The Joint Impact of Industry Structure And Financial Distress On Corporate Risk Management: An Empirical Analysis

Qian Liu

A Thesis

In

The Department

of Finance

Presented in Partial Fulfillment of the Requirements

for the Degree of Master of Science (Finance) at

Concordia University

Montreal, Quebec, Canada

March 2017

CONCORDIA UNIVERSITY

School of Graduate Studies

This is to certify that the thesis prepared

By: Qian Liu

Entitled: The Joint Impact of Industry Structure And Financial Distress On Corporate Risk Management: An Empirical Analysis

and submitted in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE IN ADMINISTRATION

OPTION FINANCE

complies with the regulations of this University and meets the accepted standards with respect to originality and quality.

Signed by the final examining committee:

______________________________________ Chair

Dr. Ulrike de Brentani

______________________________________ Examiner

Dr. Sergey Isaenko

______________________________________ Examiner

Dr. David Newton

______________________________________ Thesis Supervisor

Dr. Latha Shanker

Approved by: ______________________________________

Graduate Program Director

___March 22___2017 ______________________________________

Dean of School

ABSTRACT

The Joint Impact of Industry Structure And Financial Distress On Corporate Risk Management: An Empirical Analysis

Qian Liu

While in risk management literature, there are many studies indicating that industry structure and financial distress have effects on corporate hedging behavior individually, their joint impact, however, has never been examined. This thesis presents the first-ever empirical research investigating the joint influence of industry structure and financial distress costs upon corporate risk management by examining 396 companies in the U.S. manufacturing industries with 2-digit SIC codes from 20 to 39 over the period from 2010 to 2015. According to their financial status and the measurement of industry structure, the 396 companies are divided into 4 groups: financially unconstrained-competitive industry, financially constrained-competitive industry, financially unconstrained-concentrated industry, and financially constrained-concentrated industry. The results suggest that industry structure and financial distress have a significant combined effect only on the financially constrained companies in competitive manufacturing industries.

ACKNOWLEDGEMENT

I would like to acknowledge and to thank the people who have helped me finish my thesis.

First, I want to express my deepest and sincerest gratitude to my thesis supervisor, Dr. Latha Shanker. Her mental encouragement, professional guidance, constant enlightenment, and incredible patience have helped me greatly with the development of my thesis, and because of her unique insights and helpful suggestions, I have managed to overcome all the difficulties that I encountered at every stage of my thesis.

Second, I would also like to show my deepest appreciation to the thesis committee members: Dr. David Newton and Dr. Sergey Isaenko. Their expertise and enthusiasm not only have contributed to the completion of the thesis, but also have inspired me during the whole master program.

Last but not least, I also owe the greatest gratitude to my beloved family. Their support and love are what drives me always to study harder.

Table of Contents

List of Tables

1. Introduction

In the current literature of risk management theory, theorists have provided possible answers to the hedging incentives of companies. Well-known predictive models explain that companies hedging decisions are motivated by reduction of expected taxes, reduction of financial distress costs, and risk aversion of management. These factors, however, are all firm-specific, that is, characteristics of individual firms in an industry.

Recently, there is a growing awareness that corporate hedging behavior could possibly be connected with the degree of industry competition. In a monopolistic industry, as for example, the utility industry, companies would lack incentives to hedge because any cost of risks to which the companies are exposed could be passed on to customers, so that customers bear the cost shocks instead of the companies themselves. Alternatively, in a fully competitive industry, hedging not only could be motivated by firm-specific factors, but also could be driven by the hedging behavior of the other competitors faced by the company. For instance, all firms that buy raw materials overseas and sell products to domestic customers face foreign exchange risk, and the output price in the industry reflects this common risk exposure. If the majority of the companies hedge this risk, the output price will not fluctuate. A non-hedging company is exposed to the risk but will not be compensated by increasing the selling price and letting customers absorb the cost because the output price is stable due to the hedging conducted by the other companies. Conversely, if most companies in an industry do not hedge, then the final selling price could co-vary with the cost shock so that the profit margin of those companies is unaffected. It is then unnecessary for an individual company in the same industry to hedge because the possible increase in costs is offset by the increase in selling price.

The traditional explanatory models seem to play a less important role in the preceding example, and it shows that it is unwise to hedge without considering market conditions. This is considered as the "market side" of corporate risk management. There is a growing but limited number of papers that have studied this. My thesis analyses the effect of industry competition upon risk management and thus contributes to the risk management literature on this topic.

By examining the United States manufacturing industries with 2-digit SIC codes from 20 to 39, this thesis focuses on the joint impact of industry structure and financial distress costs upon corporate hedging behaviors. The sample companies could be divided into four groups, based on their leverage ratios and the values of Herfindahl-Hirschman Index: financially unconstrained companies in competitive industries, financially constrained companies in competitive industries, financially unconstrained companies in concentrated industries, and financially constrained companies in concentrated industries. As it is shown in later sections, the empirical results indicate that industry structure and financial distress costs have significant joint impact only on financially constrained companies in competitive manufacturing industries.

2. Literature Review of Corporate Risk Management

A. Theoretical Research

A large number of previous papers on corporate risk management focus on why companies hedge. Although the Modigliani-Miller paradigm implies no relationship between risk management and firm value, Smith and Stulz (1985) note that when hedging costs are low or negligible, the risk management of firms that tend to maximize firm-value could be most likely motivated by three factors: taxes, financial distress, which is costly to firms, and managerial risk aversion that represents a concave expected utility function of managers. However, they also point out that whether companies hedge or not also depends on hedging costs. Companies can benefit from hedging if hedging costs do not exceed the benefits or if transactions costs are negligible. Otherwise, companies may not hedge at all.

Mayers and Smith (1982) find that the purchase of insurance contracts, which serves as another tool of hedging, could also lower corporate tax liability and bankruptcy costs. Additionally, they argue that the insurance coverage required by debt covenants cause companies to engage in investment projects with low risk and positive net present value, thus helping to increase firm value and protecting the debt-holders. Lessard (1991) argues that hedging increases firm values by reducing the variability in internal cash flows, thus reducing the fluctuation in external financing needed and in potential promising investment opportunities. Froot, Scharfstein, and Stein (1993) show that the construct of an optimal hedging strategy depends on the correlation between corporate cash flows and future available investments and usable external funds, and that options prove to be more effective hedging instruments than futures and forward contracts. Using an information asymmetry model, Breeden and Viswanathan (1998) suggest that hedging highlights a critical difference between managers with higher abilities and those with lower abilities, and that it is used by more capable managers to bring more stable and higher profits to firms. Leland (1998) theorizes that larger costs of bankruptcy caused by default on debts magnify greater hedging benefits, while hedging benefits are negatively related to agency costs caused by asset substitutions, that is, lower agency costs usually induce greater hedging benefits. Table 1 summarizes the viewpoints existing in the current theoretical literature on risk management.

Table 1. Summary of Theories of Corporate Risk Management

Authors	Factors Affecting Corporate Hedging Incentives	Explanations
Smith and Stulz (1985)	taxes	Hedging could reduce tax burden of companies, and thus increase firm value
	financial distress costs	Financial distress is costly for companies, possible negative outcomes could be bad credit ratings, bankruptcy costs, less favorable credit from suppliers, and so on. Hedging could relieve companies of these costs
	managerial risk aversion	If managers are risk averse, the maximization of their utility functions require that they bear no risk unless there is an extra reward for doing so
	hedging costs	Companies hedge when hedging costs do not exceed hedging benefits, otherwise, hedging may not be used.
Mayers and Smith (1982)	insurance contracts	Compulsory debt covenants cause companies to engage in certain low risk investment projects
		The purchase of insurance policies could reduce bankruptcy costs and expected tax liability
Froot, Scharfstein, and Stein (1993) Lessard (1991)	corporate internal funds	Hedging could make companies' internal funds less variable, inducing a lesser extent to which companies rely on external funds, especially when external funds are costly
Breeden and Viswanathan (1998)	managers' professional abilities	Hedging is used by more capable managers to produce high profits and strengthen their reputations, while less capable managers are unable to realize benefits from hedging.
Leland (1998)	bankruptcy costs	Larger costs of bankruptcy caused by default on debts give companies stronger incentive to take advantage of hedging
	agency costs	Lower agency costs caused by asset substitutions make hedging benefits greater

B. Empirical Literature

Petersen and Thiagarajan (2000) examine two companies in the gold industry, of which one aggressively hedges, while the other that does not hedge at all. Their conclusions are consistent with the predictions of the theoretical literature. Why companies hedge and the heterogeneity in their hedging strategies may be attributed to their different abilities to adjust operating cash flows when in the gold price increases; to the demands for investment capital when the gold price changes; and to managerial incentives, i.e., whether the compensation of managers is based on the firm's market value or on profit. Mian (1996) obtains evidence that contrasts with the predictions made by financial distress models of hedging, and mixed results from the viewpoint of taxes, external funding costs, and contracting costs. By studying the North American gold mining industry, Tufano (1996) finds evidence supporting the theory of managerial risk aversion, under which managers who own more of the companies' stock tend to manage risks more, while the theories of shareholder wealth maximization are unsupported. Nance, Smith, and Smithson (1993), however, present results that match the predictions of the theoretical literature, that is, companies that choose to hedge indeed have convex tax functions, depend less on external funds, and have better abilities to take advantage of potential investment opportunities.

C. Literature Review: The "Market Dimension" of Risk Management

Compared with the traditional risk management literature, theoretical papers and empirical ones on corporate hedging motives under the impact of market structure are few in number.

C.1 Current Developed Theories On Market Structure and Risk Management

By examining the hedging incentives of non-financial companies within an equilibrium setting, Adam, Dasgupta, and Titman (2007) not only state that the heterogeneity in corporate risk management could be explained by the number of companies in an industry, demand elasticity, and the convexity of production costs, but explain how the hedging decisions of firms could depend on those of their competitors. In their paper, the industrial equilibrium price is considered to be a function of the aggregate of investment and hedging decisions. Firms could gain more from additional investment if the other firms in the same industry invest less, implying that this fact could motivate firms to hedge in order to have more funds available when other firms are financially constrained. In other words, the risk management incentive of companies increases if their competitors choose not to hedge. By following their models, the authors also predict that the more competitive the markets are, the more heterogeneity remains in corporate hedging decisions.

Mello and Ruckes (2005) investigate corporate hedging behavior by building a duopoly model in which external financing is expensive. First, they suggest that hedging has two unique effects: one is to stabilize corporate internal funds, which has been discussed much in the previous literature, while the other is characterized as being "strategic". A company having more than enough internal funds can "prey" on those companies that are financially constrained by using an aggressive product market strategy, implying that the company is exposed to certain risks. If the strategy works, a potential increase in market share could be achieved, and this in turn strengthens the company's future financial position. Thus, in the case of strategic hedging, it is not the most ideal to implement a complete hedge. Second, they conclude that oligopolistic firms tend to hedge less when their financial situations are similar to those of their competitors. In addition, they present several testable implications of this topic from their models: (1) the more aggressively their competitors behave in business, the less hedging the oligopolistic companies use, implying that these companies face greater exposure. This behavior is consistent with the empirical findings of Williamson (2001). As Mello and Ruckes (2005) explained, one single company's exposures depend on those of other companies, and it is not optimal to completely hedge. The hedging strategies of its rivals should be considered when a company makes its own hedging decisions; (2) if their final output products are more homogeneous, meaning more product substitutes, the oligopolistic companies hedge less; (3) within oligopolistic industries in which higher operating leverage exists, the companies tend to hedge less; (4) oligopolistic companies hedge less if external financing is less costly.

C.2 Empirical Research On Market Structure and Risk Management

Unlike the empirical studies of risk management theories that found mixed results, a high degree of uniformity is exhibited by results of empirical studies on the relationship between industrial structure and hedging. The results indicate that corporate hedging strategies are interdependent within industries.

C.2.1 Supporting Evidence For The Market Structure Factor

The impact of the competitive market structure on risk exposures was originally analyzed by Campa and Goldberg (1995). The market structure is measured by the price-over-cost markup[1] and risk exposure is captured by the pass-through effect of exchange rate changes on corporate investments: the exchange rate exposure is reflected in the profitability of companies, which in turn affects companies' future investment decisions. The empirical results show that in durable goods sectors with stable markups, the pass-through effect is highly significant while in sectors of non-durable goods with variable markups, no significant effect is found. Thus, they argue that the industrial structure could be related to corporate hedging responses.

