



UNIVERSIDADE CATÓLICA PORTUGUESA

Hedging strategies with financial derivatives on pulp &
paper industry: a quantitative study

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by

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Abstract

This work studies the hedging policies of 42 pulp and paper companies in 2014. My focus is on the use of financial derivatives as a hedging strategy to mitigate the commodity risk exposure. Theories of hedging based on market imperfections show that hedging should increase firm's value by reducing expected taxes, probability of financial distress and the agency costs of debt and equity.

To provide evidence on these hypotheses, I collected detailed financial information of the firms included in the sample, to develop two econometric models capable of giving consistent insights, in order to infer which firm's characteristics are associated to the theoretical hedging incentives and if consequently this hedging decision is connected to higher firm value within this industry.

The data suggest that hedger firms have less coverage of fixed claims and have a higher percentage of managerial ownership comparing to the non-hedger firms. Furthermore, I found evidence that there is no advantage for larger firms within this industry to develop hedging strategies to mitigate their commodity risk exposure, not giving support to the argument of economies in scale in hedging. There is also no support for the hedging tax incentive, rejecting the theoretical background that firms hedge in response to tax schedule convexity. Using Tobin's Q as an approximation for firm value, I found evidence that firms with more growth opportunities in their investment set and with lower levels of debt have higher Tobin's Q ratios. However, I found evidence that hedging commodity risk within this industry with financial derivatives does not seem to be a value-enhancing strategy for firms.

Contents

Acknowledgments	ii
Abstract	iii
Contents	v
Table Index	viii
Introduction	1
2. Literature Review	4
2.1. Shareholder Maximization Hypotheses	10
2.1.1 Reducing the probability of bankruptcy	10
2.1.2. Taxes.....	11
2.1.3. Under-investment problem and cost of raising funds	15
2.1.4. Stakeholders	18
2.2. Managerial Utility Maximization Hypotheses	19
2.2.1 Managerial compensation and hedging.....	19
2.2.2. Signaling managerial skill.....	20
2.3. Evidence of hedging and firm value.....	21
2.4. Evidence of hedging and firm characteristics.....	24
2.5. Evidence on managerial and institutional ownership.....	27
3. Data.....	30
3.1. Study sample	30
4. Model and Results: Hedging firm characteristics	33
4.1 Empirical evidence on hedging and firm characteristics model.....	40

4.1.1 Summary statistics	40
4.1.2. Hedging and firm characteristics model findings.....	42
5. Model and Results: hedging and firm value model	45
5.1 Empirical evidence on hedging and firm value model.....	50
5.1.1. Summary Statistics.....	50
5.1.2 Hedging and firm value model findings	52
6. Conclusion	53

Table Index

Table 1 – Study sample hedging decision.....	32
Table 2 - Differences between hedgers and non-hedgers	37
Table 3 - Alternate Specifications of Logit regressions explaining the use of financial derivatives to hedge against the commodity risk exposure	38
Table 4 - Hedgers vs Non hedgers – Statistic mean differences.....	49
Table 5 - Hedging and firm value model results.....	50

Introduction

Companies across all the industrial sectors manage their exposure to commodity prices in many different ways. However, the recent strong unpredictability observed in commodity prices has triggered uncertainty in every market and business lines. Many industrial companies started to view commodity risk as a key threat, due to the heightened volatility and complexity in world markets. The present work approaches the pulp and paper industry, once commodity risk tends to be central to the company's value proposition within this industry. This dissertation core is on the relation between corporate risk management and strategies developed by the firms within this industry to mitigate their exposure to commodity prices, since there is evidence that volatility in commodity prices is typically greater than volatility in other financial risk factors, such as foreign currency or interest rate uncertainties.

Strategies to manage commodity risk exposures can vary significantly, although my focus is only on the mitigation of this specific risk exposure through derivative hedging strategies. Derivative financial instruments are taken as the most flexible and cost-effective tools to manage price risk and to synthetically hedge underlying price exposures. Foreign currency and interest rate markets are characterized by having a broader and extensive offer and companies can efficiently manage their risks, once the derivatives can be tailored to meet the specific needs of a corporate risk policy. However, in the commodity markets, given the highly specific needs of the risk profiles users, timing and delivery locations, commodity derivatives can have a limited efficiency in their application.

Taking into consideration all these particularities, finance theory suggests that the use of derivatives as a hedging strategy can increase firm value by reducing expected costs of financial distress, taxes and agency costs. The first purpose of this dissertation is to provide evidence regarding the relationship between the hedging decision and firm characteristics within this industry, and if in accordance to hedging theory, they have the necessary characteristics and conditions to profitably benefit from the establishment of a corporate risk management to mitigate the commodity risk exposure. Namely, and in accordance to the related hedging literature incentives: which firm's characteristics can awaken the willingness to develop a specific hedging strategy to mitigate commodity risk exposure?

After discerning about the characteristics, the second purpose of this work is to provide deeper understanding regarding the direct evidence between hedging commodity prices and firm value. After controlling for the effects of the different firm characteristics on firm value, I will provide evidence regarding the most debated question on the risk management literature: does hedging commodity risk add value for companies within the pulp and paper industry?

The first section of the dissertation takes us through the various streams of corporate risk management. Theorists developed many explanations behind firm's decisions to establish risk management policies. Moreover, they developed two main classes of theories, which intend to explain why managers undertake risk management policies. For both theories, the shareholder maximization and managerial utility hypotheses, I will provide the knowledge developed throughout the time by scholars, regarding their studies to test the accuracy behind the benefits associated to hedging. Taking their models as a starting point and focusing on the scope of my study, subsequently I will provide their empirical evidence regarding the several relations also studied on this

dissertation: hedging and firm characteristics, hedging and firm value and the implication of managerial and institutional ownership for the hedging decision-making.

To give answers for the questions mentioned above, I constructed two different econometric models based on the financial data collected for 42 companies within the pulp and paper industry. For the first question, I established the denominated hedging and firm characteristics model based on the approaches of Nance, Smith and Smith (1993) and the revisited work to the previous study made by Fok, Carroll and Chiou (1997). Regarding the second question, I developed a model based on the approach made by Jin and Jorin. (2006) and changed their study spectrum from the oil and gas producers to the pulp and paper industry.

On the last section of my dissertation, I provide evidence on my tested models and conclusions in the light of the hedging theory. Moreover, I connect these to the specific growing challenges available for the pulp and paper companies. Furthermore, aware of the limitations of my study range, I will suggest some insights for further investigation.

2. Literature Review

When introduced to finance courses, individuals are presented to the two main pillars of modern finance. The concepts of efficient markets and diversification. Market efficiency simply means that markets don't leave money on the table and opportunistic behaviors are not rewarded. Information is provided for free and is incorporated in prices, so that one can't make profits from it. Therefore, a corporation with a given risk exposure, if the expected returns seems reasonably good, it is only because this exposure derives from risks rewarded by the market (Stulz (1996)). The concept of diversification refers to the ability of the shareholders to diversify the risks of a corporation, excluding common risks, such as business cycles. Hence, a corporation strategy to reduce diversifiable risks only makes sense if these risks impose possible losses and real costs for the corporation.

According to Modigliani and Miller, if a firm chooses to change its hedging policy, investors who hold claims issued by the firm can change their holdings of risky assets to offset any change in the firm's hedging policy, leaving the distribution of their future wealth unaffected (Smith and Stulz (1985)). Modigliani and Miller (1958) explained that with fixed investment policy and with no contracting costs or taxes, corporate financing policy is irrelevant. Haushalter (2000) also stated that in a perfect market world, we can only look to risk management as a financial transaction, not having any effect on the market value of the firm".

In a fluid and frictionless capital market with no asymmetric information, risk management at the firm level is predicted to be a negative NPV project as in a Modigliani and Miller world of perfect capital markets, active corporate risk

management would be irrelevant, since shareholder can hedge on their own at the same costs (Campello et al. 2011).

However, in the real world, where investor's information is far from complete and financial troubles can disrupt a company's operation, a bad outcome resulting from a diversifiable risk, (e.g., an unexpected spike in a currency or commodity price) can have costs that go well beyond the immediate hit to cash flow and earnings (Nocco and Stulz (2006). In practice, imperfect markets create many reasons for a firm to minimize its risk exposure. As Gay and Nam (1998) suggested on their work about the underinvestment problem and derivatives usage by firms, financial economics offers several hypotheses to explain why corporate hedging can be rational or value enhancing, each of them relies on some form of market imperfection.

The concept of risk management can be defined as the "process of identification, analysis and either acceptance or mitigation of uncertainty in investment decision-making ". Risk management have been developed to help companies to identify relevant risks and to ensure that a company have enough cash available to make investments that have a positive net present value (NPV) (Froot et al. 1994).

The first definitions on the finance literature about the thematic of hedging, back to the beginning of the nineteen century. Hardy & Lyon (1923) defined hedging as a "coincident purchase and sale in two markets which are expected to behave in such way that any loss realized in one market will be offset by an equivalent gain in the other". With their vision, the authors contemplated hedging as a common tool in risk management that can be used as an insurance to reduce risk, or transfer risk from one party to another.

