SCHOOL OF ECONOMICS
AND MANAGEMENT
Lund University

Department of Business Administration
BUS 860 Master Thesis
June 2006

Hedging Core and Non-Core Risks: Evidence from the Forestry and Paper Industry

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Abstract

A great number of empirical researches show that hedging is associated with higher firm value, particularly hedging interest rate and exchange rate. However, there is no clear support for value-added risk management hypothesis in the case of *producers* of commodities. Moreover, according to Shrand and Unal (1997), there are two types of risks, core business risks (or core risk) and homogeneous risks (or non core risks), which are based on a firm's comparative advantages with respects to the source of risk. Firm can earn economic profits for bearing core risks in which it has a comparative information advantage. Firm earn a zero economic rents for bearing non-core risks, where it has no advantage information than its competitors. Therefore, our objective is to study the impact of hedging commodity selling prices (could be core risk for some firms), interest rate and foreign exchange rate (non core risks) on firm value in a commodity industry - the forestry and paper industry in North America, Europe and Australia. Using Tobin's Q as an approximation for firm value, we find that hedging core risk is significantly associated with lower firm value and hedging non core risks is positively correlated with firm value. This result is robust to some control variables (size, profitability, access to financial market, leverage, growth opportunities). We conclude that the hedging premium depends on the types of risks to which the firm is exposed.

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1. Introduction

The introduction describes the background to our choice of research topic. Further on a brief explanation of the risk management operations in corporations will be addressed.

1.1 Background

Risk management is one of the most attractive areas within the area of finance. There are many existing and ongoing research examining why risk management can add value to a firm and how a firm manages and hedges its risks. In a perfect world of Modigliani and Miller (M&M) (1961), risk management is irrelevant since shareholders can hedge on their own at the same costs. In practice, imperfect market creates many reasons for a firm to minimize its risk exposure. Some of these theories are based on the hypothesis of maximization of shareholder value, for example risk management can add value through reducing taxes, reducing financial distress and bankruptcy costs and help a firm carry out its promising investment opportunities (Stulz (1996), Leland (1998), Mayers and Smith (1982), Mayers (1977), Jensen (1986), Froot, Scharfstein and Stein (1993)). Some other theories are based on the utility maximization for managers, like risk management can reduce managerial risk aversion or increase efficiency of monitoring manager's activities (Smith and Stulz (1985), Demarzo and Duffie (1995)). There are some empirical researches whose results support these theories. Allaynanis and Weston (2001) find that hedging cause an increase in firm values when examining the use of foreign currency derivatives in large non-financial firms in the U.S. Tufano (1996) show evidence that firms whose managers hold more stock manage more gold price risks.

However, there are some empirical researches which provide little support for predictive power of theories that view risk management as a tool to maximize shareholder value. Tufano (1996) find almost no empirical evidence that risk management can increase value of firms in gold industry. Jin and Jorion (2006) show that hedging does not seem to affect market value for the oil and gas industry.

Lookman (2004), in working paper, examined hedging oil and gas price risk of exploration and production firms in this industry and find that firms which hedge primary risk (oil and gas price risk for firms that has 80% or more revenue from their exploration and production) will trade off at lower market value and firms which hedge secondary risks will increase their market value. These findings raise a question of whether risk management is always a tool to increase value for a firm. Looking back to theories through lens of value, cash flow or earnings, we can see that most of theories treat risks as total risks and argue that firm can increase its market value by reducing all risks that lead to an increase in volatility of cash flow, expected tax or underinvestment problems. Fortunately, there are some other theorists who present another way of treating risks. Stulz (1996) argues that companies could add value to a firm by taking risks of which a firm has informative comparative advantages deriving from its normal business activities. Culp (2001) suggests that a large firm in the oil and gas industry should not hedge much of their oil pricing risks since this firm can obtain comparative information advantage about price fluctuations. Unfortunately, there is very small development in empirical research in this selective risk management. Shrand and Unal (1997) provide an explanation for hedging as a tool of allocating rather than reducing risk, in which they show evidence that credit risk - which is a core business risk that helps a firm earn economic profits - will increase and interest rate risk which is homogeneous (non-core) risk will decrease in thrifts conversions.

1.2 Problem Discussion

The internationalized and uncertain economies, the more severe competitive environment, the increasing attention to the firm's risk management activities by investors, analysts and supervisory authorities are all increasing corporations' awareness of several types of risks like operational, market, liquidity, legal risks. Risk management in general and hedging strategies in particular are increasingly playing an important role in long-run profitability and value creation of companies.

Corporations, in practice, set up goals of risk management differently. Some choose to reduce volatility in reported earnings or cash flow; some want to control the downside of the exposure, other companies aim to improve the company's access to financial

market and to reduce its capital cost. Moreover, decisions on bearing certain risks differ among firms. Operating in a global business environment, almost all companies are exposed to fluctuations of exchange rate and choose to hedge this type of risk. On the other hand, in commodity industry like gold, company like Homestake Mining choose not to hedge its gold price risk at all, meanwhile American Barrick choose to hedge almost all its gold products (Tufano (1996)). This practical hedging activity raises an interesting question of which types of risks a firm should bear or should hedge.

As mentioned above in the background, theoretical studies provide many motives for risk management activities. There are some empirical researches conducted to demonstrate whether or not practical risk management activities support theorists' ideas. For example, Allaynanis and Weston (2001) find that hedging foreign exchange rate helps to increase firm value. In hedging commodity prices, some studies show that *users* of commodities increase their value by taking position in commodity derivatives (Carter, Rogers and Simkins (2002)). However, there is no clear support for value-added risk management hypothesis in the case of *producers* of commodities (Lookman (2004), Jin and Jorion (2006)).

A company's business strategy and its operations drive its value. And that value comes from taking risks and choosing risks wisely. According to Shrand and Unal (1997), there are two types of risks, core business risks (or core risk) and homogeneous risks (or non core risks), which are based on a firm's comparative advantages with respects to the source of risk. Firm can earn economic profits for bearing core risks in which it has a comparative information advantage. Firm earn a zero economic rents for bearing non-core risks, where it has no advantage information than its competitors. This idea of Shrand and Unal (1997), together with empirical research in commodity industry (Lookman (2004), Jin and Jorion (2006)), raise a question of whether commodity price is core risk - from *producers*' point of view and if *producers* of commodities should hedge price fluctuation of their products. Moreover, most of studies mentioned above based on hypothesis of maximization of shareholder's value and personal utility maximization for managers. Therefore, there still is a need for further studies to

increase the understanding of hedging strategies, which still relies on shareholder value maximization and managerial utility maximization theories and also bring the idea of hedging core and non core risks.

In this paper, we study hedging activities in the forestry and paper industry in North America, Europe and Australia. We choose the forestry and paper industry because producers in this industry produce some commodity like timber, pulp and they face the risk of high fluctuation in their selling prices, like other commodity industry. Furthermore, almost all previous studies based on gold, or oil and gas industry. To our knowledge, there is no study in the forestry and paper industry which examine the impact of hedging activities on firm value; therefore, a study in this industry can increase some knowledge in this industry. We only focus on hedging using derivatives. Commodities in our research are the products that companies sell like timber, pulp, paper. We do not focus on commodities like raw material or energy. We argue that fluctuation in interest rate and foreign currency exchange rate are non-core risks for firms in this industry, since forestry and paper companies are non-financial firms and therefore they do not engage their primary business in these financial sectors. However, selling product prices could be core risks for some firms in this industry, since they operate actively in their own industry and as a result, they may have comparative advantages in bearing price risk. If interest rates and foreign currency exchange rates are non-core risks, then hedging these risks will help to increase the value of firms since risk management can reduce the downside probability of these risks. If commodity prices are the core risk of this industry, then hedging this risk could lead to a trade off in lower firm value due to forgone opportunities and hedging expenses.

