THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND PROFITABILITY OF U.S. MANUFACTURING COMPANIES: AN EMPIRICAL ANALYSIS

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It has been an important research topic for decades to investigate the relationship between capital structure and profitability. It is critical to optimize capital structure to maximize the company's profitability and improve its competitiveness. However, the results from previous researches have not been conclusive and the debate is unlikely to be addressed soon due to various influences of different situations. The objective of this study is to identify the relationship between capital structure and profitability of U.S. manufacturing companies. Historical data (2009-2018) are collected from the audited financial reports of a sample of 15 U.S. manufacturing companies for this study. Applying the panel analysis techniques, the regression models of capital structure and profitability ratios are empirically constructed. The result reveals that the capital structure plays a vital role in the overall profitability of the underlying organization. Particularly, the Coverage Ratio (CR) is significantly and positively related to profitability which is represented by Return on Assets (ROA) and Return on Invested Capital

(ROIC). Total Debt to Equity (TDE) and Total Debt to Tangible Assets (TDTA) ratios have a significantly negative relationship with profitability. Firm Size (FS), as a control variable, has a positive impact on profitability. Therefore, profitability has a strong correlation with the capital structure of U.S. manufacturing companies.

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Chapter 1- Introduction

1.1 Background

With the slogan "Make American Great Again" and a series of tax cut policies, the U.S. manufacturing industry has begun to recover and grow in these years. The GDP contribution from the manufacturing industry in the United States increased to $2139.80 billion in the third quarter of 2018 from a record low of $1798.60 billion in the first quarter of 2009 after the financial crisis of 2007–2008 (Appendix A). In the last ten years, the growth rate of GDP from the manufacturing industry in the United States attained 18.97%. Furthermore, the manufacturing industry plays an essential role in the United States economy. Based on the data of value added by industry group as a percentage of GDP (Appendix B; Appendix C) from the U.S. Bureau of Economic Analysis, manufacturing industry is the third highest industry in the U.S. which is 11% and is only less than the other two sectors which are respectively 21% in finance & insurance etc. and 13% in business services (Appendix D). The number of U.S. manufacturing employees has increased from 11.45 million in March 2010 to 12.83 Million in February 2019 (Appendix E). The percent change of all employees and the Industrial Production of Manufacturing Industry from a year ago in 2009-2018 is displayed (Appendix F). The growth rate of U.S. employees from the manufacturing industry achieved 12.05% in the past decade.

1.2 Purpose of the Research

To research the performance of the U.S. manufacturing companies can bring some benefits to the U.S. economy and manufacturing industry. To evaluate a company's performance, one of the most crucial indicators is profitability. Most managerial decisions are ultimately related to improving their company's profitability (Eltabakh, Ngamkroeckjoti & Siad, 2014). To enhance profitability is essential to a company's competitiveness in a competitive environment. It is vital and meaningful to seek the factors that impact a manufacturing companies' profitability.

It has been an important research topic for decades to investigate the relationship between capital structure and profitability (Biswas, 2018). A firm's profitability is affected by multiple factors, especially by capital structure. Any company's financial decisions are essential to the company's management. A critical determination comes from an optimal capital structure (Naseem, Malik & Zhang, 2017). Capital, the external source, becomes a sign of a company's financial debts. Capital structure plays an essential role in company operation. It is a critical and common determinant to measure the firm's profitability for many researchers and managers. The decision of the capital structure is crucial to any companies' development. Capital structure is composed of debt and equity, and it is the combination of debt and equity that are used for financial analysis. To run day-to-day company operations, managers always use two ways to get the capital: one way is from debt, which includes issuing bonds, and loaning from creditors, and the other way is from equity that includes issuing stocks to investors. Ordinarily, minimizing the company's capital cost and maximizing the company's profit can help companies perform well. The rise of debt increases the capital cost and the risk of bankruptcy – inability to pay off the lenders' debt. When a company's cash flow from operations is not enough to pay off current liabilities, this situation might lead the company to go bankrupt. Therefore, the debt levels of a company should not be too high. Moreover, heavily issuing stocks will dilute the owners' equity. The risk of losing control right will go up in the future. The optimal capital structure is one of the critical factors of the companies' capital strategy. Most companies intend to achieve the optimal capital structure and maximize their profitability.

Many researchers and managers try to seek an optimal model for capital structure that could improve the firm's ability to increase profitability for long-term success. The performance of a firm is variable in different kinds of industries, and the influence of capital structure on profitability is not similar. Therefore, different scholars focus on diverse industries and various indicators. Meanwhile, different conclusions and models are elicited because the capital structure is different in various industries.

1.3 Objective of the Research

To contribute to this important topic, the objective of this study is to study the relationship between capital structure and profitability of companies in the U.S. manufacturing industry. Historical data (2009-2018) are collected from the audited annual financial reports of a sample of 15 U.S. manufacturing companies for this study. Applying the panel analysis techniques, the regression models of capital structure and profitability ratios are empirically constructed. The Coverage Ratio (CR), Total Debt to Equity (TDE), Total Debt to Tangible Assets (TDTA) ratios are selected to reflect the capital structure. Return on Assets (ROA) and Return on Invested Capital (ROIC) are utilized as the profitability ratios (*Know Your Profitability Metrics,* 2016). Firm Size (FS) as a control variable is also used in this study. Results from multiple dimensions over time effectively reveal the relationship between capital structure and profitability of U.S. manufacturing companies. Capital structure plays an essential role in the overall profitability of the underlying organization and has a statistically significant impact on profitability.

1.4 Significance of the Research

While past studies on the relationship between capital structure and profitability are focused on specific countries or areas or a blend of different industries, few have studied the relationship of companies from the U.S. manufacturing industry during the latest ten-year period. Furthermore, this study extends the research on Total Debt to Tangible Assets and Coverage Ratio which are important ratios for manufacturing companies in the U.S. The findings of this study are beneficial to manufacturing companies using the best combination of capital structure to get optimal performance. Additionally, the results reveal the close relationship between capital structure and profitability of the manufacturing sector.

1.5 Organization of the Research

This thesis is organized in the following five chapters. Chapter 1 is introduction; the background, research purpose, research method and content are briefly introduced. The relevant existing literature on capital structure and performance is reviewed in Chapter 2, and the limitation of previous researches and the new approaches of this thesis are elaborated. In Chapter 3, the panel data analysis method is described and applied in attaining the purposes of the study; especially, the data sources and hypothesis are detailed. Chapter 4 summarizes the results of the regression models and the critical findings of the relationship between capital structure and profitability. Finally, conclusion, limitation and future research suggestions for researchers and managers in company finance are summarized in Chapter 5.

Chapter 2- Literature Review

The purpose of this study is to study the impact of capital structure (Coverage Ratio, Total Debt to Equity, Total Debt to Tangible Assets) on the profitability (Return on Assets, Return on Invested Capital) of U.S. manufacturing companies. The understanding of the relationship between capital structure and profitability is reviewed and discussed in this chapter. The literature review is made up of three sections. In the first section, the literature of capital structure is presented, and the variables utilized in the researches of capital structure are reviewed. The second section shows the literature that examines the profitability and the represented variables. The literature review of the relationship between capital structure and profitability is given in the third section, and the limitation of the previous studies is also discussed in this section.

2.1 Capital structure

In the past decades, various theories were proposed and developed on the capital structure and its relation to the firm's performance and profitability. The most influential theories are the "MM" theory propounded by Modigliani and Miller in 1958, the trade-off theory (Miller, 1977), pecking order theory (Myers & Majluf, 1984).

These various research efforts focus on whether the capital structure directly affects company profitability. With the seminal study by Modigliani and Miller (1958), they provided a foundational and constructive theory of "capital structure irrelevance", which was based on a perfect capital market, no tax and no transaction costs. This theory indicated that capital does not impact the company's performance. However, the capital market with these restrictive assumptions does not exist in the real business world which is complicated with other conditions. MM theory laid the foundation for the development of capital structure theory in the future. In the following years, Modigliani and Miller (1963) incorporated corporate income tax into the MM theory as a factor of capital structure, and the conclusion of the fixed MM theory is that debt is influenced by the interest tax deduction on the firm's value. In other words, the debt capital has a positive impact on the company's value. To maximize a company's worth, the company should use more debt.

The argument is extended by more theories on other determinants, such as bankruptcy cost, agency costs and pecking order (Abor, 2005). The trade-off theory was proposed by Miller (1977). Miller claimed that the cost of bankruptcy would increase with the growth of debt capital. There are two kinds of bankruptcy costs in companies: direct cost and indirect cost. The direct bankruptcy cost (the legal and administrative cost) is close to 5% of the company's value before bankruptcy (Warner, 1977) or less than 10% of the company's profit before bankruptcy (White, 1990). Most researchers argue the direct bankruptcy cost is high. However, the indirect bankruptcy cost which is called financial distress cost would bring the company more loss than direct cost. The loss of customers, suppliers, excellent employees would be influenced by the company operation. Meanwhile, the indirect cost cannot be measured, but it is higher than 10%. The trade-off theory indicates the debt capital has a positive effect on financial risk and agency cost. Company's debt leads to agency cost, and it impacts the relationship between managers and shareholders separating ownership and management (Jensen & Meckling, 1976). The divergence between them is the conflict of interest from a different position. Shareholders pursue the maximum of enterprise value while managers seek a comfortable working environment and flexible working time. Moreover, owners cannot monitor every decision from managers. Therefore, the debt capital can mitigate the conflict and decrease the agency cost.

The pecking order theory was proposed by Myers and Majluf (1984). This theory suggests a company should get capital from a hierarchy of capital options, which includes internally generated funds (such as retained earnings), external financing from debt and issuing equity to meet the other capital requirements (Nadaraja, Zulkafli & Masron, 2011). Internally generated funds are provided by the firm itself, thus they are the best source of financing. When the cash flow generated from operations is not sufficient to finance future capital requirements for growth, etc., the company can raise money from either debt capital or equity capital. If the company has to finance from the external sources, the better choice is secured debt as opposed to risky debt and common stocks issuance (Abor, 2005). Hossain and Hossain (2015) researched to identify the crucial determinants of capital structure. They selected data from a sample of 74 manufacturing companies listed in Bangladesh Dhaka Stock Exchange during the period from 2002 to 2011, and used a panel data analysis to test the hypothesis. The conclusion showed tangibility and liquidity ratios have a positive relationship with long-term debt and a negative relationship with short-term debt and total debt.

2.1.1 Debt and Equity

Capital structure is a mixture of debt and equity that is utilized by a company's operations (Shubita & Alsawalhah, 2012). In some studies, the debt ratio is measured by debt over assets or long-term debt over assets (Abor, 2005). However, using one ratio to explain the capital structure is not sufficient since many factors impacts the capital structure. Following the prior researches, three metrics are selected for the capital structure to seek a relationship with profitability. One of the most common ratios, Total Debt to Equity (TDE), is used to indicate the capital structure, which measured by total debt over equity (Tailab, 2014). Total Debt to Equity (TDE) ratio indicates the level of a company's debt financing. Thus, it shows how much debt is applied in financing related to owner's equity (Nissim & Penman, 2001). A study aimed to determine the effects of capital structure and profitability on manufacturing companies from 2012 to 2014. The author selected a sample of 135 manufacturing companies listed on Indonesia stock exchange, and used linear regression models. The results showed that the debt to equity ratio as a capital structure metric has a significantly negative effect on the company value (Ela, Iskandar & Gusnardi, 2016).

The ratio is represented by the following equation:

$$\text{Total Debt to Equity (TDE)} = \text{Total Debt} / \text{Equity}$$

2.1.2 Tangible Assets

Tangible asset is a type of physical asset, including buildings, equipment, land, plants, and cash. Usually, it is acknowledged that tangible assets have a positive correlation with the debt because it is a tangible value and easy to be evaluated in external financing (Johnson, 1997). Intangible assets, such as goodwill, brand recognition and intellectual property, are difficult to monitor and measure (*Liquidation Value*, n.d.). Tangible assets play a role as security for additional borrowings as collaterals to decrease the risk and cost of financing (Rajan & Zingles, 1995). Thereby, it is important to study tangible assets component of the capital structure. While studying the factors of cement companies' capital structure in Pakistan, the author selected a sample of 18 cement companies in a period from 2005 to 2010, used a regression model to analyze the relationship between assets tangibility and leverage, which represents capital structure. The findings showed that asset tangibility has a positive influence on leverage ratio (Shah, Perveen & Javed, 2013). Another study by Chevallier and Miloudi (2014) aimed to seek the relationship between profitability, asset tangibility, size, growth opportunity, and leverage, and they selected a sample of 986 French High-tech companies from the European DIANE database in a six-year period (2005-2010). The conclusion of this research showed a higher volume of tangible assets in a company is easier to gain trust from the creditors. In this research, Total Debt to Tangible Assets (TDTA) is used as a ratio to represent the capital structure, measured by total debt over tangible assets. Thus, the ratio is represented by the following equation:

Total Debt to Tangible Assets (TDTA) = Total Debt / Tangible Assets

Tangible Assets = Total Assets – Intangible Assets

2.1.3 Coverage Ratio

The trade-off theory introduces that the cost of bankruptcy would increase with the growth of debt capital. With the increase in the company's debt, the company should be aware of the risk of bankruptcy. Therefore, the company must hold enough earning to pay off its interest cost on debts. The interest coverage ratio as a variable of capital structure is researched by Harris and Raviv (1990); and Eriotis, Vasiliou and Ventoura-Neokosmidi (2007). When the company's income cannot pay off the debt and interest cost, the risk of bankruptcy would be high. Therefore, the interest cost would impact the capital structure and thus, studying the interest coverage ratio is important. In this study, the Coverage Ratio (CR) is measured by earnings before interest and taxes (EBIT) dividing by interest cost. If the value of the CR is high, the company can easily pay off its interest cost.