First developed by Hardy & Lyon (1923), the main goal of the hedging theory was to give some clarification about hedging and how it can be used. On the first approach, Hardy & Lyon (1923) stated that hedging has become a popular tool for risk management to reduce and transfer risk. They claimed that the point of hedging is to make a company capable of compensate losses in one market with gains in another market. For instance, entering into a derivative contract can help a company to be protected against unfavorable price changes or any other financial risks, enabling them to have the right to buy or sell for a specific price at a specific time or lock in a specific price in a specific moment of time. Forward contracts are designed to neutralize risk by fixing the price that the hedger will pay or receive for the underlying asset. Option contracts, by contrast, provide insurance. They offer a way for companies to protect themselves against adverse price movements in the future. (John C. Hull, 2008). On a more simplistic view, corporate hedging refers to the use of a wide range of derivatives instruments— forwards, futures, swaps and options – to reduce the volatility of firm value.

Campello et al. (2011) stated that nearly all large corporations around the world have a risk management program that includes hedging in some way to protect themselves against financial risks. Companies are exposed to several financial risks and all of these risks such as market risks, liquidity risks and credit risks need to be taken into account if a firm want to create a long-term value for its shareholders. Among the many different strategies to mitigate their exposure, a corporation can manage risks in one of two fundamentally different ways: (1) one risk at a time, on a largely decentralized basis; or (2) all risks viewed together within a coordinated and strategic framework. The latter approach is

denominated “enterprise risk management”, or “ERM¹” for short (Nocco and Stulz (2006)).

However, hedging is very versatile and companies can have very sophisticated or simple hedging strategies. According to Hardy and Lyon (1923), the “perfect hedge is the one that offset all changes in price, locking the price from both downward and upward movements”.

Nevertheless, Haushalter (2000) argues that despite the prevalence of corporate risk management and the effort that has been devoting to developing theoretical rationales for hedging, there are no widely accepted explanations for risk management as a corporate policy. Regardless the extensive research on this field, there are uncertainties of whether company should hedge and how it affects the market value of a firm.

The first research was elaborated by Ralph H. Stiles, who developed the oldest and recognized study on the thematic, on his research regarding how millers can protect themselves from adverse price fluctuations. In his paper, Stiles (1922) acknowledged that small price variations could have a negative impact on the producers’ profits, leading them to a situation of financial distress.

Later, Johnson (1960) presented a revised concept of hedging that had the same objective as modern portfolio theory (MPT²): to minimize the variance and to define risk as the standard deviation of a two-asset hedge portfolio. He developed a model which incorporated speculation in the futures market, in

¹ Enterprise risk management (ERM) is synonymous with integrated risk management (IRM) and enterprise-wide risk management.

² Modern portfolio theory (MPT) is a theory on how risk-averse investors can build their own portfolios in order to maximize expected return based on a given level of market risk. Establishing that risk is an inherent part of a higher reward.

order to calculate the optimal amount of forwards and futures that companies should buy or sell. On the other hand, unlike Johnson's (1960) approach, Stulz (1984) developed a model for value-maximizing firms that use an active hedging policy, by assigning the manager with the key role in the hedging decision and not the shareholders. Stulz (1984) model was a continuous-time model that can be revised when the company receives new information, which gives us a more dynamic model that can be improved over time.

More recently, Brown & Toft (2002) on his work related to the problematic of how firms should hedge, concluded that the optimal hedging for a value maximizing firm company is much more complex than previous literature has suggested. They asserted that "simply selling expected output forward is rarely, if ever, the optimal risk management strategy". A perfect hedge is very rare in practice and therefore the aim of hedging strategies is to create a position that perform as closely to perfect as possible (Hull, 2008).

Developing an optimal hedging strategy will always be a continuously and an unfinished work. However, risk management through financial hedging has become increasingly important in recent years, with the International Swaps and Derivatives Association (ISDA)³ reporting that virtually all of the world's largest companies use derivatives to hedge their business and financial risks.

The recently intensification and increase in corporate risk management policies, introduced by companies to mitigate their risk exposures is a challenge for the Modigliani and Miller paradigm. Modigliani and Miller approach underlies that "buying and selling financial derivatives contracts cannot alter the company's

³ ISDA, the International Swaps and Derivatives Association was established in 1985 and has been a leader in promoting sound risk management processes and practices around the world in order to enhance the understanding and treatment of derivatives as a corporate risk management tool.

value, since individual investors in the company's stock can always buy and sell such contracts themselves if they care to adjust their exposure to a certain risk".

Moreover, as Froot, Scharfstein and Stein (1993) documented on their work about risk management and how to coordinate corporate investment and financing policies that "corporations are increasingly take risk management very seriously and this management policy is ranked by the financial executives as one of their most important objectives".

Most of theoretical research in corporate risk management argues that firms can increase value by hedging. Theorists developed many explanations behind firm's decisions to establish risk management policies, reflecting how and why they use the most diversified hedging strategies to deal with the uncertainties underpinned by their risk exposures. On their notorious efforts to study and explain more deeply the decision-making regarding risk management, they have developed two major classes of explanations related to the managers' choices of risk management strategies on behalf of their firms.

The first explanation relies on risk management as a tool to maximize shareholder value and the other one focuses on risk management as means to maximize managers' private utility.

On the next section, I will start to describe the theoretical explanations for risk management, the shareholder maximization hypotheses and the managerial utility maximization hypotheses. Later on, I will provide empirical evidence of hedging in raw materials industries, giving some insights about characteristics and the impact in firm value for companies that have an active risk management policy with financial derivatives.

2.1. Shareholder Maximization Hypotheses

The first class of theory that explains why managers undertake risk management activities is based on shareholder value maximization. The argument of shareholder maximization claims that firm's hedge to diminish the multiple costs related to the higher volatility of cash flows.

2.1.1 Reducing the probability of bankruptcy

Mayers & Smith (1982) and Smith & Stulz (1985) stated that hedging reduces the probability that a firm encounters financial distress by reducing the variance of firm value, and thereby reduces the expected costs of financial distress. The likelihood for a firm to incur in a situation of financial distress is directly related to the size of the firm's fixed claims relative to the value of its assets, meaning that hedging becomes more valuable as the firm's fixed claims rise.

Stulz (1996) also argued that bankruptcy costs provide the simplest example of a real resource cost that can be saved through risk management: "A firm where the cash flows fluctuate randomly over time, if the firm has debt, it could happen that with a bad cash flow draw, the firm has to file for bankruptcy". When bankruptcy has real resource costs, the present value of these real costs reduces firm value. If the firm can establish a corporate hedging policy that eliminates the risk of bankruptcy, it essentially sets the present value of these real resource costs to zero and increases firm value accordingly (Stulz, 1996). Hence, Stulz (1996, 2003) sustained that any potential value creation role for risk management is in the reduction of "costly lower-tail outcomes". These lower tail realizations are essentially negative earnings and negative shocks, which have both direct and

indirect costs. Direct costs are incurred when the firm have to incur in expenses related to lawyers and courts, whereas indirect costs are associated with the loss of reputation that may affect costumer and vendor relationships.

Costs of financial distress can have a real negative impact on the present and future earnings of a firm. The failure to develop valuable investments is translated into a real resource cost for the firm. However, if hedging can be used to lower the expected bankruptcy costs, it will increase firm value, by opening up opportunities to potential bondholders to invest. Campello et al. (2011) highlighted that firms that hedge pay lower interest rate spreads will likely have less tight restrictions on their debt agreements. Bessembinder (1991), on his study about the relation between the use of forward contracts and firm value, also contend that risk management reduces the expected costs of bankruptcy.

All of these arguments serve to reach to same conclusion as Stulz (1996), when he argued that risk management could be value creating if it is able to reduce the likelihood of the mentioned negative earning shocks and in turn, help the firm to avoid the direct and indirect costs associated with financial distress.

2.1.2. Taxes

In a distinguished seminal article, Smith and Stulz (1985) stated that firms facing an income tax liability function that is convex in taxable income could reduce expected tax liabilities by hedging taxable income.

Taking into consideration Jensen's inequality⁴ definition, if a firm's effective tax schedule is convex, expected taxes are diminished by hedging (Mayers and Smith (1982) and Smith and Stulz (1985)). The statutory progressivity factor generate a convex tax schedule and the more convex the effective tax schedule, the greater the attenuation in expected taxes. Therefore, firms with more of the range of their pretax income in the progressive region of the tax schedule have greater tax-based incentives to hedge.

In addition to progressive marginal tax rates, the convexity of the tax function arises from the existence of tax shields such as tax loss carrybacks and carryforwards, implying that the tax benefit of hedging is greater if the firm has more tax preference items. These tax shields are used to extend or stretch the convex portion of tax function of the firms.

Green and Talmor (1985), performed a completely different and interesting approach regarding the objective to demonstrate what is firm's behavior in the presence of asymmetric tax treatment of positive and negative incomes. They stated that the tax liability of a firm could be thought as a government written call option on future income streams, with the strike price equal to the value of allowable deductions on taxable earnings. On their research, their findings enabled them to conclude that "as the volatility of pre-tax earnings declines, the value of the call option - the amount of the tax liabilities – drops". This gives firms an incentive to hedge.

