

Product Diversification and Debt maturity: North-American Companies

By

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**Abstract:**

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This paper provides an explanation whether product diversified firms tend to have more long-term debt compared to non-diversified firms. To conduct this study a sample of 571486 firms (North-American) was taken from a period of 1976 to 2013. For simplicity, only firms with operations the within US and Canada were considered. Geographic diversified firms were excluded. The long-term debt level of diversified firm was compared with non-diversified firms for various product lines, and the results show that diversified firms have more long-term debt compared to non-diversified firms. Moreover, I also find that debt level increases with the increase of product lines.

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## **Chapter 1: Introduction**

### **1.1 Background**

According to finance theory and concepts, diversification means to hold a portfolio of financial instruments with various degrees of correlation among the instruments. The main focus or purpose of the diversification is to minimize systematic risk and so that a loss on one is offset by another. From a firm's point of view, a company or corporation wants to flourish with organic growth and a strong profit margin. Diversification can assist the firm reducing default or bankruptcy risk. One way to diversify their business or operation is to increase product lines and operate within the same geographic area or expand their business to different countries or regions.

A firm or corporation's diversification structure mainly depends on how it is financed. There are various choices. The usual and liquid forms of financing are common equity and debt financing. In debt financing, a firm might take on short-term debt which is paid off within a year and long-term debt which is paid off over more than a year.

The literature attempting to answer the question of why a firm diversifies their operation or business is expensive. They indicate the agency costs of debt (Jensen and Meckling, 1976; Myers, 1977), the use of debt to overcome the 'free cash flow' problem (Jensen, 1986), transaction cost economics (Williamson, 1975), and the resource based view of the firm (Penrose, 1959). According to agency theories, among those papers, transaction cost economics and resource based view of the firm are the most convincing. Diversification increases organic and sustainable growth of the firm which will ultimately lead to an increase in the compensation plan of manager. The significant benefits of product diversification are economies of scope and

economies of internal capital markets (Jones and Hill, 1988). Economies of scope arise when the cost of jointly producing two goods are lower than the cost of producing them individually (Teece, 1982). With an internal capital market, the corporate headquarters draws all cash flows, and then invests in projects most compatible with the strategy of the firm, investment proposals and monitors them closely (Williamson, 1975).

On the other side of coin, we can also examine significant research that has been conducted to understand the firm's dynamic financial decision process and what factors influence the ultimate decision. Debt maturity and debt structure also influence the firm's expected probability of bankruptcy. According to a study by Dangl and Zechner (2006), if the transaction of rolling over of debt is low and costs of financial distress are larger, the firm will maximize firm value by going for short-term debt. If the cost of rolling over of debt is high and costs of financial distress are low, then the firm will maximize the value by issuing longer term debt.

## **1.2 Hypotheses**

Diversified and specialized firm differ from each other in two essential aspects: cash flow and investment opportunities. A diversified firm tends to generate higher cash flows compared to non-diversified firms (Whited, 2001). Besides, investment opportunities of diversified firms are lower compared to non-diversified firm (Lang and Stulz, 1994; Berger and Ofek 1995). According to the agency-based capital structure model (Jensen, 1986) it implies that firms with high free cash flow and fewer investment opportunity have an incentive to expand their business beyond their optimal size due to management incentives. The management see this expansion as (1) increasing the resources under their control (2) giving them promotional opportunity and

responsibilities, and (3) ultimately an increase in compensation package. For Jensen, leverage reduces the agency problem of overinvestment because debt reduces the free cash flow available for discretionary spending.

As shown previously, diversified firms have larger free cash flows and lower NPV projects than non-diversified (specialized) firm. Therefore, the potential for leverage to reduce agency cost linked with overinvestment should be higher for diversified firm compared to specialized firms. Moreover, leverage also triggers the likelihood of bankruptcy. Bankruptcy cost is lower with a specialized firm compared to diversified firms. However, leverage also increases the likelihood of underinvestment. So the underinvestment cost is low to a diversified firm due to its low growth opportunity compared to a specialized firm.

In summary, the potential capacity of leverage to reduce agency costs should be higher with a diversified firm than to a non-diversified firm. On the other side, the cost of underinvestment and bankruptcy is higher with non-diversified firm. Therefore, we expect that leverage will create value for diversified firms.

### **1.3 Objectives of the study**

The main objective of this paper is to determine whether an average diversified (product diversification) firm uses more long-term debt compared to specialized firms. In this paper, a robust test is use to identify product diversification, i.e. diversification will be defined as more than one product lineand then test for correlation. Diversification will then be defined as more than two product lines and then test for correlation. The process will be repeated and todetermine correlation, every time the product line is increased by one. The secondary objective is to find

out an explanation why diversified firm go for long-term debt. A regression model will be used to support the pattern of the first objective.

