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**Investigation of the Relationship between M&A and  
Corporate Hedge**

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## **Abstract**

**Title:** Investigation of the Relationship between M&A and Corporate Hedge

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**Aim:** Conclude the theoretical explanation and obtain empirical support for the relationship between M&A and corporate hedge.

**Method:** Logit and Tobit Model are applied to test two null hypotheses about M&A, along with six other proxies that are seen as determinants of corporate hedging activity.

**Result and Conclusions:** Corporate hedge is affected by mergers and acquisitions. First, M&A will increase the likelihood of doing hedging. Then, M&A have positive impact on hedging activity, the increase in M&A would cause firm to do more hedge.

**Suggestions for future research:** Further research could expand the sample scale, which is to do the research in other industries and other districts, and the years after 2008 also worth to inquiry. Marginal tax rate rather than tax-loss carryforward could be used as the proxy for tax hypothesis in the future. Additionally, marginal effects of Tobit model could be introduced to explain quantification relation between M&A and hedge ratio. Furthermore, the three theories used in this study to explain the positive relation between M&A and hedging activity could be tested in the future study.

**Contribution of the thesis:** This study fills up the theory gap for the relationship between M&A and hedging activity, since there is no previous paper studies whether hedging would be affected by M&A. This study uses managerial hubris theory, underinvestment theory and deduction of cost of financial distress to explain the relationship. It provides the theoretical and actual evidence for the firms to do hedge when making M&A.

**Key words:** Hedging, M&A, Corporate risk management, Oil and gas industry

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## **Abbreviations**

M&A	Mergers and acquisitions
FCF	Free cash flow
CDF	Cumulative distribution function
NGL	Natural gas liquids
Dep	Dependent variable
P-value	Probability value
NPV	Net present value

## **1. Introduction**

*This chapter firstly explains the background of the research, following with a detailed problem discussion which becomes the foundation for the research question of this study. Afterwards, this chapter also includes the purpose and limitation of the study. Lastly, it's the outline of all the following chapters.*

### **1.1 Background**

Company's profitable growth could be generated internally as well as externally (Gupta, 2012). As for external growth, it can be achieved through acquiring existing business corporations (Ghosh & Das, 2003), among which mergers and acquisitions (M&A) are quite effective forms to obtain external growth (Mallikarjunappa & Nayak, 2007).

During the last two decades, extensive mergers and acquisitions have become strategic means for obtaining sustainable competitive advantages in the business world (Pinto & C.H., 2006). To be specific, in 2007, the aggregate deal value for acquisitions of U.S. targets was \$1.37 trillion (from Securities Data Company (SDC)). Compared to aggregate capital expenditure activity of \$1.85 trillion (by Compustat firms), \$1.37 trillion strongly indicates that acquisition activities occupy a large portion of corporate investment (Garfinkel & Hankins, 2011).

Since the world financial crisis in 2008, mergers and acquisitions activities have been facing increasing risks (Bhimani, et al., 2015), since mergers and acquisitions nowadays show several new trends. Firstly, cross-national M&A activities are increasing, which originally contain higher risks (Dension, et al., 2011; Grave, et al., 2012). Secondly, companies in maturing industries are rebalancing their assets through selling off the complicated activities that are not easy to unpack by acquirers. Thirdly, acquisition priorities are preferably targeting at revenue growth rather than cost reduction, which would result in significant hurdles in difficult economic period (Goranova, et al., 2010).

### **1.2 Problem discussion**

Traditionally, M&A activities were defined with the emphasis on value creation to shareholders (Gaughan, 2002; Holmstrom & Kaplan, 2001; Holmstrom & Kaplan, 2001; Pagano & Volpin, 2005), and several studies have reported positive returns (Cakici, et al., 1996; Doukas, et al., 2002; Beitel, et al., 2004). However, many studies have also stated

significant negative returns with the scale of 1–5 percent for varied windows especially ahead of the announcement to shareholders in the acquiring companies (Morck, et al., 1990; Mitchell & Stafford, 2000; Beitel, et al., 2004). What's more, M&A activities would possibly become not beneficial for shareholders in the case when certain risks that cannot be managed take place (Hitt, et al., 2009).

The risks of M&A failure derive from several factors, consisting of poor synergy, bad timing, incompatible cultures, off-strategy decision-making, hubris, and greed (Perry & Herd, 2004). In many cases, pure managerial self-interest attitude results in value destruction rather than value creation (King, et al., 2004; Moeller, et al., 2005). Weak risk management and poor compliance procedures would give opportunity to the occurrence of managerial self-interest behavior, thus result in the failure of M&A. This has brought the emphasis of risk management to a large scale of firms, markets and institutions (Holmstrom & Kaplan, 2001; Hitt, et al., 2009).

Additionally, as for corporate that has been attempting to improve performance, a takeover is always considered as a shock. After the shock, the profitability turns to be lower in near period. However, M&A activities would be beneficial for both managers and shareholders with the appliance of careful risk management. Thus, the strategy of risk management becomes important for avoiding unexpected results (Rani, et al., 2015).

Among the methods of risk management, using derivatives to do hedge is considered as a common way to reduce financial risks. Through trading derivatives on financial markets, firms could modify and reduce the exposure of its cash flow to several types of market risks, for example, commodity price risk and equity price risk. Especially, in the situation where these market risk exposures influence the investment opportunity and the risk of default, risk management turns to be a critical means for the arrangement of investing and financing decisions (Rani, et al., 2015).

Through researching these previous literatures, it is known that M&A could bring several risks and problems, and result in value destruction, while using hedge could manage several relative risks and with tight risk management M&A could be beneficial to both shareholders and managers. There have been quite a lot literatures that study the fundamentals for firms' hedging decision and indicate several reasons explaining why firms should do hedge. In detail, hedging alleviates underinvestment and overinvestment costs (Smith & Stulz, 1985), lowers financial distress costs (Haushalter, 2000; Georges &

Martin, 2003), reduces taxes (Smith & Stulz, 1985; Tufano, 1996; Graham & Smith, 1999) and decreases agency costs (Stulz, 1990; Tufano, 1996). However, these theories about hedge have not ever been connected to M&A situation. To the best of the authors' knowledge, there is no explicit theory or article really explains the relation between hedge and M&A and how they are connected. Moreover, there is also no empirical finding suggests whether corporate hedge would be affected by M&A or not.

### 1.3 Research question

From previous reviews, M&A play an important role in corporate investment. And nowadays, M&A are facing increasing risks. If certain unmanageable risks eventuate, M&A activities may not prove beneficial to shareholders. And a takeover is commonly perceived as a shock to the firm with a constant effect on changing business performance. Since hedging can maximize the shareholder value, reflect management risk aversion, help reduce the risk of adverse price movements in an asset and modify the exposure of cash flow to some marketable risks. Therefore, the research question comes out:

Is there any potential relationship between M&A and corporate hedge?

### 1.4 Purpose

The study intends to conclude the theoretical explanation and offer empirical support for the relation between M&A and hedging. Based on previous theories and literature, the authors find the theoretical and empirical gap and then come up with the hypotheses about their relation. If the result is significant shown from the regression, then the authors can prove that, except those control variables that have already been identified would influence hedging decision, M&A also have impact on firm's hedging motive.

### 1.5 Limitation

In this paper, the authors attempt to get a result of the research question, by gathering data of hedge ratio, M&A amount, tax-loss carryforward, institutional ownership, leverage ratio, market-to-book value, and firm size, from 101 companies in 9 years within the oil and gas industry and doing regressions to see whether the results are significant or not.

The research is limited in the oil and gas industry, considering the accessibility of data. And within this industry, data was gathered from 101 companies within North America.

Different industry has its own characteristic and demands, and different district usually has unique economic, financial and political situation. Thus doing the research in one industry within one district has the limitation, it is possible that the result does not fit other industries or regions. Moreover, the time period of the data has a limited range from 2000 to 2008. Therefore, the limitation of this study lies in the data restriction in oil and gas industry within North America, and the time period of the data.

## 1.6 Outline

The following chapter, chapter 2, discusses the literatures related to the theories of Mergers & Acquisitions, corporate risk management and hedge specifically, and accordingly, develops the hypotheses. Chapter 3 includes the explanation of all the data used, the description of each independent variable and dependent variable specifically, and the process of model set-up plus model adjustment. Chapter 4 interprets the descriptive statistics, tests and results from the regressions. And chapter 5 is the detailed analysis of the results from chapter 4. Finally, chapter 6 gives the conclusions and applications resulted from the analysis, following with the contribution of this study, the indication for further research and personal reflection.