Another contribution for the hedging literature was made by Géczy, Minton and Schrand (1997). At the time, this work differed from the others, because it was

⁴ Jensen's inequality was introduced by Johan Jensen, a Danish mathematician who proved that the convex transformation of a mean is less than or equal to the mean applied after convex transformation.

one of the first cross-sectional studies to examine the determinants of corporate derivatives using merely firms that had ex ante exposure to foreign exchange risk and also by employing new annual report disclosures required by the Financial Accounting Standard Board, rather than survey. Based on the variance reducing tax-hedging argument of Smith and Stulz (1985), the authors evaluated the availability of tax preference items, taking into account the book value of net operating loss carryforwards scaled by total assets (NOL) of the firms included in their study sample. The results achieved by Géczy, Minton and Schrand (1997) on their investigation, enabled them to disagree from the Smith and Stulz (1985) tax explanations behind the decision to develop a corporate risk management program.

Graham and Smith (1999) also streamlined the literature on risk management, by using stimulated methods, rather than employ survey or regression analysis. They stimulated a given reduction in the volatility of taxable income to examine the extent to which hedging strategies can change a firm's expected liability. From their analysis, they found that in approximately 50% of the cases, corporations face convex effective tax functions and thus have tax-based incentives to hedge.

Graham and Rogers (2002) also focused their work on tax incentives for corporations to hedge: to increase debt capacity and interest tax deductions and to reduce tax liability if the tax function is convex. Whereas by that that time, most hedging papers only investigated large companies, Graham and Rogers (2002), constructed their study sample on a broad cross sections of firms and their holdings of corporate derivatives. They investigated whether firms resort to the use of derivatives to implement risk management strategies in response to tax incentives. Earlier studies only investigated derivatives holdings to identify which of the supposed theoretical hedging incentives were behind the

establishment of a risk management. Nevertheless, Graham and Rogers (2002) paper added to the hedging literature by testing whether corporations respond to two tax-related incentives to hedge. Namely, the incentive to reduce volatility, thereby increasing debt capacity and the tax benefits of debt. Second, the incentive to reduce tax liabilities by reducing the volatility of taxable income. On their work, Graham and Rodgers (2002) started from Smith and Stulz hypothesize, on which firm's hedge in response to tax function convexity, and so by the Jensen's inequality, companies can reduce expected tax liabilities by hedging to reduce income volatility. Moreover, they argued that virtually every empirical study that investigates the use of derivatives includes a wrong variable to proxy for tax function convexity. Instead, their option was to use tax function convexity as a proxy to infer about the relation between derivative holding and convexity. The authors considered this work as the first direct examination of hedging and tax function convexity.

As Graham and Rogers (2002) argued that most empirical derivatives papers measure tax convexity with the wrong proxy variables. Furthermore, Graham and Rodgers argued that variables based on existing net operating loss carry forwards (NOL's) are too simple to capture incentives that result from the shape of the tax function, and might work backwards for expected loss firms.

Subsequently, in a joint effort, Graham and Smith (1999) and Graham and Rogers (2002) investigated the tax incentive to hedge and concluded that U.S. firm hedge to increase their debt capacity, but both papers rejected the idea that firms hedge in response to tax schedule convexity.

Haushalter (2000) on his study about hedging policies of oil and gas producers referred that firms with low leverage tax rates are assumed to be more likely to face varying marginal tax rates in the future, which creates an incentive to hedge.

A more recent study elaborated by Bartram et al. (2009), investigated the motives for companies to use financial derivatives, with a broadly coverage sample. They agglomerated firm's from more than 50 countries that stood for 80% of the global market capitalization. The authors stated that tax incentives to hedge exist for firms that face a convex tax schedule, either because increasing marginal tax rates (statutory progressivity) or tax preference items ⁵(investment tax credits, foreign tax credits, tax loss carry forward, etc.). Moreover, Bartram et al. (2009) claimed that there is a stronger interest to hedge if firms have many tax preference items, because unused tax preference items can lose value in present value terms. However, they proved that previous hedging theories regarding the tax determinant to hedge are not conclusive to explain why companies use derivatives instruments for hedging.

Departing from the literature, one can expect that a firm would like more income when its tax rate is low and less income when its tax rate is high. Since tax rates increase with taxable income, a risk management program that reduces the risk of taxable income ends up decreasing expected taxes as well.

2.1.3. Under-investment problem and cost of raising funds

Myers (1977) characterizes firms' potential investment opportunities as options and demonstrates that, with fixed claims in the firm's capital structure, taking a positive net present value project can reduce shareholder's wealth if the gain accrues primarily to debtholders. Consequently, shareholders can have incentives to forego positive NPV projects and Myers call this as the underinvestment problem. By restricting the states in which the firm would

⁵ Tax preference items are in summary, tax-exempt items that investors can deduct them from their taxable income and hence lower their tax bills.

default on bond payments, hedging can control this problem. Hence, firms with more growth opportunities in their investment opportunity set are more likely to undertake a hedging program aimed to reduce the variance of the firm value. Since the underinvestment problem is more pronounced with more debt in the firm's capital structure, firms with higher leverage are more likely to hedge.

Bessembinder (1991) states that in theory, hedging commits firms to meeting obligations in states of the world in which they would fail and makes it more difficult for managers to engage in risk-shifting. Bessembinder (1991) also demonstrated that by reducing the probability of default, hedging could reduce the incentive for equity holders to underinvest, which improves contracting terms with debtholders.

As described in Froot, Scharfstein, and Stein (1993) work about coordinating investment and financing policies, costly external financing is a market imperfection that makes hedging a value-enhancing strategy. That is, an underinvestment problem results when firms find that external financing is sufficiently expensive that they must reduce investment spending during times when internally generated cash flows are not sufficient to finance growth opportunities. Hedging or risk management in this situation adds value because it helps ensure that the corporation has sufficient funds available to take advantage of attractive investment opportunities.

Pagach & Warr (2010) referred that indirect costs hamper the possibility to pursue profitable growth options, and the ability to realize the full value of intangible assets upon liquidation. For instance, as a firm becomes weaker financially, it becomes more difficult for the firm to raise funds, so that it may become unable to undertake profitable investments.

Gay and Nam (1998) extended the previous findings on determinants of corporate hedging strategies with derivatives, by examining more closely the underinvestment hypothesis modeled by Froot, Schraferstein and Stein (1993). Specifically, they studied the interaction effects among a firm's investment opportunities, cash stock and internally generated funds in order to make a clearer distinction between the roles of the underinvestment hypothesis on the determinants of corporate hedging policy. The authors analyzed 486 publicly traded U.S non-financial firms in 1995 and find evidence of a positive relation between a firm's derivatives use and its growth opportunities. Their main findings include insights about the interaction effects between a firm's cash stock and its investments opportunities. The authors claimed that firms with enhanced investment opportunities sets use derivatives more when they also have lower levels of cash flow. Moreover, they suggested that the correlation between internally generated cash flow sand investment expenses also have impact on a firm's derivative usage. The related findings disclosed by the two authors support the hypotheses that the use of derivatives by firms is driven in part by the need to avoid a possible problem of abandon growth investment opportunities that otherwise could had be an important driver of value creation. All of this evidence is consistent with the theory that risk management can reduce under-investment of Froot, Schraftstein and Stein (1993).

Niam (1998) on his working paper related to the determinants of corporate hedging policies, claimed that once the under-investment problem is more pronounced for firms with more discretion in their investments decisions, hedgers are predicted to be firms that capture a relatively higher proportion of their market value from growth options relative to assets in place. Using the ratio of the market to book value of total assets as a proxy for the relative importance of discretionary investment decisions, Gay and Nam (1998) argued that firms

with more growth options would have market values higher than their book values. Hence, the authors predicted that hedgers would have higher market-to-book ratio as compared to non-hedgers.

On their study about the real and financial implications of corporate hedging, Campello, Lin and Zou (2011) identified precise mechanisms through which hedging affects real and finance corporate outcomes. By using an extensive, hand-collected dataset on corporate hedging activities, they assessed the impact of hedging on firm's external financing costs and investment spending. Accordingly, to the existent literature, Campello, Lin and Zou (2011) were the first to investigate simultaneously the impact of hedging on the cost of debt and their connection to capital expenditures and investment. The paper contribution to the hedging literature is to show that corporate hedging has a first-order effect on firm financing and investment. Their evidence suggest that hedging reduces the cost of external financing and eases the firm's investment process.

2.1.4. Stakeholders

If a company found itself in a situation of financial distress, stakeholders (workers, creditor or someone else that have a stake in the company) will be more negatively affected than the shareholders because they are not able to diversify risk. Thus, if a company suffer from a dramatic situation marked by the need to abandon profitability growth projects and consequently lose some investment opportunities, workers immediately after that negative period, will consider their jobs in the firm less attractive. They will also demand a higher salary, which ultimately affect the global costs of the company. In fact, workers are not able to create their own risk management program to hedge this risk, because of a lack

of economies of scale, but the firm will be able to do so for them. As Stulz (1996) stated on his paper about risk management, if a company successfully undertakes a risk management program that reduces the risk of financial distress, it will have lower wage costs.

2.2. Managerial Utility Maximization Hypotheses

The second class of theories focuses on risk management as a means to maximize manager's private utility. This hypothesis relates to hedging as an incentive that managers have to maximize their personal utility function.