1.3 Objectives

The objective is to study the impact of hedging commodity selling prices, interest rate and foreign exchange rate on firm value in the forestry and paper industry. Based on quantitative research and studying how firms in this industry manage their risks and if they treat the risks they are exposed to differently, our aims are to further increase the

understanding behind the hedging strategies and to contribute to existing research in the risk management area.

1.4 Limitation

In this paper, we test the hypothesis of whether risk management can help a firm to increase its value by comparing hedging activities in commodity prices, interest rate and exchange rate. There are many factors that affect a firm's value rather than hedging or risk management strategies, for example, the size of the firm, financial constraint, growth opportunities, tax structure, and managerial risk aversion; therefore, it is impossible to take every possible factor into account. We then only focus on controlling influence of size, access to financial markets, investment growth, profitability and leverage on firm value. Furthermore, hedging policies on interest rate and exchange rate are better reported in this industry. However, commodity prices are not well-reported in annual reports. In order to make comparable analysis, we only use hedging dummy variable as our proxy for hedging.

One of the best ways to understand why this firm hedge its product selling price while its competitors do not hedge is to interview managers about their view on this type of risk, for example if managers hedge, is it because they believe they have more advantage information than their competitors do? However, since we study companies in North America, Europe and Australia, it is impossible for us to do so in such a limited time.

1.5 Disposition

Chapter 1 presents a brief background on the relation between risk management and firm value, our objectives, problems which motivated this research and its limitation. In chapter 2 we give a review of the theory of risk management and firm value and empirical evidence. In chapter 3 we describe samples and methodology. Chapter 4 presents the results of testing the relationship between hedging and firm value. Chapter 5 is our analysis. Chapter 6 is the conclusion and chapter 7 is our recommendation for future work.

2. Literature Review

This section addresses already published studies within the field of risk management and firm value. Unfortunately there are not many studies that address core and non-core risk.

2.1 Theory of motivations for risk management.

Theorists construct many explanations for motives of risk management of a firm. The first is based on maximization of shareholder value. The second focuses on the utility maximization for managers.

2.1.1 Theory of shareholder value maximization

The theory of shareholder value maximization argues that risk management can increase market value of the firm by reducing cost of financial distress, fixing the level of taxable earnings and relieving under-investment problem.

2.1.1.1 Financial distress

Hedging strategies can reduce expected bankruptcy costs and expected financial distress costs. In the papers of Smith and Stulz (1985) and Mayers and Smith (1982), they argue that hedging to reduce volatility and total firm's risk would make financial distress less likely, therefore increasing a firm's expected value. This also implies that a firm can increase value by reducing deadweight costs and by increasing debt capacity which is associated with a higher tax shield. Shapiro and Titman (1986) extend the benefit of reducing financial distress in a way that it can help a firm maintain a valuable relationship with suppliers and buyers, which in turn contribute to the value of a firm in long-term period. Another way to contribute to a firm's debt capacity is that risk management can help reduce agency cost of free cash flow (Jensen, 1986). For example, managers like to have free cash on their hand to consume on non-pecuniary goods or to invest heavily in negative NPV projects to flex their growth muscles. Having recognized this, shareholders will force manager to issue more debt in order to control free cash flow problems. As a result, risk management can help the firm issue more debt but still face lower probability of bankruptcy. Moreover, hedging can reduce

risk-shifting or asset substitution (Campbell and Kracaw (1990)). Debt can entail deadweight costs if creditors know that the borrower has incentive and opportunity to increase the firm's risk to expropriate wealth from the creditors. Therefore a commitment to hedge can reduce these deadweight costs.

2.1.1.2 Taxes

Tax incentive arguments for risk management, formulized by Smith and Stulz (1985), show that firms may reduce their expected tax liability if the tax function is convex. Another incentive for a firm is that it can increase its debt capacity and therefore capture higher tax shield (Stulz (1996) and Leland (1998)). Debt holders care about total firm volatility, the larger the volatility, the higher the probability that the firm will default. By smoothing gross profit, the firm has a higher chance to raise its debt-to-equity ratio.

2.1.1.3 Under-investment problems

Risk management also can reduce under-investment problems or debt-overhang (Mayers, 1977). Because most profits of positive net present value (NPV) investments may come to debt holders, managers who act for the benefit of shareholders will not take those projects. However, a bond covenant requiring hedging or risk management may act in favour of undertaking positive NPV projects and reducing costs of debt. Bessembinder (1991) agree with these motives of hedging. He states that corporate risk hedging increase value by reducing incentives to under-invest because equity holders can capture larger portion of the benefit from new investments thanks to the decreased sensitivity of senior claim value to incremental investment. Requiring risk management in debt covenants can reduce the over-investment problem or asset substitution (Jensen and Meckling, 1976), where debt creates an incentive to take risky projects since the debt holders will bear all the downside risk of a project.

2.1.1.4 Costly external financing

In addition, risk management can add to a firm's value by providing internal funding for investment projects. External financing is costly in imperfect capital markets, particularly in the presence of information asymmetries (Froot, Scharfstein and Stein, 1993). Managers have private information about the future expected earning of new

projects, but they can not convey all the information to the market due to competitive reasons. Being under-informed about the future earnings, the market usually undervalues equity that a firm raises. Sometimes the situation is too severe and the firm has to forgo potential profitable projects. In order to avoid this, a firm can increase its value by smoothing cash flow, helping the firm to ensure that it will be able to fund promising projects internally.

2.1.2 Theory of utility maximization for managers

The second class of theory claims that hedging stem from the incentive of managers to maximize their personal utility function. Through the lens of this theory, risk management could reduce managerial risk aversion. Smith and Stulz (1985) argue that risk-averse managers have incentives to invest in less risky projects; even those projects can create value to a firm. If risk management can be used to reduce the risks of those risky but promising projects, managers can accept them and as a result, benefit shareholders of a firm. Smith and Stulz (1985) ascertain that if a manager's expected utility is a concave function of the value of the firm, the manager's optimal solution is to completely hedge the firm. Because the variability of their compensation is related to the volatility of a firm's cash flow, and if managers can not hedge effectively in their own portfolio or if it is cheaper for a firm to hedge, then firm hedging can improve managerial welfare. They also predict that managers who hold more stocks would prefer more risk management, because stocks provide a linear payoff as a function of stock prices, meanwhile managers who hold more option would prefer less risk management, since values of options will increase with higher uncertainty of stock prices.

Risk management, in general, can lead to easier and better performance evaluation, therefore reducing external monitoring costs. Demarzo and Duffie (1995) argue that hedging may serve as a signal that helps labour market better evaluate and monitor performance of the firm's managers under asymmetric information world.

2.2 Empirical researches on firm risk management

There are many empirical researches focusing on the relationship between firm characteristics and hedging activities. These findings include relation between risk management and firm characteristics, relation between firm value and risk management.

2.2.1 Risk management and firm characteristics

Consistent with tax incentives for risk management and financial distress hypothesis, Graham and Rogers (2002) provide evidence that firms hedge in response to tax convexity and expected financial distress. They conclude that hedging foreign exchange rate and interest rate risks results in an increase of 1.1% in firm value through increased debt capacity associated with increased tax shield. Nance, Smith and Smithson (1993) show that firms which hedge face more convex tax function and have more growth options in their investment opportunity set.

Consistent to hypothesis of hedging helps firm to reduce financial distress costs, Haushalter (2000) study of oil and gas producers shows that the extent of hedging is related to financing costs; in particular, companies with greater financial leverage manage price risks more extensively. Howton and Perfect (1998) compared derivatives use by 451 non-financial, non-utility firms in the Fortune 500 or S&P 500 indexes against 461 random-selected firms and find that derivatives use is directly related to financial distress, external financing costs and tax considerations. Dodle (1995) find that hedging and leverage policies are interrelated because both affect expected costs of financial distress and agency costs. Purnanandam (2005) provide evidence that financially distressed firms in more concentrated industries have higher hedging incentives.