## **2. Literature review**

*To understand the connection between hedging and M&A, this chapter includes a number of theories and literatures. It begins by introducing theories about M&A, then risk management, next the hedge within risk management specifically, then the connection between M&A and hedge. Finally, it gives the hypotheses generated from those theories and literatures.*

### 2.1 Theories of M&A

#### 2.1.1 Motives to promote M&A

The valuation hypothesis considers that when the stock of an acquiring firm is overvalued, the firm tends to make acquisitions (Shleifer & Vishny, 2003). Shleifer and Vishny also state that during the high market valuation period, merger waves would possibly occur. Based on their hypothesis, Ismail (2008) adopts P/E ratio to view the difference between the return of single and multiple acquirers. The result shows that the valuation of multiple acquirers is largely higher than that of single acquirers.

According to Kishore (2009), making use of the knowledge that a company is undervalued is listed as the initial motive for M&A. The second important reason to do M&A is to achieve more rapid growth, following with meet market demands offering additional products and services, get rid of risks of internal start-ups expansion, and raise earnings per share, etc.

#### 2.1.2 Value creation of M&A

According to the value increasing theories, “synergies” generated between the acquirer and the target is the major cause of mergers and acquisitions, since synergies, in turn, increases the value of the firm (Hitt, et al., 2001). After M&A, through economies of scale and scope, operative synergies, or efficiency gains could be achieved (Weitzel & McCarthy , 2001). Many literatures conclude that operating synergies is significant source of gain (Devos et al., 2008; Houston et al., 2001; Mukherjee et al., 2004). What’s more, the theory of efficiency suggests, in fact, that only when there is an expectation of sufficient realizable synergies, there would be a merger. It is the symmetric expectations of gains that play an important role in “friendly” mergers to make the deal beneficial to both parties (Eckard , 1998).

Besides operative synergies, allocative synergies that resulted from increased market power can be another valid motive for M&A (Weitzel & McCarthy, 2009). Increased allocative synergies would offer the firm positive and significant private benefits (Feinberg, 1985). Since with greater market power, when other elements remain at the same level, firm is able to charge higher prices and earn greater margins through the appropriation of consumer surplus. Moreover, market power allows for the deterrence of potential future entrants (Motta, 2004; Besanko, 2006; Gugler, et al., 2003), which can again provide the firm with a significant premium, and thus offer another long-term source of gain.

Following the corporate control theory, there is always another firm or management team willing to acquire an underperforming firm, to eliminate those managers who have failed to capitalize on the opportunities to create synergies, and thus to improve the performance of its assets (Weston, et al., 2004). Specifically, managers who offer the highest value to the owners, will take over the right to manage the firm until they themselves are replaced by another team that discovers an even higher value for its assets (Weitzel & McCarthy, 2009).

### 2.1.3 Value destruction of M&A

Around 60% to 80% of mergers are classified as “failures” if they fail to create value (Puranam & Singh, 1999). A number of value destroying theories have been listed to explain the failure of mergers.

Theory of managerial hubris (Roll, 1986) suggests that managers may have positive intentions in increasing their firm’s value but, being over-confident; they over-estimate their abilities to create synergies, which may lead to improper corporate decisions that would destroy the firm value. The probability of overpaying increases with overconfidence (Hayward & Hambrick, 1997; Malmendier & Tate, 2008), and overconfidence may lead the winning bidder to the situation of a winner's-curse, which dramatically increases the chances of failure (Dong, et al., 2006). Managerial hubris hypothesis could also result in higher leverage being taken to pay for subsequent acquisitions (Moeller et al., 2004; Malmendier & Tate 2008). Malmendier and Tate (2005) show that overly optimistic managers, who voluntarily retain in-the-money stock options in their own firms, more frequently engage in less profitable diversifying mergers, and

Rau and Vermaelen (1998) find that hubris is more likely to be seen amongst high market-to-book value firms.

Jensen's (1986) theory of managerial discretion claims a negative relation between the presence of excess liquidity, or free cash flow (FCF) and productive acquisitions. Firms who hold excess internal funds have more chance to make quick strategic decisions. Instead of investing in the required positive net present value projects, the firms are more likely to engage in unproductive investments. Large-scale strategic actions with less analysis are more likely to be taken by these firms than their cash-strapped peers. With high level of liquidity, the managerial discretion resulted in will make it increasingly possible for managers to choose poor acquisitions and run away from good ones (Martynova & Renneboog , 2008).

As the degree of managerial discretion increases in FCF, or in high market valuations, the opportunity for self-interested managers to pursue self-serving acquisitions raises (Jensen, 2005). Research has shown that bidder returns are, for example, generally higher when the manager of the acquiring firm is a large shareholder (Lewellen, et al., 1985), and lower when management is not (Lang, et al., 1991; Harford, 1999). This suggests that managers pay more attention to an acquisition when they themselves are financially concerned. Further, it supports the notion of agency costs and the managerial theories of the firm (Berle & Means, 1932; Marris, 1963), which broadly indicates that managers pursue self-serving acquisitions, and it is this fact that leads to value-destruction.

Similarly, the presence of conflict between management and shareholders will bring agency problems. Management may do harm to shareholders' wealth by maximizing their own interests at the first place (Jensen, 1986). The theory of managerial entrenchment (Shleifer & Vishny, 1989) claims that unsuccessful mergers would occur when managers engage in the investments that could minimize the risk of replacement. The aim of pursuing projects for management is not in an effort to maximize enterprise value, but in an effort to entrench themselves through increasing their individual value to the firm. Entrenching managers will therefore make manager-specific investments that would make shareholders cost more to replace them. Instead of investing in shareholder value-maximizing projects, entrenching managers will choose to invest in manager-specific assets which will reduce the firm value. Amihud and Lev (1981) empirically support this

notion, and suggest that managers pursue diversifying mergers in order to decrease earnings volatility which, in turn, enhances corporate survival and protects their positions.

#### 2.1.4 Success or failure elements of M&A

According to Bennett (2005), there are mainly two broad issues responsible for success or failure of M&A transactions, which are “Fit” issues and “Process” issues. “Fit” issues are those which assess the juxtaposition of the acquirer and the target. As Mallikarjunappa and Nayak (2007) illustrate, “Fit” issues for failure contain size, diversification, previous acquisition experience, poor organization fit, poor strategy fit, poor cultured fit, striving for bigness, and incompatibility of partners. For acquirers, they do not have enough ability to influence the fit issues; however, there are some factors over which control can be asserted. “Process” issues are those over which the acquirer can exert a large degree of control. It consists of lacking of proper communication, limited focus, paying too much, poorly managed integration, poor evaluation of the target company’s condition in detail, incomplete and inadequate due diligence, and inefficient top management (Mallikarjunappa & Nayak, 2007).

### 2.2 Theories of corporate risk management

#### 2.2.1 Corporate risks

Financial risk faced by the firm is what this study mainly focuses on. Financial risk is a source of potential unexpected losses for a firm that will arise due to some adverse changes in market conditions, the financial condition of an obligor to the firm, or the financial condition of the firm itself. And it can impact a company’s cash flows, accounting earnings, and/or value. Financial risks include market risk, funding risk, market liquidity risk, credit risk and legal risk (Culp, 2006). Among them, market risk is relevant with the study. The common forms of market risk include interest rate risk, exchange rate risk, commodity price risk and equity price risk (Culp, 2006).

#### 2.2.2 Corporate risk management

In general, there are two major rationales for corporate hedging decision, the maximization of the shareholder value and the management risk aversion (Spricic et al., 2008). This part reviews the following four theories of corporate hedging: taxes,

asymmetric information and agency conflicts, bankruptcy and financial distress costs, and underinvestment and coordination of investment and financing.

The tax argument is first introduced by Smith and Stulz (1985). They argue that if the firm faces a convex tax function, the tax rate increases disproportionately to earnings. Therefore, compared to volatile earnings, constant earnings will lead to a lower tax liability, according to Jensen's inequality. Since hedging could reduce the volatility of earnings, it will enhance the value of the firm facing with a convex tax function. This prediction is confirmed by Nance, Smith and Smithson (1993) and many other following studies.