The ratio is represented by the following equation:

Coverage Ratio (CR) = EBIT / Interest Cost

2.1.4 Control Variable

In the previous researches, control variables are taken to classify different types of companies, such as firm size, growth, industry types (Gill, Biger & Mathur, 2011). Findings from the past researches show that firm size is an essential factor of capital structure and more debt is used in larger companies due to their lower risk of default and bankruptcy (Elsas & Florysiak, 2008). The result of a study argued the firm size has a negative relationship with the capital structure (Ting & Lean, 2011). However, research on the U.S. service companies found the firm size has a significant impact on company performance, and it has a positive influence on larger firm size (Gill, Biger, Pai, and Bhutani 2009). Also, in a research by Amran and Che-Ahmad (2011), they claimed that the firm might fall into unmanageable operations if the size of a firm is too large and lead to negative firm performance. Firm size is an important control variable in this study. The natural logarithm of annual revenue is used to reduce spurious correlation (Mittoo & Zhang, 2008; Titman & Wessels, 1988). Therefore, the firm size in this study is the proxy for the natural logarithm of annual revenue (Gill et al., 2011).

The ratio is represented by the following equation:

Firm Size (FS) = Natural logarithm of annual revenue = Ln (annual revenue)

2.2 Profitability

Profitability is defined as the ability of a company to generate earnings greater than its cost (*What is Profitability,* n.d.). When a company is profitable, the difference between the revenue and cost should be greater than zero. Profitability, which shareholders and managers focus on, is an important indicator of the company's policies and decisions. In many previous studies, profitability is represented by various ratios. Most of them are going to seek how effective the company's management is in generating profit during a specific period. The most common ratios used in researches are Return on Equity (ROE), Return on Assets (ROA), Return on Invested Capital (ROIC) (Abor, 2005; Negasa, 2016). For these ratios, a higher positive value indicates a better company performance and the company is more profitable. However, a negative value of these ratios demonstrates the company is run at a loss. Two variables utilized in this study to represent profitability are Return on Assets (ROA) and Return on Invested Capital (ROIC).

2.2.1 Return on Assets

Return on Assets (ROA) is defined as a ratio to show the percentage a company earns on its assets within a given year (*ROA*, n.d.). It indicates the amount of profit in a company can be generated on its assets. The common calculation is net income divided by average total assets. The net income and total assets are separately found in the annual income statement and the annual balance sheet. The higher the ROA, the better. ROA higher than 5% is generally considered good.

ROA is calculated as:

Return on Assets (ROA) = Net Income / Total Assets

2.2.2 Return on Invested Capital

Return on Invested Capital (ROIC) is a financial ratio that measures a company's efficiency and profitability of using the invested capital to generate returns. The calculation is net income divided by average invested capital (*ROIC*, n.d.). Invested capital includes total stockholders' equity, long-term debt and capital lease obligation, and short-term debt and capital lease obligation (Negasa, 2016). The net income and invested capital are separately found in the annual income statement and the annual balance sheet. The higher the ROIC, the better. ROIC of 10-15% is generally considered good.

ROIC is calculated as:

Return on Invested Capital (ROIC) = Net Income / Invested Capital

2.3 Relationship between capital structure and profitability

The relationship between capital structure and profitability was a prevalent topic in the past decades. To determine an optimal model is a goal for many researchers all over the world. It is, however, an arduous undertaking to demonstrate an optimal capital structure because of differences among various companies and industries. Therefore, many scholars limit their research to a specific industry or a region.

Abor (2005) selected a five-year period data of 22 Ghana listed companies in his research, and used regression models to seek the correlation between capital structure and profitability. The conclusion showed that there was a negative relationship between long-term debt and profitability. The total debt also had a negative correlation with profitability, but the short-term debt had a positive impact on the profitability. The firm size and growth were positively related to profitability. The results indicated that the primary financing way should be short-term debt.

Margaritis and Psillaki (2010) studied the French manufacturing companies to identify the relationship between capital structure, ownership and company performance by using a regression model. The results showed profitability has a negative effect on leverage for all industries on average and also across different capital structures. The impact on profitability appears to be stronger for firms with higher debt.

Ting, Wei and Hooi (2011) have investigated the relationship between the capital structure and profitability of Malaysia companies. They selected data from 1997 to 2008 and used a panel data analysis to build a regression model. The conclusion of this research was that total debt had a positive relationship with tangible assets but had a negative impact on profitability. The long-term debt had negative influence on profitability and tangible assets, while the short-term debt had a significantly negative effect on profitability.

Gill, Nahum and Neil (2011) researched how the capital structure impacts profitability with a sample of 272 U.S. companies from 2005 to 2007. They utilized a regression model to seek the relationship between capital structure and profitability. They found that debt to total assets has a positive relation with profitability in the manufacturing companies.

Soumadi and Hayajneh (2015) studied the Jordanian public companies which were selected from the Amman stock market during a five-year period (2001-2006) by using multiple regression models. They found that capital structure had a negative effect on company performance. The results also showed the financial leverage had a negative impact on the company performance and the financial leverage is the same between the low-growth and high-growth companies for the Jordanian companies.

Chadha and Sharma (2015) studied a sample data of 422 Indian manufacturing companies from 2003 to 2013 to research the correlation of capital structure and profitability. In this research, the conclusion indicated the leverage ratio is not related to Return on Assets. But, it revealed a significant negative relation with Return on Equity. Thereby, the result also indicated a significant association between firm size, tangibility, ROA and ROE.

Ayad and Mustafa (2015) investigated the relationship of capital structure and profitability on four industrial companies from the Iraq during a ten-year period (2004-2013) by using multiple regression models via ordinary least squares analysis. They found that capital structure had a significantly positive impact on profitability.

Vijeyaratnam and Anandasayanan (2015) researched a sample of listed manufacturing companies in Sri Lanka from 2008 to 2012 by using regression analysis. They found the nondebt tax shield had a significantly negative impact on profitability for manufacturing companies. There is not a significant relation between tangibility and determinants of leverage.

Alimi et al. (2016) researched a sample of 115 Nigerian companies during the period from 1998 to 2012 using a generalized method to study the relationship between capital structure and profitability. In the end, the study demonstrated the performance is negatively related to capital structure.

Negasa (2016) studied 32 large private manufacturing firms in Ethiopia from 2006 to 2010. A linear regression model was used to examine the relationship between capital structure and companies' profitability. The results showed that a positive relationship between debt and profitability was existed and there was a significantly positive relationship between firms' growth and profitability as well as firms' size and profitability.

2.4 Summary

This chapter summarizes the literature reviews on capital structure and profitability. Based on the previous researches, the variables used in this study are also introduced. The formulas of ROA, ROIC, TDE, TDTA, CR and FS ratios are explained in each section. Additionally, the previous studies of the relationship between capital structure and profitability are summed up. In summary, according to the prior researches, there is significant relationship between capital structure and profitability. This research contributes to the existing literature on the topic of capital structure and profitability of manufacturing companies.

Abundant researches are conducted on the capital structure of companies in different industries and countries. However, few studies are focused on U.S. manufacturing companies after the financial crisis of 2007–2008. After the financial crisis of 2007-2008, the U.S. economy is gradually recovering from the bottom of an abyss to another crest. To study the historical data from 2009 to 2018 can bring more significance for the U.S. manufacturing companies' development and might provide a different conclusion of the relationship between capital structure and profitability. This study is to examine the relationship between capital structure and profitability of the U.S. manufacturing companies by using the latest data. A panel data analysis is employed to build regression models utilizing the total debt to equity, coverage ratio, total debt to tangible assets as independent variables, which are also capital structure ratios, and return on assets and return on invested capital as dependent variables, which are profitability ratios, as well as a control variable, firm size.

Chapter 3- Methodology

3.1 Research Methodology

Researchers often use two types of methodologies - quantitative and qualitative methods. Quantitative research collects data in a numerical form that can be measured in units and can be used to draw a table and graph of original data (Carr, 1994). Qualitative method gathers data by using open-ended questionnaires, participant observation, and diary accounts (Denzin & Lincoln, 1994). In this present research, quantitative methodology is utilized. Various statistical tests are applied to select the most appropriate model with the most accurate and adequate data.

3.1.1 Panel Data

To study the relationship between capital structure and profitability of U.S. manufacturing companies, a panel data analysis is employed to build empirical regression models. Panel data analysis is a statistical method, widely used in social science, medical science and econometrics to analyze multi-dimensional data involving measurements over some period of time (*Panel analysis,* 2018). The data used in research are derived from some observations over time on some cross-sectional units like individuals, firms, or governments (Moffatt, 2018). Researchers can study the problems in a cross-sectional time-series data which reflects the different meanings. Using panel data regression model can make research problems complex, but the panel data bring the data more flexibility and increases the researcher's degree of freedom to examine the variables and relationship between them (Moffatt, 2018). The data and models have both cross-sectional and time-series dimensions (*Panel Data Models*, n.d.).

Panel data include three different types of models which are pooled model, fixed effects model (FE) and random effects model (RE) (*Panel analysis,* 2018). In order to examine the most appropriate regression model for testing the relationship between capital structure and profitability, two main tests are commonly applied. One is Breusch-Pagan Lagrange Multiplier (LM) Test to decide which model should be used between the random effects regression model (RE) and pooled model (*Analysis of the relationship between Leverage and Profitability*. n.d.). Moreover, the Hausman Test is to determine the best model between the fixed regression model (FE) and the random regression model (RE). In this study, the STATA statistic software is used to do these two tests to figure out the best regression model.

The common panel data regression model is given as:

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it}$$

Where:

Y_{it} = dependent variables of firm i at time t

X_{it} = independent variables of firm i at time t

i = the individual cross-sectional dimension (i.e., firms)

t = the time dimension (i.e., 2009-2018)

α = constant

β = coefficients

ε_{it} = the residual error of firm i observation at time t

3.1.2 Model Estimation

3.1.2.1 Breusch-Pagan Lagrange Multiplier (LM) test:

The LM Test is used to decide between a random effects model and a pooled model. The null hypothesis in the LM test is that variances across entities are zero which means no significant difference across units (Torres-Reyna, 2007). The hypothesis is conducted as below:

H_0: The Pooled model is accepted.

H_1: The Random model is accepted.

In this study, the STATA statistical software is applied, and the probability value of LM Test is compared with a common significance level of 0.05. If the P-value of LM Test is smaller than 0.05, the null hypothesis should be rejected, and the random effects model should be accepted. Contrarily, if the P-value of LM Test is higher than 0.05, the null hypothesis should be accepted, and the Pooled model should be accepted.

3.1.2.2 Hausman Test

It is widely used in research to determine the appropriate model between the Fixed effects model and the Random model. Hausman test evaluates whether there is a significant difference between the fixed and random effects estimators (Greene, 2008). The hypothesis of the Hausman Test (Hausman, Abrevaya & Scott-Morton, 1998) is shown as below:

H_0: The Random effects model is accepted.

H_1: The Fixed effects model is accepted.

To decide a better model between fixed effects model or random effects model, the P-value of the Hausman Test is compared with a common significance level of 0.05 in statistics. The Random effects model should be accepted when the P-value is larger than 0.05. Besides, when the P-value is smaller than 0.05, the null hypothesis should be rejected, and the Fixed effects model should be employed.

In this study, the data are selected from 15 manufacturing firms during the ten-year period. The characteristics of these data can meet the requirements of the panel data analysis. Therefore, using a panel data model to seek the relationship between capital structure and profitability is beneficial to investigate the best regression model. Based on the results of the LM Test and Hausman Test, the most appropriate model can be built. Using panel data allows the investigator to analyze the data and relationship among different dimensions and to provide more informative findings.

3.1.3 Definitions of Indicators

In this part, definitions of various indicators are introduced. The selected data have to be tested for the normality, stationarity, and collinearity before using the panel data to seek the appropriate regression model. Besides, the results of regression models are also defined in this section, such as R-square, P-value, F-test, and T-test.

3.1.3.1 Normality

An assumption of normality is the precondition for many statistical procedures. The data should be checked to make sure their validity to run the regression model. (Ghasemi & Zahediasl, 2012)

The standard method to test the data's normality is to draw a histogram with a normal probability curve. If the curve fits a bell-shaped, the data can meet the requirement of normality. The data can be used to build regression models.

3.1.3.2 Stationarity

The stationarity of data is a common assumption in many time series statistical procedures (Gozgor, 2011). A stationary distribution can be better used in the panel data analysis. The primary cause to lead non-stationarity in sample data is that the unit-roots exist in the observations, such as a high R-square value. Therefore, the results of the regression model are not precise. Some statistical tests can be used to investigate the stationarity of the observations. The following common tests are used to estimate the unit-root (Gozgor, 2011):

a. Augmented Dickey-Fuller-Fisher Test (ADF-Fisher Test)

b. Levin, Lin and Chu Test (LLC Test)

c. Breitung Test

d. Im, Pesaran and Shin Test

e. Phillips-Perron Test (PP Test)

In this study, the ADF-Fisher Test and LLC Test are utilized to check the stationarity of the observations.

3.1.3.3 Collinearity

Collinearity, also called multicollinearity, is a phenomenon that occurred among the predictors or independent variables, which means there are two or more highly linearly correlated variables impacting the response variables or dependent variables (*Multicollinearity,* 2019). It is a problematic condition in regression analysis. Collinearity can decrease the statistical significance of the regression model when all these collinear variables are included. The accuracy of the model can be reduced due to the existence of two same tendency variables in the same model. When the collinearity is in the model, the variables should be removed from the model. In order to test the collinearity of the independent variables, the variance inflation factor (VIF) is used. VIF provides a measure of the degree of collinearity. Generally, the value of VIF should be smaller than 10, which means that the collinearity is in the model if the VIF higher than 10.

3.1.3.4 T-test, F-test, P-value and R-square

In statistics, there are a lot of indicators to test the appropriateness of the regression models. Generally, the probability value (P-value) of T-test, F-test as well as the value of R-square are commonly used in the prior researches. In this thesis, these indicators are used to interpret the regression models between capital structure and profitability. The explanation of these indicators is provided below.

