# Operational risk and its determinants among five companies in manufacturing industry in Germany

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# OPERATIONAL RISK AND ITS DETERMINANTS AMONG FIVE COMPANIES IN MANUFACTURING INDUSTRY IN GERMANY

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## ABSTRACT

Operational risk management is an important aspect in an organization to manage operational risk efficiently. Hence, this study intended to investigate the effects of internal and external factor in manufacturing industry towards operational risk. This study employs time series regression analysis of manufacturing industry in Germany from 2012 to 2016. The analysis shows that firm specific factors (average current ratio and average collection period) and macroeconomic factors (the company's beta) influence the operational risk of the company. This study suggests the company to manage their average collection period by managing their account receivable efficiently through establishing clear credit policies and incorporate more corporate governance elements such as accountability, fairness, independence and transparency.

***Keywords:*** *Operational risk, Average collection period, corporate governance*

# CHAPTER ONE

# INTRODUCTION

## 1.1 Introduction

This chapter begins with an overview of the Germany manufacturing industry. This is followed with the discussion of the problem statement, the research objectives, scope of the study and lastly the organization of the study.

## 1.2 Overview of Germany Manufacturing Industries

The economy of Germany is very well known as the highly developed social market economy. In Europe itself, it has the largest national economy, the fourth largest by nominal Gross Domestic Product (GDP) in the world, and fifth by GDP. According to International Monetary Fund (IMF), the country accounted 28% of the euro area economy. In 2017 itself, the GDP of Germany was $3,686,606 million putting Germany in the ranking of 4$^{th}$ out of 196 countries in the world. In 2016 alone, the GDP of manufacturing industries in Germany amounted up to $168.23 Euro Billion. Before unification phase took place in Germany, 40% of Germany workforce was involved in manufacturing, with the main industries being machine tools, automotive manufacturing, electrical engineering, iron, steel, chemical and optics (Congress, n.d.). Thus, the future German economy will retain a powerful industrial component that will likely total above 30 percent of German GDP. And now, Germany has proven to the world that the country's manufacturing industries conquered among the largest percentage. The world wonder what makes Germany manufacturing industry so successful. From luxurious car of Volkswagen to our sport attire by Adidas, it gives the insight Germany provides the world almost everything. Among the answer to Germany success in manufacturing field is their economy emphasise on 'making things' instead of using the readymade machine from outside their country. Thus, after World War II, Germany government put in place a financial and institutional structure which supported manufacturing (Ydstie, 2018). They invest in very capable of

small and middle size company called Mittelstand. That's how the Germany built the foundation of the country's manufacturing success (Ydstie, 2018).

## 1.3 Problem Statement

It is really essential for company to manage their operational risk. Operational risk management is defined as a methodology for organizations looking to put into place real oversight and strategy when it comes to managing risk. Every business has the probability of facing circumstances or fundamental changes that caused risk to come into it, from minor inconveniences to major form which might put the business existence in jeopardy. According to Investopedia however, operational risk summarizes the risk that company undertakes as it gave attempt to operate within a given field or industry. Operational is also the risk of business operation failing due to human error. It changes from industry to industry, and it is an important consideration when decision of looking for potential investment been made. According to Investopedia also, the lower the human interaction in that particular industry, the lower the operational risk. Among the main problems recognised for business firms in Germany are energy costs, following the introduction of surcharges to promote the production of renewable energies; and shortage of skilled labour (Office, 2017). This has contributed to human resources problem in Germany which affect their firm's operational system. In Germany, in order to overcoming the existing problem regard their human resource, the Local Chambers of Commerce is responsible in providing vocational education with extensive but rigid system (Office, 2017).

## 1.4 Research Objectives

Overall, this study aims to determine the Germany manufacturing companies' operational risk and the effect by internal and external factors by manufacturing industries. Objectives of this study particularly are:

1. To investigate the specific factors towards operational risk.
2. To investigate the macro-economic factors towards operational risk.
3. To investigate the specific factors and macro-economic factors towards operational risk.

## 1.5 Scope of Study

The scope of sample study consist of five manufacturing companies in German which is BMW, Adidas, Daimler and Siemens. The accounting and financial ratios was based on each company's annual report for 5 years (from 2012 to 2016).

## 1.6 Organization of the Study

This study includes of five main chapters. Chapter one provides background of study, which consists of an overview of the study, problem statement, scope of the study, and organization of the study. Chapter two reviews the literature, the subject discussed in this chapter is about firms' operational risk and the effect of internal and external factors towards it. Chapter three details the proposed methodology, approach and design of study. Chapter four discusses the results and findings of the study, which includes the descriptive statistical analysis, correlation and diagnostic test. Finally, chapter five includes summary and conclusions of the study, implications of the study, the limitation of the study and also recommendation for future work.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

This chapter is dedicated to the review of literature related to the study. This chapter consists of three sections. Section 2.2 will provide the insight into the operational risk and its effect consist of specific factors and macroeconomic factors.

## 2.2 Operational Risk

Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. Other classes of risk could also be included such as fraud, security, privacy protection or environmental risks. Woods and Dowd (2008) studies explained operational risk arises due to internal system and human error. Operational risk faced by a firm is different from each other depending on the type of operation conducted by the firm Nastiti (2017).

