</td>
<td>-0.3053 (-1.35)</td>
<td>-0.2661 (-1.58)</td>
<td>-0.1442 (-1.34)</td>
<td>-0.3053 (-1.35)</td>
<td>-0.2661 (-1.58)</td>
<td>-0.1442 (-1.34)</td>
</tr>
<tr>
<td>HEDGE*FAMILY FIRM</td>
<td>0.2588 (1.34)</td>
<td>0.2548 (2.02)**</td>
<td>0.0476 (0.67)</td>
<td>0.2588 (1.34)</td>
<td>0.2548 (2.02)**</td>
<td>0.0476 (0.67)</td>
</tr>
<tr>
<td>HEDGE*DEBT TO</td>
<td>-0.0652 (-1.51)</td>
<td>-0.0614 (-1.23)</td>
<td>-0.0168 (-0.90)</td>
<td>-0.0652 (-1.51)</td>
<td>-0.0614 (-1.23)</td>
<td>-0.0168 (-0.90)</td>
</tr>
<tr>
<td>EQUITY1</td>
<td>-0.4231 (-2.54)**</td>
<td>-0.4233 (-2.50)**</td>
<td>-0.0997 (-1.39)</td>
<td>-0.4231 (-2.54)**</td>
<td>-0.4233 (-2.50)**</td>
<td>-0.0997 (-1.39)</td>
</tr>
<tr>
<td>HEDGE*DIVIDEND1</td>
<td>0.1612 (1.24)</td>
<td>0.1715 (1.49)</td>
<td>0.0565 (0.92)</td>
<td>0.1612 (1.24)</td>
<td>0.1715 (1.49)</td>
<td>0.0565 (0.92)</td>
</tr>
<tr>
<td>HEDGE*LSIZE1</td>
<td>0.0543 (1.24)</td>
<td>0.0550 (1.28)</td>
<td>0.0073 (0.39)</td>
<td>0.0543 (1.24)</td>
<td>0.0550 (1.28)</td>
<td>0.0073 (0.39)</td>
</tr>
<tr>
<td>HEDGE*PROFITABILITY1</td>
<td>0.0045 (0.72)</td>
<td>0.0041 (1.21)</td>
<td>-0.0004 (-0.16)</td>
<td>0.0045 (0.72)</td>
<td>0.0041 (1.21)</td>
<td>-0.0004 (-0.16)</td>
</tr>
<tr>
<td>HEDGE*INVESTMENT1</td>
<td>-0.1019 (-2.10)**</td>
<td>-0.0970 (-1.62)</td>
<td>-0.0195 (-1.06)</td>
<td>-0.1019 (-2.10)**</td>
<td>-0.0970 (-1.62)</td>
<td>-0.0195 (-1.06)</td>
</tr>
</tbody>
</table>

| Year Dummies     | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of obs.    | 308 | 308 | 308 | 308 | 308 | 308 |

1 In model 3 and 6 HEDGE is equal to the predicted value of HEDGE from the first stage Probit regression (HEDGE_HAT)
Figure 1
The sensitivity of option value to stock price and stock return volatility as a function of moneyness

This figure illustrates the sensitivity of the median option in our sample to stock price changes and stock return volatility as a function of moneyness. The option has 3 years to maturity, 0.36 yearly volatility, and the risk free interest rate is set to 5 percent.
Endnotes

1 Bodnar, de Jong, and Macrae (2003) find that institutional differences also appear to impact risk management practices and derivate use across US and Dutch firms.

2 Nydahl (1999) investigates currency exposure and the use of currency derivatives by Swedish firms. He finds that Swedish firms are sensitive to exchange rates and that the exposure is reduced by the use of currency derivatives.

3 The accounting practices regarding exposures and hedging for Swedish firms did not follow strict rules over the course of the sample period. Recommendations from Bokföringsnämnden (BFN R9) stipulated that firms should report net revenues, investments, and employees for geographical markets, with considerable freedom in deciding what the “geographical market” was. Of two accounting methods allowed for hedging, deferral accounting and mark-to-market, almost all firms used deferral accounting. Firms were required to disclose derivatives positions in footnotes, and most firms reported a net position rather than per currency, type of exposures hedged, or exposures partitioned over time. It is also noteworthy that practices varied widely among firms. Overall accounting practices for international operations and hedging seem to some extent to lag those in the US, at least for the sample period.

4 Firms were asked in the questionnaires to specify how much of their revenues and costs that were denominated in foreign currencies for each year. Also, the respondents were asked whether or not they hedged FX exposure with derivatives and if so, if their hedging concerned translation and/or transaction exposure. A translated version of the questionnaire (from Swedish to English) is available in Hagelin and Pramborg (2004) or by request from the authors.

5 This is similar to Christie and Marshall’s (2001) response rate of 49 percent when investigating hedging practices of UK firms. Our response rate is higher than Bodnar, Hayt, and Marton’s (1996) 26 percent response rate and De Ceuster, Durinck, Laveren, and Lodewyckz (2000) 22 percent response rate when investigating US and Belgium firms’ hedging practices, respectively.

6 Results are available by request from the authors.

7 Alkebäck, Hagelin, and Pramborg (2004) showed that more than 90 percent of the firms that were listed at the Stockholm Stock Exchange and were engaged in hedging activities hedged their FX exposure.

8 However, the usual disadvantages associated with the use of survey data apply, e.g. that the respondents misinterpret the questions, or provide incorrect answers.

9 If hedging is costly, CEO CONTROL has two opposing effects on the CEO’s incentive to hedge. When the CEO has a large equity holding (CEO CONTROL = 1), the CEO holds a less diversified portfolio, ceteris paribus, and therefore has stronger incentives to hedge. On the other hand, a large equity holding by the CEO
aligns the interest of the manager and the outside shareholders and the CEO has weaker incentives to do costly hedging.

10 In 45 observations the annual reports stated that the CEO held stock options but we found no information about these options in Sundin and Sundqvist (1997-2001). These 45 observations were therefore deleted from the sample.

11 The 21 changes are recorded for seven firms that changed once, four firms that changed twice, and two firms that changed hedging policy three times.

12 We have run all models treating the investment level (INVEST) as a control variable, i.e. including it also in the HEDGE regression. It does not affect the results.

13 We also ran tests using the moneyness of managers’ options as a proxy for their incentive to hedge. The coefficient was positive and significant. However, we don’t report the result, because, referring back to Figure 1, it is difficult to interpret its implication. As moneyness increases, DELTA increases and VEGA simultaneously decreases.

14 For ease of presentation in the text for our 2SLS results in M3 and M6 we write HEDGE, which is actually HEDGE_HAT, from our simultaneous equations estimation procedure.