First, the T-test is to examine the relationship between one of the independent variables and the dependent variable in a regression model. The determination of this test is to compare the probability value (P-value) with a common significance level of 0.05 in statistics. Ordinarily, when the P-value is smaller than 0.05, the significant relation exists between this independent variable and dependent variable. On the contrary, if the P-value is larger than 0.05, there is not substantial evidence to say the independent variable has a significant impact on the dependent variable.

Additionally, F-test is a statistical test to investigate whether the overall independent variables have a significant effect on the dependent variable. The result of the F-test is represented by P-value which is compared with a common significance level of 0.05 in statistics. The null hypothesis is that the fit of the intercept-only model and your model are equal, which means the overall independent variables cannot explain the dependent variable in the regression model. If the P-value higher than 0.05, the null hypothesis of the F-test should be accepted and it indicates the overall independent variables in the regression do not significantly influence on the dependent variable. Therefore, when the P-value is smaller than 0.05, the regression model can fit the analysis which means there are at least one independent variable is significantly related to the dependent variable.

Moreover, the P-value is a measurement to decide whether the null hypothesis should be rejected or accepted at a different level of significance. Generally, when P-value smaller than the various significance level, the null hypothesis should be rejected. There are four interpretations of P-Value as follows (Ronald, Wasserstein & Nicole, 2016):

1) P-value < 0.10, some evidence shows the null hypothesis is rejected; prudently, it is not selected by most researchers.

2) P-value < 0.05, strong evidence shows the null hypothesis is rejected.
3) P-value < 0.01, very strong evidence shows the null hypothesis is rejected.
4) P-value < 0.001, extremely strong evidence shows the null hypothesis is rejected.

Finally, R-square is a statistic indicator to show how much percentage of the variance of the dependent variable is explained by the independent variables in a regression model (Jugurnath & Emrith, 2018). The value of R-square ranges from 0 to 1 and is shown as a percentage from 0% to 100%. R-square = 1 means the explanatory ability of independent variables to dependent variables is 100%. When R-square = 0, the independent variables cannot explain the dependent variable. It is meaningful if the R-square value is higher than 0.35 or 35% in social sciences (Jost, 2019; Bowerman, O'Connell & Koehler, 2005).

3.2 Hypothesis

A hypothesis indicates a proposed phenomenon explanation (*Hypothesis*, 2019). The scientific method is used to test the hypothesis. The common way is statistical tests which are used to decide the overall observed effect when the hypothesis is rejected. In statistical hypothesis tests, two hypotheses exist. The null hypothesis (H_0) states no relation is between the observed variables in the phenomenon, and the alternative hypothesis (H_a) is the opposite of null hypothesis: there is a relationship between the investigative variables (Altman, 1990). There are several forms of statements for the alternative hypotheses which are a probable direction and a definite positive or negative direction (Altman, 1990). Typically, the P-value is utilized to determine whether the null hypothesis is rejected or accepted. As the P-value and the significance levels in the P-value section were introduced, there are four common significance levels for hypotheses testing which are 0.10, 0.05, 0.01, 0.001. If P-value is smaller than the significance level, the null hypothesis should be rejected. (Mellenbergh, 2008). Previously, the relationship between capital structure and profitability has been studied by researchers from different contexts. In order to research the relationship between capital structure and profitability in the U.S. manufacturing companies and based on the rationale so far, four hypotheses are put forward in the present study as below:

$H1_0$: No correlation between profitability and coverage ratio.

$H1_a$: Profitability is correlated to coverage ratio.

$H2_0$: No correlation between profitability and total debt to equity.

$H2_a$: Profitability is correlated to total debt to equity.

$H3_0$: No correlation between profitability and total debt to tangible assets.

$H3_a$: Profitability is correlated to total debt to tangible assets.

$H4_0$: No correlation between profitability and firm size.

$H4_a$: Profitability is correlated to firm size.

3.3 Variables

In this study, there are three types of variables which are dependent variables, independent variables, and control variables. In a regression model, the dependent variables are explained by independent variables and control variables. Based on the previous literature, several ratios are applied to indicate the elements of capital structure and profitability. In this study, the profitability is dependent variable represented by return on assets (ROA) and return on invested capital (ROIC). Meanwhile, the capital structure is represented by three independent variables using the following three ratios: total debt to equity (TDE), coverage ratio (CR), total debt to tangible assets (TDTA). The control variable is firm size (FS). These ratios used in this study are introduced at Chapter 2 literature review.

All the measurement of variables is summarized in Table 3.1 below:

Table 3.1 *Measurement of Variables*

Variables	Definition	Formula
Dependent variables:		
ROA	Return on Assets	ROA = Net Income / Total Assets
ROIC	Return on Invested Capital	ROIC = Net Income / Invested Capital
Independent variables:		
TDE	Total Debt to Equity	TDE = Total Debt / Equity
CR	Coverage Ratio	CR = EBIT / Interest Cost
TDTA	Total Debt to Tangible Assets	TDTA = Total Debt / Tangible Assets
Control variable:		
FS	Firm Size	FS = Ln (Annual Revenue)

Note. EBIT: Earnings Before Interest and Taxes

Based on the introduction of common panel data regression model and hypothesis as well as variables, the regression models are built as below:

Model 1: ROA = C + α1CR + α2TDE + α3FS

Model 2: ROIC = C + β1CR + β2TDE + β3FS

Model 3: ROA = C + α1CR + α2TDTA + α3FS

Model 4: ROIC = C + β1CR + β2TDTA + β3FS

3.4 Sample and data collection

In the present study, the purpose is to examine the relationship between capital structure and profitability of manufacturing companies in the U.S. Data collection is an important step of any study. The data used in this study are collected from the audited annual financial reports. In order to precisely and comprehensively analyze the topic, data from the U.S. Department of Commerce and Bureau of Economic Analysis as well as Federal Research Economic Data

(FRED) are used in the discussion. In this study, a sample of 15 U.S. manufacturing companies is selected. The cross-section of 15 manufacturing companies and the time series of 10 years create 150 observations from 2009 to 2018 in this study (Appendix G). The values of different variables are calculated in EXCEL tables from the raw data extracted from the audited annual financial reports. In order to ensure accurate data and results, different types of statistical software are applied in this study, such as SPSS, STATA, EVIEWS, and the results are compared. Therefore, using the selected dataset to analyze the significant relationship between different variables is credible, and it can generate reasonable and accurate outputs.

The criterion of company selection is based on the range of annual revenue and the classification of companies. The classification is represented by the Standard Industrial Classification (SIC) codes (Appendix H; Banker, Bardhan, Chang & Lin. 2006). The SIC codes are four-digit numerical codes assigned by the U.S. government to identify the primary business of the companies. It is an important classification rule in North America, and the purpose is to improve the comparability of business data of the U.S. and Canada. In this thesis, the companies are selected from the wide range of SIC codes between 3500 and 3800. In order to comprehensively analyze the relationship between capital structure and profitability, different types of manufacturing companies are selected from the list of the 500 largest public manufacturing companies in the U.S. (*List of largest manufacturing companies by revenue,* 2018). The companies and the SIC codes, as well as primary businesses are shown as Table 3.2:

Table 3.2 *Companies selected*

Number	Company	SIC Code	Primary business
1	General Electric Co.	3699	Electrical Equip.
2	General Dynamics Corp.	3799	Railcars & Ships Equip.
3	Northrop Grumman Corp.	3812	Aerospace & Defense
4	United Technologies Corp.	3812	Aerospace & Defense
5	Caterpillar Inc.	3531	Machinery
6	Whirlpool Corp.	3639	Electrical Equipment
7	Cummins Inc.	3714	Motor Vehicle Parts
8	Parker Hannifin Corp.	3799	Machinery
9	BorgWarner Inc.	3714	Motor Vehicle Parts
10	Oshkosh Corp.	3799	Motor Vehicles
11	Polaris Industries Inc.	3799	Railcars & Ship Equip.
12	Colfax Corp.	3561	Machinery
13	Modine Manufacturing Co.	3714	Motor Vehicle Parts
14	National Oilwell Varco Inc.	3533	Machinery
15	Watts Water Tech. Inc.	3561	Machinery

Meanwhile, the companies are selected from a range of mean annual revenue from 1,422 million dollars to 135,266 million dollars. In this sample, there are four companies' ten-year average revenues lower than 5,000 million dollars. And there are six companies' ten-year mean incomes lower than 20,000 million dollars. Besides, five companies' average revenues are higher than 20,000 million dollars. The companies are selected from different range of mean revenues. It indicates that these selected companies are reasonable to explain the relationship between capital structure and profitability.

3.5 Summary

The panel data analysis used in the study as a quantitative research method is explained in detail in this chapter. The precondition of the panel data method is the normality, stationarity, and non-collinearity of data. Besides, the chapter presents the hypotheses and variables applied in the study. Ultimately, based on the SIC codes and the range of ten-year mean revenue, the sample and data collection are provided. 15 U.S. manufacturing companies during a ten-year period (2009-2018) are selected. These companies and the primary businesses are summarized in Table 3.2. The collected sample data is anonymized for confidentiality reasons before performing further analysis in the following chapters.

Chapter 4- Empirical Results

4.1 Descriptive Statistics

The essential characteristics of the quantitative research method are the data's validity and reliability (Leung, 2015). In the current study, the reliability and validity of the data are highly emphasized because they are gathered from the audited financial reports.

In this chapter, four sections are used to discuss the data selected in the study to research the relationship between capital structure and profitability of U.S. manufacturing companies. The panel data analysis is employed in the estimation, and the most appropriate models are built. The findings of the models are described. Based on the hypotheses that have been put forward in chapter 3, the results of panel data models are estimated to decide if the null hypotheses should be rejected. Based on different results, the real economic interpretations are explained, and the figures and tables are also used to show the relevant data and economic significance.

The first section is about the descriptive statistics and correlations of the data. At the same time, mean values are compared, and the economic interpretations are explained in various viewpoints, such as descriptive statistics of data by company, descriptive statistics of data by year, and time graphs of multiple variables by a company. Before using the panel data analysis, the data should be tested for the normality, stationarity, and collinearity as discussed in chapter 3. Therefore, the second section provides the test process of the data, including the normality, stationarity, and collinearity of data. In part 3, the data are examined by the panel data method, and the results of the models are displayed in a table. The indicators of the Hausman Test and LM Test are discussed. The findings are presented, and the relationship between capital structure ratios and profitability ratios are examined. Finally, the summary of this chapter is discussed in section 4.

4.1.1 Descriptive statistics of data by companies

The purpose of this section is to determine mean values of various variables for different companies in ten years. In Table 4.1, the highest average value of CR ratio is 54.74 from company C12 which means the earnings before interest and tax can pay off 54.74 times of the interest cost. The safety of this company is high, and the debt used in its operation is relatively low, or the earnings are high. On the contrary, the lowest average value of CR ratio is 1.35 for company C7. It shows that the earnings of this company before interest and tax can only pay off 1.35 times of the interest cost. One reason is its low earnings, and another is the high debt. For the TDE ratio, the highest and lowest values are respectively 4.92 and 0.52 from C5 and C9. The ratio will go up as the debt increases. Therefore, a high TDE can raise the bankruptcy risk of the company. C5 may be pressured due to their high debt. Most companies' TDTA ratios are close to 1.0, which means the total debt equals to the tangible assets. From the economic viewpoints, the lenders have considered the company's tangible assets as the guaranty to avoid financial risk. The value of the FS is a natural logarithm of annual revenue for respective companies. Average FS varies from 7.26 to 11.82, which indicates the annual revenue of selected companies are within a reasonable range and different annual revenue companies selected to research in this study are meaningful. The ROA ratios are varies from 0.33% to 16.33% and they come from C5 and C12 respectively. The Highest CR ratio is also from C12. Therefore, this company's profitability is excellent. In this company, a low-level debt to generate a high profit means the management of this company is prominent. C5 has a low ROA, and the TDE is 4.92. The TDE is a relatively high number. The ROA and TDE indicate that this company has a high debt and a low income. Therefore, C5 company needs to increase its earnings and decrease its debt to stay healthy. The ROIC ratio is in a range of 0.7% to 31.08%. They come from C5 and C12 respectively. From the discussion above, the debt level is related to the earnings, and earnings are indicators of company's profitability. A high-level debt can increase the risk of bankruptcy, but the high profitability can decrease the risk of bankruptcy. A comparison of mean values of company-specific variables (2009-2018) is shown as Figure 4.1.