2.2.1 Managerial compensation and hedging

Shareholders choose the management compensation package, affecting the hedging policies that managers undertake. If shareholders make managerial wealth a concave function of firm value, managers will have more incentives to develop hedging programs. Managers, whose compensation is a concave or not too convex function of firm value, have incentives to reduce cash flow variability. That could lead to a situation where such managers might reject variance-increasing positive NPV⁶ projects. As Smith and Stulz (1985) argued that risk-averse managers have incentives to invest in less risky projects, even those projects that can create value for the company. In a situation of a completely concave function, the manager optimal solution is to hedge the firm entirely.

⁶ Net present value (NPV) is used to analyze the profitability of a projected investment and is the difference between the present value of cash inflows and the present value of cash outflows of a project.

On the other hand, if risk management goes toward the risk reduction of those risky but promising projects, managers can accept the investments, benefiting shareholder's wealth.

However, if the manager's compensation plan is a convex function of the firm's value, it can be the case that the manager wealth improves if the firm option is not to hedge.

Smith and Stulz (1985) also predicted that managers who hold more stocks would prefer more risk management strategies. The reason is that stocks provide a linear payoff as a function of the firm's stock prices. Nonetheless, managers who hold more options on firm's stock would prefer less risky management, because the value of the option and consequently the manager compensation will improve with higher uncertainty related with the stock prices of the company.

2.2.2. Signaling managerial skill

Demarzo and Duffie (1995) approach differed in a significant way from the analysis of the earlier literature on hedging. Rather than focus on the role of hedging in directly reallocating risk among parties, Demarzo and Duffie stressed the "information effect of hedging". They extended the model of Holmstrom and Ricart i Costa (1986) and considered an environment in which uncertainty regarding managerial ability and project profitability implies that shareholders learn about the quality of the firm's management and investments projects from observations of the firm's performance. Moreover, by hedging price fluctuations, managers can alter the risk of the firm's current profits, which in turn affects the risk of their future wages.

Demazo and Duffie documented that if hedging positions are disclosed by a corporation, hedging eliminates a source of noise from the firm's profits. By doing that, it makes profits a more informative signal of managerial quality. The authors also stated that hedging might serve as a signal that helps labor market better evaluate and monitor performance of the firm's managers under asymmetric information world.

2.3. Evidence of hedging and firm value

Froot, Scharfstein and Stein (1993) tested the possibility of hedging increase firm value to the extent that it helps to ensure that a company has sufficient internal funds available to take advantage of attractive investment opportunities, assuming that capital market imperfections make external sources of funds costly. Collecting data based on the firms hedging strategies in a broad range of industry sectors, they concluded that an optimal hedging strategy capable of creating value for a given firm will depend on either the nature of product market competition and on the hedging strategies adopted by its competitors.

On a more industry-specific analysis, Tufano (1996) investigated 48 gold mining companies that used hedging as a risk management tool in the beginning of the ninety decade. Those studied firms shared a common and clear risk exposure, because their output is a globally traded, volatile commodity. Moreover, Tufano (1996) updated the model done by Froot, Scharfsyein and Stein (1993) by adding manager-shareholder agency costs to his model. By doing that, his work contradicted all the theoretical value incentives behind a risk management program. As the author mentioned, over 85% of the firms in this industry used a rich set of financial instruments to manage their gold price risk in 1990-1993. However, the author found little empirical evidence support for the predictive

power of theories that view risk management as a means to maximize shareholder value. For Tufano (1996), risk management strategies are only capable of destroying value for the companies. Stulz (1996) also stated that the risk minimization with financial derivatives do not increase the value of a firm with a lower leverage regarding their capital structure.

Haushalter (2000) on his study about risk management activities of oil and gas producers addressed some questions regarding the interaction of firm value and corporate hedging activities. Documenting a wide range of hedging policies among oil and gas producers, the author argued that differences in the costs of raising funds can have impact on the value of hedging. In other words, the more difficulties a company have in obtaining outside financing, the costlier a shortfall in cash will be and the greater is the value that hedging provides.

One year after the study of Haushalter, Allaynannis and Weston (2001) published their work about the use of foreign currency derivatives in large non-financial firms in the U.S. and find support for the theory of shareholder maximization. They found evidence consistent with the hypothesis that the company's use of foreign currency derivatives as a hedging tool, increases firm value. Using a recognized finance metric, the Tobin's Q ratio as a proxy for firm value, they discovered that foreign exchange rate hedging is associated with a 4.8% premium comparing with firms which do not hedge that specific risk. They also mentioned that the hedging premium associated with an increase in firm value among firms with foreign currency exposure, is higher during periods in which the US dollar appreciates.

Later on, Carter, Rogers and Simkins (2006) investigated jet fuel behavior of firms in the U.S. airline industry during 1992-2003, to examine whether such hedging is a source of value for these companies. The main objective of the authors was

to deliver a better understanding of the source of potential value from hedging by airlines. The authors also extolled the contribution of their study, because for them the homogeneity and competitiveness of the airline industry offers a unique perspective to analyze the value of firm's hedging activities. Being the first to find empirical evidence pointing to the source of value from hedging operations, they documented that jet fuel hedging is positively related to airline firm value and the coefficients regarding the hedging variables on their regression analysis suggested a higher hedging premium, comparing to the research done by Allaynannis and Weston (2001). Carter, Rogers and Simikins (2006) referred that airlines employing a jet fuel hedging policy, trade at a premium. Moreover, they argued that hedging provides an additional source of cash for making acquisitions during periods of high jet fuel prices which in turn are directly connected to a time of more distressed airline companies. Their arguments serve to prove that they provide evidence that hedging can add value for the sector companies because reduction of jet fuel price risk exposure is undoubtedly economically significant.

With their focus on the oil and gas sector, Jin and Jorion (2006) collected detailed information regarding hedging strategies and on the valuation of oil and gas reserves. They criticized the research done by Allaynannis and Weston (2001), arguing that the sample of their study was limitative because it covered a large number of firms in different industries and with different growth rates. Jin and Jorion (2006) constructed, by that time, the largest same-industry sample used to assess the hedging premium and included the hedging activities of more than 100 U.S. oil and gas producers from 1998 to 2001 to examine the connection between hedging and firm value. Their findings suggested that in fact, exists an important difference between the nature of the commodity risk exposure of oil and gas producers and the foreign currency exposure of US multi-nationals. For

the authors, hedging commodity risk is easier to identify and to hedge by individual investors, since investors can go to the market and can hedge on their own, implying that hedging does not give a special advantage for the sample firms. Regarding the question of whether financial derivatives can add value or not, the authors did not give a simple answer, stating that, at a minimum, the hedging premium depends on the types of risks to which the firms are exposed.

2.4. Evidence of hedging and firm characteristics

On the thematic of hedging, many studies were conducted by several scholars regarding the decision-making of a firm to develop hedging strategies to mitigate their risk exposure. Namely there are several different research papers related to the possibility of the firms having the necessary characteristics to profitable benefit from using hedging as a tool to manage their risks. On their studies the authors separate companies by their decision to hedge or not and provide evidence related to which value-enhancing firm characteristics can distinguish the two groups.

The study developed by Géczy, Minton and Schrand (1997) is an example of the mentioned topic. The authors developed their study based on a sample mainly constituted by the use of financial derivatives for hedging purposes by U.S. large corporations in 1990 and after modeling the determinants of corporate use of currency derivatives, they demonstrated differences between currency derivatives users and non-users. Géczy, Minton and Schrand (1997) concluded that firms which have their portfolio associated with strong growth opportunities but with more difficulty to raise internal and external funds are most likely to use currency derivatives. The authors also enumerated other distinguish firm characteristics, referring that hedger firms are generally larger, have a greater

institutional ownership and also stronger managerial option holdings. Although, the authors documented that both, users and non-users are similar in their managerial share ownership

Leeland (1998) also examined risk management on his work about agency costs, risk management and capital structure. Leeland (1998) argued that hedging allows for a big portion of debt on the firm's capital structure, a conclusion that goes toward the theoretical and literature research about hedging. However, the author surprisingly documented that the benefits of hedging are greater for a firm with lower agency costs.

Graham and Smith (1999) focused their work on the tax incentives of hedging and differentiate firm's characteristics, taking into consideration, their tax functions. The authors stated that for firms facing convex tax functions, the average tax savings from a 5% reduction in the volatility of taxable income are about 5.4% of expected tax liabilities and in extreme cases, these savings exceed 40%.

Bartram, Brown and Fehle (2003) also presented international evidence on the use of financial derivatives by non-financial firms across different countries and argued that the size of the local derivatives market can be an important factor to determine the derivatives usage by firms. In less developed countries with less liquid derivatives market, the usage of financial derivatives as a hedging tool is lower. Moreover, they followed the same structure as Nance (1993) and examined the theoretical negative association between the availability of hedging substitutes and the usage of financial derivatives to conduct the necessary hedging strategies. Bartram, Brown and Fehle (2003) argued that firms with lower levels of preferred stock, convertible debt and more liquid assets, as well

as higher dividend payouts will probably have more financial derivatives in their portfolio to mitigate their risks.

Nance et al (1993) on their study on the determinants of corporate hedging suggested that firms that use hedging instruments to mitigate their risk exposure, have consistently more growth options in their investment set and more convex tax schedules. Moreover, they stressed firms owned by well diversified investors, by saying that if we take into account the risk aversion factor, it will provide incentives for the firm to hedge more to manage its risk exposure. On the mentioned study, hedging is only positive in order to reduce volatility, increasing both the capacity for investment expenses and to raise funds from external investors.