#### **1.4 Justification of the study**

There has been much work on why firms go for product or geographic diversification. Moreover, we also examine the research work that exists on firms financing decisions and what are the key factors that influence such decisions. However, there are very few studies in the literature to test the correlation between product diversification and debt maturity in North-American companies. From this point of view, this research paper will provide empirical evidence to explain whether any significant correlation is exists or not between companies product diversification and debt maturity, short or long-term, using recent data of North-American companies.

#### **1.5 Organization of the study**

This paper is broken down into five distinct chapters. This current chapter delivers a brief overview of the research topic and purpose of the study. Chapter 2 covers a review of the literature and the foundation on which this research is constructed. Chapter 3 provides a brief description of the data set and methodology that were used to conduct this research. Chapter 4 presents the empirical results and analysis of the research. Finally, Chapter 5 gives a summary of research findings and recommendations.

## **Chapter 2: Literature Review**

This chapter will provide a literature review which will point out the issues of diversification and leverage and their individual and joint effect on firm's performance and valuation process. From the previous research work, we would like to see whether a diversified firm's performance and valuation depend on product diversification or not whether this will lead the firm to go for long-term debt. The main focus of this review is to find out the correlation between product diversification and debt maturity.

### **2.1 Leverage and diversification**

A firm's capital structure and debt maturity can have major implications for the firm's operations and this can be create both opportunities and limitations for the firm. Many studies have provided both theoretical and empirical evidence to identify the key characteristics of capital structure and debt maturity. Among them are agency costs of debt (Jensen and Meckling, 1976; Myers 1977), the signaling effect of firms' quality (Ross 1977; Brealey, et al, 1977); the use of debt as an anti-takeover device (Harris and Raviv, 1988), the use of debt to overcome the free cash flow problem (Jensen, 1986). Other papers have attempted to explain the correlation between financial leverage and valuation and diversification and valuation. Among them are debt maturity and dynamics of leverage (Dangl and Zechner, 2006); governance structure, product diversification and performance (Oijen and Hendrikse, 2002). There are few studies that explain the correlation among financial leverage, diversification and valuation jointly. In this area the most promising paper is that of Ruland and Zhou(2005). In their paper, they argued that diversified firms have higher free cash flow and low positive investment opportunities compared to specialized firms. Besides that, agency costs are higher with diversified firms' due to higher free cash flow. They also implied that financial leverage should reduce agency costs for

diversified firm, which in turn will increase the value of the firm. Their results show a strong support for their hypothesis which is:

“Diversified Firm value increase with leverage and this tendency is not observed for specialized firm” P-277

From this review, we can conclude that leverage will be useful for diversified firms compared to non-diversified. As mentioned earlier, Jensen (1986) showed that leverage may be used to minimize free cash flow and the agency costs associated with potential over-investment and Berger and Ofek (1996), also confirmed that diversified firms have higher free cash flow than specialized firms and the capital expenditure is almost the same for both groups. This finding also suggests that diversified firm have increased potential for overinvestment. Ruland and Zhou (2005) suggest that even though leverage has some negative impact on the firm, this problem should be more applicable to the specialized firm than to the diversified firm. Therefore, theory suggests a higher correlation between leverage and valuation for diversified firm than the specialized firm.

The main focus point of this paper then is to determine whether a trend exists or not in diversified firms using more long-term debt compared to specialized, non-diversified firm. Based on the previous studies, it look like leverage will have a favorable effect on diversified firms compared to a specialized firm. If this paper shows any correlation between debt maturity and product diversification, then I would like to find out what are the reasons for this. A prior the most likely explanation will be that diversified firms have more free cash flow and less volatile net income.

Low and Chen (2004) examined the effect of diversification and capital structure within an international perspective. Their results also showed that product diversification is positively

related to financial leverage, indicating that such diversification minimized firm overall risk and led to higher debt level. Some of the earlier studies of this field, suggested that product diversification is negatively related with risk of the business and thus positively related with the higher level debt (Barton and Gordon, 1987, 1988). Diversified firms with several business lines tend to have stable net income compared to specialized firms. All of these studies showed that a diversified firm tends to carry higher level of leverage compared to a specialized firm due to their higher free cash flow and low business risk.

## **2.2 Product diversification effects on firms' performance**

Aswinand George (2002), studied the diversification strategies of cooperatives and compared them with corporations. From Oijen and Hendrikse (2002), can utilize a working definition of corporations as

“Corporations have shareholders. The shares give them rights to the assets, including the rents, of the corporation. The shares can be traded with relative ease. The managers of corporations can but do not necessarily have to own shares of the firm”. P-1.

And Cooperatives as

“Cooperatives have members, who have rights to the assets, including the rents of the cooperative. The rights are difficult to transfer from one member to another. In addition, the members are suppliers or customers of the cooperative (or both). Cooperatives are managed by managers who are usually not a member of the cooperative”. P-1.

