BI Norwegian Business School - campus Oslo

GRA 19703

Master Thesis

Thesis Master of Science

ERM usage and value premium for Norwegian firms

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Start: 15.01.2021 09.00

Finish: 01.07.2021 12.00

Master Thesis

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Hand-in date:
01.07.2021

Campus:
BI Oslo

Examination code and name:
GRA 19703 Master Thesis

Program:
Master of Science in Business with major in Finance

Name of supervisor:
Costas Xiouros

Abstract

This thesis examines the effect of risk management on firm value. We test our main hypothesis that the implementation of ERM provides a value premium relative to TRM usage. By identifying ERM and TRM usage in Norwegian firms we estimate the additional benefit of using the two risk-mitigating strategies by estimating different versions of Tobin's Q as a proxy for firm value. We find statistically significant evidence indicating that ERM users are rewarded with a higher firm value. Further, we find no evidence that our results are explained by the occurrence of reverse causality. However, we do not find evidence suggesting that ERM users are successful in reducing the volatility of earnings or cash flow.

Acknowledgments

We would like to thank our supervisor, Associate Professor Costas Xiouros for providing valuable guidance throughout the process. We would also like to thank Wharton Research Data Services for providing company data for our sample. This process has allowed us to greatly expand our knowledge and understanding of the importance of risk management.

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1.0 Introduction and motivation

Risk management has been around for thousands of years in one form or another. In the last decade; however, the practice has seen many new additions. In the 50s, scholars introduced the term “Risk management” which later was labeled traditional risk management (TRM) (Kloman, 1992). Roughly 40 years later in the mid-1990s, a more holistic way of managing risk emerged, called enterprise risk management (ERM) (McShane, 2018). The classic Modigliani–Miller theorem (1958), suggests that in a perfect market with rational investors, a firm’s value is independent of its capital structure. Furthermore, the capital asset pricing model (CAPM) implies that investors care only about the systematic risk of a company since the firm-specific risk can easily be managed on an individual level by diversification (Sharpe, 1964). According to these theories, risk management should be unnecessary and not contribute to value creation.

Numerous studies find that risk management benefits the firm (Allayannis & Weston, 2001; Carter et al., 2006; Grace et al., 2015; Graham & Rogers, 2002; Hoyt & Liebenberg, 2011); thus, implying that the Modigliani-Miller theorem, does not hold in the real world. However, other studies find opposing results (Guay & Kothari, 2003; Jin & Jorion, 2006; McShane et al., 2011; Pagach & Warr, 2015), which implies that more research needs to be conducted on this topic.

Previous studies have uncovered vast amounts of information regarding the use and effect of different risk-mitigating strategies; however, few have ventured towards investigating the added benefit of using one over the other. In this paper, we investigate the relationship between firm value and ERM. We have chosen the following research question for our paper:

Does the implementation of ERM create a value premium relative to TRM for Norwegian firms?

With our sample of 120 firms, we investigate whether firms that have implemented an ERM strategy have a higher value than firms using TRM. In addition to this main hypothesis, we test whether there exists a causal relationship between the implementation of ERM and an increase in value. To test whether there is a relationship between firm value, proxied by Tobin’s Q, and risk management choice, we conduct univariate and multivariate tests. Bartram et al. (2011) and

Pagach and Warr (2015) find evidence that hedging and ERM are related to reduced volatility. While reduced volatility does not necessarily increase firm value, it may be one reason for implementing a sophisticated risk management system. Hence, we test whether ERM implementation contributes to reduced volatility in key performance metrics.

We find statistically significant evidence suggesting that the use of ERM indeed leads to a value premium compared to the use of TRM, as well as uncovering a relationship between risk management and firm value. Our results are consistent for several different measures of firm value and support our expectations that ERM provides a value premium compared to TRM. Further, our tests show no evidence that suggests a reverse causal relationship between ERM implementation and firm value. This means that we cannot infer that firms implement ERM due to having a high firm value. However, we do not find evidence of decreased volatility in performance metrics following the adoption of ERM.

In the remainder of this paper, we will (1) review existing relevant literature; (2) explain our methodological approach to answering our research question; (3) describe and present the data in our chosen sample; (4) provide a discussion and presentation of the results from our test; and (5) summarize the paper and provide suggestions for further research.

2.0 Literature review

2.1 Risk management

Risk management has been utilized for thousands of years (Covello & Mumpower, 1985). As the practice has evolved and become more popular over the years, the literature describing it has followed. Previously, risk management was limited to simply buying insurance, but over the last two decades, several theories and strategies have emerged (Nocco & Stulz, 2006). Hedging risks using currency derivatives have proven to be an efficient way of decreasing exposure to risk (Allayannis & Ofek, 2001).

However, other theories suggest that hedging might be redundant. The Modigliani-Miller Theorem (1958) is widely known in the world of corporate finance. According to their proposition, a value-maximizing manager operating a firm in a perfect capital market with rational investors will not engage in hedging activities, as it does not add value to the firm. In other words, hedging economic exposure is irrelevant and should not be undertaken, as investors can just as easily hedge risk on their own behalf. However, if the assumption of perfect capital markets is violated, there may be rational reasons for firms to hedge. Several articles have documented extensive corporate use of derivatives (Campello et al., 2011; Hentschel & Kothari, 2001; Kumar & Rabinovitch, 2013). Most of the existing literature on hedging today loosen the constraints in the models presented by Modigliani and Miller. By relaxing these constraints, we arrive at several different reasons a manager might choose to hedge.

Stulz (1984) assumes that managers choose the optimal hedging strategy to maximize their expected lifetime in the firm. Further, Smith and Stulz (1985) provide evidence for different value-maximizing reasons: (1) by reducing the variability of pre-tax firm value, the expected tax liability is minimized which increases the expected post-tax firm value; and (2) minimizing the cost of financial distress by reducing expected bankruptcy cost through a lowered variability of future firm value. In addition to these motives, Stulz (1996) adds that a risk management strategy might eliminate the risk that the company will not be able to carry out the planned investment strategy, thus forgoing positive net present value (NPV) projects which could potentially increase the firm value. In addition, the elimination of downside risk might help push companies toward an optimal capital and ownership structure.

DeMarzo and Duffie (1992) present another hedging decision based on the motives of a manager. They argue that firms' performance affects the investors' perception of managerial ability. This gives managers an incentive to undertake hedges that improve the market's perception of them, possibly increasing the market value of the firm.

The theories proposed by Lessard (1991) and Froot et al. (1993) both describe models that are based on inefficient investments. They rely on the basic observation that firms may be forced to underinvest when they are not hedging because it might be too costly to secure outside financing. Furthermore, Stulz (1990) argues that agency costs related to managerial discretion are lowered through financial policies such as hedging. The managerial discretion in this situation has two costs: an overinvestment cost and an underinvestment cost. Overinvestment costs arise when the management invests too much in some situations, exhausting available resources. Underinvestment costs, on the other hand, arise when management lack credibility when claiming that they cannot fund positive NPV projects with internal resources.

Further, Stulz's (1990) paper provides rationale for risk management policies that reduce the volatility of cash flows. He shows that when the volatility of a given period's cash flow falls, it is less likely that resources available to management will differ significantly from the resources that shareholders expect management to have.

2.2 Traditional risk management

Contrasting with the Modigliani-Miller theorem (1958), market imperfections including bankruptcy and financial distress costs, asymmetric information, taxes, lack of diversification, and agency costs may produce circumstances where hedging adds value. Numerous studies investigate risk management using derivatives to hedge risk as a proxy for risk management activities (Bartram et al., 2011; Carter et al., 2006; Graham & Rogers, 2002; Guay & Kothari, 2003; Jin & Jorion, 2006; Nelson et al., 2005). However, looking at the value effects of TRM, we find mixed results. Allayannis and Weston (2001) report evidence that the firm value is higher for U.S. firms using foreign currency derivates to hedge their exposure compared to nonusers. Graham and Rogers (2002) present similar evidence, showing that hedging allows firms to increase their market value by an average of 1.1% by enabling firms to increase their debt capacity. Further, Carter et al. (2006) find evidence supporting the previous findings by investigating jet fuel hedging in the airline industry and find that hedging is positively related to market value. In fact, their findings suggest that the effects are greater than reported by Allayannis and

Weston (2001). Bartram et al. (2011) find results similar to Allayannis and Weston (2001). Additionally, Bartram et al. (2011) find that hedgers have lower cash flow volatility, idiosyncratic volatility, and systematic risk than nonhedgers.

Nelson et al. (2005) conduct a study similar to Allayannis and Weston (2001), where they measure the effect of hedging on stock returns. They find evidence that hedging firms on average outperform nonhedging firms by 4.3%. In their sample, the firms that exclusively hedge their exposure using currency derivatives experience abnormal compounded annual returns of 12.2% on average. Further, Nelson et al. (2005) supplement the study by examining the firm value expressed as Tobin's Q. This study produces similar results as Allayannis and Weston (2001) in the sense that large hedging firms have relatively higher valuations than large nonhedgers. However, when Nelson et al. (2005) extend the study to smaller firms, they find that hedgers have lower firm value than nonhedgers.