Table 4.1 *Mean values of Company-Specific Variables (2009-2018)*

Company	CR	TDE	TDTA	FS	ROA	ROIC
C1	15.22	1.32	0.73	8.92	6.72%	11.31%
C2	9.10	4.54	0.91	10.80	3.93%	7.27%
C3	4.80	2.15	1.11	7.70	1.86%	4.22%
C4	40.26	1.12	0.57	9.76	10.37%	19.01%
C5	9.61	4.92	0.99	11.82	0.33%	0.70%
C6	28.27	1.89	1.10	10.38	7.16%	15.46%
C7	1.35	1.86	0.70	7.30	0.66%	4.62%
C8	11.09	2.50	1.31	10.21	7.46%	15.09%
C9	27.35	0.52	0.59	9.48	3.17%	4.82%
C10	5.70	2.21	0.99	8.87	4.47%	10.17%
C11	12.41	1.36	0.95	9.41	7.58%	12.59%
C12	54.74	2.09	0.79	8.18	16.33%	31.08%
C13	8.94	2.02	1.23	10.98	6.64%	13.38%
C14	5.26	1.00	0.82	7.26	2.91%	4.91%
C15	3.35	3.18	1.01	9.88	3.00%	9.95%

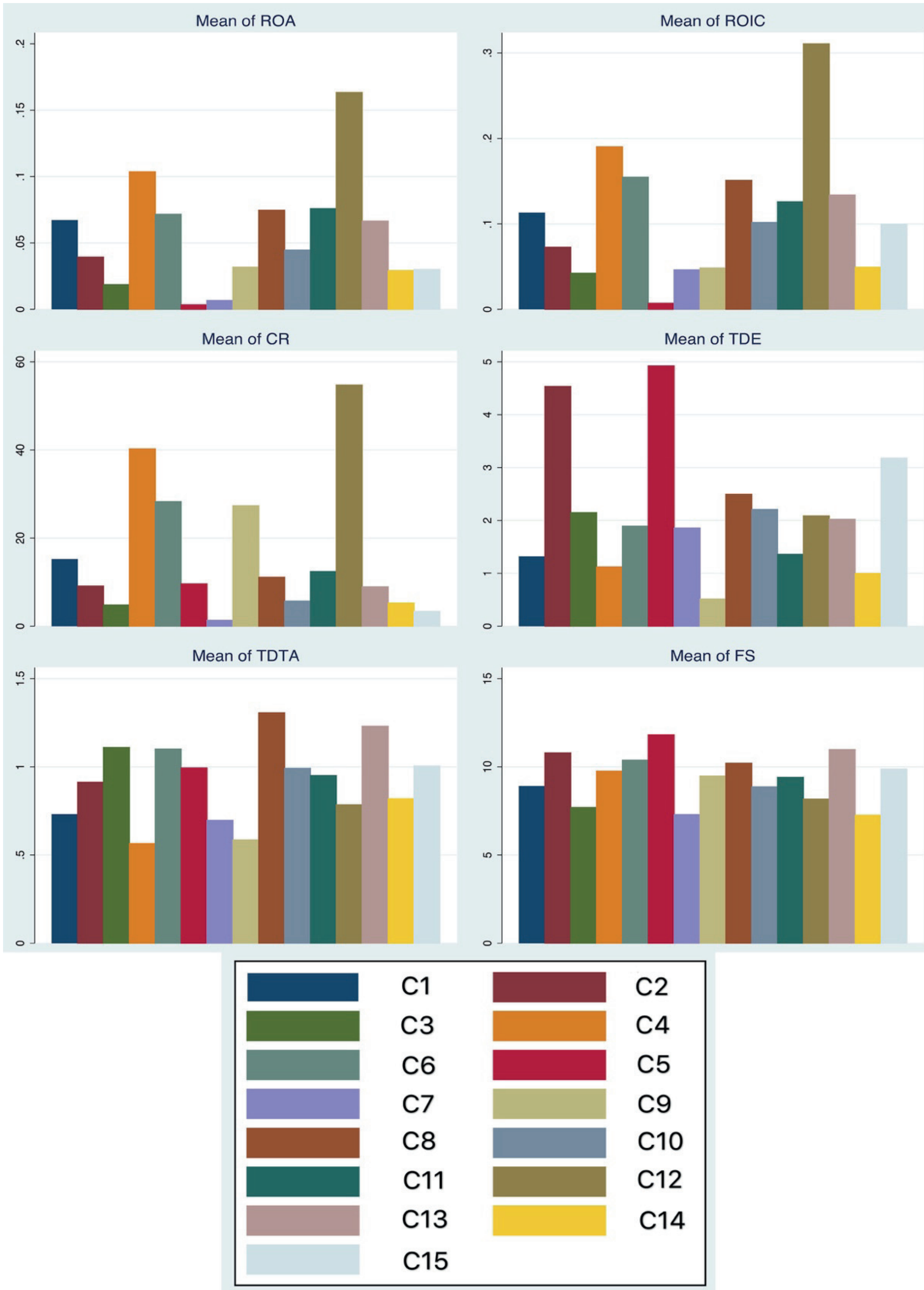

Figure 4.1 Comparison of Mean Values of Company-Specific Variables (2009-2018)

4.1.2 Descriptive statistics of data by years

The mean values of year-specific variables are displayed in Table 4.2. The value of CR is in the range of 9.01 to 23.70, which are from years 2016 and 2011 respectively. The values of CR ratio have increasing trend from 2009 to 2013 with a decreasing trend from 2014 to 2018, which means most companies reduced their debt to avoid the risk of bankruptcy after the financial crisis. This point of view is proved by the trend of TDE ratio which decreases from 2009 to 2013 and increases from 2014 to 2018. The values of TDTA are relative stationary close to 1.0, and it demonstrates that most companies have total debt equivalent to their tangible assets. Firm size, indicated by annual revenue, has an increasing trend from 2009 to 2018. The historical data indicates most manufacturing companies' revenue is recovered from the bottom of the abyss of the financial crisis in 2007-2008. However, the trend of ROA and ROIC is different from the FS trend. The ROA and ROIC ratios have a bad performance in 2009 and increase from 2010 to 2014. Then these ratios decrease from 2015 to 2017. The trends of ROA and ROIC are changing in different years, indicating that the profitability of the companies in 2009 is not good after the financial crisis in 2007-2008. However, the values increase from 2010, which shows the companies implement the policy of reducing debt and various types of cost. Therefore, with the steady increase in annual revenue, the ROA and ROIC can have a high increase rate in 2010. With five years' recovery, companies are once again increasing their debt. Although the revenue is increasing, the ROA and ROIC ratios have fallen, which demonstrates that raising the debt and associated cost for the companies' development negatively affects profitability. The TDE ratio can also prove this result. In the recent two years, the ROA and ROIC ratios are recovered to a reasonable level with the U.S. Government's favorable policies for manufacturing industry. A comparison of mean values of year-specific variables is shown in Figure 4.2.

Table 4.2 *Mean values of Year-Specific Variables (15 Companies)*

Year	CR	TDE	TDTA	FS	ROA	ROIC
2009	10.11	2.78	0.91	9.11	1.90%	5.73%
2010	17.37	2.14	0.86	9.21	6.55%	13.26%
2011	23.70	2.16	0.86	9.32	7.31%	14.59%
2012	23.52	1.91	0.89	9.48	6.61%	12.56%
2013	21.92	1.68	0.85	9.49	6.72%	12.82%
2014	19.87	1.84	0.89	9.52	8.04%	15.50%
2015	14.07	2.01	0.94	9.45	5.10%	10.32%
2016	9.01	2.15	0.96	9.37	3.75%	8.00%
2017	9.73	2.29	0.97	9.43	3.81%	7.30%
2018	9.01	2.81	1.06	9.55	5.28%	9.65%

Figure 4.2 Comparison of Mean Values of Year-Specific Variables (15 Companies)

4.1.3 Time graphs of various variables

Figure 4.3 presents all values and trends of variables used in the study for all companies over the latest ten-year period in a multiple time graph, which can clearly be distinguished from separate time graphs. Table 4.3 shows the number and corresponding company's identifier to match with Figure 4.3. The average ten-year values of variables were analyzed in section 4.1.1. In this section, company C12 is selected to discuss the trends of every variable in a ten-year period. As shown in Table 4.1, C12 has high CR, ROA and ROIC ratios. Based on Figure 4.3 below, the values of CR increase from 2009 to 2013 and then decrease from 2014 to 2018. In the same trend as the ROA and ROIC ratios, they attained a peak in 2014 that shows the CR ratio has a relationship with the profitability. The TDE and TDTA ratios have a similar trend and are changing in the opposite direction based on the CR ratio. Therefore, TDE and TDTA also are related to profitability.

Figure 4.3 Time Graphs of Various Variables by Company

Table 4.3 *Number and Corresponding company's identifier*

Number	1	2	3	4	5	6	7	8
Company	C5	C6	C8	C13	C2	C15	C4	C11
Number	9	10	11	12	13	14	15	
Company	C1	C10	C12	C3	C7	C9	C14	

4.1.4 Descriptive Statistics and Correlations

The descriptive statistics of the observations are recorded in Table 4.4, as well as the correlations. The values of mean, minimum, maximum and standard deviation of entire observations are displayed, together with the associations of variables used in this study. The mean value of CR ratio is 15.83 with the minimum and maximum values, which are -23.98 and 93.5 respectively. The standard deviation is 20.07 which implies how the CR ratio of the individual companies is further away from the mean value for all companies. The mean value indicates the earnings before interest and tax (EBIT) can pay off 15.83 times of interest cost. The average amount of CR ratio shows the risk of the bankruptcy is low and it is good enough to maintain the company's day-to-day operation. With the mean values of 2.18 and 0.92 for the TDE and TDTA respectively, the values, in general, revealed that the manufacturing companies have heavy fixed assets. TDE ratio is higher than 2.0, but it should not be above 2.0 to ensure the health of company's operation. Meanwhile, the TDTA ratio is a sound ratio and can be controlled by the lenders who would make sure their capital's safety. Moreover, the minimum (6.26) and maximum (11.96) values of the FS show that the companies are selected from a range of annual revenue numbers, and the data selection is rational. ROA and ROIC are the profitability variables, and the mean values are 6% and 11% respectively. The mean values can meet the expected criteria introduced in chapter 2 which are more than 5% and are in a range of 10% to 15% separately. The companies selected perform well on their profitability.

The correlations of these variables are exhibited in Table 4.4. Commonly, a value greater than absolute value of 0.7 indicates a high correlation between the variables. The correlation coefficient between CR and ROA is 0.74 and the coefficient between CR and ROIC is 0.69. There is a highly positive association between CR and the profitability variables: ROA and

ROIC. It indicates the CR ratio has a positive effect on the profitability in the U.S. manufacturing companies. The TDE ratio has a negative correlation with ROA and ROIC that the coefficients are -0.37 and -0.31 respective. Therefore, the TDE ratio has a negative relationship with profitability. The conclusion of TDTA is same as TDE. The Pearson correlation coefficients of TDTA for ROA and ROIC are -0.2 and -0.15 respectively. FS is positively related to profitability with these two coefficients: 0.03 and 0.01.

Table 4. 4 *Descriptive Statistics and Correlations*

	N	M	Min	Max	SD	1	2	3	4	5	6
1. CR	150	15.83	-23.98	93.5	20.07	1					
2. TDE	150	2.18	0.43	8.32	1.49	-0.27	1				
3. TDTA	150	0.92	0.49	1.67	0.25	-0.39	0.47	1			
4. FS	150	9.39	6.26	11.96	1.36	0.03	0.4	0.34	1		
5. ROA	150	6%	-20%	24%	6%	0.74	-0.37	-0.2	0.03	1	
6. ROIC	150	11%	-27%	48%	10%	0.69	-0.31	-0.15	0.01	0.97	1

Note. N: Number of observations; M: Mean; Min: Minimum; Max: Maximum; SD: Standard deviation.

4.2 Data Test

4.2.1 VIF and Tolerance

The purpose of this section is to ensure that the collinearity is not existent, which was introduced in chapter 3. The value of VIF is calculated in the SPSS statistic software. VIF values in Table 4.5 manifest they are all smaller than 10 and the tolerance values are higher than 0.1. Hence, the collinearity of the data utilized in this study is nonexistent. The data can be used in the panel data analysis to build the regression models.

Table 4.5 *Collinearity Statistics*

Model	Variables	Tolerance	VIF
Model 1	CR	0.903	1.108
	TDE	0.758	1.319
	FS	0.818	1.222
Model 2	CR	0.903	1.108
	TDE	0.758	1.319
	FS	0.818	1.222
Model 3	CR	0.820	1.220
	TDTA	0.728	1.374
	FS	0.856	1.168
Model 4	CR	0.820	1.220
	TDTA	0.728	1.374
	FS	0.856	1.168

4.2.2 Normal Distribution

Based on Figure 4.4, the distribution of every variable used in this research is similar to a bell-shape. Therefore, the data fit the normal distribution and can be used into the panel data models.

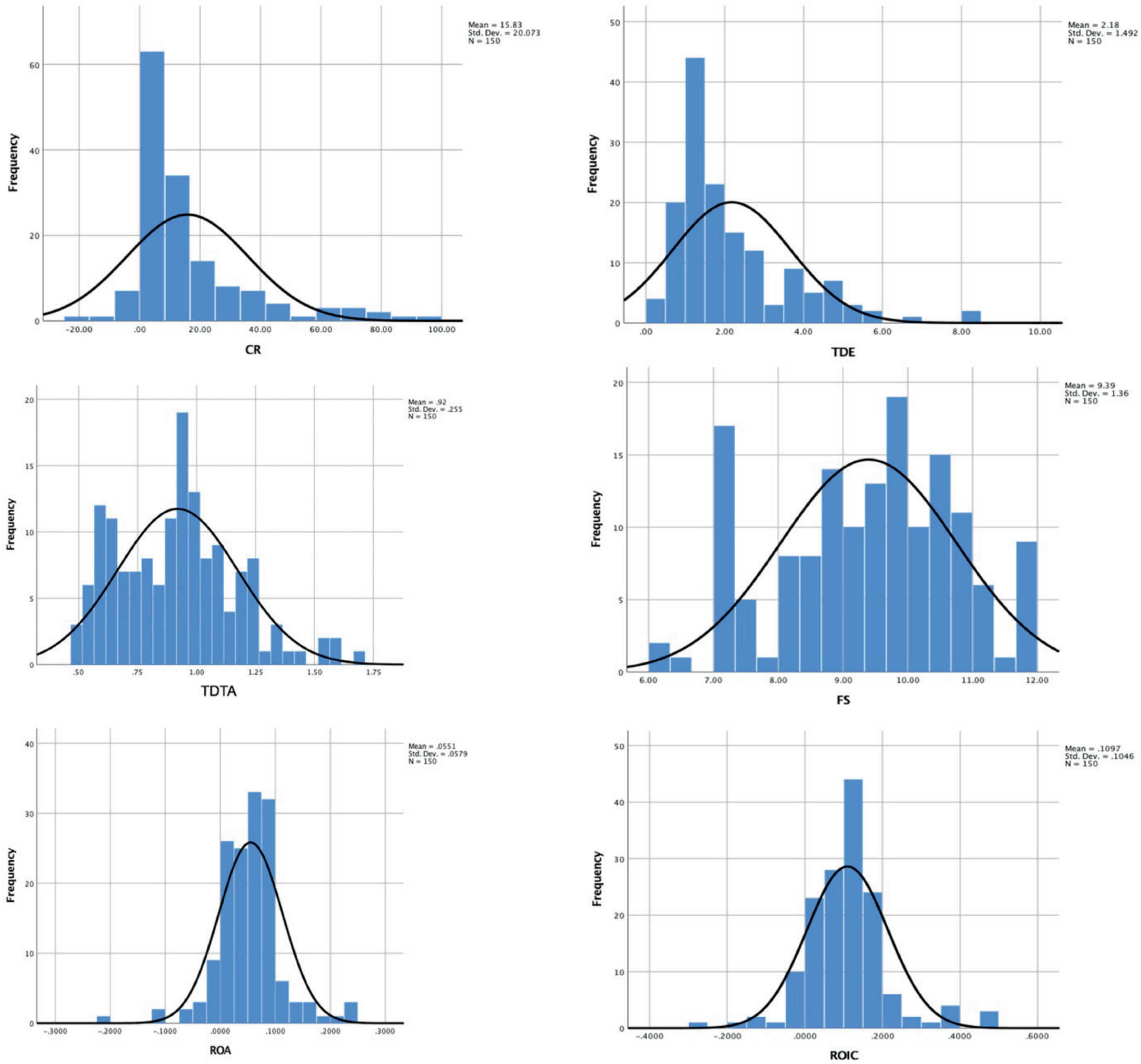

Figure 4.4 Normal Distribution of Variables

4.2.3 Comparison between CR, TDE, ROA and ROIC ratios

As the descriptive statistics of data by companies are discussed in section 4.1, the graphs of the relationship between CR, TDE, ROA and ROIC for different companies are shown in Figure 4.5. Some good companies are located in a prominent place on various graphs in Figure 4.5. For example, C12 is always located in high ROIC and ROA ratios area indicating high profitability and the low TDE ratio means a low-level debt capital. The high CR ratio can indicate the company's healthiness. As a result, C12 with high CR, ROA and ROIC ratios as well as a low TDE ratio indicate that C12 has a good performance on profitability and excellent control of the risk of bankruptcy.