From their work, they have an affirmative answer for the two questions which had been raised in their paper which are (i) Do the diversification strategies of corporations and cooperatives differ?; and (ii) Do diversification strategies have different implications for financial performance?

They found that cooperatives diversify relatively more into unrelated activities than corporations which has a negative impact on their performance. Cooperatives differ from corporations not just in terms of performance, but the extent and type of product diversification. Therefore, the main conclusion is that governance structure does matter for the product diversification and its performance.

The results of extensive empirical analysis of both product and geographical diversification effects on performance are inconclusive and contradictory, as Datta, et al (1991), and Grant, et al (1988) have illustrated.

A research paper by Tallman and Li, (1996) studied the effect of international and product diversification on the performance of the firm. If diversified firms have a favorable effect on their performance, then it is more likely that they might go for more long-term debt due to their stability in their performance. So all the research has this finding that diversification has a favorable effect on firms' performance and this can be used as a strong and supportive point for the reason of why diversified firms (both geographic and product) tend to go for long-term debt.

### **2.3 Debt maturity and firms' performance**

There is evidence from previous studies that diversification has a positive effect on a firm's performance and provides stability to a firm's earnings. Based on the result of these, it can be stated that diversified firms, industry and international diversified firms, have better access to more long-term debt and a diversified firm may go for more long-term debt due to the favorable cost of debt and terms, steady income and other factors such as size, liquidity, reputations, credit rating (investment grade) etc. Schiantareli and Sembenelli (1995) investigated the determinants and consequences of debt maturity using UK and Italian firms' data. They found that duration plays an important role for firms to choose the maturity structure of debt. They also concluded that more profitable firms tend to have more long-term debt due to a loss of control of short-term debt and fear of liquidation. It also makes sense that banks and lenders are willing to give more long-term debt in terms of short-term debt based on a firm's income stability and lower risk level.

The results do not support the hypothesis that short-term debt, better monitoring and control, does not boost efficiency and growth of the firm. The results support the opposite conclusion. Data of both countries give a positive relationship between initial debt maturity and the firm's subsequent medium-term performance. They documented the relationship between firm's characteristics and their individual choice of debt maturity.

On the other side of coin, it is also important to know whether these research results would still hold in recent times, especially after the 2008 financial crisis. Kuppuswamy and Villalinga (2010), showed that the value of diversified firms increased compared to specialized firm. The results were not driven by firm's self-selection of diversified decisions. Moreover, as the

financial crisis reflects exogenous shocks to external capital markets, their results couldn't be attributed to endogenous differences in firms' financing constraints.

Kuppuswamy and Villalonga (2010) also found in their study that the increase in value for diversified firms did not simply reflect changes in investor sentiment or perceptions, but real differences in investment and corporate finance. They explained two reasons which boost diversified firm value in crisis periods. The reasons are: a) greater access to credit market due to debt coinsurance provided by conglomerates and b) access to an internal capital market. While these financing alternative are always available to the firm, they become more valuable during crisis time.

In most cases, it was found that product diversification does create value by reducing financing cost, favorable terms, earning stability, liquidity etc. Readers will recall that Jensen (1986) also discussed the benefit of debt in minimizing the agency cost of free cash flow.

The main purpose of this research paper then is to identify any correlation between product diversification and debt maturity, long or short-term debt. We were interested too in identifying any existing trends between them and what factors trigger the financing decisions.

## **Chapter 3: Research Design**

### **3.1 Data and sample:**

For this study of product diversification and debt maturity and to determine whether diversified firm tend to go for more long-term debt compared to specialized firm, two North-American data sets were used i.e. for North-American data. For this paper, I obtained firm-specific financial data from the annual database of Standard and Poor's *Compustat Industrial* for the period of January, 1969 to July, 2013. Segment information were obtained from the *Compustat Historical Segment* files from the same period. Although there were 571486 firms and the maximum number of different product line is 33, all firms used in this study were North-American based firms of various industries. This data set includes domestic and non-domestic companies. A domestic company refers to U.S companies and a non-domestic company refers to Canadian companies.

One of the main limitations of the data collection is that due to different rules and regulations between U.S and Canadian accounting systems, not all the Canadian companies separately published their segment wise revenue.

The *Compustat1976\_2013* file was used to determine the short-term and long-term debt level of each firm. Short-term debt refers to debt with a maturity of less than one year and long-term debt refers to debt with maturity of more than one year. A description of *Compustat1976\_2013* and *Segment1976\_2013* file is given in Appendix A.