In 2012, Allied Irish Bank conduct an error in sending an incorrect statement that affect the creditworthiness of 12,000 of its customer and as a result, the bank incurred a high cost in order to fix the error (Carswell,2012), which shows the impact of operational failure. Operational risk can be classified into two types namely risk arises from the error in the technology used by the company which the failure in the process and transactions is included.

The second type of risk is known as risk arises due to agency cost as stated by Jarrow (2008). Power (2003) however suggested operational risk is necessarily a forensic category and therefore any definition of operational risk in part by what it is sensible to blame a single middle level manager as compared to Chief Executive Officer. Khalil (2017) stated operating profit margin ratio was used as a measurement to indicate the efficiency of the firm's operation by dividing the operating income to total revenue.

## 2.3 Liquidity Risk

The common understanding when it comes to liquidity risk is the failure of business or financial institution to meet their short term debt obligations. It simply means that the assets cannot be convertible quickly to cash. Ahmed Mohammed Dahir (2018) in his studies defined liquidity risk as uncertainty in the bank's inability to meet its payment obligation. He also mentioned how liquidity risk acts as driving risk factor which gives threat to financial system and that threat coming from different sources. According to Felice and Hall (2013), it is said to be the outcome if the manufacturing company is unable to pay its liabilities without incurring any additional charges and penalties. Meanwhile, it is understood liquidity risk has significant effect on the company's performance and asset base hence becomes a key factor in considering of making and investment plan.

Let say if the company failed to minimize spending, when the current liabilities fall due , it will not be settled, additional charges hence will be attached to the obligation of the company credit scores to the fund providers and suppliers (Mathuva, 2010). In company, liquidity risk is measured using liquidity ratios such as current ratio, quick ratio and cash conversion cycle (CCC). Current ratio is equal to current assets divided by current liabilities. The quick ratio on the other hand is equal to current assets minus inventories divided by current liabilities. It can also be calculated as cash and cash equivalents plus marketable securities plus accounts receivable then divided by current liabilities.

On the other hand, companies that have favourable liquidity position usually will have favourable credit policy. Ojeka (2011) in his studies explained that negative effect on liquidity of manufacturing companies did not exist. According to him, to reduce liquidity problem is by setting up credit standards and collection period.

## 2.4 Credit Risk

According to Investopedia, credit risk refers to the risk that a borrower may not repay a loan and that the lender may lose the principal of the loan or the interest associated with it. The reason credit risk arises is because borrowers expect to use future cash flows to pay current debts. Interest payments from the borrower or issuer of a debt obligation are lender's or investor's rewards of assuming credit risk. The way credit risk is calculated is based on the overall ability to pay of the borrower. In order to asses credit risk on consumer's loan, lenders look at 5C's namely credit history, capacity to repay, capital, condition and also collateral. Credit risk can be divided into three types: credit spread risk which happen when there is fluctuations between the difference in investments' interest rate and risk free rate , default risk due to borrower's inability to fulfil contractual obligations, and downgrade risk due to downgrade in risk rating of an issuer.

During economic boom, customer tends to pay cash purchases and punctual in paying their debt to avoid bad debt (Ifrueze, 2013). However during economy recession, it is all based on uncertainty which befalls the repayment of the debt. Studies also shows that liquidity risk and credit risk are interrelated. Based on Muhammad Usama (2012), he found out there is negative relationship between average collection period and firm's liquidity. The shorter the firm's average collection period, the higher the liquidity capacity thus lowering credit risk probability.

## 2.5 Market Risk

Market risk can be defined as the risk of losses in positions because of movements in market prices. It is the possibility of an investor experiencing losses due to factors that affect the overall performance of the financial markets. Market risk is also referred to as systematic risk or non-diversifiable risk because it cannot be eliminated through diversification though it can be hedged against. Sources of market risk include recessions, political turmoil, and changes in interest rates, natural disasters and terrorist attacks. In investment risk, there are two major categories commonly mentioned. It is market risk and also specific risk.

The most common types of market risk include interest rate risk, equity risk, currency risk and also commodity risk. Interest rate risk covers the volatility that may accompany interest rate fluctuations due to fundamental factors, such as central bank announcement related to monetary policy changes. Equity risk however related to changing prices of stock investment whereas commodity risk functions in covering the changing prices of commodities such as crude oil and corn. Currency risk also known as exchange rate risk. This risk arises from the change in price of currency. Specific risk or unsystematic risk in contrast is tied directly to the performance of the particular security and can be protected against through investment diversification. One example of unsystematic risk is a company declaring bankruptcy, thereby making it stock worthless to investors.

## 2.6 Corporate Governance

According to Investopedia, corporate governance is the system of rules, processes and practices to direct and control a company. The main purpose of corporate governance is to achieve balance of interest between company stakeholders such as shareholders, management, customers, suppliers, financiers, government and also the surrounding community. Since the framework of corporate governance provide the company's objectives, corporate governance also encompasses every sphere of management, from action plans and internal controls to performance measurement and corporate disclosure because it provides the framework for attaining the company's objectives. Communicating corporate governance is a key component of community and investor relations. OECD (2004) defines corporate governance as a set of relationships between a company performance, board, shareholders and other stakeholders and provide the structure through which the objectives of company are set and the means of attending those objectives and monitoring performance are determined. Good corporate governance in a firm will create transparent set of rules and controls in which shareholders, directors and officers have aligned incentives. That is the reason why most companies or firms strive to have high level of corporate governance.