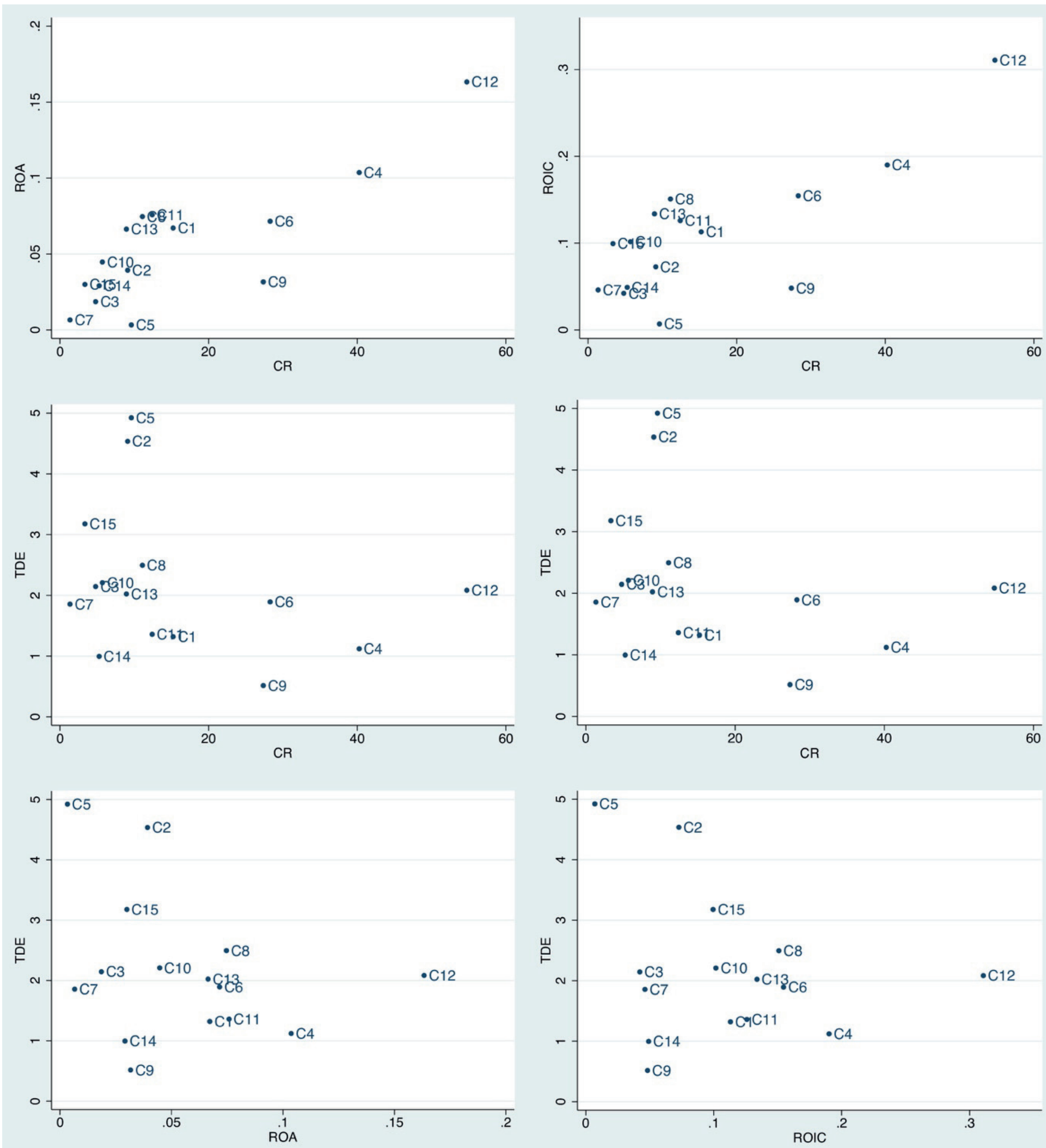

Figure 4.5 Comparison between CR, TDE, ROA and ROIC ratios

4.3 Panel data analysis

4.3.1 Unit Root Test

In this section, the panel data analysis is employed. To prevent the occurrence of spurious regression estimated in the study, the stationarity of data should be examined first. The LLC Test and Fisher-ADF Test are run in the EVIEWS statistic software, and the results of each variable are exhibited in Table 4.6 which show the P-value of each test is significant at the 5% level. The null hypothesis is rejected, and the data are stationary.

Table 4.6 *Unit Root Test for Data Stationarity*

Variables	Test Type	P-value	Stationarity
ROA	LLC Test	0.0000	Stationary
	Fisher-ADF Test	0.0006	
ROIC	LLC Test	0.0000	Stationary
	Fisher-ADF Test	0.0001	
CR	LLC Test	0.0000	Stationary
	Fisher-ADF Test	0.0000	
TDE	LLC Test	0.0000	Stationary
	Fisher-ADF Test	0.0409	
TDTA	LLC Test	0.0000	Stationary
	Fisher-ADF Test	0.0002	
FS	LLC Test	0.0000	Stationary
	Fisher-ADF Test	0.0182	

4.3.2 Results of Panel data models

The results of panel data models are discussed in this section. This study is to address the relationship between capital structure and profitability via various variables. Before the most appropriate models are decided to use in this study, a series of tests are run. First, each model is run in Fixed effects (FE) and Random effects (RE) with the panel data. Then, the LM Test and Hausman Test are examined to determine which model can be fit by panel data. Final models are exhibited in Table 4.7.

Based on Table 4.7, the P-value of Hausman Test on model 1 and model 2 are respectively 0.4070 and 0.4311 which are larger than 0.05. Hence, the RE model is accepted for model 1 and model 2. From the value of the LM Test, the P-values of model 1 and model 2 are all 0.0000 < 0.05. Thus, model 1 and model 2 should use the RE model. Next, from the P-values of LM Test which are all 0.0000 for model 3 and model 4, the null hypotheses should be rejected, and the RE models should be used into model 3 and model 4. However, the results of the Hausman test of model 3 and model 4 show that the P-values are 0.0000 and 0.0007, which are smaller than 0.05, hence, FE model should be used in model 3 and model 4.

The results of the F Test for model 1 to model 4 are shown in Table 4.7. The P-values are all 0.0000 < 0.05. This means all variables are meaningful and the models built are significant. Besides, the values of R-square from model 1 to model 4 are 0.529, 0.433, 0.477 and 0.390 respectively. This shows that the independent variables at least have a 39% explanatory ability on the dependent variable.

Therefore, according to the results, the panel data regression Model 1 to Model 4 are shown as follows. Please note that the ROA and ROIC valued documented in Appendix G are represented in percentages, whereas the ROA and ROIC values in these models are represented in decimals (not in percentage terms)

Model 1: ROA = -0.0102 + 0.001772CR – 0.0137TDE + 0.00713FS

Model 2: ROIC = 0.0446 + 0.00302CR – 0.0199TDE + 0.00645FS

Model 3: ROA = -0.174 + 0.00168CR – 0.0656TDTA + 0.028FS

Model 4: ROIC = -0.124 + 0.00288CR – 0.0963TDTA + 0.0295FS

Based on the models built above, the hypotheses discussed in chapter 3 can be tested.

$H1_0$: No correlation between profitability and coverage ratio.

$H1_a$: Profitability is correlated to coverage ratio.

$H1_0$ should be rejected from model 1 to model 4. It indicates that the CR ratio is positively related to profitability. When the value of CR goes up 0.001772-unit, 0.00302-unit, 0.00168-unit and 0.00288-unit respectively from model 1 to model 4, the ROA and ROIC ratios increase 1 unit. The CR ratio is significant at 1% level in these four models. Therefore, the CR ratio has a significantly positive relationship with profitability. This conclusion is consistent with Harris et al. (1990), and Eriostis et al. (2007).

$H2_0$: No correlation between profitability and total debt to equity.

$H2_a$: Profitability is correlated to total debt to equity.

As is shown in Table 4.7, the TDE ratios have a significant negative impact on ROA and ROIC in model 1 and model 2 at 1% level. The coefficients are -0.0137 and -0.0199 separately in these two models. Hence, the $H2_0$ is rejected, and the total debt to equity is negatively related to profitability. This conclusion is consistent with Ela et al. (2016), Ting et al. (2011), Soumadi et al. (2015), Chadha et al. (2015), and Alexandraet al. (2016).

$H3_0$: No correlation between profitability and total debt to tangible assets.

$H3_a$: Profitability is correlated to total debt to tangible assets.

The two coefficients for TDTA ratio are -0.0656 and -0.0963 respectively in model 3 and model 4, demonstrating that TDTA ratios have a significant negative effect on profitability at 1% level and 5% level separately. As the results showed, the $H3_0$ is rejected, and H3a is accepted. There is a significant negative relationship between TDTA and profitability which also indicates the tangible assets have positive influence on profitability. This conclusion is consistent with Ting et al. (2011), Rajan et al. (1995), and Chevallier et al. (2014).

$H4_0$: No correlation between profitability and firm size.

$H4_a$: Profitability is correlated to firm size.

Based on Table 4.7, the coefficients for firm size are 0.00713, 0.00645, 0.0280 and 0.0295 from model 1 to model 4. Firm size has a positive effect on profitability in all models, especially significant in model 3 and model 4 at level 1% and 10% respectively. This finding is not consistent with $H4_0$ that the null hypothesis should be rejected. There is a positive relationship between FS and profitability. The conclusion is consistent with Gill et al. (2009), Abor (2005), Chadha et al. (2015), and Negasa (2016).

Table 4.7 *Results of Panel Data Models*

Variables	Model 1 (RE)	Model 2 (RE)	Model 3 (FE)	Model 4 (FE)
	ROA	ROIC	ROA	ROIC
CR	0.00177***	0.00302***	0.00168***	0.00288***
	(0.000177)	(0.000348)	(0.000212)	(0.000410)
TDE	-0.0137***	-0.0199***		
	(0.00258)	(0.00508)		
FS	0.00713	0.00645	0.0280***	0.0295*
	(0.00437)	(0.00872)	(0.00899)	(0.0174)
TDTA			-0.0656***	-0.0963**
			(0.0212)	(0.0410)
Constant	-0.0102	0.0446	-0.174**	-0.124
	(0.0415)	(0.0830)	(0.0815)	(0.158)
Observations	150	150	150	150
R^2	0.529	0.433	0.477	0.390
F Test	169.95 [0.0000]	116.63 [0.0000]	40.06 [0.0000]	28.10 [0.0000]
LM Test	70.56 [0.0000]	70.56 [0.0000]	26.96 [0.0000]	27.46 [0.0000]
Hausman Test	2.90 [0.4070]	2.75 [0.4311]	23.68 [0.0000]	16.96 [0.0007]

Note. a. Standard errors in parentheses.
b. P-value of F Test, LM Test and Hausman Test in square brackets.
c. *** = significant at 0.01; ** = significant at 0.05; * = significant at 0.1.

4.4 Summary

In this chapter, the relationship between U.S. manufacturing firms' capital structure and profitability is researched by using the panel data analysis. Before running the regression models, a series of tests focused on observations are performed, such as the data's normality, stationarity, and collinearity. To select the best suitable model, the LM test and Hausman test are used to decide the model between Pooled model, FE model, and RE model. Moreover, four models are established. Finally, based on the values of R-square and P-values for F-test and T-test, the discussions of the variables and relationships between them are exhibited and the hypotheses are verified.

All four models show a significant relationship between capital structure and profitability for U.S. manufacturing companies over the latest ten-year period (2009-2018). The four null hypotheses are all rejected by the results of regression models. In conclusion, the coverage ratio has a significantly positive relation with profitability. The total debt to equity and total debt to tangible ratios have a significantly negative relationship with profitability. Firm size is positively related to profitability. Therefore, it can be concluded that the overall capital structure has a significant impact on profitability for U.S. manufacturing companies.

Chapter 5- Conclusions, Limitations and Further Research Direction

This chapter is organized in three sections. In section one, the conclusions are presented. Next, the limitations of this study are provided in section two. Finally, the future research direction is discussed in section three.