Smith and Stulz (1985) suggest that financial distress costs provide a valid explanation to corporate risk management for that firms with hedging activities face lower probability of financial distress. They argue that hedging can decrease the present value of financial distress costs for a fixed investment policy. Consequently, hedging increases firm value since it decreases the expected value of direct bankruptcy costs and the loss of debt tax shield. The prediction is confirmed by Berkman and Bradbury (1996) and Haushalter (2000) and other studies.

Agency cost is regarded as a rationale for firms' hedging activities as well. Managers (but also other claimholders like employees, suppliers, and customers) are usually less diversified than regular investors, as they have the present value of future compensations tied to the firm's value (Arnold, et al., 2014). Since they are risk averse, they will require additional compensation if they feel exposed to a high level of risk through the firm. Hence, managerial risk aversion provides an incentive for corporate hedging, since hedging can add value to the firm through a reduced extra compensation (Zhu, 2011).

Underinvestment problem is also a popular explanation of corporate risk management. It describes cases where shareholders forego positive net present value projects because the gains mainly go to bondholders (Myers, 1977). Hedging can decrease the underinvestment costs by shifting cash from states in which income are sufficient to meet the firm's obligations to states where cash flows are insufficient to do so. Furthermore, Froot, Scharfstein and Stein (1993) show that, when the cost of external financing is higher than the cost of internal financing, hedging can alleviate the underinvestment problem, from another respect, by ensuring the availability of internally generated funds to meet the need of the firm's investment opportunities.

## 2.3 Hedge

### 2.3.1 Determinants of hedge

According to Ammon (1998), there are two choices that managers would choose when doing corporate hedge, one is to maximize equity value, and the other is to maximize personal value. The first choice is that managers would do hedge on the behalf of shareholders. Hedging could be used to lower costs of taxes, costs of financial distress and costs of external finance or to replace the hedging made by shareholders. The second choice is that managers prefer to maximize their personal value rather than the market value of firm equity. Their hedging arrangement, consequently, is decided by their compensation plan and reputation consideration.

There are several empirical findings on the dominant hedging motives. The motives rely on the environment where the firm is in (e.g., tax schedule) and the firm characteristics (e.g., capital intensity). Commonly, it is found that (i) firms would hedge more with a high probability of financial distress, (ii) companies would hedge more with greater growth opportunities, (iii) managers with common stockholdings would hedge more than those with option holdings and (iv) managers with high ability would hedge more (Ammon, 1998).

### 2.3.2 Benefits from hedge

Through stock ownership, equity-based payment, and firm-specific human capital, the majority of corporate insiders have significant amounts of wealth linked to their firms. As a result, this situation gives them motivations to lower their exposures to firm-specific risks, and further, monetize their equity positions in their firms' stock. There are two methods for these insiders to reach these aims. One is to sell shares in the open market; the other is to use over-the-counter derivative securities (Bettis, et al., 2015). However, in the first situation, selling in the open market would cause tax burden to insiders, which is likely to deter them from choosing this way.

Moreover, taking derivatives to smooth cash flows helps enhancing shareholder value during which post-tax cash flows act as a concave function of pre-tax cash flows as a result of progressive tax rates, according to Smith and Stulz (1985). Afterwards, Nance et al. (1993) and Graham and Smith (1999) get empirical evidence that supports this argument. As Graham and Stulz (1999) state, bankruptcy cost is also regarded as a

motive to get involved in hedging activities. Several empirical studies have been found that suggest a positive relation between firm leverage and the use of derivative (Nance, et al., 1993; Tufano, 1996; Haushalter, 2000), which are consistent with Graham and Stulz's (1999) finding. What's more, Froot et al (1993) demonstrate that hedging helps ease underinvestment problem for shareholders.

### 2.3.3 Derivatives

Derivatives, from an economical perspective, are transactions containing time and place other than the here and now (Culp, 2004). And they invariably include some elements of futurity, for example, the right or obligation to buy or sell an asset at a price fixed today for delivery on a specific date in the future. Derivatives cover a diverse spectrum of underlings, including physical assets, exchange rates, interest rates, commodity prices, equity prices, and indexes (Culp, 2006).

There are several forms of derivatives, one is forward contract. A forward contract helps eliminate cash-flow uncertainty from a future transaction. Option is another common form of derivative. It is considered as financial insurance and can protect holders from the financial consequences of unfavorable changes in market prices (Sundaram & Das, 2011). Swap is also a type of derivative. It helps converting the exposure to one market into exposure to another market. What's more, it provides pricing link between different financial markets (Sundaram & Das, 2011).

### 2.4 Relation between M&A and hedge

Since there is no previous literature talks about the relationship between M&A and hedging activities, this part comes from authors' own analysis. From the literature review in M&A part, it is known that managers would probably be over-confident about their abilities to create synergies through M&A according to the managerial hubris theory from Roll (1986). The over-confidence of managers may result in bad decisions to be made.

One probability is that they may raise higher leverage to pay for the acquisition (Moeller et al., 2004; Malmendier and Tate, 2008). With high level leverage, the probability of financial distress and even bankruptcy would become high as a consequence, while hedging is able to lower the probability of financial distress (Smith & Stulz, 1985), and reduce the costs of financial distress (Ammon, 1998). Another probability is that overpayment may be made (Hayward & Hambrick, 1997; Malmendier & Tate, 2008).

Then there would be great chance that equity price fluctuates afterwards, while hedge could help reduce the price movement risk.

Additionally, managers always have motivations to do the hedge during M&A. According to Ammon (1998), some managers would behave in the best interest of shareholders, while some managers prefer to maximize their personal value. Since M&A would always bring risks and hedging is frequently used to lower risk, managers would do hedge to protect either shareholders' value or their personal value.

## 2.5 Hypothesis development

With the absence of theory that directly depicts the relation between M&A and hedging, the authors of this study try to seek for a reasonable explanation and a valid empirical finding for the relationship. Consistent with theories for corporate risk management and M&A, the authors intend to test if companies have a significant possibility to do hedge regarding to M&A activities, for the purpose of decreasing the risk of firm value deduction according to the maximization of the shareholder value and management risk aversion hypotheses. The authors develop the hypotheses as follows:

*H<sub>01</sub>: M&A activity will increase the probability of using hedge*

*H<sub>02</sub>: Corporate hedging activity is significantly affected by Mergers & Acquisitions*

Two hypotheses are developed to see both qualitative and quantitative relation between M&A and hedging activity. In other words, Logit model is introduced firstly to test H<sub>01</sub>, that is whether M&A will initiate hedging, and then proceed to Tobit model, testing to what extent M&A will affect hedging activity, which is for H<sub>02</sub>.

To test the hypotheses, the authors examine the relation between hedging activities and M&A activities of 101 firms within oil and gas industry from 2000 to 2008 by applying Logit and Tobit model. These two models are discussed in details in next chapter.

### **3. Methodology**

*This chapter firstly describes sample selection and data collection, and then sets up two models with illustrating each independent variable and dependent variable specifically. Finally introduces data and model adjustment.*

#### **3.1 Sample selection**

The sample consists of 101 public firms within oil and gas industry in North America, which has hedgeable commodities as significant inputs components (specific company name can be found in appendix 1). Six firms without any available data were excluded from the sample. When talking about hedging, the authors of this study mean hedging with derivatives. Financial instruments market is well developed and active in North America, thus data collected from such a tight market is more complete, which makes the sample expanded and strengthened.

The sample covers the period of 2000-2008. While oil price remained essentially stable during 2000-2003, it experienced a sharply jump due to exogenous shock caused by financial crisis during 2004-2008 (Jankensgård, 2016). Such fluctuation would lead to a volatile oil price and therefore increase the commodity price risk to firms within oil and gas industry. Hedging activity is considered to be active under such circumstance, which makes us more accessible to the hedging data. Thus, this period is chosen for this study.

Although focusing on oil and gas industry raises concerns regarding the generality of the results, several features of this industry make it particularly well suited for the analysis of this study from the hedging perspective. First, oil and gas producers are exposed to a common risk: the volatility of oil and gas prices has a substantial impact on cash flow variability. Second, methods are available for these companies to hedge against the risk. Futures and options for both crude oil and natural gas are traded on the New York Mercantile Exchange (NYMEX), and forward and swap contracts are traded in the over-the-counter market.