Allayannis and Ihrig (2001) create a theoretical model in which companies import from foreign companies in order to make their final products and then sell them overseas and domestically. They identify three factors which impact exchange rate risk exposures, and empirically test the model predictions. The three factors are: (1) the competitive structure of the output markets; (2) the combined interaction of the competitive structure of the export market and the export share; (3) the combined interaction of the competitive structure of the import market and the import share. With the price-over-cost markup as the proxy for

[1] the price-over-cost markup is expressed as: $\frac{\text{values of sales} + \Delta\text{inventories} - \text{payroll} - \text{material costs}}{\text{values of sales} + \Delta\text{inventories}}$

industrial competitiveness and a sample of U.S. manufacturing companies, the empirical evidence from the data matches the prediction: In low markup industries (competitive industries), companies' stock returns exhibit large exchange rate exposures, which could cause companies to hedge; in high markup industries (oligopolistic ones), the opposite situation holds.

Allayannis and Weston (1999) and Adam and Nain (2013) both conclude that the industrial structure is an important factor affecting the extent to which companies hedge within the industries. Allayannis and Weston (1999) conduct an empirical research on the interaction between the industry structure and corporate hedging behaviors by studying the usage of currency derivatives of 916 large U.S. companies from 1994 to 1995. They conclude that companies in more competitive industries are more likely to use currency hedging, while the situation is the opposite in more oligopolistic industries because the risk exposure costs could be passed on through pricing power. With the data on the usage of foreign currency derivatives of US firms, Adam and Nain (2013) find a negative correlation between the number of companies hedging foreign currency risks and the degree of competition. They wrote: "When competition is strong firms may refrain from hedging their FX risks in order to gain a strategic advantage when prices move in their favor", which is consistent with the strategic hedging motives proposed by Mello and Ruckes (2005).

C.2.2 Supporting Evidence For The Interdependence Among Corporate Hedging Strategies

The empirical results of Nain (2004) on the currency hedging of US publicly held firms indicate that the firm value of those companies which remain unhedged falls when the majority of their competitors choose to hedge currency exposure, and that the interdependence between the hedging behavior of competitors in the same industry provides more explanatory power for corporate hedging behavior than the firm-specific characteristics addressed by the earlier literature. This is consistent with the viewpoint of Adam, Dasgupta, and Titman (2007) that the output price is sensitive to the aggregate of industrial hedging.

Besides the findings mentioned in the previous section, Adam and Nain (2013) reach a similar conclusion, that the foreign exchange risk exposure decreases if the company follows hedging strategies similar to those of the majority of its competitors, while this exposure increases if the company acts differently.

3. Research Hypotheses

The risk management literature confirms that the market structure and the probability of financial distress are factors which affect the hedging decisions of companies, but these two factors are examined individually. Therefore, it gives rise to the following two questions: (1) Could companies act differently in theory when the two factors are studied together, or could there exist a combined impact of the two factors on corporate hedging behavior? (2) If so, do the empirical results match the theoretical predictions?

As for the first question, answers are offered in the current literature. Based on the work of Adam, Dasgupta, and Titman (2007) and Mello and Ruckes (2005), the combined effect of the two factors on corporate hedging behavior is presented in Table 2.

Based on the previous theoretical predictions in section C, there are the following 4 hypotheses:

Hypothesis 1: in competitive industries, financially unconstrained firms have strong incentives to hedge.

Hypothesis 2: in competitive industries, financially constrained firms are motivated to remain unhedged.

Hypothesis 3: in imperfectly competitive industries, financially unconstrained firms tend to hedge less.

Hypothesis 4: in imperfectly competitive industries, financially constrained firms are driven to hedge incompletely if the costs of raising funds externally are small.

Table 2. Research Hypotheses Summary

This table summarizes the research hypotheses of this thesis. There are 4 possible combinations of the two factors: high degree of competition-financially unconstrained, high degree of competition-financially constrained, high degree of concentration-financially unconstrained, and high degree of concentration-financially constrained, and they represent state 1, state 2, state 3, and state 4, respectively.

In state 1, according to Adam, Dasgupta, and Titman (2007), the equilibrium market price is a function of the aggregate of investment and hedging decisions. When firms experience shortfall of cash flows, they will invest less. This condition makes financially unconstrained companies gain more benefits from additional investment. Thus, financially unconstrained companies will be motivated to hedge in order to have stable cash flows to take advantage of this situation.

In state 2, with the presence of unconstrained firms that invest more, the industrial equilibrium price is made less sensitive to cash flow shocks, which implies that constrained firms face less exposure. So, a stronger incentive is given to constrained firms to remain unhedged. The two states again show that a more competitive structure makes corporate hedging moves interdependent.

According to Mello and Ruckes (2005), in imperfectly competitive industries, companies with rich internal funds tend to hedge less in order to gain a financial advantage over those financially constrained companies, which is the "strategic" case of hedging and is state 3.

Also, they predict that the firms will hedge less if the costs of financing externally are small, or if the companies tend to hedge less within imperfectly competitive industries where higher operating leverage exists. A higher operating leverage is most likely to cause financial distress. So, the two cases match the situation of state 4.

		Financial Situation	
		Financially Unconstrained	Financially Constrained
Market Structure	High Degree of Competition	*Hedge*	*Do Not Hedge*
	High Degree of Concentration	*Hedge Less*	*Hedge Less*

4. Data Description

The sample is composed of publicly traded U.S. manufacturing companies with Standard Industrial Classification (SIC) codes ranging from 20 to 39 that are exposed to foreign exchange risk. The final sample contains 396 companies with no missing annual fiscal-year financial data in COMPUSTAT from 2010 to 2015, after excluding those with missing data in COMPUSTAT and those with no foreign exchange risk exposure. The total fiscal-year observations of the data sample are 2376.

Statement of Financial Accounting Standards (SFAS) 119 and SFAS 133 published by the Financial Accounting Standards Board (FASB) require that companies disclose whether they use derivatives for hedging purposes or for trading purposes. Therefore, data on foreign currency derivatives used only for trading purposes such as futures, forwards, options, and swaps are hand-collected from the 10-K filings of the companies in the EDGAR database

Data for all the financial ratios that are used to measure the variables in the shareholder wealth maximization models are obtained from the COMPUSTAT database, and data on the variables used to proxy managerial incentives are collected from ExecuComp.

To measure the concentration of an industry, I use the Herfindahl-Hirschman Index (HHI), whose estimation is detailed in sub-section 5.2.2 that follows. Data on the HHI for each industry for the year 2012 are obtained from the official website of the United States Bureau of the Census, which is required by the U.S. Constitution to regularly conduct a population and economic census every 5 years.

Table A.2 in Appendix A displays an example of the data that I collected. The table reports the data over the period from 2010 to 2015 on one company: Conagra Foods(Ticker Symbol: CAG).

5. Research Methodology

The first step is to address the company’s decision to hedge or not. To estimate the probability that a company hedges its exposure, I follow the model of Géczy, Minton, and Schrand (1997). The model is a logit regression model, and there are two sets of factors that affect corporate hedging decisions: (1) the combined impact of the industrial structure and the financial situation on selected companies; (2) the earlier predicted incentives for companies to hedge, which are the control variables in the model.

The next question that is addressed, is, if a company is motivated to hedge, how much will it hedge? In order to estimate how companies adjust their degree of hedging, both an ordinary least squares regression (OLS) and a 2 stage least squares regression (2SLS) are conducted. A 2SLS approach is used in order to address the possible endogenous relationship between the magnitude of hedging and the corporate financial situation.

5.1 The Models

5.1.1 Model of The Hedging Decision

First, a logit regression model is run to examine the interactive effect of the industrial structure and the corporate financial situation on the probability that companies choose to hedge. The description of the model is presented as the following:

$$HEDGE_i = \frac{\exp[\beta_0 + \beta_1(\frac{HHI_m}{FS_i}) + \sum_{n=1}^{N}\beta_n X_n]}{1 + \exp[\beta_0 + \beta_1(\frac{HHI_m}{FS_i}) + \sum_{n=1}^{N}\beta_n X_n]} + \varepsilon_i \qquad (1)$$

Where *exp* stands for the exponential function, and $HEDGE_i$ is the binary dependent variable, which indicates whether the i^{th} company in the m^{th} industry chooses to hedge or not. $HEDGE_i$ is equal to one if the i^{th} company utilizes foreign currency derivatives such as forwards, futures, and options, and is equal to zero otherwise. $\frac{HHI_m}{FS_i}$ is a variable which incorporates the interaction between competition and financial distress, where HHI_m is an estimate of the degree of competition in the m^{th} industry, and FS_i is an estimate of whether or not the i^{th} company in the m^{th} industry is in financial distress.

The remaining terms in the model are the N number of control variables that measure the earlier corporate hedging incentives offered in the previous research, and the error term. Definitions of the variables are provided in section 5.2.

5.1.2 Models of The Degree of Hedging

Secondly, an OLS regression and a 2SLS regression are run to determine the relationship between the magnitude of hedging and the combined impact of the industry structure and the financial situation, the latter since the degree of hedging and the financial situation could be endogenous. While previous theoretical studies suggest that financial distress costs could motivate companies to hedge, empirical studies have investigated if the extent of hedging in a company in turn could influence its financial situation. The results, however, are mixed. By implementing the instrumental variable approach, Magee (2013) concludes that the extent of hedging, which is estimated by the usage of foreign currency derivatives, and the probability of financial distress, which is proxied by the leverage ratio, are endogenous because the more a company hedges its foreign currency risk, the less likely a company is found to experience financial constraints. In contrast, by studying the hotel industry, Tang and Jang (2009) test the endogeneity of the degree of hedging and leverage by implementing the Durbin-Wu-Hausman (DWH) test and do not find evidence supportive of endogeneity of these variables.

If the degree to which a company hedges and financial distress are not endogenous, an OLS regression model is appropriate. A model that is employed is the following:

$$INCHEDGE_i = \beta_0 + \beta_1(\frac{HHI_m}{FS_i}) + \sum_{n=1}^{N} \beta_n X_n + \varepsilon_i \qquad (2)$$

Where $INCHEDGE_i$ is the dependent variable measuring the degree of hedging of the i^{th} company in the m^{th} industry, and $\frac{HHI_m}{FS_i}$ is the interactive variable, which proxies for the interaction between competition and financial distress. The third term represents the N number of control variables that are explained in detail in section 5.2.3. The last term in the equation is the error term.

Regarding the 2SLS regression used to address the possible endogeneity effect, I follow the 2SLS model of Tang and Jang (2009), which has the following form:

$$FS_i = \alpha_0 + \alpha_1 FIX + \alpha_2 GW + \alpha_3 EVOL + \alpha_4 CASH + \alpha_5 ROA + \varepsilon_i \qquad (3)$$

$$INCHEDGE_i = \beta_0 + \beta_1(\frac{HHI_m}{\hat{FS}_i}) + \sum_{n=1}^{N} \beta_n X_n + \varepsilon_i \qquad (4)$$

Where the equation (3) is a regression equation of the variable FS_i on the instruments of FS_i. According to Tang and Jang (2009), whether a firm is financially constrained could be estimated by the following factors:

(1) The amount of fixed assets. This factor is estimated by the variable *FIX*, and *FIX* is defined as the ratio of total property, plant and equipment (PP&E) to total assets. Tang and Jang (2009) states that companies with a high level of property, plant and equipment use more long-term debt to finance fixed assets, so the effect of this variable on the dependent variable is expected to be positive.

(2) Growth opportunities. This factor is estimated by the variable *GW*, and *GW* is defined as the market-to-book ratio (MB ratio). According to Tang and Jang (2009), future earnings reflect a company's growth opportunities. Because the market value indicates both the net worth of a company and its future earnings, the MB ratio serves as the "current expectation of the company's future growth opportunities to the book value." In addition, Tang and Jang (2009) also argue that companies with good growth opportunities tend to maintain a lower level of liabilities because a high degree of liabilities not only transfer more control to creditors, who could force companies to reject potentially profitable investment projects, but also causes more debt payment that drains companies' internal funds. So the impact of this variable is expected to be negative.