5.1 Conclusions

The topic of capital structure and profitability has been studied by researchers for decades. Although the influence of this topic is growing, the results have not been inclusive and the debate is unlikely to be addressed soon due to various influences of different situations. It is important to set an optimal capital structure to improve the company's profitability and competitiveness. This study focuses on the dataset of 15 listed U.S. manufacturing companies during a ten-year period (2009-2018), a period after the financial crisis of 2007-2008. This study provides insight into the relationship between capital structure and profitability by examining the CR, TDE, TDTA, FS, ROA, and ROIC with a panel data analysis to establish four regression models. The data's normality, stationarity and collinearity have been tested. Besides, the appropriate models have been selected by the LM test and Hausman test. Finally, four suitable models are constructed, and the results of them reveal the close relationship between the variables used. Coverage ratio, which represents the ability of earnings before interest and tax to pay off the cost of debt, has a positive relationship with the profitability. This shows that a high CR can improve the company's profitability and a low level of debt cost can increase the company's profit. The total debt to equity ratio to indicate the percentage of debt on equity has a negative impact on the ROA and ROIC. Therefore, low debt used in a company would raise the company's profitability. The total debt to tangible assets ratio has demonstrated negative impact on the profitability. That means the tangible assets have a significantly positive effect on profitability. Companies with high tangible assets are credible for lenders. The firm size shows a positive relationship with profitability. Companies with higher annual revenue are generally more profitable. Therefore, a clear focus on increasing revenue can lead to improved profitability for a company.

5.2 Limitations

This study used 15 U.S. manufacturing companies during a ten-year period (2009-2018). The small sample size cannot adequately represent the comprehensive research on the entire manufacturing industry of the U.S. Therefore, the best way is to select all the manufacturing companies, including listed and unlisted companies, to examine the relationship between capital structure and profitability. But with thousands of manufacturing companies in the U.S., the data collection is difficult and impossible to complete due to the accuracy and unbiasedness of data. Therefore, a sample of 15 manufacturing companies provide meaningful findings that can help explain the relationship between capital structure and profitability of the manufacturing industry in the U.S.

The data used in this thesis are collected from the audited financial reports of 15 U.S. listed manufacturing companies during a ten-year period (2009-2018). It is well known that the listed companies are certified by professional auditors and the published data should be reliable and accurate. However, not all the information about the companies have been disclosed to the public. Still, the results of this study can be used to adequately examine the relationship between capital structure and profitability.

This research has selected four predictors and two response variables to investigate the impact of capital structure on profitability. These indicators are not comprehensive, and there might be other significant variables that this study had excluded. The results of R-square in this study are between 39% to 52.9%, which means these independent variables can explain 39% to 52.9% on profitability. Therefore, there should be other factors that need to be used in the study. However, the results of regression models can support the findings.

5.3 Future Research Direction

This study focused on 15 U.S. listed manufacturing companies during a ten-year period. Researchers and managers are encouraged to reference the findings in this thesis to design optimal capital structure in order to achieve higher profitability for manufacturing companies. In future research, it is recommended to include a larger sample of companies, as well as include the longer time period to further examine the different results with this present study. The panel data analysis method can be used to research the companies from other industries or other areas as well. The metrics of capital structure and profitability selected for this study are CR, TDE, TDTA, FS, ROA, and ROIC. For comprehensiveness, additional variables can be used in future studies. Several factors influence a company’s operations and profitability. Therefore, more determinants in various aspects should be explored in future.

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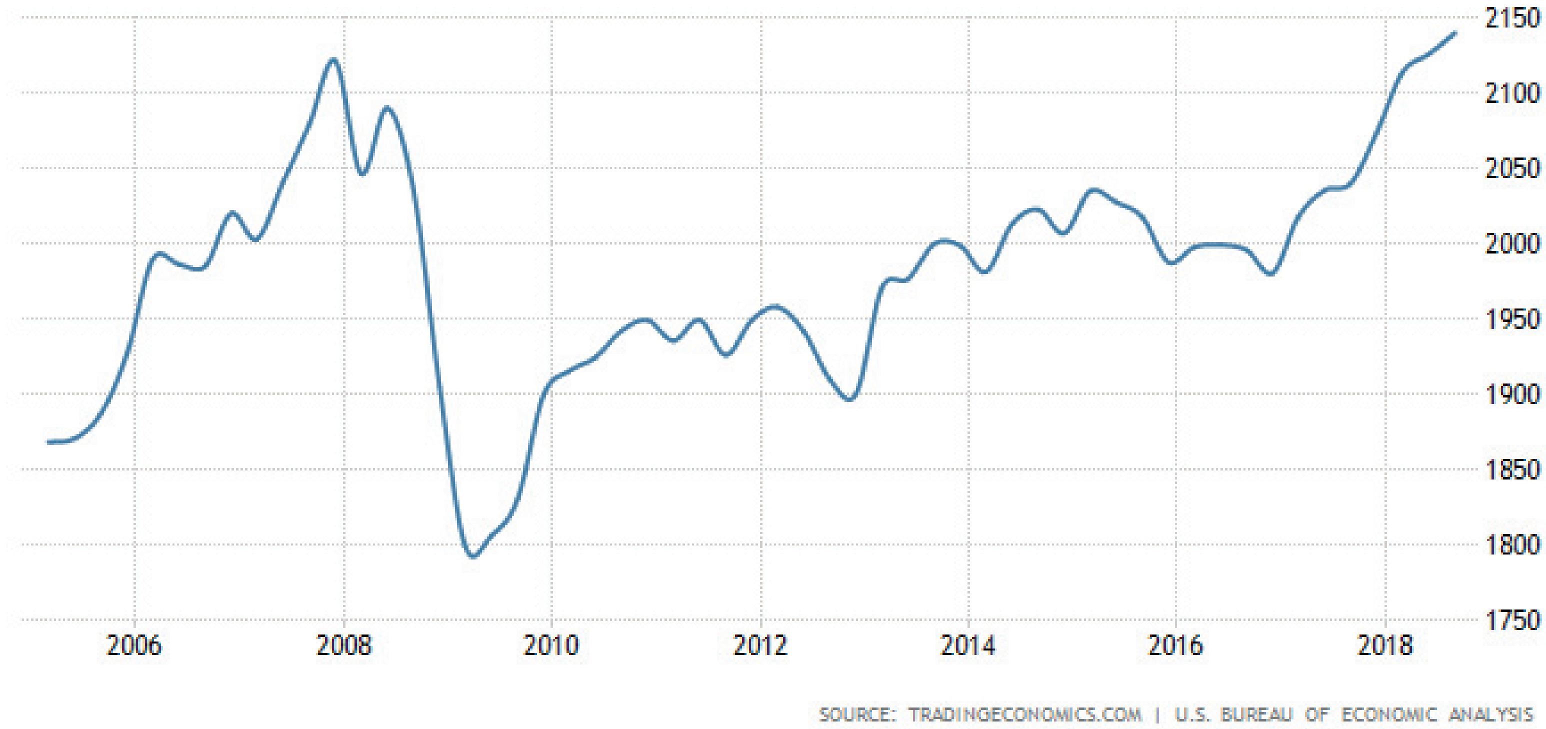
Appendix

Appendix A Tendency of the U.S. GDP from 2009 to 2018



Source: http://tradingeconomics.com

Appendix B Value Added by Industry Group as a Percentage of GDP

February 21, 2019

Table 5a. Value Added by Industry Group as a Percentage of GDP

Line		2016	2017	2016				2017				2018		
				I	II	III	IV	I	II	III	IV	I	II	III
1	**Gross domestic product**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
2	**Private industries**	**87.2**	**87.4**	**87.2**	**87.2**	**87.3**	**87.3**	**87.3**	**87.4**	**87.4**	**87.5**	**87.6**	**87.8**	**87.8**
3	Agriculture, forestry, fishing, and hunting	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.8
4	Mining	1.2	1.4	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.6
5	Utilities	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5
6	Construction	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.1	4.1	4.1
7	Manufacturing	11.1	11.2	11.3	11.2	11.1	11.0	11.1	11.1	11.2	11.3	11.3	11.4	11.4
8	Durable goods	6.3	6.3	6.4	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
9	Nondurable goods	4.8	4.9	4.9	4.9	4.8	4.7	4.8	4.9	4.9	5.0	5.0	5.1	5.0
10	Wholesale trade	6.1	6.0	6.2	6.1	6.1	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
11	Retail trade	5.6	5.6	5.7	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.5	5.5
12	Transportation and warehousing	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.2	3.2	3.1
13	Information	5.3	5.4	5.3	5.3	5.4	5.3	5.3	5.4	5.4	5.4	5.4	5.5	5.5
14	Finance, insurance, real estate, rental, and leasing	21.0	20.8	20.7	21.0	21.1	21.2	21.0	20.8	20.8	20.7	20.7	20.7	20.7
15	Finance and insurance	7.7	7.5	7.4	7.6	7.8	7.9	7.7	7.5	7.5	7.5	7.4	7.4	7.5
16	Real estate and rental and leasing	13.3	13.3	13.4	13.4	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3
17	Professional and business services	12.3	12.5	12.3	12.3	12.2	12.3	12.4	12.4	12.5	12.5	12.5	12.6	12.6
18	Professional, scientific, and technical services	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.5	7.5	7.4	7.5	7.6	7.6
19	Management of companies and enterprises	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
20	Administrative and waste management services	3.0	3.1	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
21	Educational services, health care, and social assistance	8.8	8.7	8.8	8.8	8.7	8.8	8.8	8.8	8.7	8.7	8.7	8.7	8.7
22	Educational services	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2
23	Health care and social assistance	7.5	7.5	7.5	7.5	7.4	7.5	7.5	7.5	7.5	7.4	7.5	7.4	7.4
24	Arts, entertainment, recreation, accommodation, and food services	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
25	Arts, entertainment, and recreation	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
26	Accommodation and food services	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
27	Other services, except government	2.1	2.1	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
28	**Government**	**12.8**	**12.6**	**12.8**	**12.8**	**12.7**	**12.7**	**12.7**	**12.6**	**12.6**	**12.5**	**12.4**	**12.2**	**12.2**
29	Federal	4.0	3.9	4.0	4.0	4.0	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7
30	State and local	8.8	8.7	8.8	8.8	8.8	8.7	8.7	8.7	8.7	8.6	8.6	8.5	8.5
	Addenda:													
31	Private goods-producing industries[1]	17.2	17.4	17.2	17.2	17.1	17.1	17.3	17.4	17.4	17.7	17.7	17.9	17.9
32	Private services-producing industries[2]	70.1	70.0	69.9	70.0	70.1	70.2	70.0	70.0	70.0	69.9	69.9	69.9	69.9