### **3.2 Research Methodology**

This study is conducted to test whether any correlation exists between industry diversified (based on different product lines) and their debt levels compared to specialized firms and their debt levels. To test the correlation, two data files *Compustat1976\_2013* and *Segment1976\_2013* were merged to collect information about a firm's long-term debt and product lines. The debt level was presented as long-term debt / Total debt where total debt is the sum of long-term debt and short-term debt. The relationship between diversified firms and their debt level was compared to specialized firms and their debt level was tested for any definition of diversification. The whole analysis was conducted using the *STATA* program and a robust test was conducted to test the correlation.

### **3.3 The Model**

In comparison to specialized firms, diversified firms tend to generate high free cash flows (Whited, 2001). The agency based capital-structure model implies that leverage should enhance the values of firms through the reduction of agency costs (Jensen, 1986). According to Jensen: firm leverage reduces the agency problem of overinvestment because debt puts a cap on excess free cash flow availability for discretionary spending. Managers then have fewer opportunities to overinvest or come up with legitimate projects. Berger and Ofek (1995) examined the impact of diversification on valuation. They did this by this model (Equation 3.1).

$$EV = \alpha_1 + \beta_1 D + \beta_2 SIZE + \beta_3 EBIT + \beta_4 CAPEX + \varepsilon \quad (3.1)$$

where:

EV is excess value.

D is 1 for firm reporting multiple segments; otherwise 0.

SIZE is the natural logarithm of total asset.

EBIT is earning before interest and taxes/sales

CAPEX is capital expenditures/sales.

This paper regression model in this paper is built upon Berger and Ofek (1995) who examined the impact of diversification on valuation, and debt, diversification, and valuation by Ruland and Zhou (2005). The Equation 3.2 is shown below:

$$EV = \alpha_1 + \beta_1 D + \beta_2 DEBT + \beta_3 D * DEBT + \beta_4 SIZE + \beta_5 EBIT + \beta_6 CAPEX + \varepsilon \quad (3.2)$$

where:

DEBT is the book value of long-term debt/book value of total asset, and D\*DEBT is the multiplication of D and DEBT, it implies the diversification and leverage. The long-term debt measure implies that leverage effectively locks the firm into a long-term commitment (Jensen, 1986).

In Equation 3.2, the correlation between EV and leverage for non-diversified firm is reflected by  $\beta_2$ . For the diversified firm  $\beta_2 + \beta_3$ .

In the absence of the empirical testing, I predict that  $\beta_2$  should have a negative sign and it implies that leverage is more beneficial for diversified firms. And I also predict that  $\beta_3$  will have a positive sign.

Hypotheses:

H0: Specialized firms do not tend to go for long-term debt compared to product diversified firms.

H1: Specialized firms tend to go for long-term debt compared to product diversified firm

**Chapter 4: Results and findings**

This research paper explains a trend between product diversified firms’ and debt maturity and specialized firms (non-diversified firms) and debt maturity. To test the correlation and to comply with our definition of diversification, a robust test was conducted through the STATA program. At first, one product line firms’ were considered to be a specialized firm and more than one product line firms’ were considered to be a diversified firm. Then the debt maturity level was compared between specialized and diversified firm.

Moreover, one more important trend was found in this study which was the risk indicator. The risk indicator was tested by measuring the net income volatility of the firm. For the diversified firm, one type of trend was found. The risk level of the firm increased with increasing debt as more product lines were added. At some point, with the increase of debt and product lines, the risk level of the firm decreased. But for the specialized firm, it was always an upward trend as more debt was added.

All the long-term debt and risk indicators of diversified and specialized firm results are shown in Table 4.1:

Number of Product lines to consider as diversified firms	Long-term debt percentage of non-diversified firms (%)	Long-term debt percentage of diversified firms (%)	Risk indicator of non-diversified firms	Risk indicator of diversified firms

1 and above	53.72524	62.16684	517.9108	1057.067
2 and above	54.1135	63.39867	470.3286	1115.659
3 and above	54.71629	66.52916	454.6192	1280.348
4 and above	55.53228	66.61119	555.1109	1305.423
5 and above	56.04876	66.71265	577.7105	1337.195
6 and above	57.16768	66.90753	623.3854	1387.673
7 and above	57.36456	67.56197	645.2276	1425.135
8 and above	57.62665	67.74761	657.8324	1443.234
9 and above	58.42451	69.17367	670.1313	1571.133
10 and above	58.77128	69.12394	697.5732	1615.932
11 and above	58.34128	69.61312	706.1231	1667.139
12 and above	59.36965	71.31497	729.1952	1905.354
13 and above	59.55581	71.48722	737.1328	1971.809
14 and above	59.73235	71.86171	746.1457	2061.277
15 and above	60.22548	72.34154	783.2168	2329.981
16 and above	60.45525	72.55219	796.1352	2434.535
17 and above	60.57383	72.70764	807.2427	2543.819