In October 2001, the corporate scandals began with the collapse of Enron and that continue to the present day. It had shaken investors' faith in the capital markets and the efficacy of existing corporate governance practices in promoting transparency and accountability. Satyam Scandal advocated a number of reforms which led to MCAs (Ministry of Company Affairs) Corporate Governance Voluntary guidelines 2009. It is to encourage and guide companies to adopt superior practices like appointing board committees, the appointment and rotation of external auditors, and creating a whistle blowing mechanism. Corporate governance become stringent because of the new Companies Amendment bill. It is considered as an attempt on our part to construct an objective overall corporate governance.

# CHAPTER THREE

# METHODOLOGY

## 3.1 Introduction

Research methodology is defined as "the general approach the researcher takes in carrying out the research project", Leedy and Ormrod (2011). It is also defined as the study of the rules in which knowledge is obtained. However, Cohen and Manion (1996) defined methodology as the approach used in the research to collect data. This method is used to achieve the objectives of the study and thus get a perfect result in the end of the study. This study is conducted to know the internal and external factors of manufacturing industry towards operational risk. The method used to collect data is Statistical Package for the Social Sciences (SPSS) version 24.

## 3.2 Population / Sampling Technique

The unit of analysis is the major entity that is being analyzed in a study. For example, individuals, groups and artifacts could be a unit of analysis in a study. In this study, organizations will be the unit of analysis. The population in this study is the company's effects of internal and external factors in manufacturing industry towards operational risk. From this population, four manufacturing companies from Germany were chosen which is BMW, Daimler, Siemens and Adidas. Data from the annual reports from each company from the year 2012 until 2016 is used to measure the dependent variables (operational risk) and the independent variables (firm specific factors and macroeconomic factors).

### 3.3 Statistical Technique

We chose Germany to conduct this study and narrowed down to the manufacturing industry. We have chosen four companies as samples. The companies are BMW, Daimler, Adidas, and Siemens. We have referred to the annual report (from 2012 until 2016) for each year and use the details in income statement and balance sheet from these annual report to calculate the effect of firm specific factors for each year from various aspect such as profitability, liquidity, operational, and credit. For non-financial performance, the disclosure of information regarding board of director in terms of nationality, qualification, gender diversity, audit committee, remuneration committee, board size, board meeting, experience and total remuneration are used to find index score. To determine the macroeconomic factors, we obtained the historical price (from 2012 until 2016) for the company from Yahoo Finance to calculate the beta. Besides that, GDP, interest rate, unemployment rate, inflation rate and interest for five years is collected to see the trend of the economic condition from 2012 to 2016.

Major and most common technique been used in doing research is ordinary least square regression. We used this technique to analyse data and forms the basis of other techniques. To model a particular response variable which has been recorded, we may use OLS as comprehensive modelling technique. This technique can be applied to a single or multiple explanatory variables and coded categorical explanatory variables (Hutcheson, 2011). Through sample data, we use principle of least square to fit a pre-specified regression function (Pedace, n.d). The principle stated that to minimize the squared distance between the dependent variable observed values and SRF estimated value, the sample regression function (SRF) should be constructed. Hence, OLS remains the most preferable technique to estimate regression even with existence of necessary of other alternative methods. OLS is definitely easier compared to other alternative techniques, sensible, and have desirable characteristics in its result.

### 3.4 Data Analysis

In accordance to the conceptual framework of research in the future, there are one dependent variable and two independent variables in this study. The research framework are as follow:

**Figure 3.1 Research Framework**

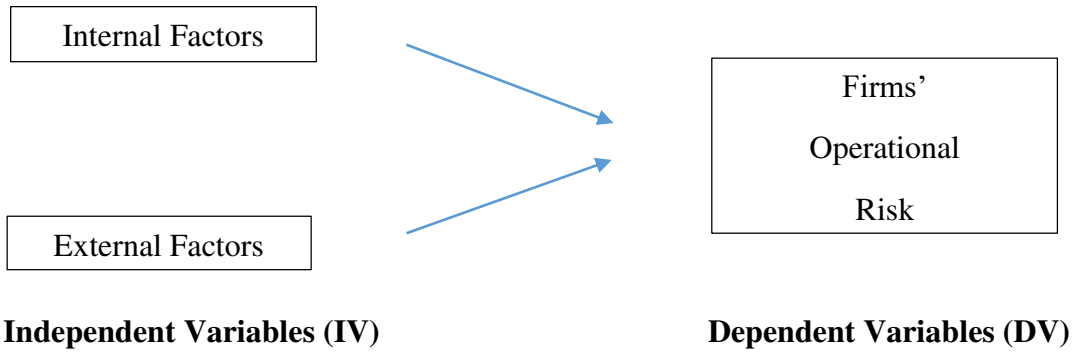



**Figure 3.1 Research Framework**

Multiple regression was used in order to determine the influence of independent variables on the dependent variable. This regression technique will describe the influence of the independent variables with the dependent variable. The multiple regression can be presented in the equation form as follows:

$$\mathbf{OPR} = \beta_0 + \beta_1\mathbf{ACR} + \beta_2\mathbf{ACP} + \beta_3\ \mathbf{INDXS} + \boldsymbol{e} \quad \text{Equation 1}$$

$$\mathbf{OPR} = \beta_0 + \beta_1\mathbf{INFLA} + \beta_2\mathbf{BETA} + \boldsymbol{e} \quad \text{Equation 2}$$

$$\mathbf{OPR} = \beta_0 + \beta_1\mathbf{ACR} + \beta_2\mathbf{ACP} + \beta_3\mathbf{INDXS} + \beta_5\mathbf{INFLA} + \beta_6\mathbf{BETA} + \boldsymbol{e} \quad \text{Equation 3}$$