Guay and Kothari (2003), find that the value generated from hedging instruments are small relative to the firms' value, which indicates that the importance of hedging needs to be reevaluated. Jin and Jorion (2006) investigate the hedging activities of firms in the U.S. oil and gas industry and find no difference in market value between hedgers and nonhedgers.

2.3 Enterprise risk management

As time has progressed, theories and practices on risk management have evolved substantially. Risk management has evolved from being limited to purchasing insurance and derivatives for hedging risks in silos to a more holistic risk management framework (Nocco & Stulz, 2006; McShane, 2018). Liebenberg and Hoyt (2003) state that "Unlike traditional risk management, where individual risk categories are separately managed in risk 'silos,' ERM enables firms to manage a wide array of risks in an integrated, holistic fashion" (p. 37). Moreover, the Casualty Actuarial Society (n.d., as cited in D'arcy & Brogan, 2001) highlights the importance of value creation from ERM, stating that the main purpose is to increase stakeholder value in the short and long term.

The following studies find a significant positive relationship between firm value and ERM use. Grace et al., (2015) investigate the relationship between ERM and firm performance, finding evidence that ERM usage increase cost and revenue efficiency. Furthermore, Hoyt and Liebenberg (2011) report a 20% premium on ERM users' Tobin's Q in the insurance industry.

However, the following studies find no relationship between firm value and ERM. McShane et al., (2011) find that for insurance companies, the benefits of implementing ERM is limited. Their results show that firm value, expressed as Tobin's Q, increase when increasingly more sophisticated TRM is implemented, but the transition to ERM do not provide additional benefits. Further, in a study examining the long-term effects of ERM implementation, Pagach and Warr (2015), find that while some firms experience a reduction in stock price volatility, their results fail to provide significant evidence of value creation from ERM.

Pagach and Warr (2015) present a possible explanation for the lack of significant change for firms adopting ERM. They theorize that some firms that adopt ERM are not positioned to benefit from the implementation. Moreover, although firms report the adoption of ERM, a radical change in strategy might face strong resistance from employees (Fraser & Simkins, 2016; Mohrman, 2007). The resistance to change might obstruct the desired effect, which can explain the absence of effect from ERM in some cases.

Overall, the literature surrounding the growing use of risk management is vast and substantial; however, the effect and necessity of this action remain debated. While a large amount of previous research has been made using a sample of U.S. firms (e.g., Allayannis & Weston, 2001; Graham & Rogers, 2002; Hoyt & Liebenberg, 2011; Pagach & Warr, 2015), our contribution comes from using a sample of Norwegian firms. Further, these articles considered the period from 1990 to 2005, while we include observations from 2013 to 2019, giving our sample a more recent insight into the effects of ERM adoption. In this paper, we investigate whether there exists a value premium from using ERM compared to TRM.

3.0 Research methodology and data

Our sample consists of Norwegian firms with accounting data available on the Compustat database as well as having a public annual statement from the same year. Further, our sample consists of firms with total assets above NOK 150 million each year in the time period 2013-2019, and that have nonmissing data on assets and market value. Our constraints are similar to those used in previous research on diversification, hedging and ERM (e.g., Allayannis & Weston, 2001; Bartram et al., 2011; Hoyt & Liebenberg, 2011; Lang & Stulz, 1994; Servaes, 1996). We exclude public utilities as these are heavily regulated. Observations for firms without a consecutive observation were also excluded to be able to measure the change in risk management over time. After applying the constraints above, we end up with a total of 636 firm-year observations.

Several firms publish their annual results in other currencies than NOK, and hence have observations in Compustat in a foreign currency. Additionally, some firms change their reporting currency within the sample period, which may distort our results if not adjusted. To enable a comparison of firms using different currencies, we convert all values denominated in foreign currencies using the respective end-of-year exchange rate to NOK.

In the analyses that follow, we use an ERM dummy to indicate whether a firm has engaged in ERM in a given year, and similarly for TRM. If for a given firm, we find no evidence of ERM, we assume the firm engages in TRM, and assign the ERM dummy equal to 0. The ERM dummy equals 1 for firm-years beginning with, and subsequent to, the first evidence of ERM usage, and 0 for the firm-year observations prior to the first observed ERM usage, similar to the method of Hoyt and Liebenberg (2011). This means that if a firm adopts ERM in 2018 we assign ERM equal to 1 for firm-years 2018 and 2019, and ERM equal to 0 in 2013-2017.

To determine whether or not firms have adopted an ERM or TRM framework, we manually examine footnotes in the sampled firms' annual reports. When searching for evidence of ERM usage, we apply similar search terms as Hoyt and Liebenberg (2011). These search terms consisted of the following phrases, their acronyms, and the individual words within one paragraph: "enterprise risk management," "chief risk officer," "risk committee," "strategic risk management," "consolidated risk management," "holistic risk management," and "integrated risk management." The second and third search terms are well-known methods for the implementation and management of an ERM program, while the other search terms are synonymous with ERM (Hoyt & Liebenberg, 2011; Liebenberg & Hoyt, 2003). In addition, we searched for the Norwegian translation of the search terms when examining annual statements written in Norwegian only. Search terms that provided a "hit" were manually reviewed in context to their surrounding text to prevent misclassification of ERM usage.

As a proxy for firm value, we use Tobin's Q (Q), similar to the simple Q method of Perfect and Wiles (1994), as well as that of Bartram et al. (2011). We define Tobin's Q as the market value of a firm divided by the replacement cost of assets. The market value of a firm is the sum of debt, common equity, and preferred stock. We collect the book value of preferred stock from Compustat using the method suggested by Lang and Stulz (1994) by using the redemption value at the end of each year. For the market value of the companies' debt and equity, we make use of the procedure that Lewellen and Badrinath (1997) and Perfect and Wiles (1994) suggest. We obtain the market value of common equity from the Compustat database. We assume that the market value of companies' short-term and long-term debt is equal to their book value; hence, taken directly from Compustat. We assume that the replacement cost of assets is equal to its book value. The replacement cost of assets is the sum of the replacement cost of fixed assets and inventories. We estimate the replacement cost of fixed assets as the book value of fixed assets, similar to the method that Perfect and Wiles (1994) and Bartram et al. (2011) describe. To estimate the replacement cost of inventories, Lewellen and Badrinath (1997) propose using the book value of inventories plus the LIFO reserves (last in first out). However, their example considers firms in the US, where LIFO accounting is a viable alternative for reporting inventory level. All our sampled companies are required to use IFRS accounting. Since IFRS does not allow the LIFO approach, this will not affect the values in our data set. Therefore, we simply use the balance sheet item "total inventories" for the firms' replacement cost of inventories. The advantage of our approach to Tobin's Q is its simplicity, and thus leaves less room for estimation errors. Moreover, Tobin's Q does not require any type of risk adjustment or normalization (Lang & Stulz, 1994).

We also test the sensitivity of our results using alternative approximations to company value. The five variations we use for Q are as follows: (1) a simple Q measure as outlined above, using the market value of common equity, debt, and preferred stock, divided by the book value of assets; (2) the natural logarithm of the simple Q, to account for the skewness we observe in our sample; (3) an industry-adjusted Q, similar to Allayannis and Weston (2001) by subtracting each year the median Q of the primary three-digit SIC that the firm belongs to from that firm's Q; (4) a ratio of firms' market value of equity and debt divided by the book value of total sales; and (5) the ratio of net income divided by the book value of total assets (ROA), similar to Hoyt's and Liebenberg's (2011) robustness approach.

3.1 Univariate test

We test our main hypothesis that firms that adopt ERM are rewarded by investors with higher firm value than TRM users by testing the null hypothesis that the mean Q is the same for ERM users as for TRM users. In our sample, the mean value of Q is higher than the median value, which implies that our distribution is skewed. Based on this skewness, we also test our hypothesis using medians. We expect the firms with reported ERM usage to be rewarded with higher valuations than TRM firms.

3.2 Control Variables

To test whether risk management increases the value of a firm, we include several control variables so that we may isolate the effect of ERM and TRM. We collect the variables outlined in the following subsection.

a) Firm size:

   Larger companies are more likely to engage in ERM (Liebenberg & Hoyt, 2003) and hedging activities (Géczy et al., 1997; Nance et al., 1993). Since our ERM indicator may be related to firm size, it is important to control for this effect. Therefore, we include firm size in our models as proxied by the natural logarithm of total assets. We also test our models using different variables to proxy for firm size such as the log of total sales, and log of capital expenditure (capex). Previous literature shows a significant negative relationship between firm value and size (Allayannis & Weston, 2001; Lang & Stulz, 1994).

b) Leverage:

To control for the relationship between capital allocation and firm value, we include a variable to proxy for financial leverage defined as the ratio of the book value of debt to the market value of equity. The predicted sign for this control variable is uncertain. One perspective is that high leverage may increase firm value by reducing free cash flow which otherwise could be used by self-interested managers to undertake unprofitable projects (Jensen, 1986). Alternatively, too much leverage might increase the probability of bankruptcy, and incur financial distress cost for shareholders; thus, having a negative effect on firm value.

c) Growth:

Firms with larger growth options have been hypothesized to have greater value in general relative to firms with lower growth opportunities (Hoyt & Liebenberg, 2011; Smith & Watts, 1992). To measure growth opportunities, we use capital expenditure divided by sales as a proxy. In addition, we test our models using an alternative proxy by using the ratio of R&D expenditure divided by total assets.