18 and above	60.75772	71.54353	837.1247	2813.909
19 and above	60.82056	71.88329	858.9009	2928.673
20 and above	60.89653	73.87898	853.1626	3157.126
21 and above	61.30461	72.13375	934.8074	2627.048
22 and above	61.34726	73.61254	951.2384	2343.679
23 and above	61.31424	73.03007	973.198	1673.057
24 and above	61.37918	73.36401	982.244	1686.606
25 and above	61.35162	73.54177	982.158	1671.103
26 and above	61.33063	73.75198	988.566	1678.375
27 and above	61.32256	71.04874	985.717	1897.558
28 and above	61.36141	72.12402	989.824	1846.344
29 and above	61.24024	71.54664	990.761	1950.185
30 and above	61.31625	70.86012	993.762	1527.102
31 and above	61.36039	75.08829	994.017	812.7213
32 and above	61.30101	83.75353	997.172	767.0206
33 and above	62.18737	88.56423	998.783	735.1987

Figure 4.1: Comparison of diversified and non-diversified firms based on long-term debt level.

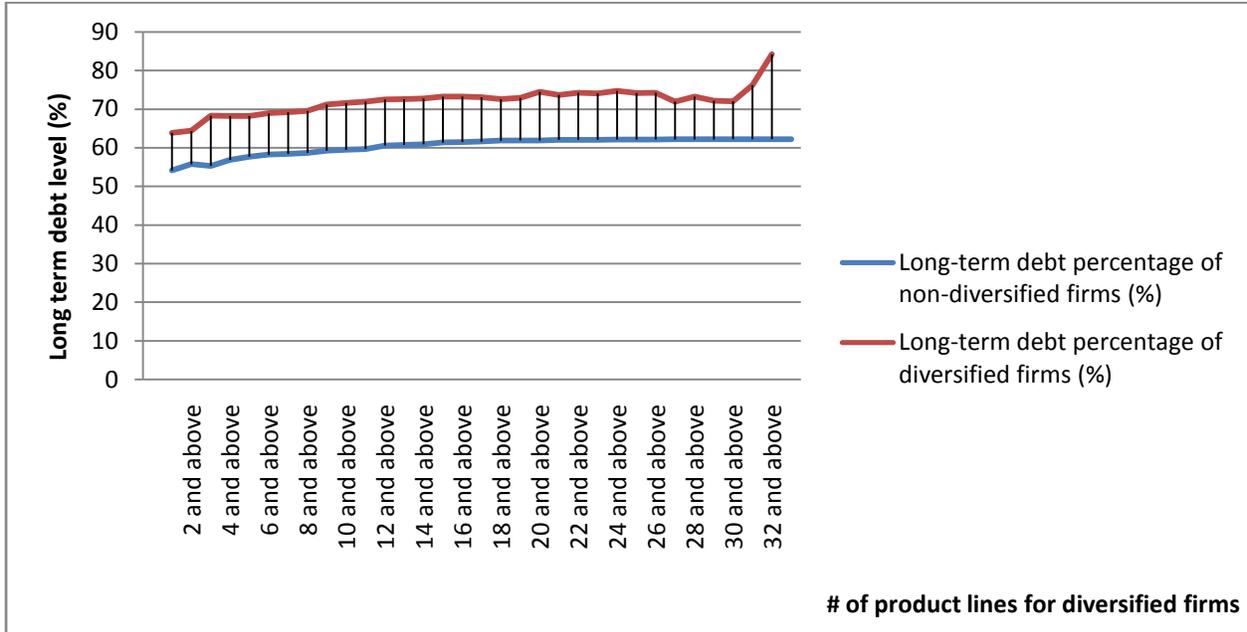


Figure 4.1 above explains that we consider a firm as a diversified firm when it has 2 or more product lines and we consider a non-diversified firm when it has only one product line. This condition is applicable on every level of diversification. For the entire robust test, we found the same result that product diversified firms are willing to go for more long-term debt compared to non-diversified firms. And the more the product lines are added with the firm, the higher the debt level rises for the firm. So this implies that increasing product lines is positively correlated with debt levels.

One of the main reasons behind why diversified firm are willing to go for more long-term debt is less net income volatility. Ruland and Zhou(2005) also imply that the value of a diversified firm increases with leverage and this trend is not correlated with non-diversified firms.

Table 4.2 Multivariable analysis

Variable	Coefficient	T-statistic
Intercept	0.576	1.13***
D	-0.235	-11.34***
DEBT	-0.713	-9.78***
D*DEBT	.324	2.9***
SIZE	.0187	.63
EBIT	.645	3.25***
CAPEX	.766	4.10***
Adj-R2 (%)	17.90	

\*\*\*indicates statistical significance at the .01 level, two-tailed tests.