Source: U.S. Department of Commerce-Bureau of Economic Analysis

Appendix C Value Added by Industry Group

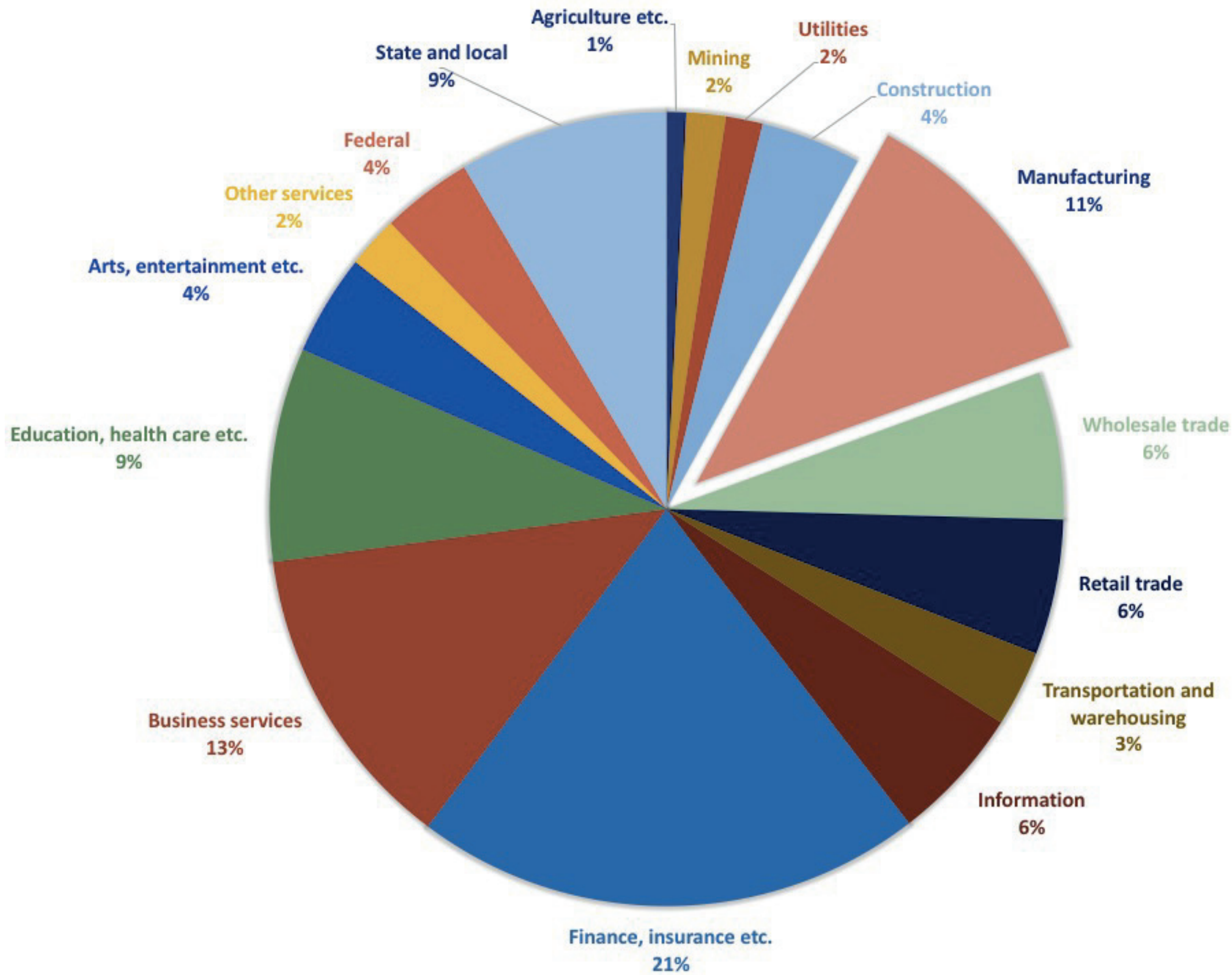
February 21, 2019

Table 5. Value Added by Industry Group

Line		Billions of dollars												
				Seasonally adjusted at annual rates										
		2016	2017	2016				2017				2018		
				I	II	III	IV	I	II	III	IV	I	II	III
1	**Gross domestic product**	**18,707.2**	**19,485.4**	**18,409.1**	**18,640.7**	**18,799.6**	**18,979.2**	**19,162.6**	**19,359.1**	**19,588.1**	**19,831.8**	**20,041.0**	**20,411.9**	**20,658.2**
2	**Private industries**	**16,319.4**	**17,031.7**	**16,043.6**	**16,262.6**	**16,403.8**	**16,567.4**	**16,729.0**	**16,911.2**	**17,126.0**	**17,360.6**	**17,561.6**	**17,918.6**	**18,142.6**
3	Agriculture, forestry, fishing, and hunting	164.9	169.2	168.7	169.8	164.0	157.1	172.9	172.2	165.9	165.9	166.6	170.4	157.6
4	Mining	216.2	268.6	195.1	211.3	221.7	236.8	255.1	261.3	265.6	292.5	301.8	321.5	333.9
5	Utilities	302.7	307.5	296.0	300.1	308.4	306.4	300.5	309.9	306.6	313.0	315.3	319.8	317.4
6	Construction	745.5	781.4	731.3	740.6	748.5	761.7	770.9	773.6	784.0	797.1	816.1	835.7	848.5
7	Manufacturing	2,085.2	2,179.6	2,075.4	2,088.5	2,088.6	2,088.2	2,124.2	2,154.8	2,194.4	2,245.0	2,271.9	2,329.0	2,353.0
8	Durable goods	1,182.0	1,226.6	1,177.3	1,180.0	1,183.6	1,187.3	1,200.5	1,215.7	1,235.3	1,255.0	1,268.4	1,293.8	1,311.3
9	Nondurable goods	903.1	953.0	898.0	908.6	905.0	901.0	923.7	939.1	959.2	990.0	1,003.5	1,035.2	1,041.8
10	Wholesale trade	1,136.6	1,174.1	1,132.8	1,133.6	1,137.6	1,142.3	1,151.8	1,168.0	1,180.4	1,196.3	1,196.4	1,220.6	1,243.1
11	Retail trade	1,052.0	1,087.1	1,042.4	1,049.1	1,053.9	1,062.4	1,071.5	1,081.2	1,092.7	1,103.1	1,113.9	1,131.6	1,141.9
12	Transportation and warehousing	577.4	608.7	569.4	577.5	576.5	586.5	594.4	605.3	613.7	621.5	633.6	643.6	650.6
13	Information	998.1	1,050.8	974.9	992.4	1,009.8	1,015.1	1,018.4	1,042.1	1,062.5	1,080.0	1,085.9	1,121.2	1,141.5
14	Finance, insurance, real estate, rental, and leasing	3,929.8	4,057.1	3,817.6	3,912.2	3,972.6	4,016.9	4,016.3	4,024.0	4,075.7	4,112.5	4,157.1	4,216.2	4,285.6
15	Finance and insurance	1,432.7	1,465.9	1,356.1	1,415.6	1,465.9	1,493.2	1,466.6	1,444.1	1,472.4	1,480.6	1,489.1	1,508.2	1,539.6
16	Real estate and rental and leasing	2,497.2	2,591.2	2,461.5	2,496.6	2,506.8	2,523.8	2,549.7	2,579.9	2,603.4	2,632.0	2,668.0	2,708.0	2,745.9
17	Professional and business services	2,299.0	2,426.3	2,270.3	2,287.4	2,301.8	2,336.5	2,376.6	2,409.2	2,445.2	2,474.4	2,509.3	2,567.2	2,595.4
18	Professional, scientific, and technical services	1,381.1	1,450.0	1,365.7	1,375.7	1,381.9	1,400.9	1,421.2	1,442.3	1,461.1	1,475.4	1,503.8	1,546.6	1,561.4
19	Management of companies and enterprises	348.4	369.4	345.8	345.9	348.3	353.5	359.5	363.9	372.6	381.5	382.3	385.2	387.9
20	Administrative and waste management services	569.6	607.0	558.8	565.8	571.6	582.0	595.9	603.0	611.5	617.5	623.2	635.5	646.1
21	Educational services, health care, and social assistance	1,639.4	1,700.3	1,613.9	1,633.9	1,641.4	1,668.3	1,678.4	1,694.7	1,707.2	1,720.8	1,746.5	1,772.2	1,791.1
22	Educational services	244.1	245.6	241.1	243.4	244.1	247.6	243.0	244.1	246.6	248.5	251.4	252.4	256.2
23	Health care and social assistance	1,395.3	1,454.7	1,372.8	1,390.5	1,397.2	1,420.7	1,435.4	1,450.6	1,460.5	1,472.3	1,495.1	1,519.8	1,534.9
24	Arts, entertainment, recreation, accommodation, and food services	770.8	804.7	758.1	765.7	776.2	783.1	789.2	801.3	812.7	815.7	821.0	835.9	846.4
25	Arts, entertainment, and recreation	203.6	214.1	198.6	201.1	206.4	208.5	208.4	212.4	218.7	217.1	216.6	222.8	226.6
26	Accommodation and food services	567.2	590.6	559.5	564.6	569.8	574.6	580.9	588.9	594.0	598.6	604.4	613.1	619.8
27	Other services, except government	401.8	416.1	397.7	400.3	403.0	406.1	408.7	413.6	419.4	422.7	426.3	433.6	436.5
28	**Government**	**2,387.8**	**2,453.7**	**2,365.5**	**2,378.2**	**2,395.8**	**2,411.8**	**2,433.5**	**2,448.0**	**2,462.1**	**2,471.2**	**2,479.5**	**2,493.3**	**2,515.6**
29	Federal	744.8	759.9	738.8	741.7	746.8	752.0	757.8	760.0	761.5	760.3	758.8	760.6	765.4
30	State and local	1,643.0	1,693.8	1,626.7	1,636.5	1,649.0	1,659.9	1,675.7	1,687.9	1,700.6	1,711.0	1,720.6	1,732.7	1,750.2
	Addenda:													
31	Private goods-producing industries[1]	3,211.8	3,398.9	3,170.5	3,210.2	3,222.7	3,243.8	3,323.2	3,361.8	3,410.0	3,500.5	3,556.4	3,656.5	3,693.0
32	Private services-producing industries[2]	13,107.6	13,632.8	12,873.1	13,052.4	13,181.1	13,323.6	13,405.8	13,549.4	13,716.0	13,860.1	14,005.2	14,262.1	14,449.6

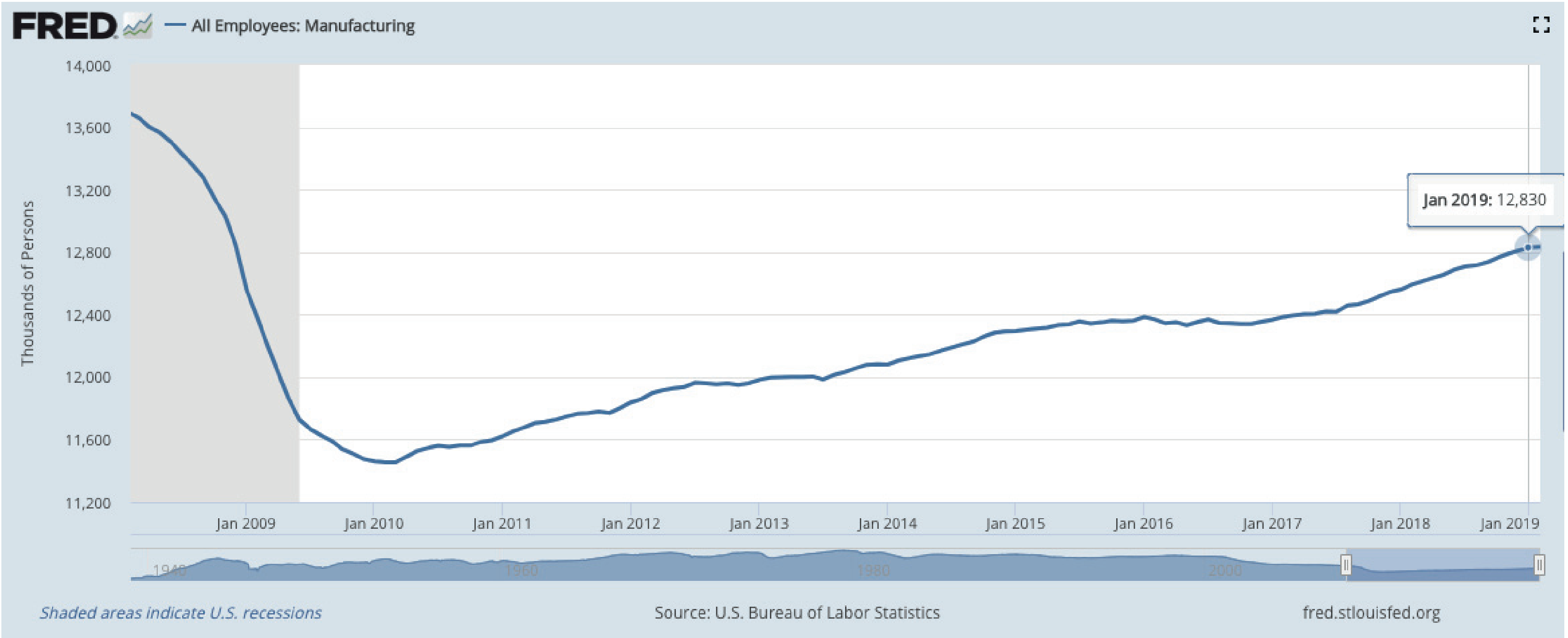
Source: U.S. Department of Commerce-Bureau of Economic Analysis

Appendix D Industry Group as a Percentage of GDP in 2018 Q3



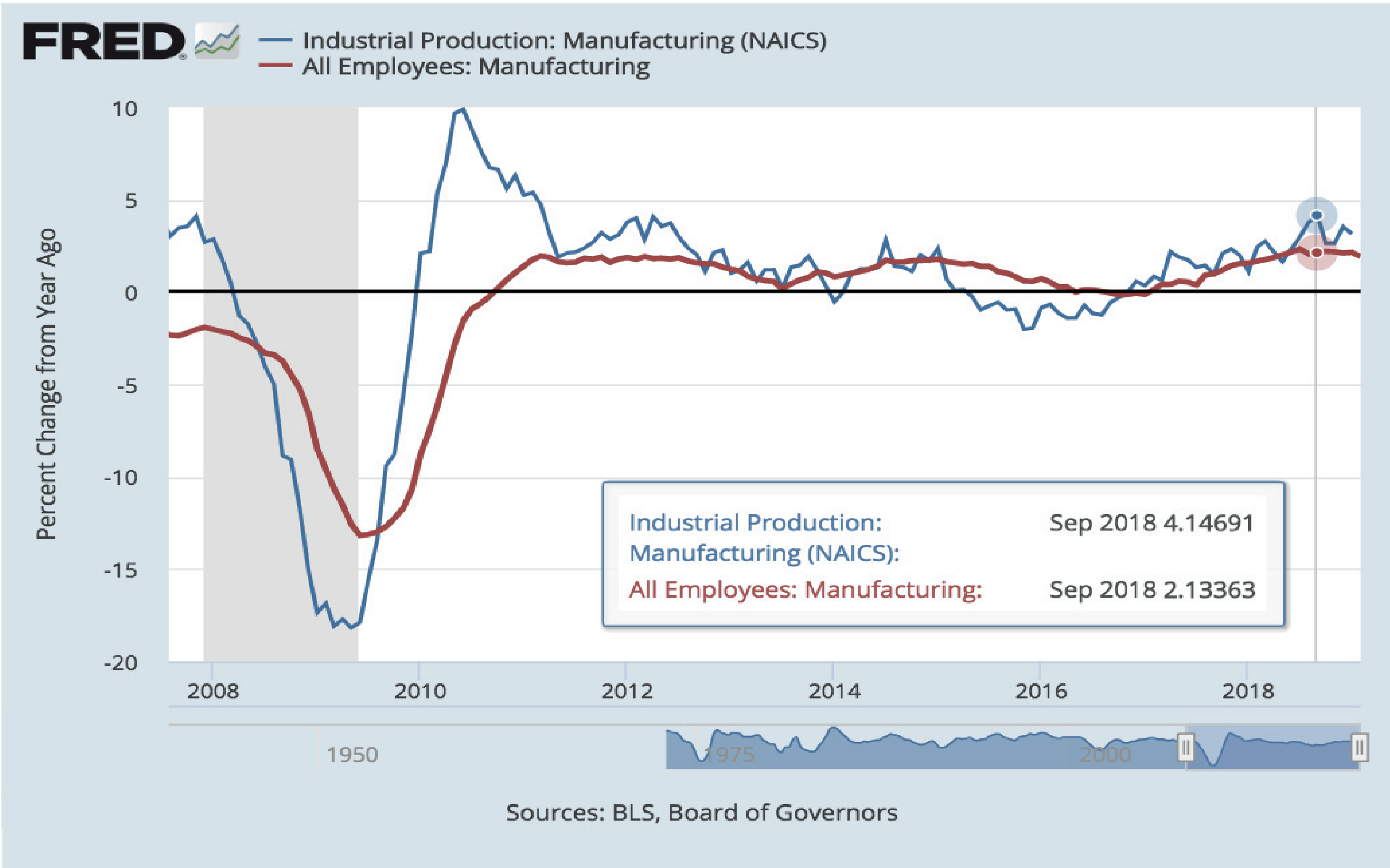
Source: U.S. Department of Commerce-Bureau of Economic Analysis