**Table 3.1 Measurement of Variables**

| No | Variables | Notation | Measurement |
|---|---|---|---|
| 1 | Operating Ratio | OPR | Operating Expenses / Net Sale |
| 2 | Average Current Ratio | ACR | Current Assets / Current Liabilities |
| 3 | Average-Collection Period | ACP | Account receivable / (Revenue / 360 Days) |
| 4 | Index Score | INDXS | Corporate governance elements |
| 5 | Inflation | INFLA | 5-years inflation rate |
| 6 | Beta | BETA | 5-years daily stock price |

## 3.5 Statistical Package for Social Sciences (SPSS)

In this study, IBM SPSS version 24 was used to compute the data to obtain a result. SPSS which also known as Statistical Package for Social Sciences are known to be a powerful software that help researchers in conducting a statistical data analysis. However, SPSS was renamed later as IBM SPSS Statistic after being required by IBM in 2009. This software become popular in data mining, research on market and marketing because of the capability in conducting descriptive statistics, numeral outcome prediction and prediction for identifying groups. But it will only be used to compute the linear regression and correlation between the variables based on the quantitative data obtained. Quantitative data is data about the numeric variables and this data were obtained through the annual report of the four companies which are Siemens, Daimler, BMW and Adidas.

# CHAPTER FOUR

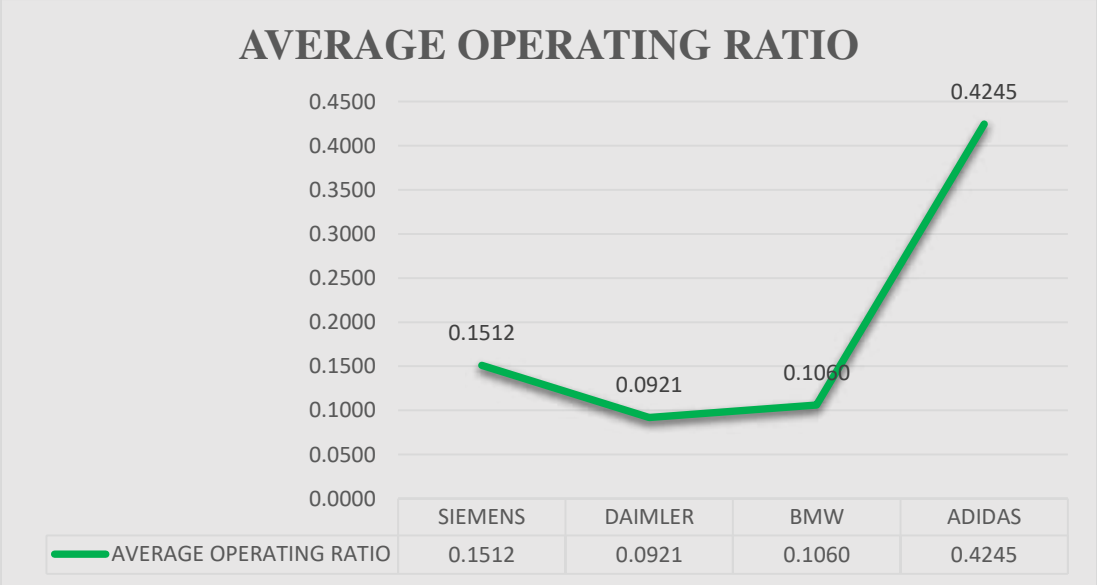
# FINDINGS AND ANALYSIS

## 4.1 Introduction

Financial statement analysis allows researchers to identify the trend of the companies by comparing the ratios across five years period. There are three main components of financial statement; income statement, balance sheet and cash flow statement. These statements allow researchers to measure the operational, liquidity, credit, market and corporate governance