d) Profitability:

Profitable firms are more likely to have a high valuation compared to less profitable firms (Allayannis & Weston, 2001). To control for profitability, we include the ROA ratio as a control variable in our models. We also test our models by substituting ROA with the EBITDA margin, defined as earnings before interest, tax, depreciation, and amortization divided by total sales.

e) Access to sufficient external funding:

Companies lacking external funding might have an increased value based on only being able to undertake projects with a positive NPV (Allayannis and Weston, 2001; Lang and Stulz, 1994; Servaes, 1996). The predicted sign for this control variable is uncertain. One perspective is that companies that pay dividends are less likely to be capital constrained and consequently might have a lower Q (Lang & Stulz, 1994; Servaes, 1996). Alternatively, to the extent that dividends reduce free cash flow that otherwise could be used for managerial consumption, the dividend payment could be expected to positively affect firm value (Hoyt & Liebenberg, 2011). We control for the ability to acquire funding by including a dividend dummy variable that equals 1 if the firm paid dividends that year and zero otherwise.

f) Geographic diversification:

Morck and Yeung (1991) found that geographical diversification (multinationalism) has a positive relation to firm value. Allayannis and Weston (2001) control for the effect of multinationalism on Q using the ratio of foreign sales to total sales. However, as data on foreign sales is unavailable on Compustat for Norwegian firms, we use net foreign income divided by total sales as a proxy for multinationalism in our tests. We expect multinationalism to have a positive relation to firm value.

g) Industry effects:

ERM users belonging to high-Q industries might have higher firm value based on their industry instead of their risk management strategy. Consequently, firms in low-Q industries may have lower firm value. This makes it hard to predict the expected sign for this control variable. We control for this industry effect by including an indicator variable for SIC codes. We also construct an industry-adjusted Q by subtracting the median Q of the primary industry given by the three-digit SIC code from each firm's individual Q, which will also control for this effect.

h) Credit quality (probability of bankruptcy):

The quality of a company's credit is reflected in its credit rating (Peltzman, 1977). Having a good credit rating will likely have a positive impact on the company value. We control for this by adding the Altman Z-score (Altman, 2013) for each firm-year observation as below. The Z-score is calculated as follows:

$$Z\ score\ = 0.717(x_1) + 0.847(x_2) + 3.107(x_3) + 0.420(x_4) + 0.998(x_5)$$

Where: x_1 is working capital divided by total assets, x_2 is retained earnings divided by total assets, x_3 is EBIT divided by total assets, x_4 is the market value of equity divided by book value of total liabilities, x_5 is total sales divided by total assets. Bartram et al. (2011) showed that Z-score had a negative relationship to firm value.

i) Time effects:
We include year dummies in our models to account for variations in valuations over time.

3.3 Multivariate tests

To examine whether there is a larger positive relationship between firm value and ERM compared to firm value and TRM, we must control for variables that influence Q. These control variables are the same as discussed in section 3.2 above. We test our hypothesis in a multivariate setting using pooled ordinary least squares (OLS) and fixed-effects models, with Tobin's Q as the dependent variable, and ERM as the independent variable along with our control variables.

According to Wooldridge (2010), pooled OLS is employed when selecting a different sample for each period of the panel data. One drawback with a pooled OLS is that it does not differentiate between different cross-sectional units; thus, not considering the differences that exist within a cross section. Furthermore, a pooled OLS assumes that all variation in the dependent variable is explained by the variables we include and other effects that are correlated with these variables. However, this assumption is unlikely to hold for our sample.

On the other side, random or fixed effects are applied when the sample consists of the same group of firms throughout the sample period. In a random-effects model, the effects that changes cross-sectionally but not over time are effectively put into the error term. A random-effects model imposes more assumptions than a pooled OLS: strict exogeneity and orthogonality between the cross-sectional effect and the independent variable (Wooldridge, 2010). Using random effects estimators are suitable when we think the unobserved effect is uncorrelated with all the explanatory variables (Wooldridge, 2019). The assumption of no correlation between the unobserved effect and the independent variables often defeats the purpose of using panel data. By estimating fixed-effects models, we allow for arbitrary correlation between these variables; thus, avoiding the assumption of orthogonality (Wooldridge, 2010).

Given our results from our estimated Breusch-Pagan Lagrange Multiplier test (Breusch & Pagan, 1980) and Hausman test (Hausman & Taylor, 1981), we find that a fixed-effects model is preferable, and therefore test our hypothesis using fixed-effects models (Appendix A, Appendix B). However, as some firms in our sample do not have observations for every year (i.e., Arcus ASA has observations only for 2016-2019), we tabulate our results from both pooled OLS and fixed effects.

When estimating the fixed-effects model, each firm is assigned one intercept. This allows us to control for the unobservable firm characteristics that might affect firm value. We expect both the fixed-effects model and the pooled OLS to show the same effect from our independent variables on firm value. We want to examine the differences in value premium of engaging in ERM as opposed to TRM usage. Therefore, we test the null hypothesis that the ERM coefficient is equal to zero. If ERM usage creates a value premium compared to TRM usage, we would reject this null hypothesis.

3.4 Additional testing

In addition to testing our main hypothesis as explained above, we also perform three additional tests to further investigate the effect of ERM and TRM usage on firm value. We test for reverse causality and perform an event study when looking at the effect of ERM implementation on firm value. Moreover, we test whether firms engaging in ERM experience lower volatility in performance metrics, compared to TRM users.

3.4.1 Reverse causality tests

ERM is likely to affect firm value; however, there may be alternative reasons for this added firm value for the firms engaging in ERM. A high Q indicates that the firm’s market value is higher than its replacement cost of assets. Firms might have incentives to hedge due to having many profitable investment opportunities, if these firms also have high Qs, then this will not prove our hypothesis that ERM usage leads to a higher value. A high Q for ERM firms might simply reflect that the firms have incentives to use ERM, and not that ERM adds value; thus, implying that reverse causality is present in our sample.

To test for reverse causality, Allayannis and Weston (2001), and Servaes (1996) classify firms into four different groups. However, we do not observe any firms that discontinue their ERM usage, as firms are unlikely to quit ERM shortly after implementation (Hoyt & Liebenberg, 2011). Hence, our three groups are: (1) firms that use TRM in both periods, $N_t N_{t+1}$; (2) firms that use ERM in both periods, $E_t E_{t+1}$; and (3) firms that use TRM in the current period but implement ERM in the following period, $N_t E_{t+1}$. We construct dummy variables for groups 1 and 2 and include these in the cross-sectional regression model, similar to Allayannis and Weston (2001). We omit group 3 to avoid multicollinearity between our three groups; thus, $N_t E_{t+1}$ acts as our baseline variable in the model below.

$$Q_t = \alpha + \beta_1(N_t N_{t+1}) + \beta_2(E_t E_{t+1}) + \gamma \boldsymbol{X_t} + \varepsilon_t$$

where $\boldsymbol{X_t}$ represents the vector of explanatory variables used in the previous regressions (foreign income/total sales, size, ROA, debt/equity, growth, dividend dummy, z-score, and year dummies) and ε is the error term.

If reverse causality exist in our data, then firms implementing ERM in the second period, $N_t E_{t+1}$, should have a value premium to firms using TRM in both periods, $N_t N_{t+1}$. Since $N_t E_{t+1}$ is the baseline variable, we expect that $\beta_1 < 0$. Furthermore, if ERM creates value, we would expect firms using ERM in both periods, $E_t E_{t+1}$, to be valued higher than firms using TRM in both periods, $N_t N_{t+1}$; thus, we expect that $\beta_2 > \beta_1$. The value increase from implementing ERM may take several years to materialize (Fraser & Simkins, 2016; Mohrman, 2007). Following this intuition, we expect firms that use ERM in both periods, $E_t E_{t+1}$, to have a higher Q than firms implementing ERM in the second period, $N_t E_{t+1}$, i.e., that $\beta_2 > 0$. Based on these expectations, we test the following hypotheses by performing Wald tests:

Hypothesis 1: $\beta_1 = 0$ (The decision to implement ERM is unaffected by Q)

Hypothesis 2: $\beta_1 = \beta_2$ (Firms using ERM in both periods does not experience a value premium over TRM users)

Hypothesis 3: $\beta_2 = 0$ (Firm using ERM in both periods does not experience a value premium over firms that implement ERM next period)

3.4.2 Event study

In this subsection, we test whether ERM implementation leads to higher firm values. This is done through a study of change in the ERM policy for firms in our sample. We do this by testing whether a firm's decision to implement ERM changes its firm value.

Similar to the preceding subsection, we divide firms into three groups depending on their ERM policy change ($N_{t-1}N_t$, $N_{t-1}E_t$, and $E_{t-1}E_t$). Then, we test the regression using change in firm value as the dependent variable, and as independent variables, we include the three groups above as dummy variables. We also control for other factors that can potentially affect firm value, by including the change in control variables used in our previous multivariate regressions. We present our regression model below, omitting group 3.

$$\Delta Q_t = \alpha + \beta_1(N_{t-1}N_t) + \beta_2(E_{t-1}E_t) + \theta\Delta\boldsymbol{X} + year\ dummies + \varepsilon$$

where ΔQ_t represents the change in Tobin's Q from time $t-1$ to time t, and $\Delta\boldsymbol{X}$ is the vector of changes in the control variables (foreign income/total sales, size, ROA, debt/equity, growth, and Z-score) along with year dummies and a dividend dummy.