(3) Earnings volatility. This factor is estimated by the variable *EVOL*, and *EVOL* at time *t* is defined as the standard deviation of earnings before interest and taxes (EBIT) during a 5-year-period prior to the time *t*. Intuitively, a higher volatility of earnings induces

expectations of greater uncertainty, and greater uncertainty further induces a high probability of financial distress. Thus, the impact of this variable should be negative.

(4) Agency costs. This factor is estimated by the variable *CASH*, and *CASH* is defined as the ratio of total cash flow to total assets. Tang and Jang (2009) suggest that when obtaining enough free cash flow, a conflict of interest exists between management and shareholders over what sort of dividend policy should be executed. In order to minimize the potential agency costs, shareholders will make outside creditors such as banks more involved in the business by absorbing more debt, so these institutions will help monitor management behavior. Thus, this variable is predicted to have a positive effect on the usage of debt.

(5) Profitability. This factor is estimated by the variable *ROA*, and *ROA* is defined as the return on assets. *ROA* is expressed as the ratio of net income to total assets. Tang and Jang (2009) expects this variable to have a negative effect because companies with higher profitability have more internal funds, so it is less necessary for them to rely on external financing such as debt. Table 3 presents the summary of the definitions of the independent variables used to conduct the analysis of equation 3.

In order to conduct two stage least squares regression, the first step is to estimate the first stage equation (3). Using the annual leverage ratio data of all 396 companies over the period 2010 to 2015, FS_i is regressed on the exogenous variables *FIX*, *GW*, *EVOL*, *CASH*, and *ROA*, and thus the fitted values of the the independent variable FS_i are obtained for each firm from 2010 to 2015. The next and also the final step is to run the second stage regression equation (4), with the fitted values of $\hat{FS_i}$ in place of the independent variable FS_i. The equation (4) is composed of two parts: the part of exogenous variables including the joint impact variable $\frac{HHI_m}{\hat{FS_i}}$ and the control variables that are uncorrelated with the random error terms, and the second part is random error terms. The next section presents a detailed definition for the dependent variables, the combined variable, and the control variables in equations (1) through (4).

Table 3. Summary Of Variables Used In Regression Equation 3

This table summarizes the descriptions of the variables in equation 3. The Variable column shows each independent variable. The “Symbol” column presents their symbols in the regression. The Measurement column shows how these variables are estimated, and the last column shows the expected signs of their coefficients in the regression equation. "+" means a positive sign and "—" means a negative sign.

Variable	Symbol	Measurement	Expected Sign of Coefficient
Fixed assets	*FIX*	PP&E / total assets	+
Growth opportunities	*GW*	Firm's market value / firm's book value	—
Earnings volatility	*EVOL*	Standard deviation of EBIT	—
Agency costs	*CASH*	Total cash flow / total assets	+
Profitability	*ROA*	Net income / total assets	—

5.2 The Model Variables

5.2.1 The Dependent Variable

The dependent variable *HEDGE* in equation (1) is a binary 0-1 variable constructed to measure the hedging decisions made by the companies. Specifically, the variable is equal to one if companies utilize foreign currency derivatives such as forwards, futures, and options, and is equal to zero otherwise. The use of foreign currency derivatives is a good proxy for the hedging decision because not only is it considered representative in terms of corporate hedging strategies, but also foreign exchange risk is a common risk faced by both multinational companies and domestic companies in the context of globalization.

The dependent variable *INCHEDGE* in equations (2) and (4) represents the degree of hedging by a company. This variable is estimated by the ratio of the notional value of foreign currency derivatives to total assets for each individual company.

5.2.2 The Combined Impact Variable

The interactive variable, $\frac{HHI_m}{FS_i}$, is composed of two elements: the degree of market competition (*HHI*) and the financial situation of each individual firm (*FS*).

First, the degree of competitiveness or concentration within an industry is measured by the Herfindahl-Hirschman Index:

$$HHI = \sum_{i=1}^{N} MS_i^2$$

Where N stands for the total number of companies in an industry, and MS_i refers to the market share of company i. A general rule used to classify industrial structure is: if the HHI of an industry is less than 1500, then this industry is considered to have a competitive industrial structure; if the HHI ranges from 1500 to 2500, this implies an industry with moderate concentration; if the HHI is higher than 2500, this indicates a highly concentrated industry.

Second, whether a company is financially constrained or not is measured by the leverage ratio. It is expressed as the ratio of total liabilities to total assets, and it measures both the company's degree of debt financing and its capacity to meet financial obligations. The higher this ratio, the more likely a company will be financially constrained.

A financially constrained firm in a competitive industry would have a low value for this variable; a financially unconstrained firm in a concentrated industry would have a high value for this variable.

5.2.3 The Control Variables

This section presents the control variables that proxy for the factors affecting corporate hedging. In Géczy, Minton, and Schrand (1997), the following control variables are used: taxes, expected utility of management, agency cost, internal funds, substitutes for hedging, and firm size. Another specific factor having an impact on currency derivatives use is the foreign exchange risk exposure. Companies facing higher foreign exchange risk exposure are more likely to use foreign currency derivatives.

As indicated in Smith and Stulz (1985), hedging will benefit companies by reducing their expected tax burden. The tax incentive is measured by the variable *TAX,* the ratio of the book value of tax-loss carry forwards to total assets.

In terms of the expected utility of management, there are two cases that would induce totally different hedging behavior. If managers directly hold the shares of their companies as wealth, then they tend to hedge in order to reduce the volatility of the firm value because they are compensated based on the performance of the companies. However, if managers hold stock options instead, they will benefit more by increasing the volatility of the companies' market values. Therefore, to measure the situation where managers hold stock, the variable *MASHAR* is constructed that measures the percentage of shares held by CEOs to the total outstanding shares. The situation of CEOs holding stock options is examined by building a variable *MAOPTI* where the market value of the shares that could be gained by exercising the stock options held by CEOs is divided by the market value of the companies.

How the agency cost is reduced by hedging is well illustrated by the under-investment problem. Hedging mitigates this problem by helping companies choose the optimal set of investment projects. To proxy for the agency cost (under-investment), the variable *AGCY* is created that calculates the ratio of research and development (R&D) expenses to total corporate sales.

The effect of internal funds on hedging decisions is estimated by employing the quick ratio (*QUICK*). The quick ratio indicates companies' ability to cover short-term liabilities, and its detailed calculation is presented in Table 4.

Companies could use other tools to reach the same effect derived from hedging. These tools, or the substitutes for hedging are convertible bonds and preferred stocks, as suggested by Géczy, Minton, and Schrand (1997). This thesis follows their logic by using the variable *SUB*, which is the ratio of the sum of the book value of convertible bonds and preferred stocks to total assets.

Finally, hedging could be costly and greater foreign exchange risk exposure makes it more likely that companies will use currency derivatives. Géczy, Minton, and Schrand (1997) argue that the cost of hedging programs exhibits economies of scale. The larger the company is, the more likely it will hedge because it can make good use of the economies of scale. Thus, this hedging cost factor is estimated by the firm size variable *SIZE*, which is the logarithm of the value of total assets. Furthermore, foreign exchange exposure is estimated by the variable *FOEX* that is equal to the ratio of a firm's pretax foreign net income to its total sales. Table 4 summarizes the variables discussed above.

Table 4. Variable Definitions

Dependent Variables			
Model Variables	Symbol	Estimator	Data Source
Hedging decisions	*HEDGE*	Dummy variable	10K filings of companies from EDGAR
Degree of hedging	*INCHEDGE*	Notional amount of foreign currency derivatives / total assets	10K filings of companies from EDGAR
The Combined Impact Variable			
Model Variables	Symbol	Estimator	Data Source
The combined impact variable	$\frac{HHI_m}{FS_i}$	Herfindahl-Hirschman Index and leverage ratio respectively	U.S. Bureau of Census COMPUSTAT
The Control Variables			
Model Variables	Symbol	Estimator	Data Source
Taxes	*TAX*	tax-loss carryforwards / total assets	COMPUSTAT database
Managerial incentives	*MASHAR*	shares held by CEOs / total shares	ExecuComp
	MAOPTI	market value of the underlying shares of stock options / the market value of the companies	ExecuComp
Agency cost	*AGCY*	R&D expenses / total sales	COMPUSTAT database
Internal funds	*QUICK*	(cash and cash equivalents + marketable securities + accounts receivable) / total liabilities	COMPUSTAT database
Substitutes for hedging	*SUB*	(convertible bonds + preferred stock) / total assets	COMPUSTAT database
Firm size	*SIZE*	log(total assets)	COMPUSTAT database
Foreign exchange exposure	*FOEX*	pretax foreign net income / total sales	COMPUSTAT database

6. Empirical Results

6.1 Empirical Results of Univariate Tests

The original sample in this paper includes publicly traded companies from the U.S. manufacturing industries classified with Standard Industrial Classification (SIC) codes from 20 to 39. Some of the companies are removed from the list because they are not exposed to foreign currency risk or have risk that the management considers is very immaterial, and some firms are also deleted due to incomplete or missing data on COMPUSTAT. After the data screening, the sample consists of 396 companies and the total number of annual data observations is 2376 in the time span of 6 years from 2010 to 2015. Table A.1 in Appendix A reports information on the manufacturing industries and the companies that form the final data sample.

Table 5 presents the summary statistics on the sample such as the mean, median, and standard deviation of the variables used in the analysis. Among all of the companies in the manufacturing industries, 158 firms decided to hedge against foreign currency risk. In terms of the degree of hedging (the ratio of the notional amount of foreign currency derivatives to total assets), the mean, the median, and the standard deviation for those using foreign currency derivatives (approximately 40%) are 0.23, 0.12, and 1.62 respectively. In addition, the mean and the median of the Herfindahl Index HHI for the U.S. manufacturing industries are 838.62 and 617.10, implying that the industrial structure is competitive. On average, the companies face financial distress, because the leverage ratio that constructs the variable *Financial Distress* has a mean value of 0.53, implying both a size of debt of over 50% of total assets and a risk level of debt. The mean of -0.05 of the variable, *ROA*, further shows that the companies are financially constrained because this variable reflects the profitability of a company. The results of Table 5 seem to support Hypothesis 2 because on average, the companies are financially constrained and the majority of them (60%) decided not to hedge foreign currency risk.

From the descriptive statistics sorted by 2-digit SIC codes in table 6, it appears that some empirical evidence could be found to support the four research hypotheses. On one hand, for firms in the competitive industries with 2-digit SIC codes of 20, 34, and 39, the mean values of the leverage ratio are 0.21, 0.27, and 0.14 respectively and more than 60% of the sample companies decided to hedge against fluctuations in foreign currency (67%, 82% and 83%). The industries with 2-digit SIC codes of 22, 24, 27, 29, 35, 37, and 38 have HHI values less than 1500, but companies in those industries, on average, experience financial distress (the mean values of the leverage ratio are over or equal to 50%), and non-hedgers outnumber hedgers in the sample. On the other hand, industries with 2-digit SIC codes of 21, 25, 26, 28, 30, 33, and 36 are concentrated industries with HHI values more than 1500. The firms in industries with 2-digit SIC codes 28 and 36 have relatively better financial performance, with mean values of the leverage ratio of 19% and 11%. For hedgers in concentrated industries, the notional amount of derivatives does not play an important role in the total assets of those companies. For example, the highest mean value of the degree of hedging for financially constrained companies is 6.17%, while for companies which have better financial performance, the averages of their degree of hedging are only 4.11% and 6.50%.

Table 5. Summary of Descriptive Statistics

This table shows the summary of descriptive statistics (mean, median, and standard deviation) for the whole data sample. "Hedging Behavior" and "Firm Characteristics" indicate the number of companies that hedge and the notional amount of derivatives utilized to hedge foreign currency risk, and the key elements reflecting a company's financial status, respectively. Those elements are collected from the COMPUSTAT database, and the unit of measurement is million shares for "Total Shares Issued" and million dollars for the rest. The symbol "$" refers to the U.S. dollar. The whole sample includes 396 companies, and the sample covers the time period of 6 years from 2010 to 2015, both inclusive.