Geczy, Minton and Schrand (1997) analysis of the use of currency derivatives of 372 firms among the 1990 Fortune 500 list of non-financial firms provide evidence that "firms with greater growth opportunities and tighter financial constraints are more likely to use currency derivatives, which suggest that firms might use derivatives to reduce cash flow variation that might preclude firms from investing in valuable growth

opportunities". Gay and Nam (1998) examine whether the use of derivatives can reduce underinvestment by analyzing 486 publicly traded, the U.S non-financial firms in 1995 and find evidence of a positive relation between a firm's derivatives use and its growth opportunities. For firms with enhanced investment opportunities, derivatives use is greater when they also have relatively low cash stocks. All of these findings are consistent with the theory that risk management can reduce under-investment of Froot, Schraftstein and Stein (1993).

Tufano (1996) examination of gold mining firms for their motives for hedging gold price over the period 1990 to 1993 shows that firms whose managers hold more stock manage more gold price risks, which is consistent with theory and model of Smith and Stulz (1985), suggesting that managerial risk aversion may affect firm's risk management policy.

Brown and Bjerre-Toft (2002) argues that many papers address why firms should hedge, however do not point out how they should hedge. The most common hedge instrument that many non-financial firms employ is derivative contracts that have been increasing dependent on increased globalization and higher competition level. How firms hedge and what type of hedge instrument to use are also dependent on future sales volatility as well as other market risk factors which the firm are exposed to. Brown and Bjerre-Toft (2002) suggest two options regarding hedging strategies and these are: vanilla derivative contracts (forwards and options) and exotic payoff function.

2.2.2 Risk management and firm value

There is a mixed support for shareholder value maximization theory. Allaynanis and Weston (2001) find evidence consistent with the hypothesis that hedging causes an increase in firm values when examining the use of foreign currency derivatives in large non-financial firms in the U.S. They use Tobin's Q as a proxy for firm value, and find that foreign exchange rate hedging is associated with a 4.8% premium for firms which exposed to foreign exchange risks. Carter, Rogers and Simkins (2005) examination of 29 U.S airlines over the period 1992-2003 find that fuel price hedging in this industry

is associated with higher firm values. In contrast, Tufano (1996) shows little empirical support for theories that view risk management as a tool to maximize shareholder value when examining gold prices hedging of firms in North America. Following Tufano (1996), Jin and Jorion (2006) study of the hedging activities of oil and gas producers in North America find that hedging does not seem to affect market value for the oil and gas industry.

2.3 Risk management- through the lens of core and non core risks

Almost all theories presented above do not separate risk into different types of risks, for example, business risks and financial risks. According to the theory of shareholder value maximization, firms should reduce any risks that increase cash flow volatility (Froot, Scharfstein and Stein, 1993) or hedge all risk that allow firms to increase debt capacity (Mayers, 1977). However, Stulz (1996) present a theory that attempts to go beyond the model of minimizing variance. He suggests that the primary goal of risk management is to eliminate the probability of costly lower tail outcomes. He also argues that firms could add value to a firm by taking risks of which firms have comparative advantages deriving from its normal business activities (core risks). This is a practice in which manager's view of future price movements influences the percentage of the exposure that is hedged.

Culp (2001) explains why some companies do not hedge all their risks. He gives an example of a theoretical firm in the gas and oil industry named EP, in which it only makes sense for this company to hedge currency risk, where the firm has no obvious comparative information advantage about exchange rate. However, that firm should not hedge all oil price exposure because this would lead EP to be an oil logistics company.

Schrand and Unal (1998) are two authors who mention non-core risks (also named homogenous risk) and core risks in their research. They segregate risk into two types based on firm's information advantages with respect to the source of risk. According to them, core risk is a risk which a firm has a comparative information advantage on it and the firm can earn rents or economic profits for bearing that type of risk. By

contrast, homogenous risk is a risk that a firm earns zero economic rents in efficient markets like foreign currency exchange rate and interest rates. Therefore, they argue that managers with compensation tied to a firm value would use risk management tools to substitute core business risk for homogenous risks. They find evidence in thrift conversions showing that mutual thrifts converting to stock institutions increase total risk following conversion, which is consistent with an increased exposure to credit risks (core business risks) and decreased interest risks (homogeneous risks) through hedging activities. However, Shrand and Unal also argue that separation between core business and homogenous risks is not straightforward. Firms within the same industry/sector would almost certainly not rank its business risk exposures in the same way as its competitors do, mainly because they have different types of business strategies. Hence the dividing up process of the risks into core and non-core risks would then be different for each firm.

Lookman (2004), in a working paper, examine hedging selling price in oil and gas exploration and production firms in U.S. Lookman contributed to the literature by distinguishing between the valuation effects of hedging primary and secondary risks, in which commodity price is primary risk for pure-play firms (firms which has 80% or more of revenue derived from oil and gas exploration and production) and secondary risk for the diversified firms. Lookman find that amongst pure - play exploration and production firms, hedging is associated with lower firm value. In contrast, for a diversified firm with an exploration and production segment, hedging is associated with higher firm value. Even Lookman does not call primary risk a core risk and secondary risk a non-core risk, but his finding shows a similarity to core and non-core risks in terms of hedging core risks are considered to reduce firm value and hedging non-core risk, where a firm has no information advantages than competitors, will increase value of a firm. Primary risk could be core risk of firm since a company focus on oil and gas exploration and production and therefore can gain advantage information on its products prices.

3. Methodology and data

In this part we present the methodology we use and a description of the data that we are analysing. The methodology is one way ANOVA and multivariate analysis, which is partly a replication from Jin and Jorion (2006).

Almost all firms in commodity industries are exposed to certain market risks as parts of their ongoing business operations, including risks from changes in their principal product selling prices, costs of commodity like raw materials and energy, interest rates and foreign exchange rates. These firms use different risk management in general and hedging strategies in particular to manage these risks. However, the impact of these hedging strategies on firm value could be different.

We argue that commodity selling prices could be core risk for some firms in commodity industries and interest and foreign exchange rate are non core risks. Using firms in the forestry and paper as our samples, our objective is to study the impact of hedging commodity selling prices, interest rate and foreign exchange rate on firm value. To make this possible we use two analyses: one-way ANOVA and multivariate analysis to compare Tobin's Q, which is an approximation for firm value, between firms which choose to hedge certain risk and firm do not hedge that risk. The focus variable in one way ANOVA analysis is mean value of Tobin's Q. The explained variable in multivariable analysis is Tobin's Q. The explanatory variables are hedging-dummy, log of total asset, ROA (return on asset), dividend-dummy, capital expenditures/total assets and leverage.

3.1. Methodology

We use two analyzing methods to test the hypothesis that hedging will increase value of firm, first of all we use one-way ANOVA analysis, after that multivariate analysis with various control variables is used for robust test.

3.1.1 One-Way ANOVA Analysis

ANOVA analysis stands for Analysis of Variance between groups and is used when comparing means between two or more samples by dividing the total sum of squares. One-way ANOVA (even called single factor ANOVA) is similar to t-test analysis. One-way ANOVA tests “between samples-groups” and “within sample-groups”, this means the samples are tested simultaneously with each other instead of individually. The one-way approach is calculated in three steps; firstly is the sum of square estimated, secondly it tests the “within sample”-comparison and lastly it estimates “between sample”-comparison. The ANOVA analysis also estimates the degree of freedom (df.) in each step. The F-statistic that is generated from the ANOVA analysis indicates if the two different sample-groups have equal standard deviation. One advantage with one-way ANOVA is that it reduces the probability of a type-1 error. One possible disadvantage with one-way ANOVA is that the F generates significant differences between testing samples but it does not tell which sample-group that differs from each other. To overcome this issue a post-hoc comparison test could be used.