If firms experience a higher Q after ERM implementation, we would expect observations classified as $N_{t-1}E_t$ to have a higher value increase relative to $N_{t-1}N_t$ observations, i.e., firms that implement ERM to have a higher ΔQ than firms that remain TRM users ($\beta_1 < 0$). In addition, we would expect observations classified as $E_{t-1}E_t$ to have a higher increase in Q compared to $N_{t-1}N_t$ observations, i.e., firms that use ERM have higher Qs than firms that do not ($\beta_1 < \beta_2$). If firms get higher Q from continued ERM usage, we expect firms that have been ERM users for several years to be valued higher than firms adopting ERM in the current year ($\beta_2 > 0$). Hence, we test the following null hypotheses:

Hypothesis 1: $\beta_1 = 0$ (Q is unaffected by the decision to begin ERM)

Hypothesis 2: $\beta_1 = \beta_2$ (ERM adds no value)

Hypothesis 3: $\beta_2 = 0$ (ERM does not provide value premium over time)

3.4.3 Testing on volatility changes

While our main hypothesis involves investigating the theorized value premium from ERM use compared to TRM use, we are also interested in finding out whether the implementation of ERM is beneficial in lowering the firms' volatility of earnings compared to the use of TRM. Bartram et al. (2011), report findings suggesting that the use of hedging derivatives can reduce cash flow volatility, which leads us to think that the same might be true for ERM usage. This theory is partly supported by Pagach and Warr (2015) who find that some firms adopting ERM experience a reduction in stock price volatility, but not in earnings volatility. Theoretically, hedging adds value to companies by reducing earnings volatility, which makes debtholders perceive the firms as less risky. Thus, firms can increase their debt level and take advantage of the tax shield of debt, potentially increasing firm value.

Based on these findings, we decide to test whether ERM implementation has a larger effect on the volatility of different performance metrics in our sample compared to TRM usage. To measure volatility we collect, from Compustat, quarterly data on the following: net operating cash flow, pretax income, income before extraordinary items, operating income before depreciation, and operating income after depreciation. For each of these figures, we calculate the intra-year standard deviation for each firm in our sample.

To test whether the engagement of ERM has a larger effect than TRM on firms' earnings volatility, we estimate pooled OLS and fixed-effects models separately, using each of the previously described volatility metrics as dependent variables. To control for effects that may impact the volatility of our performance metrics, we include the following control variables: (1) size, proxied by log assets; (2) leverage, proxied by the ratio of debt to equity; (3) growth, proxied by capex to sales; (4) access to sufficient external funding, as proxied by a dividend dummy; (5)

profitability, proxied by ROA; (6) geographic diversification, proxied by net foreign income divided by total sales; (7) industry effects, proxied by the three-digit SIC code; (8) credit quality, proxied by Altman Z-score (Altman, 2013); and (9) time effects, proxied by year dummies. We test the null hypothesis that ERM usage has the same effect on volatility as TRM usage, for each performance metric. We expect to find that ERM usage contributes to a decrease in volatility.

4.0 Data and preliminary analysis

Our sample consists of 120 Norwegian firms operating in the period between 2013 and 2019. The total firm-year observations after applying our constraints amount to 636. To test our research question, we collect the data necessary to compute Tobin's Q along with the relevant control variables for each test as described in the previous section.

4.1 Summary statistics

Table 1 presents summary statistics for all firms in our sample (panel A), and the subsamples of firms using ERM and TRM (panel B and C). ERM users have the highest mean Q in our sample, while TRM users have the lowest mean Q.

The median Q for all firms in our sample (0.91) is smaller than the mean (1.33), indicating skewness in the distribution of Q, similar to findings in previous research (Allayannis & Weston, 2001; Bartram et al., 2011; Lang & Stulz, 1994; Servaes, 1996). The same indication of skewness is also present in our two subsamples. To control for this skewness, we use the natural log of Q in addition to our simple Q, which makes the distribution of Q more symmetric.

The ERM users have higher mean assets, sales, market value of equity, and firm value (the sum of market value of equity and debt) than the subsample of TRM firms. This might suggest that ERM usage leads to higher sales and higher assets, or simply that firms holding more capital are more often able to bear the costs of implementing ERM than firms with less capital. All quantiles are higher for ERM users than for TRM users. Furthermore, ERM users have lower standard deviation than TRM users.

Table 1. Summary statistics

Variable	Obs	Mean	Std. dev.	10%	Median	90%
Panel A: All firms						
Tobin's Q	636	1.34	1.34	0.43	0.91	2.62
Total assets	636	21926	101333	251.07	2439	30459
Total sales	636	13748	59620	127.12	1687	23312
MV equity	636	14011	56224	168.26	1574	24006
MV equity + debt	636	19614	80839	335.33	2817	31924
ERM dummy	636	0.46	0.50	0.00	0.00	1.00
TRM dummy	636	0.26	0.44	0.00	0.00	1.00
FCD dummy	636	0.49	0.50	0.00	0.00	1.00
Interest rate dummy	636	0.38	0.49	0.00	0.00	1.00
Commodity dummy	636	0.16	0.36	0.00	0.00	1.00
Foreign income/total sales	636	0.06	4.15	-0.02	0.00	0.02
CAPEX/sales	636	2.34	44.58	0.00	0.03	0.30
D/E	636	2.24	12.39	0.00	0.25	3.35
Dividend dummy	636	0.51	0.50	0.00	1.00	1.00
ROA	636	-0.03	0.20	-0.19	0.02	0.11
Z-score	636	9.32	82.00	0.92	2.32	6.63
Panel B: ERM users						
Tobin's Q	292	1.41	1.25	0.54	1.01	2.70
Total assets	292	43980	146534	504.17	9186	84588
Total sales	292	27348	85939	394.03	6697	40629
MV equity	292	27931	80709	524.89	5780	68545
MV equity + debt	292	38918	116319	674.18	10076	79105
Panel C: TRM users						
Tobin's Q	344	1.27	1.42	0.34	0.85	2.54
Total assets	344	3205	5215	224.50	1348	7990
Total sales	344	2204	4855	62.94	768.47	5142
MV equity	344	2195	4575	114.11	702.43	4415
MV equity + debt	344	3227	5713	197.75	1136	9439

This table presents summary statistics for our sample of Norwegian firms in Compustat, with assets greater than NOK 150 million (120 firms) for 2013-2019 (panel A), and the subsamples of firms using ERM (panel B) and firms using TRM (panel C). Tobin's Q is defined as the market value of a firm divided by the replacement cost of assets. The ERM dummy equals 1 for firm-years beginning with, and subsequent to, the first evidence of ERM usage, and 0 for the firm-years prior to the first observed ERM usage, where the firm used TRM. MV is short for market value. The dividend dummy is set equal to 1 if the company paid dividends that year, and 0 otherwise. ROA is the ratio of income before extraordinary items divided by total assets. All numbers except for Tobin's Q, dummy variables, and Z-score are denoted in million NOK.

In general, we observe low correlation coefficients between the independent variables used in our models, which implies that multicollinearity should not be an issue in our analyses (Appendix C). However, we compute the variance inflation factors (VIF) developed by Belsley et al. (1980). None of our VIFs exceed 2.5 which indicates that it is unlikely that multicollinearity will pose any issues (Appendix D).

4.2 Univariate tests

In this subsection, we estimate various univariate tests to examine whether there exists a value premium of ERM compared to TRM. In Table 2, we compare the mean Q for ERM users (column 1), TRM users (column 2), and their difference. We compare the mean for our different measures of firm value: the simple Q and a natural log transformation of the simple Q. Furthermore, the difference in mean is tested using a Wilcoxon rank-sum (Mann-Whitney) test.

Table 2. Comparison of mean and median

	ERM users (1)	TRM users (2)	Difference (1-2)
Mean:			
Simple Q	1.41	1.27	0.14 (0.000)
LN Q	0.08	-0.14	0.22 (0.000)
Median:			
Simple Q	1.01	0.85	0.16 (0.002)
LN Q	0.01	-0.16	0.17 (0.002)
N	292	344	

This table presents a univariate comparison of mean Tobin's Q between firms for our two main measures of Tobin's Q. Our sample consist of Norwegian firms in Compustat, with assets greater than NOK 150 million (120 firms) for 2013-2019 that have implemented ERM (1), and the subsamples of firms using TRM (2). ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports, while the observations prior to evidence of ERM implementation are classified as TRM users. N shows the number of observations. P-values for testing the differences are constructed using a two-sample nonparametric Wilcoxon rank-sum (Mann-Whitney) test.

The mean Q for ERM users is generally higher than for TRM users. This results in a positive value premium for ERM users compared to TRM users and is statistically significant below the 1% level for both our simple Q and LN Q. These preliminary tests imply that ERM usage increases firm value compared to using TRM. It is, however, hard to draw conclusions based on univariate tests as they likely do not take into account effects from other important factors.