The results for Equation 3.2,  $EV = \alpha_1 + \beta_1 D + \beta_2 DEBT + \beta_3 D * DEBT + \beta_4 SIZE + \beta_5 EBIT + \beta_6 CAPEX + \varepsilon$ (in Table 4.2) show that, DEBT is negatively correlated with excess value and the coefficient for D\*DEBT is positive. When we sum the coefficient for DEBT and D\*DEBT, we get a negative sign. These results indicate that excess value decreases with leverage for specialized firms while non-specialized firm, excess value indicate less tendency to decrease with leverage. Apart from SIZE, all variables are highly significant in this model.

## **Chapter 5: Conclusion and recommendations**

This research paper is based on 571486 firms, which have different product lines from 1 to 33. Data were collected from *Compustat1976\_2013* and *Segment1976\_2013* and all the firms are from North-America. In these data sets, domestic firms represent US based companies and foreign firms represent Canadian firms.

The main purpose of this empirical study was to find out whether diversified firms are more willing to go for long-term debt compared to non-diversified firms. In this paper, we consider all possible product lines that might be associated with diversified firms. The results showed that diversified firm has more long-term debt compared to non-diversified firms. To find out a reason for this our model was derived from Ruland and Zhou, (2005) which showed us that the value of diversified firms increases with leverage and this trend is not observed for non-diversified firms.

One limitation of this paper is that it includes all North-American's firms across different industries and business life cycles and we know that operation and debt levels vary based on industry, particular firms' operations, business strategies, business life cycle and etc. Another limitation of this paper is it only includes firms that have different product lines operating in U.S and Canadian markets. For multinational firms having product lines in different countries, they were excluded. So considering these two limitations of this paper, this study can be improved in the future to include more firms such as multinational and to divide the dataset into industry and company's life cycle and so on. This will have precise data to give a more precise and clearer picture between the correlation in diversified firms and debt maturity compared with non-diversified, specialized, and debt maturity.

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## Appendix: A

Description of *Compustat1976\_2013*:

variable name	storage type	display format	value label	variable label
gvkey	long	%10.0g		Global Company Key
year	long	%d		Data Date
fyear	double	%6.0g		Data Year - Fiscal
indfmt	str12	%12s		Industry Format
consol	str2	%2s		Level of Consolidation - Company Annual Descriptor
popsrc	str2	%2s		Population Source
datafmt	str12	%12s		Data Format
tic	str8	%8s		Ticker Symbol
com	str58	%58s		Company Name
curcd	str4	%4s		ISO Currency Code
fyr	double	%4.0g		Fiscal Year-end Month
act	double	%18.0g		Current Assets - Total
aedi	double	%18.0g		Accrued Expenses and Deferred Income
at	double	%18.0g		Assets - Total
capx	double	%18.0g		Capital Expenditures
ceq	double	%18.0g		Common/Ordinary Equity - Total
che	double	%18.0g		Cash and Short-Term Investments
chch	double	%18.0g		Cash and Cash Equivalents - Increase/(Decrease)
ci	double	%18.0g		Comprehensive Income - Total
csho	double	%18.0g		Common Shares Outstanding
dlc	double	%18.0g		Debt in Current Liabilities - Total
dltt	double	%18.0g		Long-Term Debt - Total
dp	double	%18.0g		Depreciation and Amortization
dv	double	%18.0g		Cash Dividends (Cash Flow)
dvt	double	%18.0g		Dividends - Total
ib	double	%18.0g		Income Before Extraordinary Items
lct	double	%18.0g		Current Liabilities - Total
lt	double	%18.0g		Liabilities - Total
ni	double	%18.0g		Net Income (Loss)
pperb	double	%18.0g		Property, Plant, and Equipment - Buildings (Net)
prstk	double	%18.0g		Purchase of Common and Preferred Stock
sale	double	%18.0g		Sales/Turnover (Net)
txdb	double	%18.0g		Deferred Taxes (Balance Sheet)
costat	str2	%2s		Active/Inactive Status Marker
fic	str4	%4s		Current ISO Country Code - Incorporation
sich	double	%8.0g		Standard Industrial Classification - Historical
prcc_c	double	%18.0g		Price Close - Annual - Calendar
mkvalt	double	%18.0g		Market Value - Total - Fiscal
prcc_f	double	%18.0g		Price Close - Annual - Fiscal
aedi_dc	double	%4.0g		Accrued Expenses and Deferred Income Data Code
capx_dc	double	%4.0g		Capital Expenditures Data Code
ceq_dc	double	%4.0g		Common/Ordinary Equity - Total Data Code
che_dc	double	%4.0g		Cash and Short-Term Investments Data Code
chch_dc	double	%4.0g		Cash and Cash Equivalents - Increase/(Decrease) Data Code
csho_dc	double	%4.0g		Common Shares Outstanding Data Code
dlc_dc	double	%4.0g		Debt in Current Liabilities - Total Data Code
dltt_dc	double	%4.0g		Long-Term Debt - Total Data Code
dp_dc	double	%4.0g		Depreciation and Amortization Data Code
dv_dc	double	%4.0g		Cash Dividends (Cash Flow) Data Code
ib_dc	double	%4.0g		Income Before Extraordinary Items Data Code
lct_dc	double	%4.0g		Current Liabilities - Total Data Code
lt_dc	double	%4.0g		Liabilities - Total Data Code
ni_dc	double	%4.0g		Net Income (Loss) Data Code
pperb_dc	double	%4.0g		Property, Plant, and Equipment - Buildings (Net) Data Code
prstk_dc	double	%4.0g		Purchase of Common and Preferred Stock Data Code
txdb_dc	double	%4.0g		Deferred Taxes (Balance Sheet) Data Code
sic	str4	%4s		Standard Industry Classification Code