## 4.2 Operational Risk

**Figure 4.1 Average operating ratio**

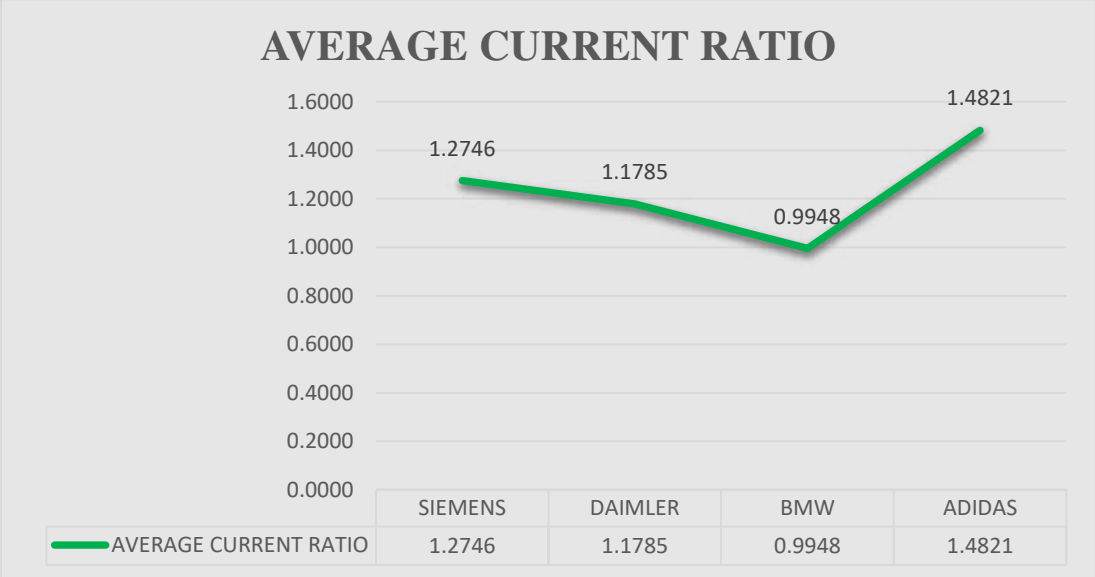



Operational risk happens because of the failure in systems, processes, people and external events. If the operational risk is not managed properly, a serious risk and business failure can happen. Operational risk is measured by computing the average operating ratio in five consecutive years from 2012 to 2016. The main objective of this ratio is to determine the efficiency of operational management in the company. Based on the descriptive

statistics (refer appendix D, Table D.1), the mean value for operating ratio for 5 consecutive years is 0.1935 that indicates 19.35% of the company's revenue are used for operating expenses. The standard deviation of the operating ratio is 0.1388% which indicates that there is big variation in operating ratio for each company. Based on the figure 4.1, company with the highest operating ratio is Adidas with 42.45% that are above the average of operating ratio among the four companies. All companies except for Adidas are below the average value. This indicates that all companies except for Adidas has the ability to manage its operation efficiently. The high ratio in Adidas implies that the company is incapable to manage their operation with efficient. The most efficient company is Daimler because it has the lowest operating ratio of 9.21%.

## 4.3 Liquidity Risk

**Figure 4.2 Average current ratio**



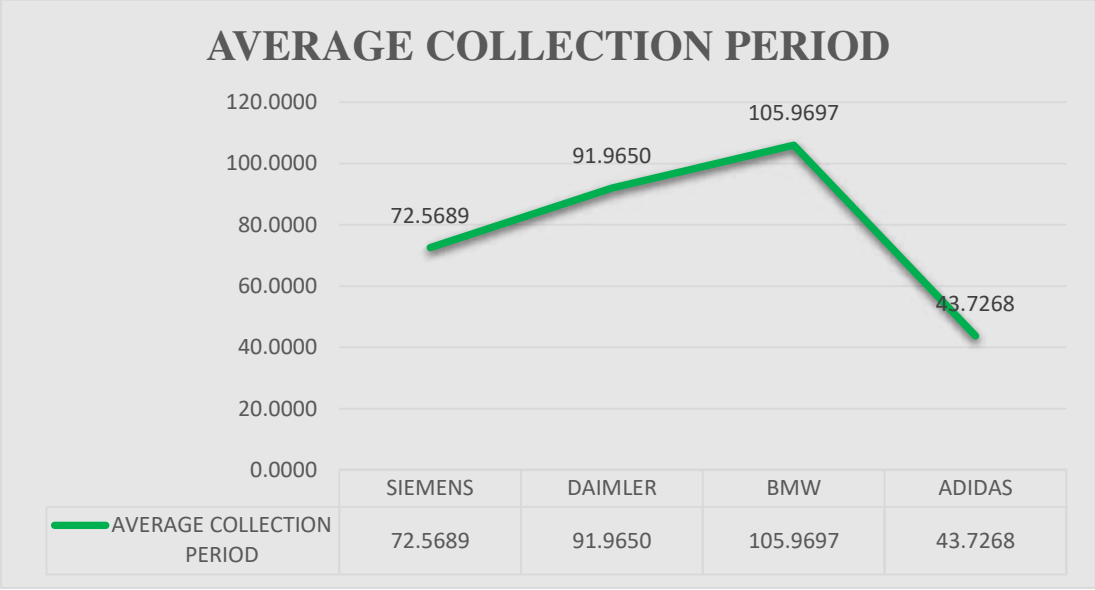

Liquidity ratio is defined as the ability of businesses or firm to meet or pay for its short term debt obligation. It measures how fast a business can convert its assets into cash to pay off all the debts. The way liquidity risk is computed is by dividing the current assets with current liability, thus producing average current ratio. The higher the ratio, the more liquid the firm hence the lesser the liquidity risk and vice versa. It is because the firm has enough assets to cover its current debt. In this study, 5 years average current ratio was

computed starting from 2012 to 2016. Based on the graph above, the highest average current ratio for the whole five years is charted by Adidas company with ratio of 1.4821 times. Meaning to say, in this year Adidas is in most liquid state compared to the other three companies thus having lower liquidity risk. It means that Adidas' current assets amounted €1.4821 managed to cover its €1 current liabilities.