5.0 Results and analysis

5.1 Multivariate tests

To investigate if ERM usage results in a value premium compared to the use of TRM, we estimate multivariate regressions to account for the effects of our control variables outlined in section 3.2. We start by performing pooled OLS for the simple Q and LN Q. Further, we estimate fixed-effects models for simple Q and LN Q similar to the pooled OLS. In the fixed-effects models, however, we do not include the industry dummies as this will lead to multicollinearity. Since the SIC codes do not change within the same panel, they do not provide additional information beyond the firm-fixed effects. The industry effects are, therefore, implicitly captured by the firm-fixed effects in this model.

Table 3. Multivariate regression - Simple Q and LN Q

	Simple Q		LN Q	
	Pooled	Fixed effects	Pooled	Fixed effects
ERM dummy	0.269 (2.04) **	0.625 (1.95) *	0.225 (3.05) ***	0.298 (1.44)
Foreign income/total sales	-0.003 (-0.11)	-0.003 (-0.18)	-0.004 (-0.31)	-0.003 (-0.42)
Size (log of total assets)	-0.146 (-3.77) ***	-0.356 (-3.75) ***	-0.076 (-2.95) ***	-0.228 (-4.70) ***
ROA	-0.298 (-0.64)	0.646 (1.67) *	-0.040 (-0.20)	0.440 (2.61) ***
Debt/equity ratio	-0.007 (-3.28) ***	-0.006 (-2.94) ***	-0.021 (-7.29) ***	-0.024 (-8.58) ***
Growth (capex/sales)	0.001 (0.55)	0.000 (0.51)	0.001 (1.39)	0.000 (0.76)
Z-score	0.000 (0.26)	0.000 (-1.50)	0.000 (0.36)	-0.000 (-1.33)
Dividend-dummy	0.147 (1.39)	0.103 (1.25)	0.188 (2.79) ***	0.139 (2.47) **
N	636	636	636	636
R-squared	0.425	0.604	0.534	0.767

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by simple Tobin's Q and LN Q. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

Table 3 presents the results from our multivariate regressions. Consistent with our hypothesis and previous literature (Grace et al., 2015; Hoyt & Liebenberg, 2011), we find evidence that firms engaging in ERM are rewarded with a higher firm value compared to using TRM. We find a positive and significant relationship between the use of ERM and simple Q. For our log Q, we find a statistically significant effect from ERM in our pooled regression but fail to in the fixed-effects model. These results imply that there exists a value premium from the use of ERM compared to TRM usage.

We find that size has a negative effect on firm value, while ROA is positively related to firm value. Both effects are statistically significant and consistent with our expectations as well as previous literature (Allayannis & Weston, 2001; Lang & Stulz, 1994).

However, the following results are significant but differ from our expectations and previous literature (Allayannis & Weston, 2001; Lang & Stulz, 1994). We find that higher leverage negatively affects Q, which we see from the significant negative debt/equity coefficient. Further, for LN Q we find that firms paying dividends are rewarded with a higher Q, whereas Allayannis and Weston (2001) report the opposite. Most of the control variables have a significant effect on Q. We also observe a significant effect on Q for most of the SIC codes in our pooled OLS models.

In the above paragraphs, we found evidence that ERM users indeed are rewarded with a higher Tobin's Q than firms using TRM. To test whether there are significant differences between the value premium of ERM and TRM usage, we employ Wald tests for both our pooled OLS and fixed-effects models when using simple Q and LN Q. We test the null hypothesis that the value premium is equal for both ERM and TRM usage. We reject the null hypotheses for the pooled OLS with both simple Q and LN Q as dependent variables at the 5% and 1% levels, respectively. For the fixed-effects model with simple Q as the dependent variable, we reject the null hypothesis at the 10% level. However, we do not reject the null hypothesis for the fixed-effects model with LN Q as the dependent variable. With a positive regression coefficient for the ERM dummy, we conclude that ERM usage leads to a value premium compared to TRM usage.

5.2 Robustness test and additional testing

5.2.1 Alternative measures for firm value

As outlined above, we test five additional variations for market value: (1) simple Q, defined as the market value of common equity, preferred stock, and debt, divided by the book value of assets; (2) the LN of simple Q; (3) a version of Allayannis' and Weston's (2001) industry-adjusted Q, by subtracting each year the median Q of the primary three-digit SIC that the firm belongs to from that firm's Q; (4) market value of equity and debt divided by the book value of total sales; and (5) ROA. We investigate the correlation between our alternative measures for market value and our benchmark Q, the simple Tobin's Q. These figures are presented in Table 4, along with the mean, standard deviation, skewness, median, and 10th and 90th percentile.

Table 4. Alternative measures for market value

Measure of firm value	Corr with simple Q	Mean	Mean for ERM users	Std.dev	Skewness	10th percentile	Median	90th percentile
Benchmark (simple Q)	1.00	1.34	1.41	1.34	3.41	0.43	0.91	2.62
LN Q	0.81	-0.04	0.08	0.82	-0.50	-0.85	-0.10	0.96
Industry-adjusted Q	0.83	0.17	0.17	1.11	3.30	-0.59	0.00	1.00
MV Equity/sales	0.17	62.37	51.20	806.36	17.03	0.24	1.03	5.51
ROA	-0.14	-0.03	-0.02	0.20	-2.80	-0.19	0.02	0.11

This table presents the summary statistics of our benchmark Q along with our alternative measures of firm value. Tobin's Q is defined as the market value of a firm divided by the replacement cost of assets. LN Q is defined as the natural log transformation of the simple Q. The industry-adjusted Q is constructed by subtracting each year the median Q of the primary three-digit SIC that the firm belongs to from that firm's Q. MV Equity/sales is defined as the market value of the firm's equity divided by its total sales. ROA is defined as the ratio of net income divided by total assets.

We observe in Table 4 that LN Q and the industry-adjusted Q are the two proxies for firm value that most closely follow our simple Q. We also see that the skewness that exists in the simple Q (3.41) is reduced when taking the natural log of simple Q (-0.50). The market value of equity to sales ratio has a considerably higher standard deviation (806.30) and skewness (17.03) compared to the other alternatives, and a 90th percentile (5.51) much lower than its mean (62.37), which implies that this firm-value proxy includes large outliers that affect these metrics. ROA is the only alternative metric for firm value with a negative correlation (-0.14) with our benchmark Q. The market value of equity to sales ratio and ROA are the only two alternative firm-value proxies where the complete sample has a higher mean firm value than ERM users have.

In addition to investigating the correlations between the alternative firm-value proxies and the simple Q, we test our main hypothesis using a fixed-effects model with alternative measures for firm value (Appendix E, Appendix F, and Appendix G). While LN Q and ROA failed to provide significant results, the other measures provided consistent results showing positive significant results. Hence, we reject the null hypotheses that the effect of ERM and TRM is equal when using the simple Q, industry-adjusted Q, and market value of equity divided by sales as proxies for firm value.

5.2.2 Removing outliers

Although the transformation from simple Q to LN Q has contributed to reducing the skewness for our sample (from 3.4 to -0.5), we estimate the effect of outliers as an additional measure. To test the robustness of our results for the effects of outliers, we estimate our multivariate regressions after excluding outliers (Appendix H). We exclude the observations with top and bottom 1% Qs in our sample, similar to Allayannis and Weston (2001). As expected, the exclusion of outliers resulted in a greater reduction in skewness for simple Q (from 3.4 to 2.6) compared to LN Q (from -0.5 to 0.03). Most of the coefficients and statistical significance remained similar to the results presented in section 5.1 for the fixed-effects models. Thus, excluding outliers contributed to strengthening our conviction that ERM usage yields a higher value premium relative to TRM usage.

5.2.3 Alternative sample constraints

Our sample consists of considerably smaller firms in terms of assets, compared to previous literature (Allayannis & Weston, 2001; Bartram et al., 2011; Hoyt & Liebenberg, 2011; Lang & Stulz, 1994; Servaes, 1996). When expanding their sample to include smaller firms, Nelson et al. (2005) found that the effect from hedging declined, and in contrast had a negative influence on valuations. To investigate whether the minimum-asset constraint have had a large impact on our results, we estimate our models using minimum-assets constraints at similar levels to Lang and Stulz (1994) and Allayannis and Weston (2001), of approximately NOK 5,000 million and NOK 1,000 million, respectively.

When applying the minimum-asset constraint of NOK 5,000 million, we are left with 246 firm-year observations. We find similar significant results as in section 5.1 and reject the null hypothesis that the effect of ERM use is equal to the effect of TRM use (Appendix I). Using the minimum-assets constraint of NOK 1,000 million, we are left with 448 firm-year observations. The results from this fixed-effects model show a positive but not significant effect on firm value from ERM use (Appendix J). The pooled OLS for the same asset constraint shows results indicating that ERM has a significant and positive effect on firm value. These results contribute to strengthening the robustness of our initial results presented in section 5.1.