Description of *Segment1976\_2013*:

variable name	storage type	display format	value label	variable label
gvkey	long	%10.0g		Global Company Key - Segment Annual Fundamentals
stype	str8	%8s		Segment Type
sid	double	%6.0g		Segment Identifier
atlls	double	%18.0g		Long-lived Assets
atlls_dc	double	%4.0g		Long-lived Assets Data Code
capex	double	%18.0g		Capital Expenditures
capex_dc	double	%4.0g		Capital Expenditures Data Code
caxts	double	%18.0g		Cost and Expenses - Total
caxts_dc	double	%4.0g		Cost and Expenses - Total Data Code
cogss	double	%18.0g		Cost of Goods Sold
cogss_dc	double	%4.0g		Cost of Goods Sold Data Code
dps	double	%18.0g		Depreciation and Amortization
dps_dc	double	%4.0g		Depreciation and Amortization Data Code
emps	double	%18.0g		Employees
emps_dc	double	%4.0g		Employees Data Code
esubs	double	%18.0g		Equity in Earnings
esubs_dc	double	%4.0g		Equity in Earnings Data Code
ias	double	%18.0g		Identifiable (Total) Assets
ias_dc	double	%4.0g		Identifiable (Total) Assets Data Code
ibs	double	%18.0g		Income before Extraordinary Items
ibs_dc	double	%4.0g		Income before Extraordinary Items Data Code
iints	double	%18.0g		Interest Income
iints_dc	double	%4.0g		Interest Income Data Code
intseg	double	%18.0g		Intersegment Eliminations
intseg_dc	double	%4.0g		Intersegment Eliminations Data Code
ivaeqs	double	%18.0g		Investments at Equity
ivaeqs_dc	double	%4.0g		Investments at Equity Data Code
mis	double	%18.0g		Net Income (Loss)
mis_dc	double	%4.0g		Net Income (Loss) Data Code
nopxs	double	%18.0g		Nonoperating Income (Expense) - excluding Interest
nopxs_dc	double	%4.0g		Nonoperating Income (Expense) - excluding Interest Data Code
ncints	double	%18.0g		Net Interest Income (Expense)
ncints_dc	double	%4.0g		Net Interest Income (Expense) Data Code
obs	double	%18.0g		Order Backlog
obs_dc	double	%4.0g		Order Backlog Data Code
ocaxs	double	%18.0g		Other Cost and Expenses
ocaxs_dc	double	%4.0g		Other Cost and Expenses Data Code
oelim	double	%18.0g		Other Eliminations (Income)
oelim_dc	double	%4.0g		Other Eliminations (Income) Data Code
oiadps	double	%18.0g		Operating Income after Depreciation
oiadps_dc	double	%4.0g		Operating Income after Depreciation Data Code
oibd	double	%18.0g		Operating Income before Depreciation
oibdpdc	double	%4.0g		Operating Income before Depreciation Data Code
ops	double	%18.0g		Operating Profit (Loss)
ops_dc	double	%4.0g		Operating Profit (Loss) Data Code
ppents	double	%18.0g		Property, Plant & Equipment
ppents_dc	double	%4.0g		Property, Plant & Equipment Data Code
ptis	double	%18.0g		Pretax Income
ptis_dc	double	%4.0g		Pretax Income Data Code
rds	double	%18.0g		Research and Development
rds_dc	double	%4.0g		Research and Development Data Code
revts	double	%18.0g		Total Revenues
revts_dc	double	%4.0g		Total Revenues Data Code
sale	double	%18.0g		Net Sales
sales_dc	double	%4.0g		Net Sales Data Code
salexg	double	%18.0g		Export Sales
salexg_dc	double	%4.0g		Export Sales Data Code
spis	double	%18.0g		Special Items
spis_dc	double	%4.0g		Special Items Data Code
tbts	double	%18.0g		Income Taxes
tbts_dc	double	%4.0g		Income Taxes Data Code
tbms	double	%18.0g		Excise Taxes
tbms_dc	double	%4.0g		Excise Taxes Data Code
xidos	double	%18.0g		Extraordinary Items and Discontinued Operations
xidos_dc	double	%4.0g		Extraordinary Items and Discontinued Operations Data Code
xints	double	%18.0g		Interest Expense
xints_dc	double	%4.0g		Interest Expense Data Code
xsgas	double	%18.0g		Selling, General & Administrative
xsgas_dc	double	%4.0g		Selling, General & Administrative Data Code
year	long	%d		Data Date - Segment Annual Fundamentals
srcdate	long	%d		Source Date - Segment Annual Fundamentals
curcds	str4	%4s		ISO Currency Code
isosrc	str4	%4s		Source ISO Currency Code
naicsh	str6	%6s		Primary Historical NAICS
srscs	double	%6.0g		Source Document
upds	double	%6.0g		Update Code
naicss1	str6	%6s		NAICS Code (Primary)
naicss2	str6	%6s		NAICS Code (Secondary)
sics1	str4	%4s		SIC Code (Primary)
sics2	str4	%4s		SIC Code (Secondary)
geotp	str8	%8s		Geographic Segment Type
srms	str244	%244s		Segment Name
soptp1	str8	%8s		Operating Segment Type 1
soptp2	str8	%8s		Operating Segment Type 2
corn	str58	%58s		Company Name
tic	str8	%8s		Ticker Symbol
cusip	str10	%10s		CUSIP
cik	str10	%10s		CIK Number
sic	str4	%4s		Standard Industry Classification Code
naics	str6	%6s		North American Industry Classification Code