#### **3.2 Data collection**

The research contains a collection and analysis of secondary and primary data. Secondary data refers to the already existed information and materials that has been collected by others (Caemmerer, 2009). It is especially helpful for understanding the research object

(Cooper & Schindler, 2003). The primary research is conducted with a specific objective and the primary data can be collected by qualitative research or quantitative research or the combination of the two (Caemmerer, 2009). In this study, quantitative research is chosen.

The amount of M&A is the amount spent on acquisitions, the data was hand collected from “M&A” in Capital IQ, “Transaction Events” in Thomson Reuters Eikon, Zephyr and 10-K forms with key word “Acquisitions” from SEC EDGAR. Since the data may be limited to cash financed acquisitions in annual report, the authors searched them firm by firm in these databases and recorded all the transactions made by the firms during the observed period. Then all the actual transactions were collected.

Other independent variables data are from Capital IQ and Compustat. The data of tax-loss carryforward and institutional ownership was collected from Compustat. Leverage ratio, commonly defined as total debt to total equity, was generated directly from Capital IQ. Market-to-book value was calculated using market value and total assets data from Capital IQ, specifically market value refers to shares outstanding times share price in this study. Firm size was collected using the market value above.

The dependent variable, hedge ratio, is defined as hedge production normalized by total production. Hedge production was hand-collected from 10-K forms. Total production data, is the sum of total oil production, total gas production and total NGL production after being hand transferred into the same unit. The original data came from Capital IQ and Compustat.

### 3.3 Model set-up

In order to see whether M&A activity could increase the probability of using hedge and to what extend it may affect hedge production, Logit model and Tobit model are introduced to test the two hypotheses respectively.

#### 3.3.1 Logit Model

The logistic model is used to estimate dichotomous data. It is appropriate when the response takes one of only two possible values representing presence or absence (Anon., u.d.). Then the logistic regression produces estimated probabilities of a binary response based on one or more predictors (independent variables). Since the regression predicts the

probability of particular outcomes, the predicted values are therefore restricted to (0, 1). The Logit model takes the form as:

$$Pr\{Y_i = 1 \mid x\} = F(x'\beta) \quad , \quad F(x'\beta) = (1 + e^{-x'\beta})^{-1} \quad (3.1)$$

where  $F(x'\beta)$  is the CDF of the logistic distribution,  $x'$  is the vector of covariates and  $\beta$  is the vector of regression coefficients.

In this study, the model relates the probability (log-odds) of using hedge to an array of explanatory variables which are discussed to have impact on hedging. Therefore, the authors code the hedge activity as “1” when it occurs and “0” when there is no hedging in the firm. The authors first consider the case where  $y_i$  is binary:

$$y_i = \begin{cases} 1, & \text{there is hedging in the estimated year} \\ 0, & \text{otherwise} \end{cases} \quad (3.2)$$

And the Logit model in this study is defined as:

$$Pr\{Hedge = 1\} = (1 + e^{-X'\beta})^{-1} \quad (3.3)$$

where *Hedge* is the hedging activity,  $X'$  is the vector of covariates and  $\beta$  is the vector of the six regression coefficients.

The test result of Logit model will estimate the increase or decrease of likelihood that *Hedge*=1. In other words, it can be known that whether an increase in explanatory variable will make the outcome of 1 more or less likely.

### 3.3.2 Tobit Model

After testing the first null hypothesis, the authors proceed to see how much influence that M&A will bring to hedging activity. Numerous studies empirically test the different theories of corporate hedging via univariate or multivariate analysis (G. David Haushalter, 2000; Graham & Rogers, 2002). As it can be seen from the hedging data, there are a significant number of zero observations for the dependent variable, indicating a non-hedging activity of the firm. Therefore, a multivariate analysis, applied by the Tobit model is introduced in this paper. The Tobit model is an econometric model proposed by

James Tobin (1958) to describe the relationship between a non-negative dependent variable  $Y_i^*$  and an independent variable matrix  $X_i$ . The term *Tobit* was derived from Tobin's name by truncating and adding *-it* by analogy with the probit model. The Tobit model is appropriate when the dependent variable is left-censored at zero. The Tobit model takes the form as:

$$Y_i^* = \beta' X_i + u_i \quad \text{where } u_i \sim NID(0, \sigma^2) \quad (3.4)$$

$$Y_i = Y_i^* \quad \text{if } Y_i^* > 0 \quad (3.5)$$

$$Y_i = 0 \quad \text{if } Y_i^* \leq 0$$

$Y_i^*$  indicates the unobservable variable. The vector of independent variables,  $X_i$ , includes all the explanatory variables discussed previously.  $\beta'$  is estimated coefficients matrix.  $u_i$  is the error term which follows the normal distribution. Function (3.4) can be seen as a classic linear model. Function (3.5) means if  $Y_i^* > 0$ , the observed dependent variable  $Y_i$  is equal to  $Y_i^*$ . If  $Y_i^* \leq 0$ , the observed dependent variable  $Y_i$  is equal to zero.

Thus the model can be defined as

$$\text{Hedge ratio}^* = \beta_1 M\&A + \beta_2 Tax + \beta_3 Institution + \beta_4 Leverage + \beta_5 MB + \beta_6 Size + u_i \quad (3.6)$$

$$\text{Hedge ratio} = \text{Hedge ratio}^* \quad \text{if } \text{Hedge ratio}^* > 0 \quad (3.7)$$

$$\text{Hedge ratio} = 0 \quad \text{if } \text{Hedge ratio}^* \leq 0$$

Where:

*M&A* is the deal value of M&A, *Tax* indicates log of 1+Tax-Loss Carryforward, *Institution* is the institutional ownership, *Leverage* is the leverage ratio, *MB* indicates log of Market-to-Book value, *Size* means firm size, market value of the firm in this case and  $u_i$  represents the error term.

In the regression, the hedge ratio is regressed on variables that may affect corporate hedging activity. Including the amount of M&A and other control variables, the joint influence of the explanatory variables on corporate hedging can be tested.

### 3.4 Regression specification

#### 3.4.1 M&A amount

There is no existing theory that shows a correlation between M&A amount and corporate hedging. From the authors own analysis, there are three explanations. M&A would cause value destruction through increasing possibility of financial distress and bankruptcy, being influenced by equity price fluctuation. During M&A, firms always meet more risks. However, hedging is helpful in lowering these risks; subsequently, firms have the incentive to do hedge during M&A. Thus it is reasonable that hedging activity could be influenced by M&A.

Dionne & Triki (2012) show that gold mining firms often expand either internally by exploring new mines or externally by acquiring existing mines. They use two measures of the firm's investment opportunities, namely exploration expenditures and acquisition expenditures, both scaled by the firm's market value. Different from hedging with horizontal acquisition, this paper focuses on hedging with financial instruments during M&A activity. The amount of M&A is the amount spent on acquisitions. In this study, the M&A amount is measured as the deal value of each M&A activity. The authors expect a positive sign of this coefficient.

#### 3.4.2 Tax

According to Smith and Stulz (1985), in the presence of a convex tax function, hedging reduces the variability of the firm's pre-tax value and its tax liability for that it locks taxable earnings in a predefined level. This conclusion is supported by empirical findings reported by Nance et al. (1993). The existence of tax-loss carryforward makes the effective tax function more convex. Since firms can deduct past tax losses only in times of positive income, hedging increases the net present value of the tax-loss carryforward. Therefore, firms that have tax-loss carryforward should have higher incentives to hedge (Nance, et al., 1993). Tax-loss carryforward is measured as the log of 1+tax-loss carryforward and is expected a positive coefficient.

#### 3.4.3 Institutional ownership

Since management has a non-diversifiable risk position in the firm, they ask an extra compensation which is commonly considered as agency costs problem. Hedging is able

to reduce their risks and therefore decrease their needs for that compensation (Arnold, et al., 2014). Firm value can then be increased. Institutional investors have a diversifiable portfolio, so the risk can be lowered if institutional investors hold substantial firm's stocks. Hedging would not be that necessary in this situation.

Furthermore, informational asymmetry is assumed to exist between managers and shareholders. Due to information asymmetries, Breeden & Viswanathan (1998) argue that a high-quality manager has incentive to hedge away uncertainty about his or her performance in order to enable the market to infer his or her ability more precisely. Since institutional investors are more accessible to corporate information, firms owned primarily by institutions thus face less informational asymmetry. Therefore high-institutional-ownership firms should hedge less.