Hedging Behavior	**Number of companies**	**Number of Hedgers**	**Percentage**
Hedging Decision	396	158	39.9%
	Mean	**Median**	**Standard Deviation**
Degree of Hedging	0.23	0.12	1.62
Firm Characteristics	**Mean**	**Median**	**Standard Deviation**
Total Assets ($)	7346.96	890.32	30321.17
Total Liabilities ($)	4535.00	399.79	19786.49
The Market Value of Companies ($)	6336.14	1064.04	21384.32
Total Sales ($)	5514.34	855.91	21743.29
Total Shares Issued	161.48	57.80	411.44
EBIT ($)	592.64	72.10	2334.67
Firm's Book Value ($)	3144.04	459.72	13822.17
The Combined Impact Variable	**Mean**	**Median**	**Standard Deviation**
Herfindahl-Hirschman Index (HHI)	838.62	617.10	801.14
Financial Distress (FS)	0.53	0.48	0.55
HHI/FS	2285.26	1520.10	2997.91
The Control Variables	**Mean**	**Median**	**Standard Deviation**
TAX	1.58	0.09	7.20

MASHAR	0.14	0.10	1.48
MAOPTI	0.08	0.01	0.14
AGCY	0.07	0.04	45.19
QUICK	1.10	0.31	2.20
SUB	0.03	0.01	0.32
SIZE	6.66	6.79	2.36
FOEX	0.71	0.02	63.53
Variables In Regression Equation 3	**Mean**	**Median**	**Standard Deviation**
FIX	0.44	0.35	0.32
GW	1.80	2.03	114.56
EVOL	0.21	0.09	0.57
CASH	0.22	0.15	0.21
ROA	-0.05	0.04	0.64

Table 6. Summary of Descriptive Statistics By Industry Group

This table presents the descriptive statistics classified by each SIC code. Panel A include details of the industry structure, the number of companies that hedged from 2010 to 2015, the number of companies included in the sample for each SIC code, and the proportion of hedgers to the total number of firms. Panel B displays the values for the mean, median, and standard deviation of the main variables of interest that this thesis examines. "Std. Dev." shows the values of the standard deviation.

Panel A. Industry Structure And Hedging Information

2-digit SIC Codes	Industry Title	HHI	Number of Hedgers	Number of Firms In Sample	Percentage
20	Food And Kindred Products	1435	12	18	67%
21	Tobacco Products	3230	0	3	0%
22	Textile Mill Products	429	1	4	25%
23	Apparel And Textile Products	234	1	3	33%

24	Lumber And Wood Products	78	0	3	0%
25	Furniture And Fixtures	1521	3	6	50%
26	Paper And Allied Products	1572	5	8	63%
27	Printing And Publishing	208	1	5	20%
28	Chemicals And Allied Products	2307	24	55	44%
29	Petroleum And Coal Products	853	1	5	20%
30	Rubber And Miscellaneous Plastics Products	1888	8	10	80%
31	Leather And Leather Products	805	0	2	0%
32	Stone, Clay, And Glass Products	344	3	5	60%
33	Primary Metal Industries	1520	3	7	43%
34	Fabricated Metal Products	1154	9	11	82%
35	Industrial Machinery And Equipment	757	24	56	43%
36	Electronic And Other Electric Equipment	3167	19	62	31%
37	Transportation Equipment	849	17	37	46%
38	Instruments And Related Products	868	18	84	21%
39	Miscellaneous Manufacturing Industries	658	10	12	83%

Panel B. Summary of Key Variables

2-digit SIC Codes	Degree of Hedging			Financial Distress (FS)			HHI / FS		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
20	5.16%	1.31%	0.26	0.21	0.19	0.17	5249.07	6182.99	2452.58
21	0.00%	0.00%	0.00	0.62	0.58	0.21	4121.57	3667.20	909.96

22	3.20%	2.14%	0.04	0.59	0.59	0.14	766.56	616.28	545.77
23	13.18%	11.45%	0.04	0.30	0.32	0.06	808.19	730.43	204.53
24	0.00%	0.00%	0.00	0.66	0.56	0.09	141.16	136.17	19.35
25	4.81%	6.66%	0.05	0.71	0.66	0.15	1355.20	1023.39	667.72
26	3.21%	1.31%	0.12	0.68	0.68	0.12	1469.79	1267.45	518.58
27	9.29%	6.99%	0.04	0.64	0.69	0.22	604.35	144.54	1070.13
28	6.50%	2.18%	0.58	0.19	0.54	0.47	2382.77	1703.79	2429.38
29	22.00%	17.00%	0.13	0.68	0.53	0.64	3632.80	1758.66	5103.75
30	5.31%	3.50%	0.15	0.57	0.54	0.22	1651.45	1373.54	1076.85
31	0.00%	0.00%	0.00	0.32	0.27	0.19	2882.17	2979.38	777.62
32	0.85%	1.00%	0.01	0.64	0.57	0.24	620.28	669.59	490.30
33	6.17%	4.06%	0.07	0.61	0.58	0.20	1835.77	1498.46	1190.22
34	15.27%	4.20%	0.22	0.27	0.22	0.20	4771.01	4091.58	1283.55
35	10.45%	5.34%	0.23	0.58	0.48	0.22	1257.00	1194.95	999.79
36	4.11%	5.07%	0.14	0.11	0.34	0.50	1992.84	1470.99	1638.58
37	20.63%	1.52%	0.25	0.79	0.62	1.24	1448.38	926.62	1471.50
38	34.49%	23.44%	1.07	0.50	0.38	0.35	2105.30	1382.99	2252.46
39	6.47%	4.34%	0.08	0.14	0.12	0.37	5130.18	4779.47	937.34

6.2 Diagnostic Analysis of The Research Models

Before we take a further step to the next section of multivariate tests, diagnostic analysis of the research models should be conducted, because the analysis helps produce reliable and more accurate estimates and statistical inferences. In this section, I mainly focus on the diagnostic analysis of the OLS regression model and the 2SLS regression model.

6.2.1 Diagnostic Analysis of The OLS Regression Model

Three important assumptions of the OLS regression model are examined: homoskedasticity, independent random disturbance terms, and non-multicollinearity of independent variables. The normality of random error terms is not a major issue in this research, because according to the central limit theorem, if the data sample is large, the t-test and the F-test is still approximately effective. As stated in section 4, the total annual observations in the data sample is 2376. This size of data could be considered large. Therefore, I mainly focus on the examinations of the three assumptions above.

Table 7 reports the test results of the homoskedasticity assumption. As it can be seen from table 7, the White test is used to test if the homoskedasticity assumption is violated and the *p*-value for the F-statistic is 0.9985. The *p*-value is statistically insignificant and suggests that the null hypothesis should not be rejected and the variances of the random terms are constant. Moreover, to check that there is no multicollinearity among the independent variables, a correlation analysis of the variables is run and it is shown in table 8. In table 8, the highest value of the variable correlation is 0.2431 between the variable *SIZE* and the variable *QUICK*. This result is intuitive: as the size of a firm is bigger, it is easier to cover short-term liabilities, and 0.2431 is not considered as a serious violation of the non-multicollinearity assumption. Finally, the Durbin-Watson test is employed to see if the error terms are serially correlated, and the results are displayed in table 9. By using the whole data sample, an OLS regression of the dependent variable Degree of Hedging on the dependent variables is run, and a D-W statistic estimate of 2.0977 based on the whole data sample is thus produced. If the D-W statistic is around 2, the null hypothesis that there is no serial correlation of error terms should not be rejected. So, it can be concluded that the assumption of non-autocorrelation among the error terms holds for this regression. In summary, the three key assumption of the OLS regression model are not violated, based on the results from table 7 to table 9.

Table 7. Test Results of The Homoskedasticity Assumption For The OLS Regression Model

This table provides the results of the White test which is conducted to determine if the variances of the random error terms are constant. The null hypothesis is that the variances are constant, and the alternative hypothesis states that the variances differ with the values of the independent variables. The White test uses the F-statistic as the testing statistic. If the estimate of the F-statistic is small, the null hypothesis is not rejected, and if the estimate is large, the null hypothesis is then rejected. The *p*-value for the testing statistic are boldfaced.

Heteroskedasticity Test: White				
F-statistic	**0.1419**	*p*-value F(9,2376)	**0.9985**	
Obs*R-squared	1.2818	*p*-value Chi-Square(9)	**0.9985**	
Scaled explained SS	654.9269	*p*-value Chi-Square(9)	0	
Variable	Coefficient	Std. Error	t-Statistic	*p*-value
C	143.5746	93.2410	1.5398	0.1237
(*HHI/FS*)^2	-3.84E-08	1.48E-07	-0.2590	0.7957

TAX^2	-0.0149	0.0776	-0.1925	0.8474
MASHAR^2	-0.3163	1.7328	-0.1825	0.8552
MAOPTI^2	-331.2848	587.6365	-0.5638	0.573
AGCY^2	-0.0016	0.0037	-0.4399	0.6601
QUICK^2	-0.2470	1.0470	-0.2359	0.8135
SUB^2	-1.2076	13.6104	-0.0887	0.9293
SIZE^2	-1.2178	1.5177	-0.8024	0.4224
FOEX^2	0.0010	0.0023	0.4375	0.6618
R-squared	0.0005	Mean dependent var	68.9227	
Adjusted R-squared	-0.0033	S.D. dependent var	2212.1410	
S.E. of regression	2215.7690	Akaike info criterion	18.2488	
F-statistic	0.1419	Schwarz criterion	18.2732	
Prob(F-statistic)	0.9985	Durbin-Watson stat	2.0001	

Table 8. The Correlation Between The Independent Variables

	HHI/FS	*TAX*	*MASHAR*	*MAOPTI*	*AGCY*	*QUICK*	*SUB*	*SIZE*	*FOEX*
HHI/FS	1.0000	-0.0592	0.0019	0.0301	-0.0056	0.1168	-0.0151	-0.1063	-0.0104
TAX	-0.0592	1.0000	0.0183	0.0859	0.0186	0.0098	0.0081	-0.2600	0.0187
MASHAR	0.0019	0.0183	1.0000	-0.0171	-0.0071	0.0100	-0.0042	-0.0640	0.0136
MAOPTI	0.0301	0.0859	-0.0171	1.0000	0.0262	0.0339	-0.0094	-0.0979	-0.0321
AGCY	-0.0056	0.0186	-0.0071	0.0262	1.0000	0.0211	-0.0024	-0.0394	-0.1677
QUICK	0.1168	0.0098	0.0100	0.0339	0.0211	1.0000	-0.0116	**0.2431**	0.0076
SUB	-0.0151	0.0081	-0.0042	-0.0094	-0.0024	-0.0116	1.0000	-0.0721	-0.0004
SIZE	-0.1063	-0.2600	-0.0640	-0.0979	-0.0394	**0.2431**	-0.0721	1.0000	-0.0459
FOEX	-0.0104	0.0187	0.0136	-0.0321	-0.1677	0.0076	-0.0004	-0.0459	1.0000

Table 9. Test Results of The Auto-regression Assumption

This table summarizes the test results of the auto-regression assumption. An OLS regression of the dependent variable Degree of Hedging on the independent variables is conducted, and the Durbin-Watson statistic estimate is given at the end of the table and is boldfaced. The null hypothesis that the error terms are not serially correlated is not rejected when the D-W statistic estimate is around 2. The symbol "*" indicates that the coefficient is statistically significant at 5% level.

Dependent Variable: Degree of Hedging			Included Observations: 2376	
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	*p*-value
HHI/FS	-2.671E-08	2.512E-08	-1.0339	0.3012
TAX	-0.0083	0.0238	-0.3478	0.7280
MASHAR	-0.0202	0.1149	-0.1758	0.8605
MAOPTI	-0.7532	1.1683	-0.6448	0.5191
AGCY	0.0273	0.0076	3.5685	**0.0004***
QUICK	0.0043	0.0811	0.0536	0.9573
SUB	0.0369	0.5266	0.0700	0.9442
SIZE	0.0650	0.0310	2.0940	**0.0364***
FOEX	0.0223	0.0054	4.1027	**0.0000***
R-squared	0.3507	Sum squared resid	162726.5000	
Adjusted R-squared	0.3169	**Durbin-Watson statistic**	**2.0977**	

6.2.2 Diagnostic Analysis of The 2SLS Regression Model

The diagnostic procedure is similar to that of the OLS regression model, the difference is that the focus is on the instrumental variables displayed in section 5.1. Accoding to *Introductory Econometrics: A Modern Approach* by Jeffrey M. Wooldridge, the 2SLS estimators could be best and unbiased if the following major assumptions are not violated: (1) instrument relevance, (2) non-multicollinearity among instrumental variables, and (3) constant variance of random error terms, conditional on the instrumental variables.