STATA CODE:

\*Starting with the data sorting\*

\*Getting the diversification indicator of the companies\*

clear all

\*Loading the file, and excluding Geographic segments\*

set memory 15g

use "C:\Users\s7914983\Desktop\MRP Data\segment1976\_2013.dta"

destringgvkey.replace

keep if stype=="BUSSEG"

\*Getting the maximum number of segment of each firm\*

\*Identifying the firm by gvkey\*

\*Excluding unuseful data in order to save memory\*

bysortgvkey year: gen maxnum= N

keepgvkey year sidmaxnum sale oibd

\*Creating a variable to indicate if a firm is diversified\*

\*When div=1, the firm is diversified\*

gen div=0

replace div=1 if maxnum>1

save Mpart1, replace

\*Starting to merge data from another file\*

\*Gathering the information of debts\*

clear all

use "C:\Users\s7914983\Desktop\MRP Data\Compustat1976\_2013.dta"

destringgvkey.replace

sortgvkey year

mergegvkey year using Mpart1

drop merge

drop if div==.

\*Getting the number of firms in each group\*

bysort div: gen firmnumber= N

\*Gathering the amount of total debt\*

\*Variable td is the total debt of the firm\*

\*Calculating td by adding long-term and current debt\*

gen td= dltt+ dlc

drop if td==.  
sortgvkey year

\*Getting the percentage of long-term debt in total debt\*

\*Variable longper is the long-term percentage\*

genlongper= dltt/td

\*Getting the sum of percentage of long-term debt of each group\*

bysort div: gen sumper=sum( longper)

sumsumper if div==0

scalnon div per=r(max)

sumsumper if div==1

scaldiv per=r(max)

\*Getting the equally weighted average long-term percentage\*

\*of each group\*

gen percentage=non div per/ firmnumber if div==0

replace percentage=non div per/ firmnumber if div==1

\*Evaluating the validity of the net income of each firm\*

\*Then, evaluating the standard deviation of the validity\*

\*the standard deviation is the risk indicator, variable risk ind\*

bysortgvkey: egen risk=sd(ni)

bysort div: egen risker=sd(risk)

genrisk ind=risker/ firmnumber if div==0

replacerrisk ind=risker/ firmnumber if div==1

\*Draw the relationship between diversification and risk indicator\*

twoway (line div risk ind)

save Mpart2, replace

\*Testing\*

clear all

use Mpart2

set more off

sortgvkey year

bysortgvkey year: gen n= n

keep if n==1

genlast div=.

genlastyr=year-1

sum year

scalyrmax=r(max)

scalyrmin=r(min)

sumgvkey

scalgvmax=r(max)

scalgvmin=r(min)

```
local k=gvmin  
while `k`<=gvmax{  
locali=yrmin  
while `i` <= yrmax {  
gen last=div if year==`i'-1 &gvkey==`k'  
sum last  
gen f=r(max)  
replacelast_div= f if year==`i' &gvkey==`k'  
drop f  
drop last  
locali=`i'+1  
}  
local k=`k'+1  
}
```