To sum up, institutional ownership is used to measure both the agency costs problem and information asymmetry. As a result, the authors of the study expect a negative sign of the variable.

#### 3.4.4 Leverage

As stated in Tufano (1996), financial distress cost is measured with leverage ratio. With a high leverage ratio, the firm has more risk in facing financial distress. Smith and Stulz (1985) show that hedging increases shareholders' wealth because it decreases the expected value of direct bankruptcy costs and the loss of the debt tax shield. The ratio is measured as the book value of the total debt divided by the total equity, and the authors expect a positive coefficient of this variable.

#### 3.4.5 Market-to-book value

When a corporation faces the risk of bankruptcy, agency conflicts between shareholders and debtholders would arise and give it incentives to hedge. In times of financial distress, management may not invest in positive net present value projects as the benefits would fully or mainly accrue to debtholders not shareholders (Arnold, et al., 2014). The underinvestment problem is measured by the market-to-book value which indicates growth opportunities. Suggested by Rau and Vermaelen (1998), firms with high market-to-book value have more chance to occur managerial hubris problem, which is seen as a motive to hedging. Therefore the authors expect a positive coefficient of this variable,

which is calculated as market value of the firm divided by book value of total assets. Due to data transformation, log of market-to-book value is taken in this study.

#### 3.4.6 Firm size

If hedging costs are proportional to the firm's size as stated by Smith and Stulz (1985), small firms should hedge more. Large firms may hedge less because they are better diversified geographically and by lines of business. Conversely, large firms might hedge more if hedging costs are fixed, especially when these costs are substantial. This variable is measured as the market value of the firm at the end of each year and the authors do not offer any expectation of the sign for this variable.

#### 3.4.7 Dependent variable

For Logit model, as discussed in 3.3.1, the authors code the dependent variable, hedging action, as "1" when it exists, and "0" otherwise.

For Tobit model, the authors use the hedge ratio as the measurement of the amount of hedging for each company. The hedge ratio is defined as hedge production divided by total production.

Overview of proxy variables in the two models are shown in Table 1 and Table 2 respectively.

**Table 1 Overview of the proxy variables for Logit model**

<b>Variables</b>	<b>Expected sign</b>	<b>Description</b>
Independent Variables		
Tax-loss carryforward	+/>0	Log of 1+Tax-Loss Carryforward
Institutional ownership	-/<0	Percentage of shares held by institutional investors
Leverage ratio	+/>0	Book value of the total debt divided by the total equity
Market-to-book value	+/>0	Market value of the firm divided by book value of total assets and then take the natural logarithm
Firm size	??	Market value of the firm
M&A amount	+/>0	Deal value of each M&A activity
Dependent Variables		
Hedge ratio	--	Code as binary data

Source: own construction

**Table 2 Overview of the proxy variables for Tobit model**

<b>Variables</b>	<b>Expected sign</b>	<b>Description</b>
Independent Variables		
Tax-loss carryforward	+/>0	Log of 1+Tax-Loss Carryforward
Institutional ownership	-/<0	Percentage of shares held by institutional investors
Leverage ratio	+/>0	Book value of the total debt divided by the total equity
Market-to-book value	+/>0	Market value of the firm divided by book value of total assets and then take the natural logarithm
Firm size	?/?	Market value of the firm
M&A amount	+/>0	Deal value of each M&A activity
Dependent Variables		
Hedge ratio	--	Hedge production divided by total production

Source: own construction

### 3.5 Model adjustment

When adjusting the model, outliers should be paid attention to. The presence of outliers can lead to deleterious effects on statistical analyses, such as inflated error rates and substantial distortions of parameter and statistic estimates (Zimmerman, 1994, 1995, 1998). Specifically, outliers generally increase error variance and reduce the power of statistical tests. Furthermore, they could also decrease normality, thus alter the odds of making both Type I and Type II errors (Osborne & Overbay, 2004). The definition of outliers varies. However, an outlier is generally considered to be a data point that is far outside the norm for a variable or population (Jarrell, 1994; Rasmussen, 1988; Stevens, 1984).

Several methods are introduced to deal with outliers. First of all, to avoid data entry mistake, the authors double checked the data to ensure that any outlier found is not resulted from data entry errors. Second, extreme unreasonable values that have no practical meanings are dropped as blank (i.e., 128 in leverage ratio). Third, for institutional ownership, the authors choose to use truncation as an alternative transformation, wherein extreme scores are recoded to the highest (or lowest) reasonable score. Since institutional ownership should be less or equal to 100%, the authors recode the outlier, specifically switch 108% to 100%. Through truncation, the relative ordering of the data is maintained, and the highest or lowest scores remain the highest or lowest scores, yet the distributional problems are reduced.

Fourth, since extreme values could also be legitimate, these cannot be dropped without analysis. Thus, the authors choose to transform the data so that these data can not only be kept in the data set, but also be remained as relative ranking of scores. The authors take the natural logarithm of market-to-book value and 1+tax-loss carryforward. They are both right skewed variables, therefore through transformation, the skew and error variance presented in the variables can be reduced (Hamilton, 1992). Log of 1+tax-loss carryforward is applied in this study due to zero value occurred in the variable. Also, even in the case of Tobit model that always considers a censored distribution to be non-normal, the residual of the regression is required to be normally distributed (Cameron & Trivedi, 2009). Via taking the log of positive skewed independent variables, residual will become more normally distributed (Tukey, 1977).

## 4. Empirical findings

*This chapter presents the results from the two regressions. The relationships between each of six proxy variables and hedge ratio are interpreted in detail, especially the relation between M&A and hedge ratio.*

### 4.1 Descriptive statistics

#### 4.1.1 Data summary

Seen from Table 3, hedge ratios have the mean of 0.0414 and median of 0.0324. These two numbers seem a bit low, but it could be explained. Since oil and gas industry prefers to take more risks in common, the hedge ratios of the firms in this industry being relatively low are reasonable. The maximum of hedge ratio is 1.5735, minimum is 0. The maximum number is quite high, but there is no reason to drop or recode it, and this is found to be the only one above 1 through observation, so the authors choose to keep it in the data.

Institutional ownership has a mean of 12.2332%, a median of 6.6000%, the maximum is 100%, and the minimum is 0%. The mean and median are in the reasonable scale. The original maximum percentage looks not good (108%), according to chapter 3.5, this irrationally large percent is adjusted to its highest limitation, which is 100%.

As for leverage ratio, the mean is 0.4718, median is 0.3670. They are in the rational range and debt is much smaller than equity. The minimum is -9.9860, and maximum is 7.8700. There are several highly leveraged firms found after observation.

The mean, median, maximum and minimum of log of market-to-book value are -0.0676, -0.0400, 3.1708 and -3.9123 respectively. The reason for the mean, median and minimum to be negative is that logarithm has been added on to the market-to-book value.

The mean and median for M&A are 200.0011 and 0, this difference comes from that there are many firms have no M&A in several years. As for firm size, it has 7414.811 and 158.6000 as mean and median. And log of (1+tax-loss carryforward) has the mean as 0.5588, median as 0, maximum as 3.6336, minimum as 0.

**Table 3 Descriptive statistics**

	Hedge ratio	Institutional ownership	Leverage ratio	Log of market-to-book value	M&A amount	Firm size	Tax-loss carryforward
Mean	0.041368	12.23323	0.471825	-0.067600	200.0011	7414.811	0.558799
Median	0.032351	6.600000	0.367000	-0.039978	0.000000	158.6000	0.000000
Maxium	1.573478	100.0000	7.870000	3.170819	24260.12	481043.2	3.633569
Minimum	0.000000	0.000000	-9.986000	-3.912253	0.000000	0.130000	0.000000
Std. Dev	0.091023	15.34525	1.084299	0.756280	1076.059	38340.63	0.921853

Source: own construction

#### 4.1.2 Pearson Correlation test

Appendix 2 and 3 report the correlation matrix for the samples applied in the two models respectively. As it can be seen from the results, the correlation coefficients are generally low. With no high enough correlations, multi-collinear problem has not been taken into consideration in this case.