This approach will be used in this study to test main hypothesis whether firms who use financial derivatives for hedging their products' prices, interest rate and foreign exchange rate have higher market value (higher Tobin's Q value) than firms who do not use financial derivatives for hedging these risks.

3.1.2. Multivariate Analysis

In order to measure the dependence of firm value (the dependent variable) on hedging strategy (the explanatory variable), we choose to use multivariate analysis. The dependent variable is Tobin's Q, which is an approximation of firm value. Independent variables are hedging policy and other factors that are considered to correlate a firm's hedging policy and its value, like financial distress, profitability, growth opportunities, corporate governance, agency costs and managerial quality. Changes in these factors will result in changes in firm value. We denote these other factors as control variables. These control variables are used in the regression equation at the same time in order to eliminate the effect of them on the explained variable. Our regression equation can be generalized as follows.

$$\text{Tobin's Q} = \alpha + \beta_{hedging} * \text{hedging proxy} + \sum_j \gamma_j * \text{control variable}_j + \varepsilon$$

Following previous studies of Jin and Jorion (2006), Lookman (2004), the regression coefficient on the hedging proxy, $\beta_{hedging,}$ is interpreted as hedging premium. All γ_j are parameters that will measure the effect of each of these explanatory variables on Tobin's Q. Each of the coefficients is a partial regression coefficient, representing the partial effect of the given explanatory variable on Tobin's Q, after controlling the effect of all other explanatory variables. Therefore, estimate of $\beta_{hedging}$ will measure the effect of hedging policy on Tobin's Q, after eliminating all the effects of other explanatory variables used in the model.

We choose to use panel least square as our method since we want to control problem with heteroscedasticity, of which we cannot control for panel data if we use ordinary least square method. However, there are some potential econometric challenges which might be problems in the regression: normality, heteroscedasticity, serial correlation of the disturbances. Residual test show that it is normal distributed. We use different robust methods for computing the coefficient standard errors. For example, our data include observations on unbalanced panel of 63 firms for 5 years. We treat each firm-year observation as independent observation, this lead to a potential problem of underestimating standard errors and over-estimating p values, since Tobin's q of one firm can be correlated from year to year. We use White period method to robust to arbitrary serial correlation and time varying variances in the disturbances (Eviews 5, user guide (2005)).

Another robust method for computing coefficient standard errors is White diagonal method, which is used to robust to observation specific heteroscedasticity in the error terms. However, White diagonal method is not robust to correlation between residuals for different observations (Eviews 5, user guide (2005)). We report both results using different methods mentioned above in section 5.

In order to take into account the 'individuality' of each company, we use cross-sectional fixed effect in our model (for testing effect of hedging commodity on firm value). However, the residual test shows that it is not normally distributed. We face the same problem when we use both cross-sectional and period fixed effects. With regards to random effects, if we use cross-sectional effects and White diagonal to control effect of heteroscedasticity, then we could not use Hausman test for this random effects.

Since value of a firm can be affected by change in its hedging policy, its investment policy, we use period effects in our model. The results are similar to results which use ordinary least square in terms of sign of coefficient. The results for using White period method are reported in Appendix 5 for further consideration.

3.2. The Data

3.2.1 Sources of data

Our sample is based on firms of the forestry and paper industry in North America, Europe and Australia over the period 2001 - 2005. For firms in the United States, we access to EDGAR, the Electronic Data Gathering, Analysis, and Retrieval system of the U.S. Securities and Exchange Commission (SEC) and choose firms which have Standard Industrial Classification (SIC) codes of 2600 (Papers and Allied Products), 2611 (Pulp Mills), 2621 (Paper Mills), 2631 (Paperboard Mills) and 2650 (Paperboard Containers and Boxes).

For firms in Canada, we use SEDAR (the System for Electronic Document Analysis and Retrieval) to find more forestry and paper companies. SEDAR is the system used for electronically filing most securities related information with the Canadian securities regulatory authorities.

All other firms in Europe and Australia, we extract information from DataStream. DataStream is one of financial products of Thompson Corporation which is a leading global provider of integrated information-based solutions to business and professional customers (http://www.thomson.com). DataStream provides detailed index related data across global markets, including valuation measures and constituent lists, global and

sector indices information, detailed information on fixed income and equity securities around the world, current and historical fundamental data, interest and exchange rates.

Financial data such as net income, market value of common equity and capital expenditures are extracted at DataStream. In order to make the results comparable, we use yearly currency exchange rates which are also extracted from DataStream to convert all financial results in other currencies into US dollar - results.

Next, we read all annual reports, which are downloaded directly from firms' websites, or through Edgar of Sedar website, to see whether firms hedge their product prices, interest rate and foreign currency exchange rate over the years 2001-2005. This information is usually displayed at items 7A- Quantitative and Qualitative Disclosures about Market Risks for US firms, at Risk Management section or Notes to financial statements for other firms. We also use other key words to find information about risk management of firms, such as: hedge, price risk, market risk, option contract, futures contract, financial derivatives, forward contract, swap, commodity futures, collar, fixed price, quantitative disclosure. Our ambition is to study many firms in the forestry and paper all over the world. We found many big companies in the forestry and paper industry in Asia like Japan, China, and Malaysia and in Europe like Germany, France. However, these companies did not provide annual reports in English or Swedish, therefore, we cannot find if they hedge their selling product price, interest rate and exchange rate or not. As a result, we have to exclude them from our data

At the beginning, there are more than 63 companies; however, after we ran residual test in multivariate analysis, we found it is not normally distributed. Therefore, some firms who have extremely high value of Tobin's Q like Kimberly-Clark (United States firm) and firms who have very low Tobin's Q like Arbec Forest (Canadian firm) are excluded. The final sample consists of 63 firms in North America (the United States and Canada), Europe (Sweden, Finland, Switzerland, Spain, United Kingdom and the Netherlands) and Australia from 2001 to 2005 or 285 firm year observations, in which 47 firms present in 5 years. Name of these companies are displayed in Appendix 1.

3.2.2. The dependent variable

Tobin's Q, which was developed by James Tobin of Yale University, Nobel laureate in economics, is used as a proxy for a firm's performance. Tobin's Q is the ratio of the market value of a firm to the replacement cost of firms' assets.

$$\text{Tobin's Q} = \frac{\text{Total MV of firm}}{\text{Total asset value}}$$

In this paper, we use it the same way as Jin and Jorion (2006) and Lookman (2004) did to calculate Tobin's Q, which is described as follows:

$$\text{Tobin's Q} = \frac{\text{BV total assets + MV of common shares - BV of common equity}}{\text{BV total assets}}$$

We compute Tobin's Q for a total of 285 firm-year observations. The mean and median Tobin's Q of all firms in our sample is 1.34 and 1.33, respectively. And it is normally distributed.

We denote Q1 as proxy for values of firms in sample of testing hedging strategy of commodity prices, Q2 as proxy for values of firms in sample of testing hedging strategy of interest rate and Q3 as proxy for values of firms in samples for testing hedging strategy of foreign exchange rate.

3.2.3. The independent variables

Hedging proxy: Dummy variable, which equals to 1 if a firm hedge in that year and equals to 0 otherwise, is used as proxy for hedging activities. We use hedging dummy variables for different types of hedging activities. The first is for hedging commodity price. The second is for hedging interest rate. The third is for hedging foreign currency exchange rate. Some other variables are used to measure the extent of financial risk management activities. Tufano (1996) and Jin and Jorion (2006) use portfolio-delta, which represents the change in the value of portfolio with respect to a small change in the price of underlying asset. Lookman (2004) use the fraction of next year's production hedged against a fall in commodities prices. Since Tufano (1996) examined gold industry and Lookman (2004) and Jin and Jorion (2006) studied the oil and gas

industry in North America, they collected all data needed, basing on available research on gold hedging activities and United States SEC's Financial Reporting Release No.48 - which requires companies to expand their disclosure requirements for market risks. However, our sample include companies in Europe and Australia, which require less disclosure about market risks in a firm's annual reports. Therefore, we only can use hedging dummy as our proxy for hedging activities due to this limited available information.