First, table 10 shows the correlation between the instrumental variables of the variable *FS*.

As it can be seen from table 10, the highest correlation is between the instrumental variable *CASH* and the instrumental variable *EVOL*, which is 0.0868. In addition, the lowest correlation is between the variable *ROA* and the variable *EVOL*, and it is -0.2805. This indicates that higher *ROA* is accompanied with lower volatility of earnings. The two limits are not considered as a serious violation of non-multicollinearity. Therefore, the non-multicollinearity assumption holds for the 2SLS regression model.

Table 10. The Correlation Between The Instrumental Variables

This table summarizes the correlation between the instrumental variables used to estimate *FS*. *FIX* measures the size of the fixed assets of a company, *GW* estimates the growth opportunities in a company, *EVOL* stands for the volatility in earnings, agency costs are measured by the variable *CASH*, and *ROA* is return on assets that indicates the profitability of a company. The highest correlation is 0.0868 between *CASH* and *EVOL*, and the lowest is -0.2805 between *ROA* and *EVOL*.

	FIX	*GW*	*EVOL*	*CASH*	*ROA*
FIX	1.0000	-0.0008	-0.1117	-0.2133	0.0158
GW	-0.0008	1.0000	0.0014	0.0028	0.0031
EVOL	-0.1117	0.0014	1.0000	0.0868	-0.2805
CASH	-0.2133	0.0028	0.0868	1.0000	-0.1642
ROA	0.0158	0.0031	-0.2805	-0.1642	1.0000

Second, instrument relevance is a condition indicating that in the first stage regression equation of the 2SLS regression model, the linear relationship between the instrumental explanatory variables and the dependent variable should be significant. In other words, the coefficients in the first stage equation should be statistically different from zero. Table 11 shows the regression results of the first stage regression equation. The results indicate that the coefficients of the variables *FIX*, *CASH* and *ROA* are consistent with the signs expected in Table 3, and the positive coefficients of the variables *GW* and *EVOL* are the opposite to what is predicted in the previous section. In addition, the regression results of table 11 also suggest that the linear relationship between the instrumental explanatory variables and the dependent variable is extremely statistically significant, as the *p*-value of the instrumental variables are 0.0000, 0.0000, 0.0001, 0.0000, and 0.0003 respectively. Thus, it could be concluded that the instrumental relevance assumption for the 2SLS regression model is not violated.

Table 11. The Results of The First Stage Regression Equation

This table displays the overview of the first stage regression in the 2SLS regression model. This regression includes 2376 annual data observations of the U.S. manufacturing industries. The symbol "*" indicates that the coefficient is statistically significant at the 5% level.

Dependent Variable:*FS* Included observations: 2376

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
FIX	0.7155	0.0249	28.6897	**0.0000***
GW	0.2309	0.0278	8.2951	**0.0000***
EVOL	0.0862	0.0214	4.0339	**0.0001***
CASH	0.4959	0.0460	10.7734	**0.0000***
ROA	-0.0711	0.0196	-3.6254	**0.0003***
R-squared	0.1239	Sum squared resid	426.0069	
Adjusted R-squared	0.1258	Durbin-Watson stat	2.0125	

Finally, the Breusch-Pagan-Godfrey test is utilized to test the null hypothesis that conditional on the instrumental explanatory variables, the variances of the random error terms are constant. As it can be seen among the test results in table 12, the *p*-value of the F-statistic is 0.9101. This *p*-value indicates that the test statistic is insignificant. Thus, it could be concluded that the null hypothesis should not be rejected, that is, conditional on the instrumental explanatory variables, the variances of the random disturbance terms are equal to a constant number.

Table 12. Test Results of The Homoskedasticity Assumption For The 2SLS Regression Model

This table provides the results of the Breusch-Pagan-Godfrey test which is conducted to investigate if the variances of the random error terms are constant, conditional on the instrumental explanatory variables. The null hypothesis is that the variances are constant, and the alternative hypothesis states that the variances vary with the values of independent variables. The squared residuals are from the second stage regression equation of the 2SLS regression models. The Breusch-Pagan-Godfrey test uses the F-statistic as the testing statistic. If the estimate of the F-statistic is small, the null hypothesis is not rejected, and if the estimate is large, the null hypothesis is rejected. The *p*-values for the test statistic are boldfaced.

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
Dependent Variable: RESID^2				
F-statistic	0.3050	*p*-value F(5,2376)	**0.9101**	
Obs*R-squared	1.5277	*p*-value Chi-Square(5)	**0.9099**	
Scaled explained SS	780.6404	*p*-value Chi-Square(5)	0	
Variable	Coefficient	Std. Error	t-Statistic	*p*-value
C	91.6685	107.0438	0.8564	0.3919
FIX	-99.1469	150.8554	-0.6572	0.5111
GW	0.0537	0.3976	0.1350	0.8926
EVOL	51.2027	83.3931	0.6140	0.5393
CASH	36.3992	232.6118	0.1565	0.8757
ROA	-31.4903	75.3570	-0.4179	0.6761
R-squared	0.0006	Mean dependent var	68.9199	
Adjusted R-squared	0.0015	S.D. dependent var	2212.1940	
S.E. of regression	2213.8250	Akaike info criterion	18.2454	
F-statistic	0.3050	Schwarz criterion	18.2600	
Prob(F-statistic)	0.9101	Durbin-Watson stat	2.0010	

Based on the test results above, the conclusion could be drawn that the assumptions regarding the 2SLS regression model in the research is not violated. In the next section, the multivariate test results from each of the three models are presented.

6.3 Empirical Results of Multivariate Tests

This section presents the empirical results of the multivariate tests. The research sample includes 396 companies in total, and based on the HHI values of the industries to which they belong and their leverage ratio, the 396 companies can be grouped into 4 categories: high degree of competition with financially unconstrained companies, high degree of competition with financially constrained companies, low degree of concentration with financially unconstrained companies, and low degree of concentration with financially constrained companies. The multivariate tests are also run by using the whole data sample.

6.3.1 The Test Results For Financially Unconstrained Companies In Competitive Industries

The results of the logit regression, OLS regression, and 2SLS regression of the financially unconstrained companies in competitive industries are reported in table 13. First, panel A displays the results of the logit regression test that investigates the relationship between the probability that a company decides to hedge against foreign currency risk and the related motivating factors. On one hand, the coefficient of the combined impact variable is negative and statistically insignificant, which means that with a small value of HHI, companies tend not to hedge as companies become less and less financially unconstrained. This is contrary to hypothesis 1, so hypothesis 1 is rejected. On the other hand, the coefficients of the control variable firm size (*SIZE*) and foreign exchange exposure (*FOEX*) are statistically significant and consistent with the predictions from the previous literature (Géczy, Minton, and Schrand). A company is more motivated to hedge if its size increases and it receives more income from overseas. Second, panel B shows the results of the OLS regression with the degree of hedging as the dependent variable. In panel B, the coefficient of the combined impact variable is again statistically insignificant, but the statistically significant values for the variables *MAOPTI, SIZE,* and *FOEX* matches what is anticipated by the risk management literature: managers who hold stock options will hedge less and the larger the size of the company and its foreign exchange exposure, the more that managers hedge. Finally, the results in panel C are similar to those of panel B, and the coefficient of the combined impact variable is again insignificant.

Table 13. The Results of Multivariate Tests For The Financially Unconstrained Companies In Competitive Industries

In this table, multivariate test results of financially unconstrained companies in competitive industries are presented. Panel A shows the results of the logit regression test, panel B and panel C display the OLS and 2SLS regression results. The total annual observations of the sample company for the three tests are 420, and the dependent variable in panel A is the dummy variable Hedging Decision (*HEDGE*) and the dependent variables in panel B and panel C are the same: the degree of hedging (*INCHEDGE*). The symbol "*" indicates that the variable is significant at the 5% level.

Panel A. The Results of The Logit Regression Test

Dependent Variable: *HEDGE* — Included observations: 420

Method: ML - Binary Logit (Quadratic hill climbing)

Variable	Coefficient	Std. Error	z-Statistic	*p*-value
HHI/FS	-3.786E-08	4.303E-08	-0.8799	0.3789

TAX	-1.0218	0.4660	-2.1925	**0.0283***
MASHAR	0.0595	0.0988	0.6024	0.5469
MAOPTI	-4.0972	1.4038	-2.9187	**0.0035***
AGCY	-1.6017	8.0465	-0.1991	0.8422
QUICK	-0.3293	0.2024	-1.6266	0.1038
SUB	-4.8557	3.8124	-1.2737	0.2028
SIZE	0.1025	0.0450	2.2767	**0.0228***
FOEX	6.3005	3.1948	1.9721	**0.0486***
Mean dependent variable	0.4717	Sum of squared residuals	54.2933	
S.E. of regression	0.4605	Log likelihood	-154.4160	

Panel B. The Results of The OLS Regression Test

Dependent Variable: *INCHEDGE* Included observations: 420

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
HHI/FS	5.703E-08	8.926E-08	0.6389	0.5234
TAX	-0.0076	0.0037	-2.0593	**0.0405***
MASHAR	0.0258	0.0202	1.2768	0.2028
MAOPTI	-0.5382	0.1964	-2.7400	**0.0066***
AGCY	0.6936	0.6980	0.9937	0.3213
QUICK	-0.0554	0.0242	-2.2887	**0.0229***
SUB	-0.5161	0.6847	-0.7538	0.4517
SIZE	0.0678	0.0086	7.8639	**0.0000***
FOEX	0.3941	0.1358	2.9021	**0.0040***
R-squared	0.2261	Sum squared residuals	51.1064	
Adjusted R-squared	0.2019	Log likelihood	-157.9475	

Panel C. The Results of The 2SLS Regression Test

Dependent Variable: *INCHEDGE*				Included observations: 420
Method: Two-Stage Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	*p*-value
$HHI / \hat{FS}$	-1.46E-09	5.00E-09	-0.2918	0.7706
TAX	-0.0078	0.0037	-2.1048	**0.0363***
MASHAR	0.0263	0.0202	1.2994	0.195
MAOPTI	-0.5507	0.1963	-2.8053	**0.0054***
AGCY	0.7603	0.6937	1.0959	0.2742
QUICK	-0.0578	0.0247	-2.3426	**0.0199***
SUB	-0.5592	0.6870	-0.8140	0.4164
SIZE	0.0745	0.0079	9.4200	**0.0000***
FOEX	0.4099	0.1346	3.0444	**0.0026***
R-squared	0.2251	Sum squared residuals		51.1709
Adjusted R-squared	0.2009	Log likelihood		-158.1146

6.3.2 The Test Results For Financially Constrained Companies In Competitive Industries

For financially constrained companies in competitive industries, the results estimated by the logit regression, OLS regression, and 2SLS regression are reported in table 14. First, the results from the logit regression test indicate that the combined impact variable does show a negative impact on companies' hedging decisions (the coefficient is -1.789E-07 and is significant at the 5% level). This implies that in a competitive industry, companies are less likely to hedge against foreign currency risk as companies perform better financially. Thus, this evidence supports hypothesis 2. In addition, the coefficients of the variables *TAX*, *MAOPTI*, and *SIZE* are 0.3251, -2.2349 and 0.0524, and they are all highly significant, implying that companies are motivated to hedge in order to reduce tax burdens, managers holding more stock options will benefit more by hedging less, and larger firms are more likely to hedge because they have the advantage of economies of scale. Second, the OLS regression results suggest that the combined impact variable does not have a significant impact on the magnitude of hedging of a company. Among the variables, only the foreign exchange exposure is significant. Finally, the results estimated by the 2SLS regression in panel C are similar to those of panel B: only the variable *FOEX* is highly significant at the 5% level.