On the contrary, BMW charted the lowest average current ratio which is only 10.9948 times. Low liquidity ratio indicates a company is struggling and having hard time to convert its current assets into cash to pay off the debt because low liquidity ratio also means high liquidity risk faced by the company. As liquidity risk in BMW is highest among the other four manufacturing companies in Germany, BMW is suggested to take precautions so that it will not get into insolvency. The overall performance of liquidity risk ratio for the four manufacturing companies in Germany for the whole 5 years (2012-2016) can be said as inconsistent as the trend shows the declining and rising trend of those ratio.

## 4.4 Credit Risk

**Figure 4.3 Average collection period**



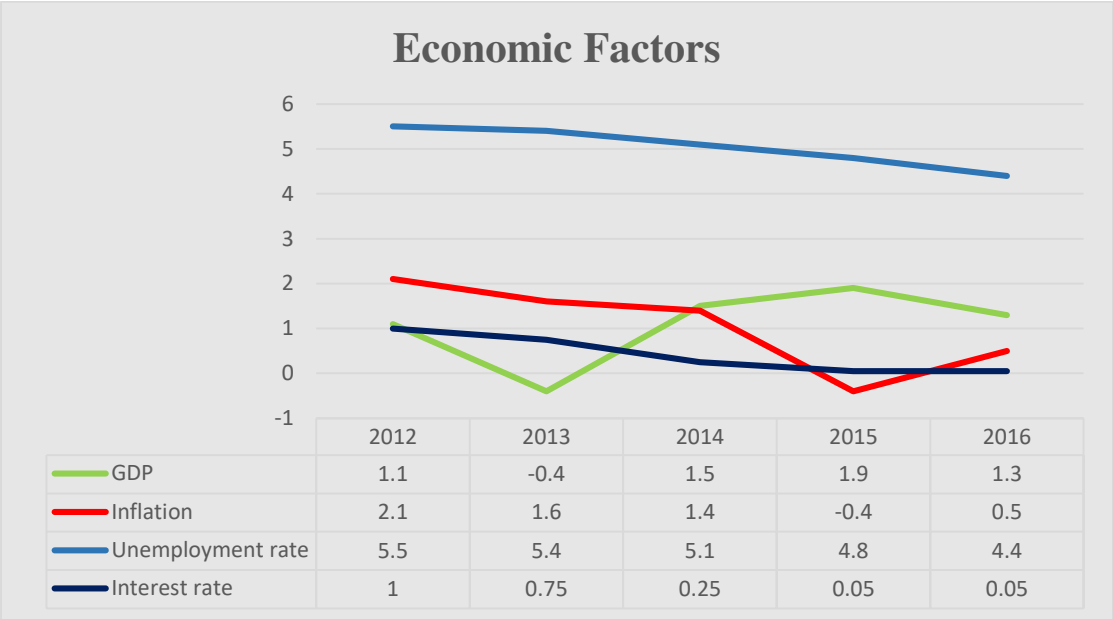
Credit risk happen when the customer is unable to meet the debt repayment hence it is said they are defaulted in their loans. In order to determine credit risk, average collection period is calculated by dividing account receivables with the Revenue/360 days. The ratio obtained will indicate how many days the company managed to collect back its receivables. The higher the ratio, the longer the days taken for company to collect the payments owed by their customer. Meanwhile the company is said to have higher credit risk.

The average collection period for the whole four companies (BMW, Adidas, Daimler, and Siemens) from 2012 till 2016 depicts an inconsistent trend of rising then declining. The highest average collection period is charted by BMW with days taken to collect their debts is approximately 106 days. This indicates that BMW is facing higher credit risk as they take the longest days to collect their receivables. On the other hand, Adidas charted the least days taken to collect the debts owed to them with average collection period of approximately 44 days. This ratio indicates that Adidas is efficient in managing their credit risk as the company's ratio credit risk is the lowest among the four companies. Siemens and Daimler however charted an average collection period of approximately 73 days and 92 days respectively putting their credit risk ranking in the middle of Adidas and BMW.

There are ways for BMW to mitigate the credit risk of their customer so they will not default on their repayment and the company can collect their receivables efficiently. First and foremost, BMW may adjust the cost of credit according to their borrower credit strength. It means that the borrower only take up the debt according to their capacity and ability to pay back as fast as possible. The company can also exercise the practice of reducing the credit available to higher risk applicants, as they have higher probability of defaulting.