Since value of a firm is affected by many factors, some other control variables are used to eliminate these effects. We include the following control variables, as in Jin and Jorion research (2006)

Firm size: Peltzman (1977) argues that the size is positively correlated to firm efficiency. Furthermore, a larger firm uses more financial instruments than a smaller firm due to the large cost of starting hedging activities. We use log of total assets as the control variable of the effect of firm size.

Profitability: Tobin's Q ratios of profitable firms are higher than Tobin's Q ratios of less profitable firms. The proxy for this control variable is ROA (Return on Asset), which is measured by net income divided by total assets.

Leverage: To control the impact of leverage on firm value, we use leverage ratio, which is defined as the book value of long term debt divided by market value of common equity with the assumption that book value of long term debt is close to market value of long term debt since almost all firms mentioned that they report financial instruments at fair value.

Access to financial markets: If firms face problems in raising external fund, it may forgo some positive NPV projects. In information asymmetry capital markets, dividends may serve as an effective signal of the firm's ability to generate earnings in the future, therefore, firms may have a higher chance to access financial markets with lower costs. The proxy for this control variable is dividend dummy, which equals to

one if the firm pays dividend in the current year and zero if firm does not pay dividend. Since not all companies reveal information about their credit rating over 5 years from 2001 and 2005, we only use dividend dummy as control variables for financial constraints.

Investment growth: Mayers (1977) argues that hedger are likely to have larger investments, therefore, the influence of investment growth on a firm's performance should be controlled. The proxy for this variable is the firm's capital expenditures over the firm's total assets. We expect a positive relationship between investment growth and Tobin's Q.

Finally, we acknowledge that production costs play an important role in making profit in this industry. However, we exclude this control variable in this paper due to unavailable information.

4. Empirical findings

The results and our analysis are presented in this section. Firstly we display the characteristics of firms. Secondly we divided the analysis into one way ANOVA and multivariate analysis.

4.1 Hedging activities and firm characteristics

Summary statistics of variables, which include Tobin's Q, total assets, market value of common stock, Return on Asset, capital expenditures/total assets and leverage, are presented in table 1 below. Panel A describes characteristics of all firms; Panel B and C describe subgroups for firms which hedge their product prices and firms that do not hedge their selling prices. Panel D and E represent firms hedging interest rate fluctuation and firms that do not. Panel G and H describe firms that hedge changes in FX (foreign exchange rate) and firms that do not use any derivative to hedge this risk.

Out of 285 firm-year observation, there are 45, 128, 168 report that they engage in hedging selling prices, interest rate and foreign exchange rate, respectively. As expected, firms with hedging activities have larger total assets (or larger size), both in mean and median value. For example, firms hedging commodity price have a mean total asset of US$ 8,740 million while firms which do not hedge have a mean total asset of US$ 3,307 million. This does not seem close to the theory of cash flow variance-minimization, since smaller firms have more volatile cash flows, greater probability of default caused by unhedged exposures and more restricted access to financial market and thus they have more motives to buy protection. On the other hand, this result is reasonable in terms of large cost for starting hedging activities.

Leverage is higher in hedging firms, both in mean and median values, for firms hedging commodity prices and hedging interest rate. This is consistent with the theory that firms hedge to avoid financial distress and take advantage of tax shield. Particularly, firms which hedge interest rate have a very high mean value of leverage (0.86). This shows that firms that have more long term debt in their capital structure

pay more attention on hedging interest rate, since changes in interest rate will be likely to affect operational results of those firms.

However, in contradiction with the hypothesis that risk management may reduce under-investment problems, capital expenditures/total assets in hedging firms is lower than non-hedging firms, in both mean and median values, for all three cases of hedging. For example, Capex/total assets in firms hedging foreign exchange rate is 5.6, which is lower than Capex/total assets of 7.4 of non-hedging firms.

Table 1; Summary Statistics for firm Characteristics (total assets and MV is in US million)

	Obs	Mean	Median	Std. Dev.
Panel A: All firms				
Tobin's Q	285	1.3408	1.3262	0.2755
Total assets	285	4,080.9150	959.7050	7,436.3880
MV of common stock	285	1,818.3870	433.7000	3,479.0370
ROA	285	0.0175	0.0210	0.0650
Leverage	285	0.6941	0.4302	1.0068
Capex/total assets	285	6.3472	3.9400	7.4803
Panel B: Hedging firm year (commodity price)				
Q1	45	1.295342	1.305395	0.226992
Total assets	45	8740.878	2752.1	10019.31
MV of common stock	45	3307.526	1408.56	4363.082
ROA	45	0.007108	0.009794	0.037634
Leverage	45	0.76107	0.671116	0.665269
Capex/total assets	45	4.631261	4.41	2.482097
Panel C: Non-hedging firm years (commodity price)				
Q1	240	1.349289	1.336576	0.283309
Total assets	240	3207.172	819.8517	6509.646
MV of common stock	240	1539.174	347.3418	3222.142
ROA	240	0.019489	0.024201	0.068818
Leverage	240	0.681501	0.394857	1.059274
Capex/total assets	240	6.668989	3.755	8.043453
Panel D: Hedging firm year (interest rate)				
Q2	128	1.389376	1.34698	0.273382
Total asset	128	7424.601	2130.9	9560.19
MV of common stock	128	3268.144	1668.04	4475.315
ROA	128	0.014041	0.016806	0.039193
Leverage	128	0.861537	0.619835	1.189289
Capex/total asset	128	4.844712	3.591702	4.861845
Panel E: Nonhedging firm year (interest rate)				
Q2	157	1.301144	1.317666	0.271746
Total asset	157	1354.852	397.0153	3100.775
MV of common stock	157	636.42	178.9417	1612.198
ROA	157	0.020382	0.02535	0.080147
Leverage	157	0.557527	0.327388	0.807575
Capex/total asset	157	7.572235	4.58	8.90279
Panel F: Hedging firms (FX)				
Q3	168	1.358969	1.331339	0.284238
Total asset	168	4701.214	1850.055	7537.183
MV of common stock	168	2180.691	677.8354	3641.752
ROA	168	0.017316	0.019419	0.041602
Leverage	168	0.632454	0.396189	1.063475
Capex/total asset	168	5.6025	4.25	4.832884
Panel G: Non-hedging firm (FX)				
Q3	117	1.31464	1.312534	0.26151
Total asset	117	3190.229	452.557	7228.164
MV of common stock	117	1298.157	184.5	3174.412
ROA	117	0.017847	0.021662	0.088617
Leverage	117	0.782531	0.49907	0.916607
Capex/total asset	117	7.416617	3.56	10.07022

4.2 Hedging activities and firm value

4.2.1 One-Way ANOVA analysis

ANOVA analysis stands for Analysis of Variance between groups. The variable in focus in our paper is the mean value of firms Tobin Q (Q). The sample groups are: commodity price, interest rates and foreign exchange rates. Each sample group is divided into hedging and non-hedging firms.

The mean of non-hedging commodity price firm has a Tobin Q of 1.35 and hedging firms has a Q of 1.28 (Table 2:1).

TOBIN Q

	N	Mean	Std. Deviation	Std. Error	95 % Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Non-Hedging Price	238	1,3514	,28354	,01838	1,3152	1,3876	,62	2,16
Hedging Price	47	1,2869	,22572	,03293	1,2207	1,3532	,79	1,86
Total	285	1,3408	,27553	,01632	1,3086	1,3729	,62	2,16

Table 2:1 Commodity Price (Price)

The variation between groups (non-hedging price firms and hedging price firms) is rather low in comparison with the variation within each group (Table 2:2). The F-test between groups is 2,156. The F-test present if the two different groups have equal standard deviation. Apparently the standard deviations are not equal. Moreover the analysis is not significant (Table 2:2).