5.2.4 Alternative control variables

We test the robustness of our results using the alternative control variables as described in section 3.2, when running a pooled OLS and fixed-effects model for both simple Q and LN Q. The alternative control variables include firm size, where we substitute log assets with log sales, as well as substituting log assets with the log of capex; growth, where we substitute the capex to sales ratio with the ratio of R&D to assets; and profitability, where we substitute ROA with the ratio of EBITDA to sales. The coefficients in all models change slightly in sign and significance when substituting the original definitions of our control variables to the alternative ones, which may indicate that they are unable to control for the same effects as our initial control variables (Appendix K). When estimating the regressions after the substitution of control variables, we find no significant effect from ERM on firm value. Several of the other control variables also change in sign and significance. We run each regression when substituting the control variables separately to determine which of the effects are the most sensitive to a change in control variable definition. The ERM dummy remains statistically significant for all models using alternative definitions of control variables, except for when substituting the profitability proxy from ROA to EBITDA/total sales (Appendix L). The effects we control for are virtually unaffected by the control variable definitions for all models, due to the small change in the effect of ERM usage on firm value. This contributes to strengthening the robustness of our results.

5.2.5 Reverse causality

Previously, we found evidence supporting our hypothesis that ERM users are rewarded with a higher firm value, compared to firms engaging in TRM. However, similar to Allayannis' and Weston's (2001) approach we believe that the decision to implement ERM could be incentivized by a high Q for some firms. To test this hypothesis, we conduct a reverse causality study to test for this effect in our sample. To do this, we follow the method outlined in Allayannis and Weston (2001) and Servaes (1996) and classify our firm-year observations into three different categories as described in section 3.4.1.

Table 5. Reverse causality

Variables	N	Simple Q	LN Q
Firm does not use ERM in either period ($N_t\ N_{t+1}$)	281	1.054 (0.90)	0.04 (0.11)
Firm uses ERM in both periods ($E_t\ E_{t+1}$)	242	0.935 (1.13)	0.13 (0.39)
Wald test (p-values)			
Hypothesis 1: NN = 0 (The decision to use ERM is unaffected by Q)		0.37	0.91

This table presents the results from a reverse causality test on the effects of changes in firms' ERM behavior. NN is an indicator set to 1 if the firm does not use ERM in the current period or the next period. EE is an indicator set to 1 if the firm uses ERM in the current period and the next period. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, dividend payout, probability of bankruptcy, ERM dummy, and year dummies. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

The results from the reverse causality test are presented in Table 5. The coefficients imply that firms engaging in TRM in both periods have a higher value in the first period than firms that implement ERM in the second period. Similarly, firms that use ERM in both periods also have a higher value in the first period than firms implementing ERM in the second period. For simple Q, the regression coefficients contradict our previous findings from section 5.1. While we previously found that ERM use provided a value premium compared to the use of TRM, we now observe that firms using TRM in the current and the next period have a higher Q than firms using ERM in both periods. However, the coefficients for our LN Q regression indicate similar results as our multivariate tests in section 5.1, indicating a value premium of ERM, but not statistically significant. Based on the high p-values, we do not reject the null hypothesis, implying that we do not find evidence of reverse causality. In other words, we do not observe any indication that a high Q affects the decision to implement ERM. However, none of our variables are statistically significant. Our results support Allayannis' and Weston's (2001) findings, which show no evidence of reverse causality for US firms.

5.2.6 Event study

In the previous subsection, we found that there is no evidence of reverse causality between firm value and the decision to implement ERM. In this subsection, we test whether a change in hedging behavior leads to a change in firm value. We test our regression model as described in section 3.4.2 for both our simple Q and LN Q and present the results in Table 6.

Table 6. Event study

Variables	N	Simple Q	LN Q
Firm does not use ERM in either period ($N_{t-1}N_t$)	282	0.70 (0.67)	0.05 (0.2)
Firm uses ERM in both periods ($E_{t-1}E_t$)	245	0.54 (0.51)	0.03 (0.11)
Wald tests (p-values)			
Hypothesis 1: NN = 0 (Q is unaffected by the decision to adopt ERM)		0.51	0.84
Hypothesis 2: EE = NN (ERM usage provides no value increase)		0.28	0.59
Hypothesis 3: EE = 0 (ERM usage over time provides the same value increase as adopting ERM in the current year)		0.61	0.91

This table presents the results from our test on the effects on firm value from changes in firms' ERM behavior. The estimated regression model is

$$\Delta Firm\ value\ = \alpha + \beta_1(NN) + \beta_2(EE) + \theta\Delta\boldsymbol{X} + \varepsilon$$

NN is an indicator set to 1 if the firm does not use ERM in the current period or the next period. EE is an indicator set to 1 if the firm uses ERM in the current and the next period. $\Delta\boldsymbol{X}$ is a vector of changes in the control variables foreign income/total sales, log assets, ROA, debt/equity, capex/sales, and Z-score. The regression also includes year dummies and a dividend dummy. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

We find that firms using TRM in both periods (NN) experience a higher increase in firm value than firms that went from using TRM to using ERM (NE), for both simple Q and LN Q. This contradicts our results in section 5.1, where we find that ERM use provides a value premium compared to the use of TRM. The results from this event study also contradict our expectations based on previous studies (Allayannis & Weston, 2001; Bartram et al., 2011; Grace et al., 2015; Hoyt & Liebenberg, 2011). Additionally, we find that firms that were ERM users in both periods (EE) had higher increase in firm value relative to firms that went from using TRM to using ERM (NE). We observe this effect for both the simple Q and LN Q. However, none of these ERM policy effects on the change in Q were statistically significant, even at the 10% level. Moreover, we do not reject any null hypotheses for the Wald tests in this subsection; thus, we find no statistically significant evidence that ERM usage leads to a change in firm value. We suspect that some of the reasons for our results differing to previous studies might be due to our sample consisting of Norwegian firms between 2013 and 2019, while most previous studies use a sample of US firms in the period from early 90s to 2005 (Allayannis & Weston, 2001; Graham & Rogers, 2002; Hoyt & Liebenberg, 2011; Pagach & Warr, 2015). As risk management has gone from mainly focusing on silos to a much more holistic perspective on risk in the last two decades (McShane, 2018), this may have contributed to our differing results to Allayannis' and Weston's (2001) findings for their event study. By considering a firm's risk exposure more holistically, there might not be a need for hedging altogether as one effect can offset another. Hence, we are wary of drawing conclusions on the causal effects of ERM based on this test alone.

5.2.7 Volatility testing

Based on previous literature (Bartram et al., 2011; Pagach & Warr, 2015) on the effects of hedging and ERM, we decided to investigate whether there exists a relationship between the use of either ERM or TRM and different volatility metrics in our sample. To assess the effect of TRM usage and ERM usage on volatility, we estimate several regression models where we include control variables that may affect our volatility metrics. To measure volatility, we estimate the yearly standard deviation of the following earnings and cash flow metrics: (1) net operating cash flow, (2) pretax income, (3) income before extraordinary items, (4) operating income before depreciation, and (5) operating income after depreciation.

The results from our regressions on the effect of ERM and TRM on earnings volatility are shown in Appendix M and Appendix N for the pooled OLS and the fixed-effects model, respectively. None of our volatility tests result in statistically significant effects from the use of ERM or TRM. Moreover, we do not reject any null hypotheses that ERM users have lower performance volatility than TRM users.

Hence, due to the having no statistically significant results, along with the large variation in the sign of the ERM variable, we cannot conclude that neither ERM usage nor TRM usage affect performance volatility.

6.0 Conclusions

This thesis studies the engagement of ERM and TRM, for Norwegian firms for a sample of 120 firms between 2013 and 2019. We examine whether the use of ERM offers a value premium relative to TRM usage.

Using Tobin's Q as a proxy for firm value we find significant evidence suggesting that the use of ERM is related to higher firm value compared to the use of TRM. Our results are consistent across several measures for firm value and several robustness tests. In essence, our study reveals a positive and statistically significant effect on firm value that is higher from ERM usage than for TRM usage.

The results provided in this paper are consistent with previous findings suggesting that ERM usage increases firm value. While most of the earlier studies examine the effect of ERM, few articles compare the effects of ERM to the effects of TRM. The findings of our paper might contribute to an increased curiosity on this subject, highlighting a rather unexplored topic.

In addition to examining our main hypothesis, we perform supplementary tests investigating the causal effect from ERM as well as the effect ERM use has on the volatility of different performance metrics. The regression results are inconclusive regarding the causal effects from ERM, and whether ERM is correlated with reduced volatility.

The discrepancies between our results and those of previous research may arise from multiple causes. One possible explanation for the lack of significant value-increasing results from ERM implementation might be that many firms are not positioned to benefit from this action (Pagach & Warr, 2015). A culture of openness to change and the board director's knowledge of ERM are some of the numerous important factors for a successful ERM implementation in a firm (Fraser &

Simkins, 2016). These factors are unfortunately hard to control for in a quantitative study like this one.

However, we believe that there is room for further investigation regarding this subject. First, we would recommend gathering a larger data set to better gauge the impact of ERM. Second, implementing ERM may face strong resistance from employees who are unwilling to adapt to new concepts (Fraser & Simkins, 2016; Mohrman, 2007), which might delay the observable effect from ERM use. Therefore, examining the effect of ERM multiple years after the initial implementation might be beneficial for explaining the benefit of using ERM. To our knowledge, the long-run effects are yet to be determined.