## 4.5 Market Risk

**Figure 4.4 Economic factors in 5 years in Germany**



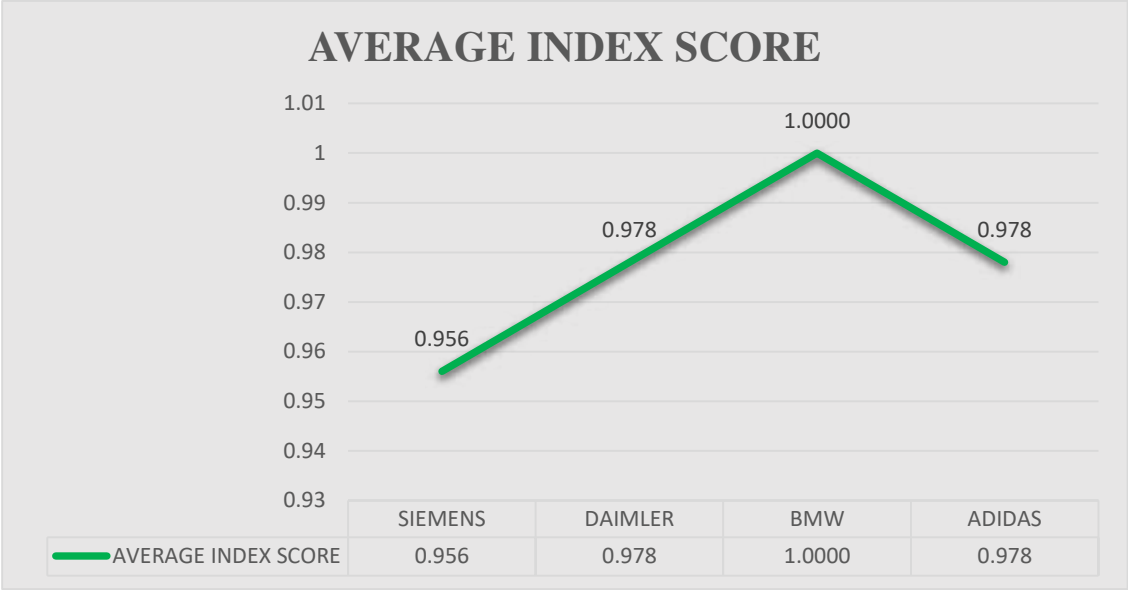

| | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| GDP | 1.1 | -0.4 | 1.5 | 1.9 | 1.3 |
| Inflation | 2.1 | 1.6 | 1.4 | -0.4 | 0.5 |
| Unemployment rate | 5.5 | 5.4 | 5.1 | 4.8 | 4.4 |
| Interest rate | 1 | 0.75 | 0.25 | 0.05 | 0.05 |

Market risk is a systematic risk or known as undiversified risk because the risk cannot be eliminated by diversification. Some of the market risk determinants are changes in gross domestic product (GDP), inflation rate, unemployment rate and interest rate. The movement of the determinants in five consecutive years for the four companies are shown in the graph above. GDP is used to measure the monetary value of the goods and services a country produces in a year. GDP in Germany was mostly the same except in 2013 that decline drastically from 1.1 to -0.4%. GDP in 2013 indicates that the economic condition in Germany is declining. This may be caused by the global financial crisis that happens around that time. However, GDP value is increasing drastically to 1.5 in 2014.

A declining trend can be seen from the graph above for inflation rate. This is a good thing to Germany as well as the company, Siemens because a high inflation is not good for the country because it will reduces the value of money except the interest rate is higher than the inflation rate in that particular year. As for the unemployment rate, a similar declining trend is showing. A lower unemployment rate shows that the economy in that particular country is expanding. Besides, the lower the unemployment rate, the more preferred it is. Additionally, the interest rate for the past five years shows a decreasing trend. Interest rate affect the inflation rate of a country directly.

## 4.6 Corporate Governance

**Figure 4.5 Average index score**




Index score were used to determine the corporate governance index of a company to determine the level of compliance of the company towards the principle of corporate governance. The index score was obtained from the annual report of the four companies that was published publicly indicates the transparency of the company. It shows the willingness of the company to disclosure its company information. 9 variables were used to calculate the index score that involved the principles of corporate governance which are accountability, fairness, independence and transparency. Firstly, a variable to determine the accountability of the company is used such as the meeting conduct of the committees in the company. Next, second variables is concerned with the fairness which are gender diversity that were used to determine the company's gender discrimination. Nationality also included to show the concern of the board to determine the nationality diversification of the company's board. The third variables used is based on the independence of the board. It is to determine the availability of supervisory board, audit committee and risk management committee. The last variable is to determine the transparency of the company by checking the availability of the annual report.