TOBIN Q

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	,163	1	,163	2,156	,143
Within Groups	21,398	283	,076		
Total	21,561	284			

Table 2:2 One-Way ANOVA

When testing firms' activity of hedging or non-hedging interest rates (IR) it generates diverse results in comparison to hedging commodity price. Firms who hedge interest rates has a Tobin Q value of 1.389 (Table 2:3) meanwhile non-hedging firms has a Tobin Q of 1.30. In other words it is beneficial to hedge IR since it increases firm value. The variation is low between IR groups while the variation within IR groups is high.

TOBIN Q

	N	Mean	Std. Deviation	Std. Error	95 % Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Non-Hedging IR	157	1,3011	,27175	,02169	1,2583	1,3440	,62	2,08
Hedging IR	128	1,3894	,27339	,02416	1,3416	1,4372	,85	2,16
Total	285	1,3408	,27553	,01632	1,3086	1,3729	,62	2,16

Table 2:3 Interest Rates (IR)

The F-test between IR groups is 7.39, a very high figure (Table 2:4). The meaning of this result is that there is no similarity between standard deviations. This analysis is significant (Table 2:4).

TOBIN Q

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	,549	1	,549	7,393	,007
Within Groups	21,012	283	,074		
Total	21,561	284			

Table 2:4 One-Way ANOVA

Hedging foreign exchange rates (FX) has a Tobin Q of 1.359 in comparison of non-hedgers that has a Tobin Q of 1.31 (Table 2:5). It is favourable to hedge FX rates as it is to hedge IR rates since it results in a higher Tobin Q.

TOBIN Q

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Non-Hedging FX	117	1,3146	,26151	,02418	1,2668	1,3625	,65	2,08
Hedging FX	168	1,3590	,28424	,02193	1,3157	1,4023	,62	2,16
Total	285	1,3408	,27553	,01632	1,3086	1,3729	,62	2,16

Table 2:5 Foreign Exchange Rates (FX)

The situation with the variations between FX groups and within FX groups is similar with the Price and IR samples (Table 2:6). The F-test between FX groups is 1.79 (Table 2:6), meaning the standard deviation is more equal than the standard deviation between IR groups. Even here the analysis is not significant.

TOBIN Q

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	,136	1	,136	1,790	,182
Within Groups	21,426	283	,076		
Total	21,561	284			

Table 2:6 One-Way ANOVA

Since the analysis for two of cases are not significant (Table 2) it can be explained that there are no significant difference between hedging groups and non-hedging groups. The result could be haphazard. The analysis of hedging interest rates is significant (Table 2:4), meaning there is a difference between non-hedging and hedging firms.

4.2.2 Multivariate analysis

In this section, we present results from testing the impact of hedging policy on firm value. Hedging_dummy represents for hedging commodity price, interest rate and foreign exchange rate, respectively. We use White period method to robust to arbitrary serial correlation and time varying variances in the disturbances (table 3). White diagonal method is used to robust to observation specific heteroscedasticity in the error terms (table 4). T-Statistic is reported in the parentheses. * and ** denote significant level at the 5% and 1% levels, respectively. Correlations between explanatory variables are provided in Appendix 2, 3 and 4. Results using least square with time effects are displayed in Appendix 5 for further consideration.

Table 3; Hedging and firm value (using White period to robust to arbitrary serial correlation and time varying variances in the disturbances)

	Q1 (commodity prices)	**Q2 (interest rate)**	**Q3 (foreign exchange rate)**
Observations	285	285	285
Hedging_dummy	-0.084	0.1003	0.0073
	(-1.75)	(1.58)	(0.13)
Size	0.0263	0.011	0.0216
	(2.1)*	(0.86)	(1.94)
ROA	0.9715	1.0134	1.0082
	(3.4)**	(3.51)**	(3.47)**
Leverage	-0.0687	-0.0746	-0.0684
	(-3.49)**	(-3.72)**	(-3.41)**
dividend dummy	0.055	0.0461	0.0493
	(0.79)	(0.69)	(0.72)
Capex/total assets	0.0055	0.0058	0.0054
	(2.25)*	(2.51)*	(2.26)*
R-squared	0.22	0.23	0.21
Adjusted R-squared	0.20	0.21	0.19

Table 4; Hedging and firm value (White diagonal is used to robust to observation specific heteroscedasticity in the error terms)

	Q1 (commodity prices)	Q2 (interest rate)	Q3 (foreign exchange rate)
Observations	285	285	285
Hedging_dummy	-0.084	0.1003	0.0073
	(-2.28)*	(2.87)**	(0.23)
Size	0.0263	0.011	0.0216
	(3.5)**	(1.48)	(3.07)**
ROA	0.971	1.0134	1.0082
	(3.77)**	(3.94)**	(3.89)**
Leverage	-0.0687	-0.0746	-0.0684
	(-5.46)**	(-5.8)**	(-5.31)**
dividend dummy	0.053	0.0461	0.0493
	(1.32)	(1.15)	(1.19)
Capex/total assets	0.0055	0.0058	0.0054
	(3.32)**	(3.58)**	(3.34)**
R-squared	0.22	0.23	0.21
Adjusted R-squared	0.20	0.21	0.19

After including various control variables, the results show that hedging does not always help to increase value of firms. Instead, it depends on what types of risks firms choose to hedge. Hedging premium is negative for hedging commodity prices and positive for hedging interest rate and foreign exchange rate. An existence of commodity prices is associated with a lower MV of 0.084 units. In contrast, existence of hedging changes in interest rate and fluctuation in foreign exchange rate will increase value of firm by 0.1 units and 0.0073, respectively. The coefficients on the hedging commodity prices and foreign exchange rate are statistically significant when using White diagonal method but are insignificant when using White period method. However, hedging premium of foreign exchange rate is insignificant, in both White period and White diagonal methods.

Additionally, the sign of coefficient for all control variables are consistent with theory and similar for all three tests. As expected, profitability (measured by ROA), growth opportunities (measured by capex/total assets), size and opportunity to access to financial markets (measured by dividend-dummy) are positively related to firm values. Leverage is significantly negatively related to firm's value at 1% level, in both methods using White period and White diagonal, showing that investors are concerned about the firm going bankrupt.

R squared is comparable to other researches. The test of Jin and Jorion (2006) has R square of 0.27 (table VII). R square in Allayannis and Weston (2002) is 0.25 (Table 5) and in Lookman (2004) is 0.2 (table 5)

5. Analysis

This section provides an analysis of our empirical findings from multivariate test. Moreover the interpreted analysis is related to the firms in the forestry and paper industry.

Maybe the most interesting observation is the contrary results from the impact of hedging commodity prices and the impact of hedging interest rate and foreign exchange rate on firm value (table 3 and 4). The existence of hedging commodity price is associated with lower firm value; meanwhile the existence of hedging interest rate and foreign exchange rate is associated with higher firm value.

Hedging activities are quite active in this industry, since many firms are exposed to certain market risks as part of their ongoing business operations, including risks from changes in their principal product selling prices, costs of commodity like raw materials and energy, interest rates and foreign exchange rates.

The markets for forestry and paper products are cyclical and are influenced by many factors. These factors include period of excess product supply due to industry capacity additions, periods of decreased demand due to weak general economic activity, inventory de-stocking by customers. During periods of low prices, companies are subject to reduced revenues and margins, resulting in substantial declines in profitability and possibly net losses. Therefore, some of the companies in this industry choose to hedge their product selling prices. Out of the 285 firm year observations, 45 firm years report using hedging tool for managing selling price risk of their products.