Table 14. The Results of Multivariate Tests For The Financially Constrained Companies In Competitive Industries

This table reports the multivariate test results of financially constrained companies in competitive industries. Panel A shows the results of the logit regression test, panel B and panel C display the OLS and 2SLS regression results. The total annual observations of the sample company for the three tests are 888, and the dependent variable in panel A is the dummy variable Hedging Decision (*HEDGE*) and the dependent variables in panel B and panel C are the same: the degree of hedging (*INCHEDGE*). The symbol "*" indicates that the variable is significant at the 5% level.

Panel A. The Results of The Logit Regression Test				
Dependent Variable: *HEDGE*				Included observations: 888
Method: ML - Binary Logit (Quadratic hill climbing)				
Variable	Coefficient	Std. Error	z-Statistic	*p*-value
HHI/FS	-1.789E-07	3.939E-08	-4.5422	**0.0000***
TAX	0.3251	0.0663	4.9054	**0.0000***
MASHAR	-0.0072	0.0409	-0.1768	0.8597
MAOPTI	-2.2349	0.5447	-4.1032	**0.0000***
AGCY	-0.8146	0.5005	-1.6276	0.1036
QUICK	-0.0286	0.0443	-0.6455	0.5186
SUB	0.1548	0.2473	0.6259	0.5314
SIZE	0.0524	0.0135	3.8802	**0.0001***
FOEX	0.0011	0.0018	0.6224	0.5337
Mean dependent variable	0.3565	Sum squared residuals		230.2614
S.E. of regression	0.4514	Log likelihood		-663.3332

Panel B. The Results of The OLS Regression Test				
Dependent Variable: *INCHEDGE*				Included observations: 888
Method: Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	*p*-value
HHI/FS	7.343E-08	1.3343E-07	0.5503	0.5822

TAX	-0.0313	0.0529	-0.5925	0.5537
MASHAR	-0.0249	0.1668	-0.1492	0.8814
MAOPTI	-1.1426	2.1188	-0.5393	0.5898
AGCY	0.0008	0.0269	0.0294	0.9766
QUICK	-0.0719	0.1409	-0.5104	0.6098
SUB	0.1533	1.1013	0.1392	0.8893
SIZE	0.0990	0.0594	1.6671	0.0958
FOEX	0.0250	0.0070	3.5486	**0.0004***
R-squared	0.1900	Sum squared residuals	116543.5539	
Adjusted R-squared	0.1634	Log likelihood	-4248.6489	

Panel C. The Results of The 2SLS Regression Test

Dependent Variable: *INCHEDGE* Included observations: 888

Method: Two-Stage Least Squares

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
$HHI / \hat{FS}$	1.39E-07	1.764E-07	0.7878	0.4310
TAX	-0.0353	0.0530	-0.6650	0.5062
MASHAR	-0.0268	0.1668	-0.1605	0.8725
MAOPTI	-1.1826	2.1153	-0.5591	0.5762
AGCY	0.0002	0.0269	0.0089	0.9929
QUICK	-0.0433	0.1247	-0.3472	0.7285
SUB	0.1572	1.1006	0.1428	0.8865
SIZE	0.0721	0.0752	0.9587	0.3379
FOEX	0.0248	0.0071	3.5096	**0.0005***
R-squared	0.2902	Sum squared residuals	116510.7661	
Adjusted R-squared	0.2234	Log likelihood	-4248.4888	

6.3.3 The Test Results For Financially Unconstrained Companies In Concentrated Industries

For financially unconstrained companies in concentrated manufacturing industries, the estimated results are shown in table 15. First, the probability is examined that those companies decide to hedge when exposed to foreign currency risk. According to the results in panel A, the combination of a good financial status and a concentrated industry does not affect a company's hedging decision. However, the coefficients, which are 0.1323 -0.1086, -3.8010, and 0.1288 respectively and statistically significant, of the variables *AGCY*, *QUICK*, *SUB*, and *SIZE* are consistent with their impacts on the corporate hedging decision based on prior research (again please put in the references in the brackets), except for the variable *TAX*. Moreover, as for the OLS regression results about the magnitude of hedging in panel B, there exists a negative relationship between the degree of hedging and the combined impact variable, but the variable is not statistically significant. Hypothesis 3 is, therefore, rejected. Panel C suggests the same results, indicating that the amount of hedging only depends on how much income is received from overseas.

Table 15. The Results of Multivariate Tests For The Financially Unconstrained Companies In Concentrated Industries

Table 15 reports the multivariate test results of financially unconstrained companies in concentrated industries. Panel A shows the results of the logit regression test, panel B and panel C display the OLS and 2SLS regression results. The total annual observations of the sample company for the three tests are 672, and the dependent variable in panel A is the dummy variable Hedging Decision (*HEDGE*) and the dependent variables in panel B and panel C are the same: the degree of hedging (*INCHEDGE*). The symbol "*" indicates that the variable is significant at the 5% level.

Panel A. The Results of The Logit Regression Test

Dependent Variable: *HEDGE* Included observations: 672

Method: ML - Binary Logit (Quadratic hill climbing)

Variable	Coefficient	Std. Error	z-Statistic	*p*-value
HHI/FS	-1.175E-07	1.70E-08	-6.9011	**0.0000***
TAX	-0.1406	0.0588	-2.3900	**0.0168***
MASHAR	0.0104	0.0722	0.1435	0.8859
MAOPTI	0.1036	0.6472	0.1601	0.8728
AGCY	0.1323	0.0587	2.2560	**0.0241***
QUICK	-0.1086	0.0522	-2.0802	**0.0375***
SUB	-3.8010	1.1538	-3.2944	**0.0010***

SIZE	0.1288	0.0192	6.7227	**0.0000***
FOEX	0.4803	0.2837	1.6927	0.0905
Mean dependent variable	0.3889	Sum squared residuals		129.4024
S.E. of regression	0.4321	Log likelihood		-384.2542

Panel B. The Results of The OLS Regression Test

Dependent Variable: *INCHEDGE* Included observations: 672

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
HHI/FS	-9.64E-09	3.5056E-07	-0.0275	0.9781
TAX	-0.0021	0.0334	-0.0638	0.9492
MASHAR	-0.0534	0.2657	-0.2009	0.8409
MAOPTI	-0.9406	2.2169	-0.4243	0.6715
AGCY	0.0285	0.0579	0.4926	0.6224
QUICK	0.0824	0.1303	0.6323	0.5274
SUB	-0.0396	0.6328	-0.0626	0.9501
SIZE	0.0303	0.0602	0.5041	0.6143
FOEX	0.0226	0.0460	0.4914	0.6233
R-squared	0.2041	Sum squared residuals		45251.6748
Adjusted R-squared	0.2114	Log likelihood		-2458.3825

Panel C. The Results of The 2SLS Regression Test

Dependent Variable: *INCHEDGE* Included observations: 672

Method: Two-Stage Least Squares

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
$HHI / \hat{FS}$	1.39E-06	1.76E-06	0.7878	0.4310
TAX	-0.0353	0.0530	-0.6650	0.5062
MASHAR	-0.0268	0.1668	-0.1605	0.8725

MAOPTI	-1.1826	2.1153	-0.5591	0.5762
AGCY	0.0002	0.0269	0.0089	0.9929
QUICK	-0.0433	0.1247	-0.3472	0.7285
SUB	0.1572	1.1006	0.1428	0.8865
SIZE	0.0721	0.0752	0.9587	0.3379
FOEX	0.0248	0.0071	3.5096	**0.0005***
R-squared	0.1921	Sum squared residuals		116510.7661
Adjusted R-squared	0.2277	Log likelihood		-4248.4888

6.3.4 The Test Results For Financially Constrained Companies In Concentrated Industries

The tests results about financially constrained companies in concentrated industries are displayed in table 16. In the logit regression test, the coefficient of the combined impact variable is -3.03E-07 but statistically insignificant. The variables *AGCY*, *SIZE*, and *FOEX*, however, are statistically significant and have the same expected effects predicted by previous research. Additionally, the results of the combined impact variable in both the OLS regression and the 2SLS regression suggest that hypothesis 4 is rejected, with the statistically insignificant coefficient of 1.777E-07 in the OLS regression test and the insignificant coefficient of -1.56E-07 in 2SLS regression test.

From the results shown in table 13 through table 16, it can be concluded that hypothesis 2 is accepted that in a competitive industry, financial constraints will make companies less likely to hedge, while hypothesis 1, hypothesis 3, and hypothesis 4 are rejected.

Table 16. The Results of Multivariate Tests For The Financially Constrained Companies In Concentrated Industries

Table 16 reports the multivariate test results of financially constrained companies in concentrated industries. Panel A shows the results of the logit regression test, panel B and panel C display the OLS and 2SLS regression results. The total annual observations of the sample company for the three tests are 462, and the dependent variable in panel A is the dummy variable Hedging Decision (*HEDGE*) and the dependent variables in panel B and panel C are the same: the degree of hedging (*INCHEDGE*). The symbol "*" indicates that the variable is significant at the 5% level.

Panel A. The Results of The Logit Regression Test

Dependent Variable: *HEDGE* Included observations: 462

Method: ML - Binary Logit (Quadratic hill climbing)

Variable	Coefficient	Std. Error	z-Statistic	*p*-value
HHI/FS	-3.03E-07	1.75E-07	-1.7333	0.0830
TAX	-1.1403	0.6755	-1.6880	0.0914
MASHAR	-0.3792	0.2669	-1.4206	0.1554
MAOPTI	0.3542	1.0190	0.3476	0.7281
AGCY	-49.2246	14.2563	-3.4528	**0.0006***
QUICK	1.3153	0.9584	1.3724	0.1700
SUB	5.7303	5.3132	1.0785	0.2808
SIZE	0.2249	0.0591	3.8061	**0.0001***
FOEX	11.5638	4.6224	2.5017	**0.0124***
Mean dependent variable	0.6091	Sum squared residuals		39.2482
S.E. of regression	0.4569	Log likelihood		-113.7589

Panel B. The Results of The OLS Regression Test

Dependent Variable: *INCHEDGE* Included observations: 462

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
HHI/FS	1.777E-07	7.436E-07	0.2390	0.8114
TAX	-0.0653	0.2491	-0.2622	0.7935
MASHAR	-0.0587	0.1674	-0.3508	0.7262
MAOPTI	-0.5854	0.6679	-0.8766	0.3818
AGCY	4.3579	7.4902	0.5818	0.5614
QUICK	-0.3475	0.4469	-0.7776	0.4378
SUB	7.2855	3.1843	2.2879	**0.0233***
SIZE	0.0023	0.0282	0.0823	0.9345
FOEX	5.6226	2.8605	1.9656	0.0508
R-squared	0.1547	Sum squared residuals		407.1277

Adjusted R-squared	0.1451	Log likelihood	-351.0343

Panel C. The Results of The 2SLS Regression Test

Dependent Variable: *INCHEDGE* Included observations: 462

Method: Two-Stage Least Squares

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
$HHI / \hat{FS}$	-1.56E-07	4.662E-07	-0.3346	0.7383
TAX	-0.0228	0.1981	-0.1151	0.9085
MASHAR	-0.0383	0.1755	-0.2180	0.8277
MAOPTI	-0.6184	0.6729	-0.9189	0.3593
AGCY	4.7384	7.4804	0.6334	0.5272
QUICK	-0.2835	0.3884	-0.7299	0.4664
SUB	7.4479	3.1031	2.4001	**0.0174***
SIZE	0.0133	0.0311	0.4262	0.6705
FOEX	5.4823	2.9035	1.8882	0.0605
R-squared	0.2550	Sum squared residuals		407.0091
Adjusted R-squared	0.2148	Log likelihood		-351.0056

6.4. The Test Results Based On The Whole Data Sample

Finally, table 17 shows the multivariate test results from the point of the whole manufacturing industries in the United States. As the univariate test results indicate in section 6.1, the U.S. manufacturing industries are, on average, competitive and companies, in general, operate with financial constrain. Hypothesis 1 is supported by the test results in the logit model. In panel A, the extremely statistically significant coefficient of the combine impact variable is -8.217E-07 with the *p*-value of 0.0000, implying that companies facing financial distress are less likely to hedge in the competitive manufacturing industries. Other statistically significant variables include *TAX*, *MAOPTI*, *QUICK*, and *SIZE*. This result is consistent with the theoretical predictions of the risk management literature, as the factor of the tax burden motivates companies to hedge, managers holding stock options tend to prefer more risk, companies with more internal funds are less likely to hedge, and the bigger size of a company induces more risk management. However, results from both the OLS regression model and the 2SLS regression model show that the combined impact variable is not statistically significant, since the coefficient in the OLS regression model is -2.671E-07 with the *p*-value of 0.3012 and the coefficient in the 2SLS regression model is 2.133E-07 with the *p*-value of 0.2653. The results from panel B and panel C show the lack of a statistically significant relationship between the degree of hedging and the combined impact variable.