#### 4.1.3 Testing Goodness of fit

To test whether the Logit model has effectively made the correct prediction, the goodness of fit test is introduced. The result comes out with the percentage of true predictions to total predictions (Brooks, u.d.). As shown in Appendix 4, this could be considered as a reasonable and convictive set of predictions with 82.51% of the total predictions correct.

#### 4.2 Logit model

The regression results are demonstrated with six proxy variables separately in Table 4. The model, after the adjustment, includes 587 observations, 204 observations with Dep=0 and 383 observations with Dep=1. The table shows the coefficient, std. error, z-statistic and p-value (with a 10% significance level) of each variable.

From the table, M&A has a p-value of 0.0435, thus the coefficient of M&A is significant at 10% significance level. In particular, the probability for a firm to do hedge depends on

M&A deal value. Since the coefficient has a positive sign, the larger the M&A deal value is, the more likely that the firm seeks to hedge. The result supports the first null hypothesis.

With a p-value of 0.1593, the coefficient of market-to-book value is not significant at 10% level. Thus it cannot prove that the probability of doing hedge would be influenced by market-to-book value. As for institutional ownership, the p-value is 0, which represents that the result is significant. Specifically, institutional ownership has impact on the probability that a firm would do hedge. And with a positive sign on coefficient, the increase in institutional ownership would enhance the probability of the firm hedging.

The leverage ratio has a p-value of 0.0655 and the coefficient is positive, thus the probability of corporate hedging depends on leverage ratio. And with higher leverage ratio, the firm is more likely to take hedge. As the p-value for tax-loss carryforward is not significant with 0.2547, the coefficient of tax-loss carryforward is not significant. As a result, the amount of tax-loss carryforward cannot be proved to be influential on the probability of firm hedging. The p-value of firm size is 0.0616, and the coefficient is negative. Consequently, firm size affects the probability of doing hedge. And as the firm size expands, the firm would be less likely to take hedge decision.

**Table 4 Logit model regression result**

Dependent Variable: HEDGE\_PROB  
 Method: ML - Binary Logit (Quadratic hill climbing)  
 Date: 05/29/16 Time: 18:40  
 Sample: 2000 2008  
 Included observations: 587  
 Convergence achieved after 8 iterations  
 QML (Huber/White) standard errors & covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
M_A	0.010168	0.005036	2.019153	0.0435
LOGMTB	0.237074	0.168447	1.407409	0.1593
INSTITUTIONAL_OWNERSHIP	0.121351	0.015453	7.852882	0.0000
LEVERAGE	0.516663	0.280551	1.841599	0.0655
TAX	-0.173217	0.152073	-1.139043	0.2547
SIZE	-2.84E-05	1.52E-05	-1.868975	0.0616
C	-0.807104	0.178460	-4.522613	0.0000
McFadden R-squared	0.386577	Mean dependent var	0.652470	
S.D. dependent var	0.476592	S.E. of regression	0.358448	
Akaike info criterion	0.816275	Sum squared resid	74.52141	
Schwarz criterion	0.868448	Log likelihood	-232.5768	
Hannan-Quinn criter.	0.836605	Deviance	465.1536	
Restr. deviance	758.2914	Restr. log likelihood	-379.1457	
LR statistic	293.1378	Avg. log likelihood	-0.396213	
Prob(LR statistic)	0.000000			
Obs with Dep=0	204	Total obs	587	
Obs with Dep=1	383			

Source: Eviews

#### 4.3 Tobit model

The regression results are shown with six proxy variables in detail in Table 5. There are 587 observations in the model after dropping the missing data automatically by Eviews, with 204 left censored and 383 uncensored. The table shows the coefficient, std. error, z-statistic and p-value (with a 10% significance level) of each variable.

The main issue of this study is to see whether hedge will be influenced by mergers and acquisitions. Seen from the table, the p-value of M&A is 0.0638, lower than 10%, proving that the result is significant. In other words, M&A have impact on hedge ratio. According to the coefficient, the relationship between M&A and hedge ratio is positive. Specifically, with amount added in M&A deal value, hedge ratio increases. The result gives sufficient support for the second null hypothesis.

With a p-value of 0.0163, the coefficient of log of market-to-book value is significant at 10% level. It represents that market-to-book value influences hedge ratio. The coefficient

has a positive sign, which indicates that when market-to-book value rises, hedge ratio increases. As for institutional ownership, its p-value is 0, which shows that it has a significant influence on hedge ratio. With a positive coefficient, hedge ratio goes up when shares are added on institutional ownership.

As the p-value for leverage ratio is 0.0220, the result is significant with significance level 10%, thus leverage ratio would also affect hedge ratio. The coefficient is positive, which explains that if leverage ratio increases, hedge ratio would also raise. The p-value for tax-loss carryforward is 0.9157, and it is much higher than 10%. Since the result is not significant, it cannot be concluded that tax-loss carryforward has an impact on hedge ratio. When it comes to firm size, the p-value is 0.0001 and the result is significant. Thus firm size has impact on hedge ratio. As the coefficient is negative, hedge ratio would become lower with the expansion of firm size.

**Table 5 Tobit model regression result**

Dependent Variable: HEDGE\_RATIO  
Method: ML - Censored Normal (TOBIT) (Quadratic hill climbing)  
Date: 05/29/16 Time: 18:36  
Sample: 2000 2008  
Included observations: 587  
Left censoring (value) at zero  
Convergence achieved after 5 iterations  
QML (Huber/White) standard errors & covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
M_A	5.47E-06	2.95E-06	1.853520	0.0638
LOGMTB	0.015679	0.006528	2.401640	0.0163
INSTITUTIONAL_OWNERSHIP	0.001291	0.000224	5.759172	0.0000
LEVERAGE	0.006605	0.002884	2.290100	0.0220
TAX	0.000333	0.003145	0.105795	0.9157
SIZE	-5.04E-07	1.25E-07	-4.019479	0.0001
C	-0.000502	0.006060	-0.082786	0.9340

  

Error Distribution				
SCALE:C(8)	0.083273	0.011065	7.525689	0.0000

  

Mean dependent var	0.039319	S.D. dependent var	0.062157
S.E. of regression	0.062792	Akaike info criterion	-0.899859
Sum squared resid	2.282930	Schwarz criterion	-0.840233
Log likelihood	272.1086	Hannan-Quinn criter.	-0.876625
Avg. log likelihood	0.463558		

  

Left censored obs	204	Right censored obs	0
Uncensored obs	383	Total obs	587

Source: Eviews

#### 4.4 Combination of Logit model and Tobit model

Seen from Table 6, there is a summarization of the results from both Logit model and Tobit model. The majority of variables have the same result from the two models, except log (market-to-book). It has insignificant result from Logit model but significant result from Tobit model. M&A, institutional ownership, and leverage ratio have significantly positive relationship with hedge ratio shown from both models, while the connection between firm size and hedge ratio is significantly negative from both models. As for tax-loss carryforward, its influence on hedge ratio is not significant in both models.

**Table 6 Results of Logit and Tobit model**

	<i>Logit model</i>		<i>Tobit model</i>	
	<i>Significance</i>	<i>coefficient</i>	<i>Significance</i>	<i>coefficient</i>
<i>M&amp;A</i>	√	+	√	+
<i>Log(market-to-book)</i>	×		√	+
<i>Institutional ownership</i>	√	+	√	+
<i>Leverage ratio</i>	√	+	√	+
<i>Tax-loss carryforward</i>	×		×	
<i>Firm size</i>	√	-	√	-

Source: own construction

## 5. Analysis

*In this chapter, the result is analyzed in detail compared with previous literatures and theories. Own viewpoints and analysis are emphasized.*

### 5.1 M&A

Seen from Logit model result, the probability for a firm to do hedge depends on M&A deal value. With larger M&A deal value, the firm becomes more likely to do hedge. Furthermore, the result derived from Tobit model provides sufficient support to this Logit model result, that is M&A have impact on hedge ratio and the influence is positive. In detail, the increase in M&A would cause firm to do more hedge. There are several reasons and motivations to analyze this result.

According to the managerial hubris theory from Rolql (1986), when managers intend to help firm create value through M&A, they could be over-confident about their abilities to produce synergies. As a result, their decision may bring adverse effects to the firm value. One consequence is that over-confidence may lead managers to raise large amount of debt to pay for acquisition, which could cause the firm end up with relatively high level of leverage (Moeller et al., 2004; Malmendier & Tate, 2008), following with costs of financial distress and bankruptcy.