Almost all firms in the forestry and paper industry operate in many different countries, from Canada, United States, Europe, and Russia to Asia. Some of the firms also issue debts in foreign currency. Therefore currency movements can have a number of direct and indirect impacts on the firm's financial statements. Direct impacts include the transaction and translation of international operations' local currency financial statements into domestic currency. Indirect impacts include the change in competitiveness of imports into, and exports out of, domestic country. There are 168

firm years use derivatives like options, futures and forwards, foreign exchange contracts to hedge their exposure to exchange rates uncertainties. Some companies choose not to hedge exchange rate and interest rate by using derivatives, for example, West Fraser Timber is Canadian company but a significant portion of the company's earnings are generated from sales denominated in U.S. dollars. This company chooses not to hedge foreign exchange rate since it also has a significant portion of its long-term debt denominated in U.S. dollars. Therefore, foreign exchange rate fluctuation can be partially naturally hedged.

Many companies are exposed to interest-rate fluctuations as a result of using debt as a source of financing their operations. Changes in interest rates affect both costs of raising capital and return on capital. Fluctuations in interest rates also affect the production costs, which is an important part of competitiveness in this industry, and demand for their products. One of the most common tools to manage this risk is interest rate swap. There are 128 firm years' uses derivatives for managing risk of change in interest rate. Some other firms choose not to hedge interest rate because they believe that fluctuation in interest rate does not significantly affect their financial results.

As presented earlier in this paper, we argue that interest rate and foreign exchange rate are non-core risks that firms in the forestry and paper industry face. To illustrate our point, first of all, we take the case of foreign currency rate. Almost all companies in this industry are active in forestry and paper products. They do not trade much on foreign currencies. It is unlikely that foreign currency trading of a firm is large enough so that its deal flow leads to a shift in demand for foreign currency. Therefore, most companies have no comparative advantage in gathering information about changes in the value of foreign currencies. As a result, bearing this risk may lead to a big loss in the company. Suffering a big loss due to not hedging foreign currency is the case of Daimler-Benz. In the first half year of 1995, Daimler-Benz lost DM 1.56 billion, in which DM 1.2 billion is from the losses of exchange rate due to the weakening U.S dollar. The company chose not to hedge an order book of DM 20 billion, of which 80% was fixed in U.S dollar because they believed that exchange rate only ranged from DM 1.2 to DM 1.7 (Stulz (1996)). Similarly, it is unlikely that firms in this industry can have a better

predictive power in anticipating changes in interest rate than the other competitors or market. As a result, hedging these risks can help a firm increase its value. However, the case can be different in hedging commodity prices. After all, firms in this industry can acquire information about certain market risks thanks to their operating activities. If a firm has the chance to gain comparative advantage information in its product selling price to competitors and shareholders, then hedging will lead to a trade off of lower value of firms in terms of forgone-opportunities and hedging expenses.

Our findings show that hedging commodity prices in the forestry and paper industry is associated with lower firm value, which implies that firms which hedge their selling products' prices are not maximizing shareholder value. This also signals that commodity prices may be core risks that some firms in this industry face. Companies which choose to hedge their commodity prices are: Canfor, Cascades, Domtar, Tembec, Catalyst Paper, Fraser Paper (Canada); Rottneros, Stora Enso (Sweden), Temple inland, Rock Tenn, Weyerhaeuser, Neenah (United States). Some companies like Temple inland, Rock Tenn, and Weyerhaeuser only report that they hedge their end product prices but did not disclose much information on their hedging activities. However, it might be interesting to study in greater detail the hedging activities of some companies in this industry.

The paper segment of Fraser Papers includes paper, pulp and lumber operations and accounted for 95% of its total net sale in 2004 and 2005. This company manufactures northern bleached hardwood kraft pulp (“NBHK”) and most of which is sold in the open market. According to industry publications, average prices for NBHK increased from $535 per tonne in December 2004 to $595 per tonne in December 2005. Strong demand from pulp importing nations like China supported the pricing increases in 2005. Unfortunately, Fraser Papers has entered into a pulp swap to deliver 24,000 tonnes of market pulp through December 2006 at an average price of $574 per tonne and also entered into lumber futures contracts for 31 million board feet of lumber (MMfbm). This swap effectively fixes the selling price on a portion of Fraser Papers’ production and is designated as a hedge of a portion of future pulp and lumber sales. The unrealized

loss on this hedge was CAD $3 million at December 31, 2005, of which CAD $2 million loss of pulp and CAD $1 million loss of pulp.

Canfor (Canada) mentioned in its annual reports that it is the largest producer of softwood lumber and one of the largest producers of northern softwood kraft pulp in Canada. In 2005, sales of lumber and pulp accounted for 84% total sales, which imply that lumber and pulp segments are primary business segments of Canfor. According to sensitive analysis, US $ 10 change per Mfbm in lumber price and Pulp per tonne will impact on annual statements after tax earnings by CAD $ 36 and CAD $9, respectively. Recognizing that fluctuation in selling price of lumber and pulp can make a great impact on earnings; Canfor uses financial instruments to reduce its exposure to this risk. There were 186 lumber futures contracts outstanding at December 31, 2005. Canfor had also entered into swaps to hedge 1,500 tonnes of pulp at an average price of US $675 per tonne. Considering the characteristics of products Canfor chooses to hedge and its position in the lumber and pulp in Canadian market, hedging lumber and paper price risk may help this company to reduce the probability of financial distress. However, this hedging policy also has an effect of taking the firm out of the lumber and pulp business and leaving it purely in the logistics of cutting trees or using pulp-machine without bearing any lumber or pulp price risks.

Another company that chooses to hedge its product prices is Rottneros (Sweden). Rottneros is a world-leading supplier of high quality paper pulp. Pulp accounted for 97% of total sales, therefore a change in pulp price significantly affect its annual profit. As shown in Rottneros annual report in 2005, a change in the pulp price of USD 50 will affect the Group’s annual profit after net financial items by SEK 260 m. In addition, Rottneros's global market share for market pulp in 2005 is 82% (for all ground pulp, CTMP and Sulphate pulp). With this strong position of Rottneros in pulp market, together with years of operating experience (Rottneros's origins in the 1600s), one might suspect that it can increase value by bearing risk in pulp price, since the company engages deeply in this business, it may acquire comparative advantage information about its product prices. However, this company chooses to remove itself from this business by hedging pulp price risk. The hedging contracts in 2003, which hedge about

18% of pulp volume, make a loss SEK 61 million and SEK 31 million in 2004 and 2005, respectively as a result of the NBSK pulp price increase in USD. Once again, hedging pulp price in this case leads to a lower firm value due to the lost-opportunities and hedging expenses.

UPM (Finland) has a different strategy in managing its selling products prices. UPM is a global forest products group whose core businesses are printing papers, specialty paper, converted products and wood products. UPM still makes a profit over the last five years (2001-2005). Net income in 2004 is € 958 million and in 2005 is € 263 million. Management of UPM recognizes that changes in UPM's product prices are the biggest factor affecting UMP's financial results. For example, 10% change in magazine paper, fine paper price will affect operating profit by € 310 million, € 130 million, respectively (based on 2005 sales). However, UPM did not hedge any product prices. After all, this is a matter of comparative advantage. UPM has production plants in 15 countries, some of them are in Finland, Germany, Great Britain, France, Australia, the United States, Canada, and China. It has a comprehensive logistics network worldwide and enjoys close and lasting relations with its local and global customers. In all its product segments, UPM is among the leading manufacturers in the most important market. For example, in the paper segment, it is in the second and third position in Europe and Global, respectively. Specifically, it is in the first position in magazine paper, both in European and Global. It is also in the second and fifth position in newsprint in Europe and Global, respectively. All of these factors put UPM in a better position than any insurance or financial market to evaluate, price and bear its product price risk. In addition, commodity investors may be interested in the volatility of commodity prices to enhance their return. As a result, this company is not likely to hedge its paper price.