On a revisit to the determinants of corporate hedging study, Fok, Carroll and Chiou documented new insights about the hedger firm's characteristics. They stated that large firms have a higher tendency to hedge, giving support to the economies of scale as a hedging argument.

Dolde (1995) focused his approach on the relationship between hedging and leverage on a way that he explained the anticipated relation between them. By doing that and controlling for primitive risk, Dolde (1995) discovered some evidence that hedging attenuate the effects of leverage.

Carter, Rogers and Simkins (2006), following the same framework as Nance, Smith, Smithson (1993), showed that airline companies with more growth opportunities in their investment set have a higher tendency to hedge. They added also that if all airlines face similar bankruptcy costs, firms with lower financial constraints hedge more.

Concerning the theoretical relation between firm characteristics and hedging, Tufano (1996) concluded that there is almost no significant association between risk management and firm characteristics. Nevertheless, he stated that firms in the gold mining industry with lower cash balances are more receptive to perform risk management strategies in order to mitigate their gold price exposure.

2.5. Evidence on managerial and institutional ownership

Stulz (1984) and Smith and Stulz (1985) documented some findings on managerial risk aversion as a driver of corporate risk management. Their models revealed that managers with higher stock ownership would prefer more to engage in risk management activities, while managers with higher options holdings would prefer less risk management. They justified their findings based on the assumptions that the global convexity of the option contract will make managers more available to take riskier investments, whereas stocks only provides linear payoffs which increases their willing to reduce the risk exposure. Guy and Nam (1998) extended their findings on the risk manager aversion topic. They explained that risk manager aversion can have an impact on the firm's hedging decision, once managers with non-diversified personal wealth due to higher firm stock ownership, might have a stronger preponderance to develop hedging strategies policies.

On a more industry specific analysis, Tufano (1996) and Haushaler (2010) also documented their conclusions regarding the connection between ownership and hedging. Tufano (1996) after analyzing corporate risk management policies in the gold mining industry suggested evidence that managers who hold a large number of firm shares in their portfolio have a higher willingness to adopt hedging strategies with financial derivatives. On the other hand, if managers

hold more options on their firm shares, they will have an incentive to increase the earnings volatility of the firm, decreasing the amount of funds invested in risk management strategies.

Haushalter (2010) investigated whether the oil and gas producers hedges against price fluctuations is related to ownership structure. The author, did not find any evidence regarding a positive correlation between hedging and the degree of managerial stock ownership. Specifically, Haushalter (2010) demonstrated that the fraction of the commodity production hedged is negatively related to the fraction of shares held by investors. Nevertheless, he reached to the same conclusion as Jin and Jorion (2006), arguing that the fraction of production hedged is negatively correlated with the number of call options held on shares companies by the managers.

Fok, Carroll and Chiou (1996) also examined the relationship between ownership structure and firm value and added that corporate ownership structure may affect the willingness for a firm to develop hedging strategies. For them, hedging can be in the manager's best interest if a greater percentage of their personal portfolios are directly connected to the results of the firm, in the form of wage income. Fok, Carroll and Chiou (1996) concluded that a larger percentage of managerial ownership is directly related with a stronger incentive to hedge.

Furthermore, Fok, Carrol and Chiou (1996) considered insider ownership as proxy for agency costs of equity. They used the same arguments as Crutchney and Hensen (1989) and Bhagat and Jefferis (1988), when these latest appointed to the fact that due to the capacity of institutional investors to restrain an opportunistic behavior developed by managers, this implied disciplinary pressure may induce managers to strictly perform value-enhancing activities,

including hedging. Thus, the likelihood for a firm to conduct hedging strategies should be positively related to larger institutional ownership.

3. Data

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. With today's markets continuing to experience unprecedented volatility, companies are looking at commodity price risk management as an integral part of their strategy for managing costs and to develop a competitive advantage. My goal is to determine if corporate hedging activities with financial derivatives designed to mitigate the commodity price risk, which reduce income volatility, also have the expected impact on firm value, as the theoretical research has suggested many ways in which corporate hedging might increase firm value (Smith and Stulz (1985); Bessembinder (1991)).

3.1. Study sample

The sample of companies used in this study is constituted by listed firms in the forest and paper industry in North America, South America, Europe and Australia. We collect data on their risk management strategies with financial derivatives, regarding commodity price exposure over the year of 2014.

For all firms in the sample, I extracted information from Data Stream, a leading global provider of integrated based solutions to business and professional costumers, namely financial data such as net income, market value of common equity and capital expenditures.

Next, I read all the financial reports, which I downloaded directly from firm's websites, to see whether firms hedge against commodity prices, over the sample period.

In the sample of the study, I found firms of the forestry and paper industry that use many types of derivatives instruments. The ways in which hedging theoretically increases firm value are not limited to a particular type of hedging but are only related to the final objective of reducing income volatility. Therefore, I made an assumption regarding how the firms develop their hedging strategies with financial instruments: there is no need to restrict and differentiate the hedging activities to a subset of derivative instruments.

The list companies and their use of financial derivatives to manage their commodity risk is listed in table 1.

Table 1 – Study sample hedging decision

Company name	Hedgers	Non-hedgers
Ahlstrom Oyj		X
Altri SGPS SA	X	
Arctic Paper SA	X	
BillerudKorsnas publ AB		X
Canfor Corp	X	
Cascades Inc	X	
Catalyst Paper Corp	X	
Domtar Corp	X	
Empresas CMPC SA		X
ENCE Energia y Celulosa SA	X	
Fibria Celulose SA		X
Hokuetsu Kishu Paper Co Ltd		X
Holmen AB		X
Interfor Corp	X	
International Paper Co		X
Klabin SA		X
Lee & Man Paper Manufacturing Ltd	X	
Louisiana-Pacific Corp		X
Marubeni Corp	X	
Mercer International Inc		X
Metsa Board Oyj	X	
Mitsubishi Paper Mills Ltd		X
Mondi PLC	X	
Nine Dragons Paper Holdings Ltd		X
Norbord Inc		X
Norske Skogindustrier ASA	X	
Oji Holdings Corp		X
Papeles y Cartones de Europa SA	X	
Portucel SA		X
Rayonier Inc		X
Rottneros AB		X
Sappi Ltd		X
Shandong Chenming Paper Holdings Ltd		X
Smurfit Kappa Group PLC		X
Stora Enso Oyj		X
Suzano Papel e Celulose SA	X	
Svenska Cellulosa SCA AB		X
Tembec Inc	X	
UPM-Kymmene Oyj		X
Verso Corp	X	
West Fraser Timber Co Ltd		X
Weyerhaeuser Co		X

4. Model and Results: Hedging firm characteristics

To start, for the hedging and firm characteristics model, I separated firms into two groups, those which choose to hedge their commodity risk price with financial derivatives instruments and those which did not. The implicit assumption is that those firms which choose not to hedge, did so because hedging commodity price would not have offered an increase in firm value. These firms do not have the necessary characteristics to profitably benefit from hedging strategies with financial derivatives. A comparison between the firms that use the financial instruments to hedge and those which did not, should help to discern which value-enhancing firm characteristics distinguish the two groups.

After discerning about the firm's characteristics among the two classes, I will establish a model exclusively focused on the relation between hedging and firm value in order to have a more consistent conclusion about the specific case of the pulp and paper industry.

In summary, on a first step and following the same structure as Nance, Smith, Smithson (1993) on their study "on the determinants of corporate hedging", I will apply and incorporate the same approach as they did. Furthermore, I will introduce also the revisit elaborated by Fok, Carrol and Chiou (1996) and incorporate the relation between ownership structure and risk management. The objective is to bring together both works into a single one that can provide a much wider coverage of the scope of the study, in order to find consistent conclusions about the relationship of hedging and firm characteristics in pulp and paper industry - Hedging and Firm Characteristics model

To examine the relationship between the hedging decision and firm characteristics, I will employ a logistic (LOGIT) regression analysis. On the model are included a dependent variable that proxies for the decision of a firm to develop hedging strategies with financial derivatives to cover their commodity risk, plus 9 independent variables that measures the convexity of tax function, the probability of financial distress, firm size, agency costs of equity and debt also a variable to reflect alternatives to hedging.

$$HD = \alpha + \beta TLF + \beta Fsize + \beta D\backslash V + \beta E\backslash I + \beta BtM + \beta A\backslash S + \beta MO + \beta IO + \beta DY + \varepsilon$$

Dependent Variable

Hedging Dummy – The dependent variable is coded as “1” for firms which use financial instruments (futures, forwards, swaps and / or options) and “0” if they did not use any instrument to mitigate their commodity risk.

Independent Variables

One variable is used to reflect aspects of the firm’s effective tax function, which is the amount of tax loss carry forwards available in 2014 to offset tax payable in the subsequent years. Tax preference items (for example, tax loss carry forwards, investment tax credits and foreign tax credits) make the effective tax schedule more convex (Zimmerman (1998)). Therefore, is expected a positive relation between the tax variable and the hedging decision, since the tax hypothesis propose that hedger firms have a large amount of tax loss carry forwards and also that the benefits associated to a hedging decision should be higher for firms with more tax preference items (Smith and Stulz (1995)).