As Ammon (1998) concludes, firms that are close to financial distress would hedge more, since hedging is effective for lowering the probability of financial distress (Smith & Stulz, 1985), and reducing the costs of financial distress as well as external financing (Ammon, 1998). Additionally, cost of bankruptcy is also a reason to do hedge, as Graham and Stulz (1999) state. Since M&A could possibly result in value destruction because of high leverage resulted from managerial hubris, it is necessary to do hedge when the firm intends to do M&A. Through hedging, the firm could lower the probability that it comes to the dilemma of financial distress and even bankruptcy after M&A. Increasing M&A amount means more risks of financial distress, which gives the firm more incentives to do hedge.

What's more, if the firm is in high leverage situation after acquisition combining with the presence of positive NPV project to invest, it would face underinvestment problem. Under such circumstance, hedge could help to ease the problem, since it makes sure the accessibility of fund generated internally to invest the profitable project (Froot, et al.,

1993). In other words, as Myers (1977) explains, through hedging, cash could be shifted from the place where the income is sufficient to operate to the place in which the income is not enough. As underinvestment problem could also occur after M&A, it is reasonable for firms to conduct hedge to prevent problems.

Another consequence of managers' over-confidence is that the probability of overpaying for acquisitions may be raised (Hayward & Hambrick, 1997; Malmendier & Tate, 2008). The overpayment is possible to result in fluctuation in the equity price, while hedge has the function to reduce the risk of adverse price movement. Thus it can explain that with larger amount of M&A, firm would do more hedge.

Considering two behaviors of managers may occur, one is that managers prefer to behave in the best interest of shareholders, the other is that managers intend to maximize their personal value (Ammon, 1998). In the first situation, managers would do hedge to reduce the costs of financial distress and costs of external finance. Since M&A always come with risks and there are such many fail examples, managers have the motivation to protect shareholders' value through hedge. As for the second situation, things remain the same. During M&A, managers face firm-specific risks, thus they prefer to do hedge to protect their value, which help prove the result of this study.

## 5.2 Market-to-book value

This ratio is used to represent underinvestment problem since it indicates the growth opportunity (Arnold, et al., 2014), so its relationship with hedge ratio shows the relation between underinvestment problem and hedging activity. The result generated from Logit model is not significant and cannot prove that the probability of doing hedge would be influenced by market-to-book value. In contrast, the result from Tobit model is significant and market-to-book value has positive impact on hedging activity, which is consistent with the expectation stated by Arnold, et al. (2014). The reason for the insignificant result in Logit model could be that the hedge variance has been taken away after using only 0 and 1 instead. The connections between large market-to-book value and high hedge ratio or between small market-to-book value and low hedge ratio have lost.

Facing the risk of bankruptcy, agency conflicts between shareholders and debtholders is likely to occur. In particular, management may not invest in positive NPV projects as the

benefits would be fully or mainly transferred to debtholders not shareholders, according to Arnold, et al. (2014). This dilemma gives incentive to hedge, as hedge is able to ensure the firm with internal funds to invest in the profitable project (Froot, et al., 1993). As Rau and Vermaelen (1998) state, with high Market-to-book value, the probability for managerial hubris problem to appear is high, and managerial hubris problem is regarded as a good motivation for hedging. Thus if the firm occurs underinvestment problem, it is likely to apply hedging strategy to ease the problem. And more severity the problem is, more hedges would be taken.

The result in this study can also show that there is a positive connection between growth opportunity and hedging activity. This is insistent with Ammon's (1998) argument that companies with greater growth opportunities would hedge more.

### 5.3 Institutional ownership

According to Logit model result, the increase in institutional ownership would enhance the probability of the firm hedging. Tobit model also shows that institutional ownership positively affects hedging activity. Both results are contrary to our expectation and are inconsistent with most literatures (DeMarzo & Duffie, 1991; Breeden & Viswanathan, 1998), but consistent with Arnold et al., (2014) and Graham et al., (2002). Several reasons are analyzed to explain the adverse result.

The most possible explanation is that institutional investors may hold thousands, even millions of firm's shares, and when they decide to sell, such substantial sell-off will lead to a crash of the firm's stock price. In order to protect the firm's value, firms will do more hedging to avoid the sudden fall of the price and lower the loss of such shock, which leads to positive relationship between the institutional ownership and the hedging activity.

Another explanation is that outside owners are seen to act as a monitoring role of the firm. Institutional investors with a strong shareholder-value orientation are usually considered to represent a professional form of corporate governance (Chung & Zhang, 2011). Under such strong supervising, management is less likely to engage in self-serving actions, therefore they prefer more hedging to spread the risk of their non-diversifiable position.

#### 5.4 Leverage ratio

The results of leverage ratio from Logit and Tobit model are both same with the expectation. Logit model result indicates that with higher leverage ratio, the firm is more likely to take hedge. And Tobit model result offers more specific evidence that increase in leverage ratio causes the firm to take on more hedge. In previous description, leverage ratio represents the level of financial distress. High leverage ratio means high probability of financial distress. In return, firms with high probability of financial distress would do more hedge. This is same with Ammon's (1998) conclusion, that firms that are close to financial distress would hedge more. Just as Smith and Stulz (1985) state, hedging could lower the probability of financial distress, and reduce the costs of financial distress and external financing (Ammon, 1998).

#### 5.5 Tax-loss carryforward

The relationship between tax-loss carryforward and hedge ratio is not significant in both Logit and Tobit model, therefore this variable cannot be seen as an indicator in favor of tax hypothesis. The result is inconsistent with Nance, Smith, and Smithson (1993) who show a positive relation between the two variables. However, our finding is consistent with Arnold et al., (2014), who also get an insignificant relationship. Aretz and Bartram (2010) demonstrate that "in most cases, tax-loss carryforward do not significantly associate with corporate hedging". The result of this study clearly verifies this argument.

The precondition of smoothing earnings volatile via hedging to increase firm value is that the firm has a convex tax function. Tax-loss carryforward is taken as the indicator for that this variable is able to lead a convex tax function. However, according to Graham & Smith (1999), the existence of tax-loss carryforward does not necessarily lead to a convex tax function. Other proxies such as marginal tax rate and tax code progressivity dummies may be more suitable in this case (Arnold, et al., 2014), but the authors were not able to test tax hypothesis with these variables due to data shortage.

#### 5.6 Firm size

The results of firm size in both Logit and Tobit model are significant and have negative connection with hedge ratio. There is no collective evidence that shows an exactly relation between firm size and hedging. The negative coefficient in this study indicates that hedging decreases with the expansion of firm size. Large firms are less likely to face

financial constraints and therefore do not hold so much excess precautionary cash. With the decreasing need for smoothing cash flow as well as less risky position, large firms may not engage in hedging. Furthermore, with informational scale economies, firms with a larger business presence in a particular market are more likely to acquire valuable information about this market and invest in diversified project (Nance, et al., 1993). Diversification of assets lowers the risk and leads to a less likelihood of hedging.

## **6. Conclusion**

*This chapter summarizes the study and concludes the result. Moreover, contribution and further study and personal reflection are also included.*

### **6.1 Summarization**

The first null hypothesis “M&A activity will increase the probability of using hedge” is tested by Logit model while the second null hypothesis “Corporate hedging is significantly affected by M&A” is tested by applying the Tobit Model, along with six other proxies that are seen as determinants of corporate hedging activity, to see whether the relationships are significant. The authors do not reject these two null hypotheses at 10% significance level.

The result of this study answers the research question. In particular, corporate hedging is affected by mergers and acquisitions. First of all, M&A will increase the likelihood of doing hedging. Then, hedging is significantly positive related to M&A. This relation is explained by managerial hubris theory, underinvestment theory and deduction of cost of financial distress in this study for the first time. The conclusion from this study is that M&A have impact on hedge ratio and the influence is positive.

### **6.2 Contribution**

As stated before, previous paper has neither empirically investigated the relationship between hedging and M&A nor theoretically studied why M&A may have impact on hedging. Therefore this study fills up the vacancy in both the empirical and the theoretical area. It provides the theoretical and actual evidence to reveal the potential positive dependency of hedging and M&A.