In order to create value for a firm which operate in commodity industry, managers need to understand if commodity price is core risk for the firm or not, after that, managers can create value by taking core risks that offer the greatest opportunities within its core competence and shedding non-core risks. However, there is a risk associated with this 'selective' risk management that the firm's information may not be in fact better than the

market or its competitor's. As a result, management also needs to understand the sources of comparative advantage in the risks they intend to take in order to create value for the firm.

6. Conclusions

This part concludes what our study was about and which type of hedging strategy we find most beneficial for firms.

This paper examines the hedging activities of 63 companies in the forestry and paper in North America, Europe and Australia. We test for differences in firm value between firms that hedge and firms that do not hedge. We contribute to the literature by distinguishing between the valuations effects of hedging commodity price risk (which could be core risk for some firms) and interest rate and foreign exchange rate risks (non-core risks).

Using Tobin's Q as an approximation for firm value, we find that hedging core risk is significantly associated with lower firm value and hedging non core risks is positively correlated with firm value. Specifically we find that the existence of hedging selling prices decreases firm value by 0.084 units. In contrast, hedging interest rate and foreign exchange rate increases value by 0.1 and 0.007 units, respectively. This result is robust to some control variables (size, profitability, access to financial market, leverage, growth opportunities). This finding is contrary with the theory that assumes that hedging increases value of firms by minimizing variance in cash flow or earnings, since this theory say nothing about which risks firm should manage or it does not distinguish between core and non core risks.

Studying in depth hedging activities of some firms which choose to hedge, we find that some of them have a very strong position in market for products they produce. Since the fluctuation in selling price does affect operating results, these firms decide to hedge their commodity prices. On the one hand, hedging this risk may help firms reduce expected cost of financial distress and probability of bankruptcy, on the other hand, it has another affect that hedging will take the firm out of forestry and paper business and leaving it as purely logistics firm. There are still firms making profit by doing logistic and bear little risk on their selling price. However, if firms have a strong position in the

market and may possess a comparable advantage than its competitors and market, it should not remove itself from the business by hedging, like the way UPM does.

This paper demonstrates that the hedging premium depends on the types of risks to which the firm is exposed. Therefore, managers need to understand, measure the risk the firm is facing and provide the picture of downside possibilities to the upside opportunities. Once managers understand these potential risks, they have different choices. They can retain the risk or manage that risk internally. Or they can transfer risk to other parties. Hedging risk is only a small part of the overall risk management and should be considered carefully before making a decision, since where there is no risk taking; there is no possibility for abnormal return and no value added. This is particularly true in the case of hedging core risks.

7. Future work

The final part addresses the missing points in this study and raise interesting issue for future work.

Our aim with this study was to contribute to research in hedging premium and firm value. While most previous studies focus on theory of shareholders' value maximization and managerial interest maximization, we include the idea of impact hedging core and non core risk on firm value. Firm value is affected by many factors, however, we only can use some control variables due to unavailable information in this industry. Therefore, another research which can introduce more control variables can provide more homogenous results.

Moreover, management point of view on core and non-core risks, which is an important factor in risk management policy, is not studied within this paper. This would be an interesting area for qualitative research in order to provide a deeper understanding hedging motives and strategies of companies.

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Appendix

Appendix 1: Names of firms

No	Company	Country
1	Auspine	Australia
2	Great Southern	Australia
3	Integrated Tree Crop	Australia
4	Mark Sensing	Australia
5	Paperlinx	Australia
6	Timbercorp	Australia
7	Willmott forests	Australia
8	Atibiti:A	Canada
9	Canfor	Canada
10	Cascades	Canada
11	Catalyst paper	Canada
12	CED-or corporation	Canada
13	Domtar	Canada
14	Fraser Paper	Canada
15	Int'l absorbent	Canada
16	Int'l forest:IFPA	Canada
17	SFK Pulp fund	Canada
18	Sino forest:TRE	Canada
19	Tembec:TBC	Canada
20	Timberwest forest	Canada
21	West frase timber	Canada
22	Western forest Product	Canada
23	Stora enso	Finland
24	Stromsdal Oyj	Finland
25	UPM	Finland
26	Crown Van Gelder	Netherlands
27	Norske skogindust	Norway
28	Empresarial ence sa	Spain
29	Bergs timber	Sweden
30	Billerud:BILL	Sweden
31	Holmen AB	Sweden
32	Rottneros	Sweden
33	SCA	Sweden
34	CPH Chemie and Papier	Switzerland
35	James Cropper	Switzerland
36	Precious woods	Switzerland
37	Badger paper: BPMI	United States
38	Bowater: BOW	United States

39	Buckeye: BKI	United States
40	Caraustar	United States
41	Georgia Pacific Corp	United States
42	Gibral tar	United States
43	Glatfelter	United States
44	Impresso	United States
45	International paper	United States
46	Longview Fibre	United States
47	Meadwestvaco	United States
48	Merce International	United States
49	Mod-Pac corp	United States
50	Nashua	United States
51	Neenah	United States
52	Packing corp of america	United States
53	Pope and Talbot	United States
54	Pope resources	United States
55	Rayonier	United States
56	Rock tenn	United States
57	Schweitzer mauduit	United States
58	Smurfit stone	United States
59	Sonoco	United States
60	Temple inland	United States
61	Tufco techonologies	United States
62	Wausau paper	United States
63	Weyerhaeuser	United States

Appendix 2: Correlation between explainatory variables
Testing relationship between firm value and the existence of interest rate hedging

	Size	ROA	Leverage	Dividend-dummy	Capex/total assets	Hedging dummy
Size	1	-0.025141	0.100797	0.427136	-0.282005	0.314356
ROA		1	-0.199915	0.178262	0.201904	-0.071781
Leverage			1	-0.278793	0.120678	0.026693
Dividend-dummy				1	-0.236115	0.176677
Capex/total assets					1	-0.107215
Hedging dummy						1

Appendix 3: Correlation between explanatory variables
Testing relationship between firm value and the existence of interest rate hedging

	Size	ROA	Leverage	Dividend-dummy	Capex/total assets	Hedging dummy
Size	1	-0.025141	0.100797	0.427136	-0.282005	0.505941
ROA		1	-0.199915	0.178262	0.201904	-0.048607
Leverage			1	-0.278793	0.120678	0.150456
Dividend-dummy				1	-0.236115	0.210683
Capex/total assets					1	-0.181687
Hedging dummy						1

Appendix 4: Correlation between explainatory variables
Testing relationship between firm value and the existence of exchange rate hedging

	Size	ROA	Leverage	Dividend-dummy	Capex/total assets	Hedging dummy
Size	1	-0.025141	0.100797	0.427136	-0.282005	0.305511
ROA		1	-0.199915	0.178262	0.201904	-0.004022
Leverage			1	-0.278793	0.120678	-0.073456
Dividend-dummy				1	-0.236115	0.189993
Capex/total assets					1	-0.119513
Hedging dummy						1

Appendix 5: Results using Panel least square with period fixed effect.

	Q1 (commodity prices)	**Q2 (interest rate)**	**Q3 (foreign exchange rate)**
Observations	285	285	285
Hedging_dummy	-0.084	0.1003	0.006
	(-2.0)	(2.93)	(0.19)
Size	0.0261	0.011	0.0214
	(3.07)	(1.19)	(2.5)
ROA	0.967	1.011	1.002
	(3.98)	(4.2)	(4.1)
Leverage	-0.0667	-0.0726	-0.0666
	(-4.15)	(-4.52)	(-4.09)
dividend dummy	0.0571	0.0499	0.053
	(1.52)	(1.34)	(1.4)
Capex/total assets	0.0055	0.0058	0.0055
	(2.58)	(2.74)	(2.54)
R-squared	0.23	0.23	0.21
Adjusted R-squared	0.20	0.21	0.19