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8.0 Appendix

Appendix A. Breusch-Pagan Lagrangian multiplier test

	Var	St. dev = Sqrt (Var)
Q	1.805	1.343
e	0.715	0.845
u	0.764	0.874

Test: H_0: Var(u) = 0

chibar2 (01) $= 469.080$

Prob > chibar2 $= 0.000$

This table presents the results from a Breusch-Pagan Lagrangian multiplier test for our sample. Tobin's Q is defined as the market value of a firm divided by the replacement cost of assets. The overall error component is denoted e, while the fixed- or random-error component is denoted u.

Appendix B. Hausman test for endogeneity

	Coefficients			
	(b) Fixed	(B) Random	(b-B) Difference	Sqrt (diag (V_b-V_B)) S.E.
ERM dummy	0.625	0.600	0.026	0.355
Foreign income/total sales	-0.003	-0.005	0.001	0.003
Size (log of assets)	-0.356	-0.293	-0.062	0.081
ROA	0.646	0.181	0.465	0.117
Debt/ equity ratio	-0.006	-0.007	0.002	0.001
Growth (capex/ sales)	0.000	0.001	-0.000	0.000
Z-score	-0.000	-0.000	-0.000	0.000
Dividend dummy	0.103	0.149	-0.047	0.055
2014	-0.083	-0.088	0.004	0.012
2015	0.067	0.057	0.010	0.018
2016	0.121	0.110	0.011	0.023
2017	0.074	0.070	0.004	0.028
2018	-0.037	-0.038	0.001	0.032
2019	0.337	0.323	0.014	0.045

Test: H_0: difference in coefficients not systematic

$$chi2(14) = (b - B)' \, [V\_b - V\_B]^{-1} \, (b - B)$$

$$= 27.25$$

Prob > chi2 $= 0.0178$

This table presents the results from a Hausman test for endogeneity. The ERM dummy equals 1 for firm-years beginning with, and subsequent to, the first evidence of ERM usage, and 0 for the firm-years prior to the first observed ERM usage, where the firm uses TRM. Foreign income denotes the net foreign income divided by total sales. ROA is the ratio of income before extraordinary items divided by total assets. D/E denotes the ratio of total debt divided by the market value of equity. Growth is denoted by capital expenditures divided by total sales. The dividend dummy is set equal to 1 if the company paid dividends that year, and 0 otherwise. The Z-score is a variable set to measure the probability of bankruptcy.

Appendix C. Correlation matrix

	Q	ERM	Foreign income	Size (log assets)	ROA	D/E	Growth	Dividend	Z-score
Q	1.00								
ERM	0.05	1.00							
Foreign income	-0.01	0.03	1.00						
Size (log assets)	-0.26	0.49	-0.01	1.00					
ROA	-0.14	0.06	0.00	0.25	1.00				
D/E	-0.13	0.05	0.00	0.10	-0.14	1.00			
Growth	0.01	-0.05	0.44	-0.03	0.00	-0.01	1.00		
Dividend	-0.02	0.18	-0.02	0.39	0.43	-0.13	-0.05	1.00	
Z-score	0.01	-0.04	0.00	-0.02	-0.02	-0.02	0.00	-0.05	1.00

This table presents a matrix of the correlation between the variables used in this paper. Tobin's Q is defined as the market value of a firm divided by the replacement cost of assets. The ERM dummy equals 1 for firm-years beginning with, and subsequent to, the first evidence of ERM usage, and 0 for the firm-years prior to the first observed ERM usage, where the firm uses TRM. Foreign income denotes the net foreign income divided by total sales. ROA is the ratio of income before extraordinary items divided by total assets. D/E denotes the ratio of total debt divided by the market value of equity. Growth is denoted by capital expenditures divided by total sales. The dividend dummy is set equal to 1 if the company paid dividends that year, and 0 otherwise. The Z-score is a variable set to measure the probability of bankruptcy.

Appendix D. Variance inflation factor test

Variable	VIF	1/VIF
ERM	2.18	0.460
Foreign income	1.26	0.791
Size (log assets)	2.47	0.405
ROA	1.77	0.565
D/E	1.13	0.885
Growth	1.29	0.778
Z-score	1.06	0.941
Dividend dummy	2.41	0.415

This table presents the results from a Variance inflation factor test. The ERM dummy equals 1 for firm-years beginning with, and subsequent to, the first evidence of ERM usage, and 0 for the firm-years prior to the first observed ERM usage, where the firm uses TRM. Foreign income denotes the net foreign income divided by total sales. ROA is the ratio of income before extraordinary items divided by total assets. D/E denotes the ratio of total debt divided by the market value of equity. Growth is denoted by capital expenditures divided by total sales. The dividend dummy is set equal to 1 if the company paid dividends that year, and 0 otherwise. The Z-score is a variable set to measure the probability of bankruptcy.

Appendix E. Multivariate regression with alternative definition of firm value - Industry-adjusted Q

	Pooled	Fixed effects
ERM dummy	0.269 (2.04) **	0.625 (1.95) *
Foreign income/total sales	-0.003 (-0.11)	-0.003 (-0.18)
Size (log of total assets)	-0.146 (-3.77) ***	-0.356 (-3.75) ***
ROA	-0.298 (-0.64)	0.646 (1.67) *
Debt/equity ratio	-0.007 (-3.28) ***	-0.006 (-2.94) ***
Growth (capex/sales)	0.001 (0.55)	0.000 (0.51)
Z-score	0.000 (0.26)	-0.000 (-1.50)
Dividend dummy	0.147 (1.39)	0.103 (1.25)
N	636	636
R-squared	0.151	0.416

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by our industry-adjusted Q. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

Appendix F. Multivariate regression with alternative definition of firm value - Market value of equity to sales ratio

	Pooled	Fixed effects
ERM dummy	33.029	1395 *
	(0.76)	(1.68)
Foreign income/total sales	-41.642	-34.256
	(-0.30)	(-0.51)
Size (log of total assets)	40.3402	61.183
	(1.34)	(0.95)
ROA	-368.171	-116.068
	(-1.23)	(-0.92)
Debt/equity ratio	-1.501	-0-299
	(-1.30)	(-0.85)
Growth (capex/sales)	4.513	4.065
	(0.79)	(1.47)
Z-score	-0.201	-0.038
	(-1.15)	(-1.57)
Dividend dummy	-6.784	3.056
	(-1.15)	(0.10)
N	636	636
R-squared	0.123	0.567

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by the market value of equity divided by total sales. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

Appendix G. Multivariate regression with alternative definition of firm value - ROA

	Pooled	Fixed effects
ERM dummy	0.002 (0.07)	0.128 (0.31)
Foreign income/total sales	0.000 (0.07)	-0.000 (-0.19)
Size (log of total assets)	0.013 (1.68) *	0.045 (1.92) *
Debt/equity ratio	-0.002 (-3.13) ***	-0.003 (-2.89) ***
Growth (capex/sales)	0.000 (1.01)	0.000 (1.19)
Z-score	-0.000 (-0.95)	0.000 (0.23)
Dividend dummy	0.115 (6.55) ***	0.056 (2.67) ***
N	636	636
R-squared	0.435	0.559

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by ROA. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

Appendix H. Multivariate regression when removing outliers

	Simple Q		LN Q	
	Pooled	Fixed effects	Pooled	Fixed effects
ERM dummy	0.311 (2.66) ***	0.639 (2.06) **	0.229 (3.19) ***	0.294 (1.44)
Foreign income/total sales	-0.004 (-0.13)	-0.004 (-0.21)	-0.004 (-0.30)	-0.003 (-0.41)
Size (log of total assets)	-0.121 (-3.36) ***	-0.305 (-3.60) ***	-0.072 (-2.89) ***	-0.216 (-4.52) ***
ROA	-0.133 (-0.30)	0.368 (1.28)	-0.025 (-0.13)	0.383 (2.42) **
Debt/equity ratio	-0.009 (-3.60) ***	-0.008 (-4.08) ***	-0.016 (-3.67) ***	-0.017 (-4.55) ***
Growth (capex/sales)	0.006 (0.52)	0.000 (0.49)	0.001 (1.41)	0.000 (0.81)
Z-score	0.000 (0.27)	-0.000 (-1.54)	0.000 (0.37)	-0.000 (-1.36)
Dividend dummy	0.152 (1.62)	0.097 (1.20)	0.195 (3.05) ***	0.136 (2.47) **
N	624	624	624	624
R-squared	0.427	0.650	0.486	0.760

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by simple Tobin's Q and LN Q, when we exclude the observations outside the 1st and 99th percentiles of the dependent variable. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

Appendix I. Multivariate regressions with alternative minimum-asset constraint - NOK 5,000 million