To infer about the hypotheses regarding the reduction in the transactions costs of financial distress, I established one variable to reflect the size of the firm and two

variables to measure the firm's leverage. Size of the firm is measured by the sum of the book value of debt plus the market of equity. As Block and Gallagher (1986) stated, larger firms are more capable to invest resources in specialized management dedicated to perform and conduct a hedging program with financial derivatives. Moreover, Smith and Stulz (1995) argued that corporate risk management programs exhibit informational scale economies. Hence, is expected that large firms are more likely to hedge.

The variables used to proxy for the probability of financial distress are two debt ratios. The three year average (2012 to 2014) debt-to-firm value ratio and the times interested earned which specifically indicates how many times a company can cover its interest expenses on a pretax basis. Since that the probability to incur in a situation of financial distress is related to the capacity of a firm to fulfill its debt obligations, hedging becomes more valuable as the firm's fixed claims rise (Smith and Stulz (1985)). Therefore is expected that more levered firms adopt more hedging strategies.

As Collins and Kothari (1989) approach, the ratio of the book value of the equity to the market value proxy for the growth options in the opportunity set and can act too as representatives for the agency costs of debt. The higher the book-to-market value of equity ratio, the lower are the expected earnings growth and lower are the incentives for a firm to hedge. The ratio of the book value of the firm's assets to "my" firm size variable is the other proxy for growth opportunities and as Nance, Smith and Smith (1993) argued, firms with higher ratios of book value of assets over size have more growth potential. For both the variables is expected that firms with more growth opportunities in their investment set, are more likely to hedge.

Regarding the influence of managerial and institutional ownership on the hedging decision, two variables were established. The % of managerial ownership as an indication of agency costs of equity which is measured by the stock holdings by officers and executives. As Fok, Carroll and Chiou (1997) argued, managers who own more firm shares in their portfolios have a stronger incentive to hedge. On the other hand, the % institutional ownership includes ownership by insurance companies, investment companies, bank trust funds and foundations. Taking into consideration that institutional owners monitors management more intensively, for both dimensions of ownership structure is expected a positive relation with the hedging decision.

The last variable incorporated in the model is the five year (2009 to 2014) dividend yield of the firms included in the sample and reflect alternatives/substitutes for hedging. Since, management can adopt alternatives policies to reduce the probability of financial distress by reducing dividends, the lower is the dividend payout ratio, more capable is a firm to meet its debt obligations. Hence, the use of alternatives to hedging may reduce the need to use financial derivatives to develop a hedging strategy (Nance, Smith and Smith (1993)).

The statistic differences and the expected relations among the variables between hedgers and non-hedgers are reported on the table 2. Regarding the alternative specifications of the logit regressions explaining the use of financial derivatives to manage commodity risk, those are reported in table 3.

Table 2 - Differences between hedgers and non-hedgers

Expected relations among the variables and a comparison of the means values for the 42 pulp & paper companies included in the sample.

Variable	Theoretical Relation - Hedgers & Non Hedgers	Means		Differences in Means	
		Hedgers (n= 17)	Non Hedgers (n= 25)	H NH	t-statistic
(1) Tax Loss Carry Forward	H>NH	24,09	38,65	-14,56	0,94
(2) EBIT / Interest Expense	H<NH	2,91	5,33	-2,42	1,61*
(3) Debt / Firm Value	H>NH	49,30	27,95	21,35	-3,26***
(4) Firm Value	H>NH	3901,41	6772,41	-2871	1,38*
(5) Book / Market	H<NH	63,11	78,45	-15,34	1,28*
(6) Book Value Assets / Value	H<NH	1,31	1,08	0,23	-1,88**
(7) Institutional Ownership	H>NH	32,16	41,07	-8,91	1,01
(8) Managerial Ownership	H>NH	28,91	25,68	3,23	-0,38
(9) Dividend Yield	H>NH	1,72	3,32	1.6	1,47*

***, **, * indicate significance at 1%; 5% and 10% level, respectively.

Table 3 - Alternate Specifications of Logit regressions explaining the use of financial derivatives to hedge against the commodity risk exposure.

Entries in the body of the table are: Parameter Estimate / Standard Error / Probability Value.

	Predicted Sign of Parameter Estimate	Including All Right-Hand-Side Variables (1)	Restricted Specifications							
			2	3	4	5	6	7	8	9
Tax loss carry forwards	+	0,030	-0,0016							
		0,016	0,015							
		0,857	0,915							
EBIT/Interest	-	-0,115	-0,123	-0,126	-0,099					-0,155
		0,184	0,184	0,182	0,164					0,125
		0,532	0,506	0,490	0,546					0,02**
Debt/Value	+	0,032	0,032	0,032	0,034	0,0435		0,059	0,059	
		0,031	0,030	0,030	0,030	0,027		0,028	0,027	
		0,28	0,29	0,294	0,260	0,10*		0,034**	0,032**	

Firm Value	+	<0,001	<0,001	<0,001					<0,001	
		<0,001	<0,001	<0,001					<0,001	
		0,777	0,700	0,684					0,863	
BVA/Value	-	3,760	3,777	3,80	3,75	3,52	4,361			3,49
		1965	1958	1938	1,95	1,89	1817			1665
		0,05***	0,05**	0,05**	0,05**	0,062*	0,016***			
Book/Market	-	-0,0557	-0,054	-0,055	-0,051	-0,043	-0,049	-0,032	-0,033	-0,034
		0,023	0,022	0,021	0,019	0,018	0,017	0,017	0,015	0,015
		0,012***	0,014**	0,011**	0,001**	0,01***	0,01***	0,02**	0,03**	0,02**
Managerial Ownership	+	-0,009								0,024
		0,030								0,016
		0,765								0,139
Institutional Ownership	+	-0,058	-0,051	-0,052	-0,047	-0,044	-0,045	0,036	-0,037	
		0,037	0,028	0,026	0,022	0,021	0,020	0,018	0,02	
		0,1*	0,07*	0,046**	0,033**	0,039**	0,03**	0,04**	0,06***	
Dividend yield	+	-0,4561	-0,46	-0,462		-0,432	-0,37	-0,37	-0,38	-0,36
		0,268	0,263	0,262		0,245	0,194	0,194	0,207	0,216
		0,088*	0,08	0,078*		0,079*	0,03**	0,056*	0,065*	0,094*

***, **, * indicate significance at 1%; 5% and 10% level, respectively.

4.1 Empirical evidence on hedging and firm characteristics model

The analysis start with the sample mean difference tests for the considered hedger commodity risk firms and non-hedger firms. The hedger firms are those that used financial derivatives as hedging strategies to control their exposure to the commodity risk price in 2014. Thus, the Logit regression model explains which factors from the combined group of independent variables are connected to the likelihood of corporate hedging.

4.1.1 Summary statistics

Regarding tax incentives for a firm to hedge, the related literature suggest that the tax benefit of hedging is higher for firms with more with more tax preference items. Using tax loss carry-forwards as a proxy for the existence of tax shields, there is no support for the hypotheses that managers hedge to reduce expected liability. Moreover, the mean differences were not statistically significant, and hedger firms have a lower amount of tax loss carry-forwards than the non-hedgers.

Hedger firms have higher leverage comparing to firms that did not adopt any hedging strategy. Taking into account the risk management literature, theoretically hedging becomes more valuable as the firms fixed claims rise, supporting the thesis of hedging as value-enhancing strategy, reducing the variance of firm value and the expected costs of financial distress. Observing that the mean differences between hedgers have a statistic level of significance of less than 1%, there is important evidence consistent with the hypotheses of firms with higher leverage to have a higher tendency to develop more hedging strategies to mitigate their risks. Furthermore, the times interest earned ratio, that indicates

how many times a company can cover its debt obligations is lower for hedge firms. With a significant level of 10%, the mean differences between the two groups of firms indicates that firms with a more capacity to deal with their interest expenses are less likely to develop a specific risk management policy with financial derivatives to cover for the commodity price exposure.

As Mayers (1997) argued, hedging can control the underinvestment problem by restricting the states in which the firm would default on debt payments. To test the hypothesis that firms with more growth opportunities are more likely to develop hedging strategies, I established two variables in order to provide evidence regarding differences between the two groups in their investment set. For both the variables there are consistent significant levels regarding the mean differences between the two sample groups.

As Collins and Kothari (1989) referred on their analysis of intertemporal and cross-sectional determinants of earning response coefficients, market-to-book value ratio depends upon the extent to which the firm's return on its existing assets and expected future investments exceeds its required return on equity. Since future earnings are affected by growth opportunities, the higher the book-to-market value of equity ratio, the lower are the expected earnings growth. In accordance to the hedging literature and observing the sample values, the variable book-to-market ratio is lower for hedger firms and the mean comparisons between the groups appoint to a significant level of confidence of 10%. Despite the significance between the groups, the ratio of book value of assets over value is higher for the hedger firms as not suggested by the hedging literature. Furthermore, for the mentioned variable, there is a consistent statistical level of confidence of 5% on the mean differences between the two groups.

The mean differences in institutional and managerial ownership for hedged and non-hedged firms were not statistically significant. Nevertheless, hedger firms

have a higher percentage of managerial ownership comparing to the non-hedger firms. On the hedging literature, there are several arguments appointing to a positive relation between the willingness to pursue hedging strategies by the managers related to their higher preponderance on the corporate ownership structure. As Gay and Nam (1998) stated, managers with less diversified personal portfolios due to the higher stock ownership in the firm are more likely to develop corporate risk management, once their personal portfolios are strictly connected with the firm performance.