Table 17. The Summary of Multivariate Tests On The Whole Data Sample

This table reports the multivariate test results estimated by using the whole data sample. Panel A shows the results of the logit regression test, panel B and panel C display the OLS and 2SLS regression results. The total annual observations included in the tests are 2376, and the dependent variable in panel A is the dummy variable Hedging Decision (*HEDGE*) and the dependent variables in panel B and panel C are the same: the degree of hedging (*INCHEDGE*). The symbol "*" indicates that the variable is significant at the 5% level.

Panel A. The Summary of Logit Regression Test				
Dependent Variable: *HEDGE*			Included observations: 2376	
Method: ML - Binary Logit (Quadratic hill climbing)				
Variable	Coefficient	Std. Error	z-Statistic	*p*-value
HHI/FS	-8.217E-07	1.171E-07	-7.0183	**0.0000***
TAX	0.2697	0.0415	6.4943	**0.0000***
MASHAR	-0.0211	0.0325	-0.6509	0.5151
MAOPTI	-1.6153	0.3346	-4.8276	**0.0000***
AGCY	-0.0108	0.0184	-0.5882	0.5564
QUICK	-0.1246	0.0329	-3.7848	**0.0002***
SUB	-0.2810	0.3075	-0.9136	0.3609
SIZE	0.0649	0.0085	7.6045	**0.0000***
FOEX	0.0006	0.0016	0.3844	0.7007
Mean dependent var	0.4011	Sum squared residual	495.4355	
S.E. of regression	0.4587	Log likelihood	-1435.4980	

Panel B. The Summary of OLS Regression Test				
Dependent Variable: *INCHEDGE*			Included observations: 2376	
Method: Least Squares				

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
HHI/FS	-2.671E-07	2.512E-07	-1.0339	0.3012
TAX	-0.0082	0.0237	-0.3477	0.7280
MASHAR	-0.0202	0.1149	-0.1758	0.8605
MAOPTI	-0.7532	1.1682	-0.6447	0.5191
AGCY	0.0272	0.0076	3.5684	**0.0004***
QUICK	0.0043	0.0811	0.0535	0.9573
SUB	0.0368	0.5265	0.0700	0.9442
SIZE	0.0649	0.0310	2.0940	**0.0364***
FOEX	0.0223	0.0054	4.1026	**0.0000***
R-squared	0.35073	Sum squared resid	162726.5	
Adjusted R-squared	0.31689	Durbin-Watson statistic	2.0977179	

Panel C. The Summary of 2SLS Regression Test

Dependent Variable: *INCHEDGE* — Included observations: 2376

Method: Two-Stage Least Squares

Variable	Coefficient	Std. Error	t-Statistic	*p*-value
$HHI / \hat{FS}$	2.133E-07	1.914E-07	1.1142	0.2653
TAX	-0.0086	0.0238	-0.3625	0.7170
MASHAR	-0.0222	0.1151	-0.1928	0.8471
MAOPTI	-0.7483	1.1653	-0.6421	0.5208
AGCY	0.0273	0.0076	3.5664	**0.0004***
QUICK	0.0032	0.0751	0.0428	0.9659
SUB	0.0349	0.5266	0.0662	0.9472
SIZE	0.0580	0.0363	1.5952	0.1108
FOEX	0.0223	0.0054	4.1015	**0.0000***
R-squared	0.2751	Sum squared residual	162719.8000	

Adjusted R-squared	0.2417	Log likelihood	-8347.1050

7. Conclusion

The risk management literature predicts that both the costs of financial distress and the industry structure individually impact the hedging behavior of companies. To the best of my knowledge, previous research has not examined the interactive effect of the two variables. This paper aims to address the combined impact of the industrial structure and firms' financial constraints and contributes to the existing literature by conducting an empirical research on the manufacturing industries in the United States.

With a data sample covering 396 companies in the U.S. manufacturing industries over the period 2010 to 2015, the empirical results of this thesis suggest that financially constrained companies in competitive industries are less likely to use risk management. Thus, hypothesis 2 is accepted. However, the empirical evidence does not support hypothesis 1, hypothesis 3, and hypothesis 4. In other words, financial distress and the industry structure play an important role together in the hedging behavior of financially constrained companies in manufacturing industries with a competitive structure, but the empirical results are not indicative of a combined impact of the two variables on the hedging behavior of the financially unconstrained companies in competitive manufacturing industries and both financially unconstrained and financially constrained companies in concentrated manufacturing industries.

Future studies could extend this research by examining other industry sectors in the U.S. or on manufacturing and other industries in other countries in the world. The models in this research could also be improved by adding the variables $\frac{HHI_m}{FS_i}$ and FS_i separately in addition to the product of the two variables in the model equations.

References

Smith, Clifford W., and Rene M. Stulz. "The determinants of firms' hedging policies." Journal of financial and quantitative analysis 20.04 (1985): 391-405.

Mayers, David, and Clifford W. Smith Jr. "On the corporate demand for insurance." Foundations of Insurance Economics. Springer Netherlands, 1982. 190-205.

Lessard, Donald R. "Global competition and corporate finance in the 1990s." Journal of Applied Corporate Finance 3.4 (1991): 59-72.

Froot, Kenneth A., David S. Scharfstein, and Jeremy C. Stein. "Risk management: Coordinating corporate investment and financing policies." the Journal of Finance 48.5 (1993): 1629-1658.

Breeden, Douglas T., and S. Viswanathan. "Why do firms hedge? An asymmetric information model." The Journal of Fixed Income 25.3 (1998): 7-25.

Leland, Hayne E. "Agency costs, risk management, and capital structure." The Journal of Finance 53.4 (1998): 1213-1243.

Petersen, Mitchell A., and S. Ramu Thiagarajan. "Risk measurement and hedging: With and without derivatives." Financial Management (2000): 5-29.

Mian, Shehzad L. "Evidence on corporate hedging policy." Journal of Financial and quantitative Analysis 31.03 (1996): 419-439.

Tufano, Peter. "Who manages risk? An empirical examination of risk management practices in the gold mining industry." The Journal of Finance 51.4 (1996): 1097-1137.

Nance, Deana R., Clifford W. Smith, and Charles W. Smithson. "On the determinants of corporate hedging." The Journal of Finance 48.1 (1993): 267-284.

Adam, Tim, Sudipto Dasgupta, and Sheridan Titman. "Financial constraints, competition, and hedging in industry equilibrium." The Journal of Finance 62.5 (2007): 2445-2473.

Mello, Antonio S., and Martin E. Ruckes. "Financial hedging and product market rivalry." Available at SSRN 687140 (2005).

Williamson, Rohan. "Exchange rate exposure and competition: evidence from the automotive industry." Journal of financial Economics 59.3 (2001): 441-475.

Campa, Jose, and Linda S. Goldberg. "Investment in manufacturing, exchange rates and external exposure." Journal of International Economics 38.3 (1995): 297-320.

Allayannis, George, and Jane Ihrig. "Exposure and markups." Review of Financial Studies 14.3 (2001): 805-835.

Allayannis, George, and James P. Weston. "The use of foreign currency derivatives and industry structure." Corporate Risk: Strategies and Management, published in Brown. G. and Chew, D.,(Eds) (1999).

Adam, Tim R., and Amrita Nain. "Strategic Risk Management and Product Market Competition." Advances in Financial Risk Management. Palgrave Macmillan UK, (2013). 3-29.

Nain, Amrita. "The strategic motives for corporate risk management." AFA 2005 Philadelphia Meetings. 2004.

Géczy, Christopher, Bernadette A. Minton, and Catherine Schrand. "Why firms use currency derivatives." the Journal of Finance 52.4 (1997): 1323-1354.

Magee, Shane. "The effect of foreign currency hedging on the probability of financial distress." Accounting & Finance 53.4 (2013): 1107-1127.

Tang, Chun-Hung Hugo, and SooCheong Shawn Jang. "Interest rate hedging under financial distress: The effects of leverage and growth opportunities." (2009).

Pérez - González, Francisco, and Hayong Yun. "Risk management and firm value: Evidence from weather derivatives." The Journal of Finance 68.5 (2013): 2143-2176.

Tang, Chun-Hung Hugo, and SooCheong Shawn Jang. "Revisit to the determinants of capital structure: a comparison between lodging firms and software firms." International Journal of Hospitality Management 26.1 (2007): 175-187.

Feder, Gershon, Richard E. Just, and Andrew Schmitz. "Futures markets and the theory of the firm under price uncertainty." The Quarterly Journal of Economics 94.2 (1980): 317-328.

Jacque, Laurent L. "Management of foreign exchange risk: a review article." Journal of International Business Studies 12.1 (1981): 81-101.

Gruber, Martin J., and Jerold B. Warner. "Bankruptcy costs: Some evidence." The journal of Finance 32.2 (1977): 337-347.

Modigliani, Franco, and Merton H. Miller. "The cost of capital, corporation finance and the theory of investment." The American economic review (1958): 261-297.

Aabo, Tom, and Betty J. Simkins. "Interaction between real options and financial hedging: Fact or fiction in managerial decision-making." Review of Financial Economics 14.3 (2005): 353-369.

Allayannis, George, and James P. Weston. "The use of foreign currency derivatives and firm market value." Review of financial studies 14.1 (2001): 243-276.

Almeida, Heitor, Murillo Campello, and Michael S. Weisbach. "The cash flow sensitivity of cash." The Journal of Finance 59.4 (2004): 1777-1804.

Kaplan, Steven N., and Luigi Zingales. Do financing constraints explain why investment is correlated with cash flow?. No. w5267. National Bureau of Economic Research, 1995.

Mello, Antonio S., and John E. Parsons. "Hedging and liquidity." Review of Financial Studies 13.1 (2000): 127-153.

Gilson, Stuart C. "Management turnover and financial distress." Journal of financial Economics 25.2 (1989): 241-262.

Stulz, RenéM. "Managerial discretion and optimal financing policies." Journal of financial Economics 26.1 (1990): 3-27.

Graham, John R., and Daniel A. Rogers. "Do firms hedge in response to tax incentives?." The Journal of Finance 57.2 (2002): 815-839.

Appendix A

Table A.1 Company List

This table presents the list of companies examined in the paper. The colmn "SIC Code" provides the SIC codes to which each company belong. The colmn "Industry Title" provides the descrption of each manufacturing industry. "Company Name" includes the full names of those companies.