Appendix E Trend of the U.S. Manufacturing Employment from 2009 to 2018



Source: https://fred.stlouisfed.org/series/MANEMP

Appendix F Percent change of All Employees and Industrial Production of Manufacturing Industry from a year ago in 2009-2018



Source: https://fredblog.stlouisfed.org/2014/12/manufacturing-is-growing-even-when-manufacturing-jobs-are

Appendix G Values of 150 Observations for Various Ratios

Company	No.	Year	CR	TDE	TDTA	FS	ROA	ROIC
C1	1	2009	1.31	1.18	0.7	8.28	0.57%	2.15%
C1	2	2010	7.95	1.44	0.77	8.64	7.28%	13.36%
C1	3	2011	11.27	1.47	0.78	8.87	9.56%	16.83%
C1	4	2012	20.31	1.06	0.66	8.88	8.11%	13.34%
C1	5	2013	26.42	0.92	0.6	8.91	9.38%	14.47%
C1	6	2014	27.93	0.98	0.61	9.02	9.27%	13.91%
C1	7	2015	16.34	1.47	0.8	8.99	7.59%	11.68%
C1	8	2016	3.25	1.72	0.84	9.11	1.34%	3.19%
C1	9	2017	16.09	1.6	0.81	9.19	4.72%	8.27%
C1	10	2018	21.37	1.36	0.75	9.26	9.36%	15.91%
C2	11	2009	1.4	5.81	0.89	10.39	1.40%	4.30%
C2	12	2010	3.98	4.87	0.88	10.66	4.35%	8.97%
C2	13	2011	6.5	5.28	0.98	11	6.78%	13.46%
C2	14	2012	18.63	4.09	0.92	11.1	6.65%	11.42%
C2	15	2013	12.03	3.08	0.86	10.93	4.35%	7.11%
C2	16	2014	11.5	4.05	0.91	10.92	4.36%	7.06%
C2	17	2015	6.63	4.3	0.92	10.76	2.58%	4.55%
C2	18	2016	1.28	4.68	0.93	10.56	-0.09%	0.46%
C2	19	2017	8.69	4.61	0.92	10.72	0.99%	2.31%
C2	20	2018	20.36	4.59	0.92	10.91	7.91%	13.02%
C3	21	2009	5.33	4.05	0.98	6.26	2.27%	6.06%
C3	22	2010	5.14	3.72	0.98	6.3	1.60%	6.98%
C3	23	2011	4.38	4.75	1.07	6.54	0.43%	1.71%
C3	24	2012	1.52	2.08	1.26	8.27	-2.31%	-1.10%
C3	25	2013	3.92	1.53	1.18	8.34	2.49%	6.01%

C3	26	2014	7.98	1.24	1.2	8.44	5.35%	9.50%
C3	27	2015	5.96	1.13	1.22	8.29	2.40%	4.48%
C3	28	2016	7.93	1.14	1.16	8.2	1.95%	3.44%
C3	29	2017	0.71	0.85	0.98	8.1	2.31%	1.06%
C3	30	2018	5.15	0.96	1.07	8.21	2.11%	4.08%
C4	31	2009	19.29	1.27	0.6	9.29	4.94%	10.71%
C4	32	2010	41.42	1.16	0.57	9.49	10.82%	21.26%
C4	33	2011	61.7	1.06	0.54	9.8	16.75%	31.88%
C4	34	2012	71.97	0.84	0.49	9.76	13.59%	24.35%
C4	35	2013	52.68	0.91	0.51	9.76	10.87%	17.96%
C4	36	2014	39.03	0.99	0.53	9.86	10.82%	17.97%
C4	37	2015	32.15	1	0.53	9.86	9.05%	15.45%
C4	38	2016	28.97	1.14	0.56	9.77	9.25%	16.07%
C4	39	2017	30.2	1.37	0.65	9.92	6.04%	11.40%
C4	40	2018	25.15	1.47	0.67	10.08	11.53%	23.09%
C5	41	2009	1.55	5.6	0.94	11.96	1.36%	4.52%
C5	42	2010	1.89	5.27	0.93	11.92	1.48%	4.55%
C5	43	2011	29.71	5.15	0.95	11.87	1.78%	2.41%
C5	44	2012	22.46	4.52	0.94	11.88	1.94%	2.59%
C5	45	2013	20.02	3.98	0.93	11.87	1.94%	2.64%
C5	46	2014	16.88	3.99	0.93	11.9	2.33%	3.22%
C5	47	2015	8.04	4	0.96	11.65	-1.08%	-1.49%
C5	48	2016	8.32	3.79	1.04	11.69	1.90%	3.67%
C5	49	2017	-4.1	4.61	1.13	11.7	-1.68%	-2.49%
C5	50	2018	-8.69	8.32	1.19	11.71	-6.64%	-12.62%
C6	51	2009	21.54	1.5	1.12	10.37	8.05%	16.49%
C6	52	2010	23.69	1.44	1.07	10.39	8.25%	16.66%
C6	53	2011	24.99	1.64	1.11	10.39	7.49%	15.57%
C6	54	2012	4.22	2.01	1.1	10.36	-0.96%	-2.64%

C6	55	2013	36.02	1.44	0.94	10.35	6.76%	14.34%
C6	56	2014	37.91	1.99	1.04	10.34	7.16%	14.97%
C6	57	2015	42.86	1.98	1.07	10.36	8.80%	20.25%
C6	58	2016	43.74	1.99	1.06	10.35	9.11%	20.83%
C6	59	2017	35.85	2.06	1.05	10.34	8.58%	19.72%
C6	60	2018	11.92	2.87	1.45	10.5	8.32%	18.39%
C7	61	2009	-6.47	2.5	0.74	7.25	-10.85%	-15.97%
C7	62	2010	0.54	1.59	0.64	7.06	-3.46%	-3.10%
C7	63	2011	1.38	1.53	0.63	7.28	0.70%	6.20%
C7	64	2012	4.84	1.75	0.66	7.36	4.25%	9.55%
C7	65	2013	-0.03	2.07	0.71	7.23	-2.83%	-0.80%
C7	66	2014	2.94	1.42	0.61	7.3	14.09%	38.45%
C7	67	2015	4.52	1.6	0.63	7.31	2.22%	5.09%
C7	68	2016	0.11	1.43	0.6	7.21	-0.17%	-0.10%
C7	69	2017	2.21	2.48	0.9	7.32	1.19%	3.57%
C7	70	2018	3.47	2.19	0.85	7.65	1.46%	3.32%
C8	71	2009	9.06	1.38	1.11	10.43	5.58%	11.45%
C8	72	2010	10.23	1.32	1.04	10.46	6.66%	12.86%
C8	73	2011	14.95	1.46	1.17	10.18	7.45%	13.88%
C8	74	2012	14.99	1.79	1.21	10.14	7.61%	15.29%
C8	75	2013	12.14	1.48	1.13	10.11	7.38%	14.19%
C8	76	2014	11.41	2.67	1.37	10.08	7.81%	15.27%
C8	77	2015	10.27	3.43	1.58	10.07	7.80%	17.57%
C8	78	2016	10.71	3.87	1.55	10.11	8.79%	20.01%
C8	79	2017	9.47	3.95	1.24	10.16	6.66%	13.35%
C8	80	2018	7.66	3.6	1.67	10.31	8.90%	17.07%
C9	81	2009	42.66	0.52	0.61	9.45	6.83%	10.52%
C9	82	2010	48.94	0.46	0.55	9.41	7.48%	10.70%
C9	83	2011	74.05	0.44	0.51	9.59	8.21%	11.56%

C9	84	2012	72.53	0.55	0.57	9.91	8.74%	12.13%
C9	85	2013	31.14	0.56	0.6	10.04	7.02%	9.83%
C9	86	2014	34.28	0.62	0.62	9.97	7.32%	10.41%
C9	87	2015	-4.72	0.63	0.65	9.6	-2.55%	-2.96%
C9	88	2016	-23.98	0.51	0.62	8.89	-10.08%	-12.43%
C9	89	2017	-2.84	0.43	0.57	8.9	-1.15%	-1.12%
C9	90	2018	1.44	0.43	0.56	9.04	-0.16%	-0.41%
C10	91	2009	-4.6	8.27	1.56	8.57	-20.26%	-26.63%
C10	92	2010	7.48	2.55	1.22	9.19	16.67%	35.16%
C10	93	2011	5.59	2.02	1.1	8.93	5.73%	12.48%
C10	94	2012	4.77	1.67	0.99	9.01	4.71%	10.67%
C10	95	2013	7.74	1.26	0.88	8.94	6.51%	11.94%
C10	96	2014	7.05	1.31	0.9	8.83	6.59%	12.49%
C10	97	2015	5.65	1.41	0.9	8.72	4.98%	9.64%
C10	98	2016	6.08	1.28	0.86	8.74	4.74%	9.07%
C10	99	2017	7.88	1.21	0.78	8.83	5.94%	10.86%
C10	100	2018	9.39	1.11	0.73	8.95	9.08%	16.01%
C11	101	2009	7.08	1.3	0.98	9.24	5.02%	8.50%
C11	102	2010	8.29	1.25	0.92	9.21	5.61%	9.89%
C11	103	2011	15.18	1	0.81	9.42	10.09%	16.90%
C11	104	2012	17.99	1.28	0.88	9.48	10.44%	17.71%
C11	105	2013	15.32	1.18	0.85	9.47	8.00%	13.36%
C11	106	2014	19.85	0.99	0.74	9.49	8.07%	12.49%
C11	107	2015	13.1	1.41	0.86	9.45	7.92%	12.87%
C11	108	2016	9.17	1.63	0.91	9.34	6.63%	11.56%
C11	109	2017	9.18	1.94	1.35	9.4	7.14%	11.78%
C11	110	2018	8.96	1.61	1.21	9.57	6.89%	10.88%
C12	111	2009	37.77	2.73	0.76	7.36	13.34%	27.99%
C12	112	2010	82.55	1.86	0.67	7.6	16.12%	27.70%

C12	113	2011	87.94	1.46	0.59	7.88	19.88%	39.07%
C12	114	2012	81.89	1.15	0.58	8.07	23.01%	45.01%
C12	115	2013	93.5	2.15	0.79	8.24	23.79%	47.06%
C12	116	2014	63.22	1.41	0.66	8.41	24.15%	48.29%
C12	117	2015	60.86	1.43	0.65	8.46	20.41%	36.57%
C12	118	2016	20.2	2.58	0.97	8.42	7.76%	12.97%
C12	119	2017	10.91	2.32	0.93	8.6	5.57%	9.86%
C12	120	2018	8.54	3.76	1.25	8.71	9.29%	16.25%
C13	121	2009	9.17	1.73	0.98	10.88	6.82%	15.18%
C13	122	2010	9.72	1.68	1	10.9	7.65%	15.74%
C13	123	2011	12.3	1.75	0.99	10.97	8.30%	16.70%
C13	124	2012	8.74	2.41	1.36	10.96	6.80%	14.05%
C13	125	2013	9.04	1.8	1.24	11.04	6.36%	12.60%
C13	126	2014	9.08	1.88	1.24	11.08	6.84%	13.34%
C13	127	2015	7.84	2.14	1.34	10.93	8.51%	16.53%
C13	128	2016	7.14	2.19	1.31	10.96	5.71%	11.78%
C13	129	2017	8.63	2.21	1.26	11	4.88%	9.45%
C13	130	2018	7.76	2.43	1.59	11.1	4.56%	8.47%
C14	131	2009	4.29	0.81	0.7	7.11	1.07%	2.50%
C14	132	2010	5.14	0.83	0.7	7.15	3.63%	5.83%
C14	133	2011	4.55	0.85	0.74	7.27	3.97%	6.46%
C14	134	2012	5.08	0.82	0.73	7.28	4.02%	6.45%
C14	135	2013	5.08	0.74	0.68	7.3	3.40%	5.55%
C14	136	2014	5.18	1.13	0.94	7.32	2.73%	4.42%
C14	137	2015	-3.57	1.4	0.98	7.29	-6.20%	-6.43%
C14	138	2016	6.65	1.44	1	7.24	4.82%	7.38%
C14	139	2017	8.49	1.09	0.91	7.28	4.13%	6.07%
C14	140	2018	11.71	0.86	0.81	7.36	7.55%	10.84%
C15	141	2009	2.34	3.09	0.99	9.75	2.29%	8.24%

C15	142	2010	3.6	2.67	0.94	9.82	4.04%	12.32%
C15	143	2011	0.97	2.61	0.94	9.83	2.54%	13.77%
C15	144	2012	2.79	2.59	0.93	9.81	2.62%	9.53%
C15	145	2013	3.76	2.13	0.87	9.84	5.35%	16.08%
C15	146	2014	3.87	2.91	1.03	9.9	3.66%	10.72%
C15	147	2015	5.06	2.81	1.05	9.95	4.01%	10.97%
C15	148	2016	5.64	2.81	1.04	9.94	4.65%	12.10%
C15	149	2017	4.56	3.55	1.09	9.96	1.79%	5.35%
C15	150	2018	0.89	6.61	1.17	9.95	-0.95%	0.41%

Source: Data from the audited financial reports and calculated by author

Appendix H Standard Industrial Classification (SIC) Code of Manufacturing Industry

SIC Code	Industry Sector
Nondurable Manufacturing	
20	Food & kindred products
21	Tobacco products
22	Textile mill products
23	Apparel & other textile products
24	Lumber & wood products
25	Furniture & fixtures
26	Paper & allied products
27	Printing & publishing
28	Chemicals & allied products
29	Petroleum & coal products
Durable Manufacturing	
30	Rubber & plastics products
31	Leather & leather products
32	Stone, clay & glass products
33	Primary metal industries
34	Fabricated metal products
35	Industrial machinery & equipment
36	Electronics & electrical equipment
37	Transportation equipment
38	Instruments & related products
39	Miscellaneous manufacturing

Source: U.S. Department of Labor. https://www.osha.gov/pls/imis/sic_manual.html