The ability for institutional investors to restrain opportunistic behaviors from managers is not confirmed by the mean differences results. Moreover, contradicting the hedging theory, the hedger firms have less percentage ownership in their structure comparing to the non-hedgers. So, the argument towards the disciplinary pressure imposed by the institutional investors seems to not have an effect on manager's decision regarding their exposure to commodity prices in the pulp and paper industry.

To examine the hypotheses about the substitutes for hedging, and as Nance et al (1993) did, I collected information about the dividend yields of the sample firms. The mean differences between the two groups of firms resulted in statistical level of significance of 10%, however with a contrary signal of what the hedging theory suggested. Hedger firms have less dividends payouts than non-hedgers.

4.1.2. Hedging and firm characteristics model findings

The mean comparison tests between the groups can only work as a starting point to the analysis, providing only insights of the unconditional relationships between firm characteristics and hedging. In order to develop a more consistent and deeper analysis, I established a LOGIT regression to infer about the conditional relationships.

When including all the right-hand-side variables that correspond to the firm's characteristics that theoretically have influence in the hedging decision, the coefficients of the ratio of the book value of assets over value, the book-to-market ratio, the institutional ownership and the dividend yield variable are significant at conventional levels. For the growth opportunities proxy book-to-market the signal was as expected, although for institutional ownership, dividends and book value of assets over value ratio, the coefficient signals are in the opposite direction regarding the hedging theory.

For this industry, it is not clear that firms with more growth opportunities have a greater incentive to hedge, despite the 5% level of statistical confidence attributed to the proxy variables that are documented in the Table 3. However, the coefficient associated to the Book-to-market variable attains a level of statistic confidence of 1% on the conditional relationships derived on the restricted model, a favorable insight that goes toward the hedging literature, since lower book-to-equity value ratios represent higher investment growth opportunities for firms.

As initially documented by the mean difference tests and further on the logit regression, none of the coefficients related to the variables reflecting the tax benefit of hedging and the firm size are significant. For the sample firms, there is no advantage for the larger firms to establish hedging strategies, not giving support to the argument of economies in scale in hedging.

The sample size is small relative to the number of parameters estimated, because I used nine explanatory variables, while I only collected data from 42 companies in the pulp and paper industry. To have access to more consistent findings, I extended the unrestricted regression in order to increase the power of the logistic regression.

In the table 3, are reported the results associated with eight of these logit-regressions. The sign of the coefficient of the proxy variable for leverage, goes toward the hedging literature, with an increasing level of statistic confidence. The results of the restricted regression, suggested that if the level of coverage of fixed claims is the only variable included to proxy for leverage, it is possible to observe that the ratio of earnings before interest and taxes divided by total interest expenses is statistically significant at a reasonable level of 20% confidence. Moreover, if the only variable included in the model to proxy for leverage, is the debt over value ratio, as the table 3 reports, statistical levels of confidence of 5% are attained. Both the coefficients are in accordance to the hedging literature, with the higher levered firms more likely to hedge and firms with a higher coverage for fixed claims less likely to hedge. Undoubtedly, there is a correlation between the leverage proxy variables.

However, the option for the added restricted regressions also reduce more the confidence about the hypotheses that firms in the pulp and paper industry use of tax preference items and their firm size are important determinants of their hedging policy.

Surprisingly, the managerial ownership variable starts to have a consistent level of confidence as reported on the restricted specification number nine on the table 3. It's also important to observe a reinforcement of the predictive power of the institutional ownership variable. Despite both the coefficients of the mentioned variables have a contrary signal from what is predicted on the hedging literature, the managerial ownership coefficient sign can be a result consistent with the entrenchment hypotheses. As managers start to have a higher portion of shares of their own firm in their personal portfolios, managers become less monitored and more entrenched and their ability to consume perks increase.

5. Model and Results: hedging and firm value model

After the research about firm characteristics and hedging practices in the industry, I will apply the same approach as Jin and Jorion (2006) and their work about corporate risk management of oil and gas producers. So, as a second target I will try to infer regarding the relation of firm value and hedging with a more directly approach - Hedging and Firm Value model.

Regarding the dependence of the hedging commodity price decision (explanatory variable) and firm value (dependent variable), my option is to use a multivariate analysis. The dependent variable is Tobin's Q ratio which is a measure of firm's assets in relation to a firm's market value. The acknowledgement behind the underlying ratio is that firms should be worth what their assets are worth, so a ratio number under one theoretically appoints to a firm that is undervalued. Hence, Tobin's Q ratio is used an approximation of firm value. The independent variables are constituted by several control variables and a dummy variable that reflects the company decision of developing or not the hedging strategies designed to mitigate the commodity price exposure. Factors considered to connect and to correlate the firm's hedging decision and its value are assumed to be used as control variables: financial distress costs, level of profitability, managerial ownership and agency costs. The utility of these control variables is to remove the effect of them on the explained variable.

The regression equation is described in the following way:

$$Tobin's Q = \alpha + \beta hedging \times Hedging proxy + \sum_j \gamma_j \times control variable(j) + \epsilon$$

All the control variables are designated to gauge for the effect of each of the variables in the dependent variables, the Tobin's Q ratio. The control variables are of extreme importance and it is essential and mandatory that an assertive choice can be made regarding their inclusion in the model, once each of their coefficients represents the partial effect of the given explanatory variable on my firm value variable proxy. Resuming, each of the coefficients is a partial regression coefficient and a safekeeping to control the effect of all other explanatory variables.

Taking as a starting point, the study developed by Jin and Jorion (2006), regarding the hedging practices of oil and gas producers, my regression coefficient on the hedging proxy (β_{hedging}), is established to be understood as the hedging premium. The mentioned coefficient reflects the theoretical excess return on hedged firms versus non hedged commodity exposure firms.

All the other parameters (γ_j), will measure the effect of each of the introduced explanatory variables on Tobin's Q ratio. Since my sample of study is related to the firm's hedging practices in 2014, I interpret each firm-2014 observation for the 42 pulp and paper companies as an independent observation and by doing that, I am moving away from the problem of over-estimating p-values and underestimate standard errors, since Tobin's Q refers only to a sample firm.

Dependent variable

Tobin's Q was introduced in 1968 by James Tobin a Nobel laureate in the field of economics and William Brainard a recognized American economist and professor at Yale University.

$$Tobin's Q = \frac{\text{Total Market Value of Firm}}{\text{Total Asset Value}}$$

Independent and control variables

Regarding the hedging decision of the firm's to mitigate their commodity risk exposure, on the model is included a hedging dummy variable, a binary variable that equals "1" if the firm developed hedging strategies with financial derivatives and coded as "0" if not. This variable reflects the decision of hedging commodity price in 2014 by the specific sample firm.

There were other approaches regarding the mentioned measure. Lookman (2004) used the fraction of the subsequent production hedged to cover an unpredictable drop in commodity prices. For the same purposes, Tufano (1996) for the gold mining companies used the portfolio-delta to represent the impact on the portfolio value of a tested small change in in the price of the underlying asset.

As Jin and Jorion (2006) research on oil and gas producers and taking into account the many factors that affect the value of a firm, 5 control variables were included in the model. Since the value of a firm is affected by several factors, the purpose of the inclusion of these variables is to eliminate those effects.

Considering that companies in their decision of establishing their hedging programs can face significant economies of scale in hedging, as Haushalter (2000) argued on his empirical work about oil and gas producers is expected a positive correlation between the decision to hedge and their firm size. Furthermore, Peltzam (1977) on his work about the gains and losses from industrial concentration argued that efficiency is positively related to firm size. Hence, the sum of the book value of debt plus the market value of equity of a firm is included to control for the size effect.

In order to control for the impact of a firm leverage on value, I established the debt-size ratio (the three-year average 2012 to 2014, of the ratio of the book value of long-term debt, divided by the sum of the book value of debt plus the market

value of equity). As Jin and Jorion (2006) stated on their work, a firm capital structure is related to its value. Moreover, Masulis (1983) on his research regarding the impact of capital structure change on firm value, provided evidence pointing to the fact that changes in stock prices are positively related to leverage changes.

Campello, Lin, Ma and Zou (2011), provided evidence that hedging reduces the cost of external financing and eases the firm's investment process and also said that if firms face problems in raising external funds, they are forced to abandon profitability investment opportunities with a net present value higher than zero. Furthermore, Froot, Scharfstein and Stein (1993) stated that costly external financing is a market imperfection that makes hedging a value-enhancing strategy. Hence, the influence of investment growth and the resulting impact on a firm performance, should be controlled. I will introduce two proxies for investment opportunities, the book-to-market ratio and the book value of Assets divided by the book value of debt plus the market value of equity. Since, Guy and Nam (1998) stated that one hedger is probable to have larger investment sets.

Taking into consideration, the capacity for a firm to generate future earnings I will adopt a dividend dummy variable to proxy for the wealth financial situation of a firm, as well as, bearing in mind that wealthier firms have better conditions to access the financial markets with lower costs, which in turn is associated to higher firm values. Nissim and Ziv (2001) investigated the relation between dividend policies and firms profitability and documented that dividend changes provide consistent information regarding the levels of profitability. Furthermore, they stated that dividend alterations are positively related to earnings changes. The dividend dummy is coded as "1" if the firm paid dividends on the sample period and "0" otherwise.