SIC Code	Industry Title	Company Name			
20	Food And Kindred Products	Conagra Foods Inc	Pinnacle Foods Inc	Post Holdings Inc	Pepsico Inc
		Hain Celestial Group Inc	Smucker (Jm) Co	Mead Johnson Nutrition Co	Cott Corp Que
		Mondelez International Inc	Ingredion Inc	Campbell Soup Co	Mccormick & Co Inc
		Tyson Foods Inc	Bunge Ltd	Treehouse Foods Inc	Sunwin Stevia Intl Inc
		Pilgrim'S Pride Corp	Archer-Daniels-Midland Co		
21	Tobacco Products	Altria Group Inc	Reynolds American Inc	Lorillard Inc	
22	Textile Mill Products	Unifi Inc	Interface Inc	Albany Intl Corp -Cl A	Hanesbrands Inc
23	Apparel And Other Textile Products	Bebe Stores Inc	Ralph Lauren Corp	Talon International Inc	
24	Lumber And Wood Products	Weyerhaeuser Co	Masonite International Corp	Cavco Industries Inc	
25	Furniture And Fixtures	Tempur Sealy Intl Inc	Steelcase Inc	Knoll Inc	Lear Corp

		Miller (Herman) Inc	B/E Aerospace Inc		
26	Paper And Allied Products	Schweitzer-Mauduit Intl Inc	Graphic Packaging Holding Co	Intl Paper Co	Bemis Co Inc
		Neenah Paper Inc	Avery Dennison Corp	Sonoco Products Co	Sealed Air Corp
27	Printing And Publishing	Shutterfly Inc	Acco Brands Corp	Quad/Graphics Inc	Matthews Intl Corp
		Multi-Color Corp			
28	Chemicals And Allied Products	Air Products & Chemicals Inc	Arena Pharmaceuticals Inc	Ecolab Inc	Valeant Pharmaceuticals Intl
		Olin Corp	Compugen Ltd	Avon Products	Orasure Technologies Inc
		Calgon Carbon Corp	Dynavax Technologies Corp	Revlon Inc -Cl A	Genomic Health Inc
		Praxair Inc	Fennec Pharmaceuticals Inc	Terravia Holdings Inc	Amgen Inc
		Minerals Technologies Inc	Brainstorm Cell Therapeutics	Sensient Technologies Corp	Alexion Pharmaceuticals Inc
		Tronox Ltd	Dyadic International Inc	Celanese Corp	Aeterna Zentaris Inc
		Clean Diesel Technologies	Oramed Pharmaceuticals Inc	Huntsman Corp	Spectrum Pharmaceuticals Inc
		Chemtura Corp	Synergy Pharmaceuticals Inc	Koppers Holdings Inc	Generex Biotechnology Corp
		Dow Chemical	China Biologic Products Inc	Amyris Inc	Biomarin Pharmaceutical Inc
		Hexcel Corp	Codexis Inc	Fmc Corp	Sangamo Biosciences Inc

		Kraton Corp	Horizon Pharma Plc	China Green Agriculture Inc	Exelixis Inc
		Albany Molecular Resh Inc	Psivida Corp	Rpm International Inc	Wd-40 Co
		Abbott Laboratories	Church & Dwight Inc	Procter & Gamble Co	Albemarle Corp
		Allergan Plc	Clorox Co/De	Stepan Co	
29	Petroleum And Coal Products	Cabot Microelectronics Corp	Chevron Corp	Fuller (H. B.) Co	Quaker Chemical Corp
		Chase Corp			
30	Rubber And Miscellaneous Plastics Products	Cooper Tire & Rubber Co	Aep Industries Inc	Tupperware Brands Corp	West Pharmaceutical Svsc Inc
		Crocs Inc	Fuwei Films Holdings Co	Armstrong World Industries	Female Health Co
		Enpro Industries Inc	Aptargroup Inc		
31	Leather And Leather Products	Madden Steven Ltd	Skechers U S A Inc		
32	Stone, Clay, And Glass Products	Libbey Inc	Usg Corp	Owens Corning	Apogee Enterprises Inc
		China Advanced Constr Matls			
33	Primary Metal Industries	Carpenter Technology Corp	Allegheny Technologies Inc	Belden Inc	Materion Corp
		Ak Steel Holding Corp	Kaiser Aluminum Corp	Harsco Corp	
34	Fabricated Metal Products	Ball Corp	Bwx Technologies Inc	Crane Co	Simpson Manufacturing Inc

		Eastern Co	Ampco-Pittsburgh Corp	Circor Intl Inc	Griffon Corp
		Snap-On Inc	Barnes Group Inc	Chart Industries Inc	
35	Industrial Machinery And Equipment	Brunswick Corp	Cray Inc	Lexmark Intl Inc -Cl A	Pdf Solutions Inc
		Toro Co	Netapp Inc	Identiv Inc	Proto Labs Inc
		Alamo Group Inc	Seagate Technology Plc	On Track Innovations	Esco Technologies Inc
		Manitowoc Co	Viavi Solutions Inc	Pitney Bowes Inc	Zebra Technologies Cp -Cl A
		Terex Corp	Rit Technologies Ltd	Tennant Co	Altra Industrial Motion Corp
		Caterpillar Inc	Radcom	Middleby Corp	Flowserve Corp
		Oshkosh Corp	Wi-Lan Inc	Dover Corp	Idex Corp
		Astec Industries Inc	Lantronix Inc	Spx Corp	Xylem Inc
		Colfax Corp	Netgear Inc	Johnson Controls Intl Plc	Nordson Corp
		Hardinge Inc	Allot Communications Ltd	Standex International Corp	Fuel Tech Inc
		Kadant Inc	Cavium Inc	Hp Inc	Lam Research Corp
		John Bean Technologies	Infinera Corp	Super Micro Computer Inc	Intevac Inc
		Asm International Nv	Astronova Inc	Concurrent Computer Cp	Entegris Inc

		Kulicke & Soffa Industries	Radisys Corp	Axcelis Technologies Inc	Ceco Environmental Corp
		Lennox International Inc	Quicklogic Corp	Inphi Corp	L-3 Communications Hldgs Inc
		Maxwell Technologies Inc	Applied Micro Circuits Corp	Invensense Inc	Pctel Inc
		Ocean Power Technologies Inc	Power Integrations Inc	Semileds Corp	Utstarcom Holdings Corp
		Powell Industries Inc	Mercury Systems Inc	Skyworks Solutions Inc	Ceragon Networks Ltd
		Eaton Corp Plc	Amkor Technology Inc	Analog Devices	Aviat Networks Inc
		Rockwell Automation	Axt Inc	Diodes Inc	Neonode Inc
36	Electronic And Other Electric Equipment	Allied Motion Technologies	Silicon Laboratories Inc	Micron Technology Inc	Vocera Communications Inc
		American Superconductor Cp	Oclaro Inc	Microsemi Corp	Magal Security Systems
		Whirlpool Corp	Synaptics Inc	Semtech Corp	Vasco Data Sec Intl Inc
		Astronics Corp	Monolithic Power Systems Inc	Texas Instruments Inc	Avx Corp
		Harman International Inds	Sunpower Corp	Cypress Semiconductor	Key Tronic Corp
		Universal Electronics Inc	First Solar Inc	Qualcomm Inc	Advanced Micro Devices
		Singing Machine Co Inc	Canadian Solar Inc	Cree Inc	Mitel Networks Corp
		Adtran Inc	Netlist Inc	Microchip Technology Inc	Shoretel Inc

		Ciena Corp	Rubicon Technology Inc	Qorvo Inc	Calamp Corp
		Novatel Wireless Inc	Broadcom Ltd		
37	Transportation Equipment	Alcoa Inc	Cooper-Standard Holdings Inc	Triumph Group Inc	Modine Manufacturing Co
		Paccar Inc	Wabco Holdings Inc	Spirit Aerosystems Inc	Superior Industries Intl
		Daimler Ag	Allison Transmission Hldgs	Mcdermott Intl Inc	Borgwarner Inc
		Toyota Motor Corp	Liqtech International Inc	Huntington Ingalls Ind Inc	Sypris Solutions Inc
		Zap	Wabash National Corp	Trinity Industries	Puradyn Filter Technologies
		Tower International Inc	General Donlee Canada Inc	Greenbrier Companies Inc	Autoliv Inc
		Tesla Motors Inc	Textron Inc	Wabtec Corp	Westport Fuel Systems Inc
		Gentex Corp	Sifco Industries	Curtiss-Wright Corp	Polaris Industries Inc
		Lydall Inc	United Technologies Corp	Moog Inc	Magna International Inc
		Ford Motor Co			
38	Instruments And Related Products	Arctic Cat Inc	Atrion Corp	Mks Instruments Inc	Analogic Corp
		Northrop Grumman Corp	Bard (C.R.) Inc	Telkonet Inc	Non Invasive Monitor
		Orbit International Corp	Merit Medical Systems Inc	Rudolph Technologies Inc	Cantel Medical Corp

Flir Systems Inc	Haemonetics Corp	Hollysys Automation Tech	Boston Scientific Corp
Kvh Industries Inc	Misonix Inc	Itron Inc	Intuitive Surgical Inc
Teledyne Technologies Inc	Vascular Solutions Inc	Cohu Inc	Integer Holdings Corp
Honeywell International Inc	Unilife Corp	Data I/O Corp	Syneron Medical Ltd
Ametek Inc	Msa Safety Inc	Frequency Electronics Inc	Tearlab Corp
Electro-Sensors Inc	Lakeland Industries Inc	Giga-Tronics Inc	Nxstage Medical Inc
Esterline Technologies Corp	Wright Medical Group Nv	Hickok Inc -Cl A	Cynosure Inc
Hurco Companies Inc	Reflect Scientific Inc	Xcerra Corp	Photomedex Inc
Mesa Laboratories Inc	Zimmer Biomet Holdings Inc	Teradyne Inc	Accuray Inc
Orbotech Ltd	Cryoport Inc	Aehr Test Systems	Zeltiq Aesthetics Inc
Roper Technologies Inc	Alphatec Holdings Inc	Exfo Inc	Sunshine Heart Inc
Schmitt Industries Inc/Or	Osi Systems Inc	United Health Products Inc	Cooper Companies Inc
Formfactor Inc	Mts Systems Corp	Trimble Inc	Staar Surgical Co
Bruker Corp	Mechanical Technology Inc	Bio-Key International Inc	Avid Technology Inc
Harvard Bioscience Inc	Mikros Systems Corp	Faro Technologies Inc	Nanometrics Inc

		Fluidigm Corp	Mocon Inc	Geospace Tech Corp	Medifocus Inc
		Kla-Tencor Corp	Cyberoptics Corp	Flexpoint Sensor Inc	Ixia
		Visualant Inc	Winland Electronics Inc	Sierra Monitor Corp	Sirona Dental System Inc
		Imax Corp	Leatt Corp	Callaway Golf Co	Daktronics Inc
39	Miscellaneous Manufacturing Industries	Hasbro Inc	Black Diamond Inc	Nautilus Inc	Gaming Partners Intl Corp
		Nintendo Co Ltd	Brady Corp	Escalade Inc	Trans-Lux Corp

Appendix A

Table A.2 The Data of Conagra Foods

This Table reports the data of Conagra Foods over the period from 2010 to 2015. The symbol "M~$" means that the unit for the variable is million dollars. The symbol "$" indicates that the variable is denominated with the U.S. dollar. The symbol "M" suggests that the the variable is measured in millions, and "%" shows that the variable is measured by percentage.

Fiscal Year	Total Assets (M~$)	Total Liabilities(M~$)	Total Cash(M~$)	Total Sales(M~$)	Net Income(M~$)	Total Market Value(M~$)	Common Shares Issued (M)	Book Value Per Share ($)	Total PP&E(M~$)	Hedging Decisions(M~$)	R&D Expense(M~$)
2010	11408.7	6700.2	972.4	12303.1	817	10438.8624	567.907	11.4533	5698.1	1	81.4

2011	11441.9	6905.9	103	13262.6	467.9	10251.4418	567.907	10.8915	5995.7	1	86
2012	20405.3	15042.3	183.9	15491.4	773.9	14131.7759	567.907	12.5503	7226.5	1	93.1
2013	19366.4	14011.2	183.1	17702.6	303.1	13627.8545	567.907	12.4634	7569.9	1	103.5
2014	17542.2	12932.2	183.1	15832.4	-252.6	16532.9951	567.907	10.5697	7438.5	1	90.4
2015	13390.6	9595.8	834.5	11642.9	-677	20019.5705	567.907	8.4773	6209.2	1	66.7

Fiscal Year	Tax Loss Carry Forward(M~$)	Convertible Debt and Preferred Stock(M~$)	Earnings Before Interest and Taxes(M~$)	Pretax Income - Foreign(M~$)	Notional Value of hedging derivatives(M ~$)	Total Shares Owned - As Reported (%)	Market Value of The Stock Options(M~$)	Marketable Securities and Accounts Receivable(M~$)	Standard Deviation of EBIT Over Five years(M~$)	Herfindahl-Hirschman Index	2-Digit SIC Code
2010	68.7	0	1328.4	74.8	337.2	0.066	0	1.3	0.0295	1435	20
2011	62.7	0	849.2	177.5	379.1	0.026	0	1.4	0.0277	1435	20
2012	60.7	0	1619.9	115.8	455.7	0.052	0	1.2	0.0348	1435	20
2013	96.7	0	1699.5	133.9	359	0.133	0	1.1	0.0353	1435	20
2014	78.6	0	1557.2	71.1	170.1	0.185	0	0.7	0.0355	1435	20
2015	100.3	0	1242.8	92.3	108.6	0.185	0	0.6	0.0324	1435	20