### **6.3 Further study**

Further research could expand the sample scale, which is to do the research in other industries to see whether the influence of M&A on hedging activity remains significant or not. Additionally, more districts, other than North America, could be investigated. It is possible that different region and industry have different situation and result.

What's more, the years after 2008 also worth to inquiry. What this study has done is 2000-2008; however, the serious financial crisis in 2008 would cause changes in the

situation with high possibility. The result may fluctuate with different period range. Therefore, with more years and different regions and industries, the result of M&A's impact on hedging activities would be much more comprehensive.

Additionally, further study could use marginal tax rate rather than tax-loss carryforward as the proxy for tax hypothesis to see its effect on hedge ratio. And marginal effects of Tobit model could be introduced to explain quantification relation between M&A and hedge ratio. Furthermore, the three theories (i.e., managerial hubris theory, underinvestment theory and deduction of cost of financial distress) used in this study to explain the positive relation between M&A and hedging activity could be tested in the future study to see their practical effects on hedging activity and which one has the most significant impact on hedge ratio.

#### 6.4 Personal reflection

During the whole research period, we recognized two challenging issues that took us a long time to deal with.

First of all, data collection is much harder than expected. Five databases, including 10-K filings are used due to data deficiency. For example, deal value of M&A were collected and combined into same unit from four databases, since the uncompleted information are reported in those databases. To obtain information as accurate as we can, we double checked the event news with the data collected from the database. However, the mix of non-unified data sources could cause potential errors due to different measurements for example, which lead to biased statistical estimates.

For hedge ratio, we realize that our data could be somewhat too low even though they are under 1 and within the reasonable scale. The hedge ratio is calculated as hedge production divided by total production. The data of production were collected from two databases and were compared with each source to make sure we got the correct information. We converted the different units into the same for oil, gas and NGL production and then summed them up to obtain total production. After correcting a conversion mistake of the gas unit and investigating other possible errors (i.e., entry mistake), we still have an unsatisfied hedge ratio. More analysis within the data should have done and therefore eliminate the errors.

Secondly, model adjustment is another challenge for us. The testing and handling of outliers were the highlight during our study except for data collection. The definition of outliers can be inconclusive. With no certain highest or lowest limitation for some variables (i.e., leverage ratio and hedge ratio), it's not that easy to screen out outliers. After most outliers were adjusted via several methods stated in chapter 3.5 to eliminate the bad outcomes, some other values that "seem" high were still kept since we had no reason to drop or recode them. Additional analysis for particular extreme value might need to be conducted to ensure the data efficiency and statistical accuracy.

Overall, we have learned a lot during this period and it is a good experience.

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## Appendices

### Appendix 1 Company names

No.	Company	No.	Company
1	Abraxas	52	Murphy
2	Altex	53	Newfield
3	Anadarko	54	Noble
4	Apache	55	Oakridge
5	Arabian	56	Occidental
6	Arete	57	Panhandle
7	Barnwell	58	Pdc
8	Berry	59	Penn Virginia
9	Blue Dolphin	60	Petroquest
10	BMB Munai	61	Pioneer
11	BP Prudhoe	62	Primeenergy
12	Cabot	63	Pyramid
13	Callon	64	Quicksilver
14	Carrizo	65	Range
15	Chesapeake	66	Reserve
16	Chevron	67	Rock
17	CKX	68	Royale
18	Williams	69	SM
19	Comstock	70	Southwest
20	Conocophilips	71	Spindletop
21	Contango	72	Standard
22	Forestar	73	Stone
23	Crimson	74	Sunoco
24	Daleco	75	Surge
25	Devon	76	Swift
26	Dorchester	77	Syntroleum
27	Double Eagle	78	Tengasco
28	Earthstone	79	Tesoro
29	Empire energy	80	Texas
30	Empire petroleum	81	Torch
31	Endevco	82	Trivalley
32	Enservco	83	Vaalco
33	EOG	84	Valero
34	EPL	85	Zaxa

35	Exxon	86	American
36	Fieldpoint	87	Brigham
37	Forest	88	Par
38	FX	89	Edge
39	Glenrose	90	Eurogas
40	Goodrich	91	Frontier
41	GSV	92	Georesources
42	Gulfport	93	Meridian
43	Harvest	94	Monument
44	Hess	95	Parallell
45	HKN	96	Petrohawk
46	Hollyfrontier	97	Platina
47	Isramco	98	Sonoran
48	Magellan	99	Txco
49	Marathon	100	Valor
50	Mcmoran	101	XTO
51	Mexco		

## Appendix 2 Logit model correlation matrix

Covariance Analysis: Ordinary  
Date: 05/29/16 Time: 18:43  
Sample: 2000 2008  
Included observations: 587  
Balanced sample (listwise missing value deletion)

Correlation Probability	INSTITUITIO...	LEVERAGE	LOGMTB	M_A	SIZE	TAX	HEDGE_PR...
INSTITUTIONAL_...	1.000000 ----						
LEVERAGE	0.228306 0.0000	1.000000 ----					
LOGMTB	-0.051198 0.2155	-0.091994 0.0258	1.000000 ----				
M_A	0.035805 0.3865	0.063535 0.1241	-0.030899 0.4549	1.000000 ----			
SIZE	-0.109025 0.0082	-0.060187 0.1453	0.091575 0.0265	0.017285 0.6760	1.000000 ----		
TAX	0.143714 0.0005	0.160695 0.0001	-0.010654 0.7967	0.034376 0.4058	-0.073981 0.0733	1.000000 ----	
HEDGE_PROB	0.458263 0.0000	0.250993 0.0000	0.013046 0.7525	0.154435 0.0002	-0.171452 0.0000	0.134126 0.0011	1.000000 ----

### Appendix 3 Tobit model correlation matrix

Covariance Analysis: Ordinary  
 Date: 05/29/16 Time: 18:44  
 Sample: 2000 2008  
 Included observations: 587  
 Balanced sample (listwise missing value deletion)

Correlation Probability	INSTITUITIO...	LEVERAGE	LOGMTB	M_A	SIZE	TAX	HEDGE_RA...
INSTITUTIONAL_...	1.000000 ----						
LEVERAGE	0.228306 0.0000	1.000000 ----					
LOGMTB	-0.051198 0.2155	-0.091994 0.0258	1.000000 ----				
M_A	0.035805 0.3865	0.063535 0.1241	-0.030899 0.4549	1.000000 ----			
SIZE	-0.109025 0.0082	-0.060187 0.1453	0.091575 0.0265	0.017285 0.6760	1.000000 ----		
TAX	0.143714 0.0005	0.160695 0.0001	-0.010654 0.7967	0.034376 0.4058	-0.073981 0.0733	1.000000 ----	
HEDGE_RATIO	0.109191 0.0081	0.046719 0.2584	0.053991 0.1915	0.034597 0.4028	-0.080800 0.0504	-0.002679 0.9483	1.000000 ----

### Appendix 4 Goodness fit test

Expectation-Prediction Evaluation for Binary Specification  
 Equation: UNTITLED  
 Date: 05/29/16 Time: 18:41  
 Success cutoff: C = 0.5

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
P(Dep=1)<=C	163	62	225	0	0	0
P(Dep=1)>C	41	321	362	204	383	587
Total	204	383	587	204	383	587
Correct	163	321	484	0	383	383
% Correct	79.90	83.81	82.45	0.00	100.00	65.25
% Incorrect	20.10	16.19	17.55	100.00	0.00	34.75
Total Gain*	79.90	-16.19	17.21			
Percent Gain**	79.90	NA	49.51			

	Estimated Equation			Constant Probability		
	Dep=0	Dep=1	Total	Dep=0	Dep=1	Total
E(# of Dep=0)	128.15	75.85	204.00	70.90	133.10	204.00
E(# of Dep=1)	75.85	307.15	383.00	133.10	249.90	383.00
Total	204.00	383.00	587.00	204.00	383.00	587.00
Correct	128.15	307.15	435.30	70.90	249.90	320.79
% Correct	62.82	80.20	74.16	34.75	65.25	54.65
% Incorrect	37.18	19.80	25.84	65.25	34.75	45.35
Total Gain*	28.07	14.95	19.51			
Percent Gain**	43.02	43.02	43.02			

\*Change in "% Correct" from default (constant probability) specification  
 \*\*Percent of incorrect (default) prediction corrected by equation