	Simple Q		LN Q	
	Pooled	Fixed effects	Pooled	Fixed effects
ERM dummy	0.032	0.602	0.030	0.470
	(0.27)	(2.81) ***	(0.26)	(3.21) ***
Foreign income/total sales	-0.083	-0.023	-0.700	-0.059
	(-0.15)	(-0.04)	(-1.09)	(-0.10)
Size (log of total assets)	-0.085	-0.065	-0.031	-0.041
	(-1.33)	(-0.55)	(-0.50)	(-0.35)
ROA	1.059	0.656	1.688	1.098
	(2.10) **	(1.10)	(2.93) ***	(1.85) *
Debt/equity ratio	-0.003	-0.004	-0.016	-0.022
	(-1.88) *	(-2.09) **	(-4.98) ***	(-6.78) ***
Growth (capex/sales)	0.053	0.094	0.153	0.064
	(0.62)	(0.81)	(1.65)	(-0.39)
Z-score	0.000	-0.000	0.000	-0.000
	(0.38)	(-1.65)	(0.59)	(-1.99) **
Dividend dummy	0.106	-0.010	0.010	-0.049
	(1.04)	(-0.08)	(0.09)	(-0.46)
N	246	246	246	246
R-squared	0.477	0.559	0.638	0.743

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by simple Tobin's Q and LN Q, when we set the minimum-asset constraint to NOK 5,000 million. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

Appendix J. Multivariate regressions with alternative minimum-asset constraint - NOK 1,000 million

	Simple Q		LN Q	
	Pooled	Fixed effects	Pooled	Fixed effects
ERM dummy	0.323 (2.83) ***	0.399 (1.48)	0.207 (2.23) **	0.266 (1.26)
Foreign income/total sales	-0.027 (-2.91) ***	-0.043 (-0.47)	-0.012 (-2.90) ***	-0.065 (-1.06)
Size (log of total assets)	-0.117 (-2.57) **	-0.305 (-3.74) ***	-0.044 (-1.09)	-0.195 (-2.75) ***
ROA	1.154 (2.79) ***	0.703 (2.36) **	1.02 (2.96) ***	0.729 (2.66) ***
Debt/equity ratio	-0.003 (-2.27) **	-0.005 (-3.09) ***	-0.018 (-6.12) ***	-0.022 (-7.24) ***
Growth (capex/sales)	0.001 (3.67) ***	0.001 (0.35)	0.001 (5.03) ***	0.002 (0.93)
Z-score	-0.000 (-0.02)	-0.000 (-1.37)	0.000 (0.36)	-0.000 (-1.14)
Dividend dummy	0.046 (0.53)	0.137 (1.87) *	0.078 (1.05)	0.128 (1.99) **
N	448	448	448	448
R-squared	0.519	0.706	0.623	0.770

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by simple Tobin's Q and LN Q, when we set the minimum-asset constraint to NOK 1,000 million. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses.

Appendix K. Multivariate regression with alternative control variables

	Simple Q		LN Q	
	Pooled	Fixed effects	Pooled	Fixed effects
ERM dummy	0.199 (1.66) *	0.323 (1.58)	0.213 (3.10) ***	0.201 (1.14)
Foreign income/total sales	-0.004 (-0.67)	-0.007 (-1.26)	-0.003 (-0.90)	-0.004 (-1.31)
Size (log of sale)	-0.119 (-2.35) **	-0.063 (-0.99)	-0.078 (-3.38) ***	-0.068 (-2.01) **
EBITDA/Sales	-0.000 (-0.21)	-0.004 (-2.70) ***	0.000 (0.37)	-0.001 (-1.50)
Debt/equity ratio	-0.006 (-3.44) ***	-0.007 (-3.43) ***	-0.020 (-7.37) ***	-0.025 (-9.04) ***
Growth (R&D/Assets)	5.877 (3.26) ***	-0.691 (-0.26)	2.835 (4.20) ***	-0.264 (-0.40)
Z-score	-0.000 (-0.47)	-0.000 (-1.36)	0.000 (0.03)	-0.000 (-1.15)
Dividend dummy	0.229 (2.62) ***	0.100 (1.16)	0.260 (4.17) ***	0.153 (2.51) **
N	636	636	636	636
R-squared	0.482	0.5971	0.576	0.756

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by simple Tobin's Q and LN Q, when we substitute several of our control variables with alternative measures. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses. The same regressions when substituting the alternative proxy for size, log of sales, to the log of capex are not tabulated, but provide very similar results.

Appendix L. Multivariate regression with alternative profitability proxy

	Simple Q		LN Q	
	Pooled	Fixed effects	Pooled	Fixed effects
ERM dummy	0.267 (2.03) **	0.353 (1.34)	0.224 (3.04) ***	0.209 (0.98)
Foreign income/total sales	-0.005 (-1.18)	-0.011 (-1.79) *	-0.005 (-2.80) ***	-0.005 (-1.83) *
Size (log of assets)	-0.157 (-4.10) ***	-0.346 (-3.74) ***	-0.079 (-3.10) ***	-0.214 (-4.31) **
EBITDA/Sales	-0.003 (-3.51) ***	-0.004 (-3.16) ***	0.001 (-3.61) ***	-0.001 (-1.92) *
Debt/equity ratio	-0.006 (-3.36) ***	-0.007 (-3.85) ***	-0.021 (-7.43) ***	-0.025 (-9.02) ***
Growth (Capex/sales*)*	0.001 (2.19) **	0.006 (1.35)	0.001 (5.18) ***	0.000 (1.11)
Z-score	0.000 (0.39)	-0.000 (-1.43)	0.000 (0.43)	-0.000 (-1.26)
Dividend dummy	0.125 (1.26)	0.142 (1.80) *	0.188 (2.91) ***	0.164 (2.92) ***
N	636	636	636	636
R-squared	0.433	0.607	0.539	0.764

This table presents the results from pooled and fixed-effects multivariate tests on the effects of firms' risk management strategy on their value measured by simple Tobin's Q and LN Q, when we substitute several of our control variables with alternative measures. ERM users are defined as firms reporting the implementation of Enterprise Risk Management in their annual reports. We classify all observations prior to the first evidence of ERM usage as TRM users. The regressions include control variables for foreign sales to total sales, size, ROA, debt/equity ratio, growth, probability of bankruptcy, dividend payout, three-digit SIC code (only in the pooled OLS), and year dummies as outlined in section 3.2. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. N shows the number of observations. T-statistics are based on White (1980) standard errors and are presented in parentheses. The same regressions when substituting the alternative proxy for size, log of sales, to the log of capex are not tabulated, but provide very similar results.

Appendix M. Volatility testing - pooled OLS

Dependent variable	ERM	R-squared
Panel A: Income before extraordinary items		
Coefficients	2.41	0.078
T-statistics	(0.13)	
Hypothesis: ERM = 0 (p-value):	0.90	
Panel B: Operating income after depreciation		
Coefficients	1.31	0.142
T-statistics	(-0.93)	
Hypothesis: ERM = 0 (p-value):	0.32	
Panel C: Operating income before depreciation		
Coefficients	-1.115	0.102
T-statistics	(-1.51)	
Hypothesis: ERM = 0 (p-value):	0.13	
Panel D: Operating net cash flow		
Coefficients	-1.919	0.143
T-statistics	(-0.82)	
Hypothesis: ERM = 0 (p-value):	0.41	
Panel E: Pretax income		
Coefficients	-4.043	0.074
T-statistics	(-0.98)	
Hypothesis: ERM = 0 (p-value):	0.33	

This table presents the results from our pooled OLS on the effects of ERM usage on the volatility of several performance metrics. Each panel is a separately run regression using the volatility of the performance metrics as the dependent variable, and the dummy variable representing ERM/TRM use as an independent variable. The regressions also include the following control variables: log assets; the ratio of debt to equity; capex to sales ratio; dividend dummy variable; ROA; net foreign income divided by total sales; three-digit SIC code; Altman Z-score (Altman, 2013); and year dummies. We test the hypothesis that ERM usage has the same effect on the volatility of the performance metrics as the use of TRM. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. T-statistics are based on White (1980) standard errors and are presented in parentheses.

Appendix N. Volatility testing - fixed effects

Dependent variable	ERM	R-squared
Panel A: Income before extraordinary items		
Coefficients	3.844	-0.033
T-statistics	(0.72)	
Hypothesis: ERM = 0 (p-value):	0.47	
Panel B: Operating income after depreciation		
Coefficients	-2.015	-0.002
T-statistics	(-1.03)	
Hypothesis: ERM = 0 (p-value):	0.31	
Panel C: Operating income before depreciation		
Coefficients	-0.717	0.023
T-statistics	(-0.27)	
Hypothesis: ERM = 0 (p-value):	0.79	
Panel D: Operating net cash flow		
Coefficients	8.731	0.008
T-statistics	(1.39)	
Hypothesis: ERM = 0 (p-value):	0.17	
Panel E: Pretax income		
Coefficients	-6.672	-0.002
T-statistics	(-0.62)	
Hypothesis: ERM = 0 (p-value):	0.53	

This table presents the results from our fixed-effects model on the effects of using ERM and TRM on the volatility of several performance metrics. Each panel is a separately run regression using the volatility of the performance metrics as the dependent variable, and the dummy variable representing ERM/TRM use as an independent variable. The regressions also include the following control variables: log assets; the ratio of debt to equity; capex to sales ratio; dividend dummy variable; ROA; net foreign income divided by total sales; three-digit SIC code; Altman Z-score (Altman, 2013); and year dummies. We test the hypothesis that ERM usage has the same effect on the volatility of the performance metrics as the use of TRM. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively. T-statistics are based on White (1980) standard errors and are presented in parentheses.