Regarding the productions costs of firms within the pulp and paper industry, the crucial cost drivers are water and energy consumption. Moreover, pulp and paper industry is among the largest consumers of both. The possible differences in the production costs can establish a comparative advantage between the players in this industry regarding the ability to generate profits. A control variable, defined as the operating margin will proxy for the different production efficiencies among firms. Operating margin is defined by ratio of operating income divided by the net sales and it is expected that higher operating margins are associated with higher Tobin's Q ratios.

The statistic mean differences between hedgers and non-hedgers are reported on table 4. Regarding the impact of the hedging strategies on firm value, the results are reported on table 5.

Table 4 - Hedgers vs non-hedgers – statistic mean differences

Variable	Means		Differences in Means	
	Hedgers (n= 17)	Non Hedgers (n=25)	H - NH	t- statistic
Firm Value	3901,41	6672,41	-2870	1,38*
Debt / Firm Value	49,30	27,95	21,35	-3,26***
Book / Market	63,11	78,45	-15,34	-1,28*
Operating Margin	5,62	7,58	-1,965	10,04
Dividend Dummy	0,65	0,84	-0,193	1,44*
Tobin's Q	0,04	0,06	-23,95	2,41**

***, **, * 1%, 5%, 10% indicate significance at 1%; 5% and 10% level, respectively.

Table 5 - Hedging and firm value model results

Observations	N=42			< [95% Conf. Interval] >	
	Tobin's Q	Coefficient	Std. error	P>[t]	Lower bound
Hedging Dummy	-0,097	0,072	0,18	-0,024	0,049
Firm Size	<0,001	<0,001	0,22	<-0,001	<0,001
Debt / Size	-0,007	0,002	<0,001***	-1,048	-0,004
Dividend Dummy	-0,011	0,086	0,2	-28,57	0,063
Book to Market	-0,003	0,001	<0,001***	-0,508	-0,002
Operating Margin	0,021	0,006	0,001***	0,978	0,032
R-Squared	0,721				
Adjusted R-Squared	0,673				

***, **, * 1%, 5%, 10% indicate significance at 1%; 5% and 10% level, respectively.

5.1 Empirical evidence on hedging and firm value model

5.1.1. Summary Statistics

The summary statistics of variables derived on the hedging and firm value model are presented at table 4. Summary statistics include Tobin's Q, Firm value, Debt over Firm value, Book-to-market, dividends and the operating margin.

Regarding the 42 firms of the sector included in the model, there are seventeen that engage in hedging commodity prices with financial derivatives and twenty-five that choose to not hedge their commodity risk exposure. It is possible to observe from the table that firms that choose to hedge their commodity price

have a mean firm size of EUR 6 772 million comparing to a mean firm value of EUR 3 901 million. According to the hedging theory, what was mentioned does not seem to make sense, since it's expected that firms with more volatile cash flows are smaller and do not have the same conditions as the bigger firms, on their access to the financial markets. This observation is contrary to the conclusion reached by Fok, Carrol and Chiou (1997), when they argued that on their sample, firms hedged to take advantage of the economies of scale.

In accordance to the finance theory, when comparing the mean values, hedger firms have a higher leverage ratio comparing to non-hedgers. Hedger firms have a mean leverage value of 49.3%, compared to the 27% of the non-hedgers. As Stulz (1996) stated, if we have a firm where the cash flows are very volatile and fluctuate severely over time, it could happen that an unexpected lower tail realization immediately lead to a situation of bankruptcy.

Hedging literature suggest that firms that use more hedging instruments have more growth options in their investment opportunity set. Considering the proxy variable for growth opportunities and consequently the mean differences between hedgers and non-hedgers for the book-to-market ratio, it is clear that the hedger firms have lower book-to-market mean values comparing to the non-hedgers.

The level of profitability is measured by the operation efficiency among the sample firms. The mean differences between hedgers and non-hedgers reflect that the level of operational efficiency is higher for firms that use financial derivatives in their hedging strategies to mitigate their commodity risk exposure.

5.1.2 Hedging and firm value model findings

The existence of a strategy with financial derivatives to hedge commodity risk exposure is associated with a lower Tobin's Q ratio. Although without a traditional level of confidence, it is possible to observe that the option to hedge is associated to a lower Tobin's Q of 0,097 units, as reported in the table 5.

After the introduction of the control variables, the sign of their coefficients are consistent with theory; except for the dividend dummy that proxy for the capacity of a firm to have access to the financial markets.

The levels of profitability measured by the operating margins among the included firms are associated with higher firm value, since their positive coefficients have a significance level of 1%.

Leverage and book-to-market value of equity are negatively correlated with firm value. By observing the table both variables have a level of statistical confidence of 1%, indicating that firms within this industry with lower growth opportunities and more debt in their capital structure are associated with lower value.

R-squared of the model is 0,721, meaning that more than 72% of variation of the dependent variable is explained by the explanatory variables included in the model, which give predicting power to the model estimated.

6. Conclusion

Most of the theoretical research on risk management, suggest that hedging reduces expected tax liability, expected costs of financial distress and agency costs of debt and equity. Departing from the previous studies done by Nance, Smith and Smithson (1993) and the revisit on their work elaborated by Fok, Carroll and Chiou (1997), I have gathered the two models, in order to introduce the improvements developed by the later authors. Taking into consideration both of the studies and following the same structure and the econometric models established by the authors, I collected financial data from a diversified firm characteristics pulp and paper listed companies, with the objective to find a connection between the theoretical incentives of the hedging literature and the specific firm characteristics within this industry.

Although, the scope of the study was only on the use of the financial derivatives to mitigate the commodity risk exposure within the pulp and paper industry.

Regarding the tax incentives for a firm to hedge to mitigate their commodity risk exposure, I reached to the same conclusion as Nance Smith and Smith (1993) and Fok, Carroll and Chiou (1993). There is no support for the hypotheses that reducing expected tax liability is a key factor explaining a decision to develop a risk management policy.

Nevertheless, pulp and paper firms with higher amounts of debt in their capital structure engage more in hedging strategies to control for their commodity risk exposure. This conclusion goes toward the view of hedging as a value-enhancing strategy, as Stulz (1996) argued, firms with higher amounts of permanently debt obligations are more susceptible to suffer from a negative earnings shock or lower tail realizations.

Interestingly, my scope of analysis within the pulp and paper industry, regarding managerial ownership as provided the same results as Fok, Carroll and Chiou. If non-shareholder-value maximizing behavior increases as managerial ownership increases, consequently, firms also suffer a negative impact on their values. That is consistent with the management entrenchment hypotheses. The negative relationship between corporate hedging and managerial ownership is associated to the extent that, as managers start build up a solid firm ownership, accumulating large amounts of firm stock, they do not employ the necessary resources to value-enhancing strategies, like establishing the appropriate risk management policy. As a result of the improved ownership, managers tend to be less monitored by outside investors, whom otherwise could control for non-value maximizing activities.

Jin and Jorion (2006) investigated more directly the relation between the decision of hedging and firm value and provided evidence regarding this connection for the oil and gas producers. I established the same approach as Jin and Jorion (2006) did, although I applied it for the pulp and paper industry, in order to gather evidence on how the decision to hedge the commodity risk exposure can affect firm value within this industry.

Expected relations between firm characteristics and firm value derived from the hedging and firm value model are in accordance with theory. Leverage is negatively correlated with firm value and size of the firm, and both level of profitability and growth opportunities in the investment set are associated with higher firm values. However, the established model proves that the decision to manage commodity risk within this industry is not in accordance to the value-enhancing prospects of the hedging literature. Moreover, the results demonstrate that efforts to manage commodity risk with financial derivatives are only associated with value destruction for firms within this industry.

A contribution of this study is the proved relation between firm value and the level of growth opportunities in the pulp and paper industry. Pulp and paper industry is among the largest consumers of energy and water, which are the critical cost drivers in today's cash constrained environment within this industry. Regarding the challenge of pursuing sustainability to create value, companies within this industry must be one-step ahead, developing new products and market opportunities opened up by growing environmental consumer trends.

Taking into consideration the model results, investment growth opportunities are clearly associated to higher firm value. Hence, opportunities to improve resource efficiency which require significant capital expenditure, need to be carefully weight to ensure that those chosen, have a positive net present value and don't destroy value for the company. Developing sustainable or certified raw materials and decreasing energy consumption are not enough, however, those will be important steps towards sustainability transformation within pulp and paper industry.

To finish, the results extolled by the models allow us to affirm that the methodologies for the assessment of risks must be adapted to each organization in order to able to meet and to shape to the particularities of a particular company in a specific industry.

Future research

Risk management has assumed and increasingly important role in the strategic agenda of companies and is a fundamental tool in order to give support for management in a complex and unstable macroeconomic environment. To deal with the global uncertainties and given the challenges for firms within this industry, I recommend a deeper and more specific analysis regarding the connection between their investment opportunities and the optimal hedging

strategies to adopt. Namely, which are the most profitable and efficient hedging instruments to mitigate the firms risk exposure, including the experience from previous strategies, changes, successes and failures. Since putting forth the appropriate risk management policy within this industry can add value because it helps ensure that the corporation has sufficient funds available and make the right choices to take advantage of attractive investment opportunities.

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