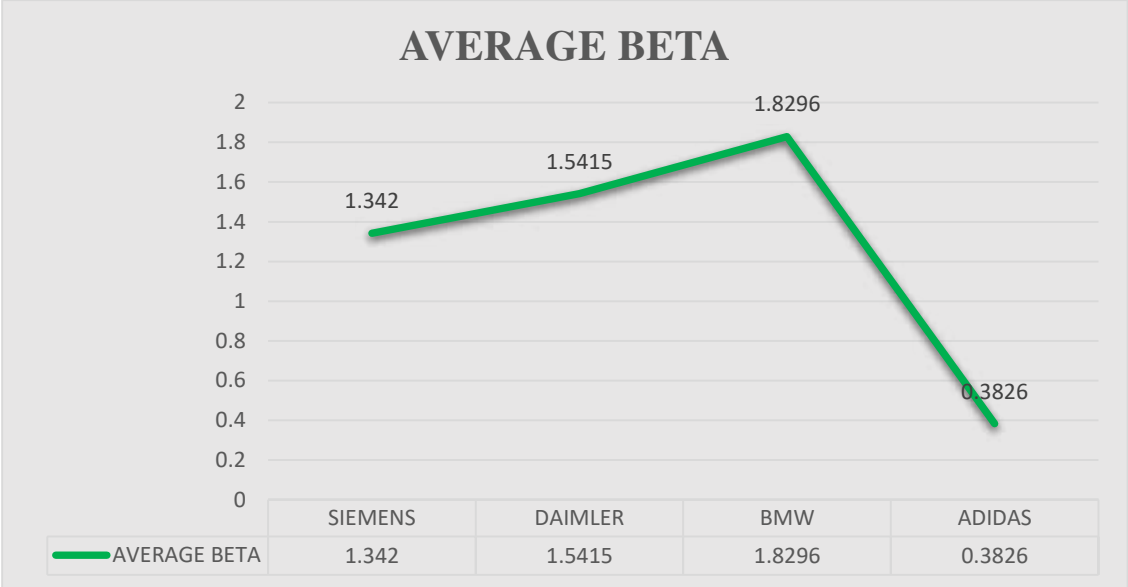
Based on the graph above, it shows the average index score of the four companies known as Siemens, Daimler, BMW and Adidas for 5 years from 2012 to 2016. The average

index score based on the descriptive statistics (refer appendix D, Table D.1) is 97.8% implies that the value serve as a benchmark to determine the optimum index score that a company should have. The company have a better compliance towards corporate governance if the index score of the company is higher the mean value. Based on the graph above, it shows that the three companies except for Siemens are higher than the mean value indicates that the companies have a better compliance towards corporate governance. The company with the highest index score is BMW with 100% of index score. This indicates that BMW is fully comply with the 9 variables used to determine the effectiveness of corporate governance and fulfilled the principles of corporate governance as compared to other companies.

Aside from the highest average index score, the lowest average index score was obtained by Siemens with 95.6% that indicates the company are less complying with corporate governance compared to other companies. The low value was because Siemens does not take into consideration to have risk management committee for 2 years from 2012 to 2013. However, later in 2014, Siemens started to take into consideration to include risk management committee to prove their independence. The standard deviation of the four companies for five years is 4.51% (refer Appendix D, Table D.1). This value indicates that the disbursement of the index score between the four companies is small. This shows that the application of corporate governance in the four companies are not much vary from each other.

## 4.7 Beta

**Figure 4.6 Average beta in 5 years**




Beta is a measure of the volatility, or systematic risk, of a security of a portfolio in comparison to the market as a whole. Besides that, beta is also known as beta coefficient. Beta actually indicates the tendency of a security's return to respond to uncertainty in the financial market. For this study, beta of four manufacturing companies (Siemens, Daimler, BMW and Adidas) for five years duration starting 2012 till 2016 is calculated using standard deviation. The way we interpret beta is by indicator whether it is equal to 1, less than 1 or more than 1. If beta is more than 1, it depicts that the security's price is more volatile than the market. If beta is less than 1, means security is less volatile and if beta is equal to 1, it indicates that security's price move with the market.

The beta for Siemens, Daimler and BMW portrays the ratio of more than 1 (1.342, 1.5415, and 1.8296 respectively). This indicates that the security's price for those three companies is more volatile than the market. Beta for Adidas is less than 1 with ratio of 0.3826 indicating that Adidas security's price is less volatile than the market price.

## 4.8 Correlations

**Table 4.1 Table of Pearson Correlation**

| Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | OPR | ACR | ACP | INDXS | INFLA | BETA |
| Pearson Correlation | OPR | 1.000 | .798 | -.897 | -.048 | -.003 | -.849 |
| | ACR | .798*** | 1.000 | -.889 | -.057 | .102 | -.811 |
| | ACP | -.897** | -.889 | 1.000 | .235 | -.110 | .858 |
| | INDXS | -.048 | -.057 | .235 | 1.000 | -.175 | .022 |
| | INFLA | -.003 | .102 | -.110 | -.175 | 1.000 | -.120 |
| | BETA | -.849** | -.811 | .858 | .022 | -.120 | 1.000 |

Note: * p < 0.10, ** p < 0.05, *** p < 0.001. OPR = operating expenses / net sale, ACR = current assets / current liabilities, ACP = account receivable / (revenue/360 days), INDXS = corporate governance elements, INFLA = 5-years inflation rate, BETA = 5-years daily stock price

Pearson correlation is used to determine the relationship between dependent variable (operational risk) and independent variables (firm-specific variables and macro-economic variables). The table below is used as benchmark to determine the relationship between the variables.

**Table 4.2 Table of correlation benchmark**

| Size of correlation | Interpretation |
|---|---|
| 0.90 to 1.00 (-0.90 to -1.00) | Very high positive (negative) correlation |
| 0.70 to 0.90 (-0.70 to -0.90) | High positive (negative) correlation |
| 0.50 to 0.70 (-0.50 to -0.70) | Moderate positive (negative) correlation |
| 0.30 to 0.50 (-0.30 to -0.50) | Low positive (negative) correlation |
| 0.00 to 0.30 (0.00 to -0.30) | Negligible correlation |

**Source: Hinkle, Wiersma & Jurs as cited in Mukaka (2012)**

Based on Table 4.1, average current ratio is strongly positive and significantly correlated to operational risk with $p < 0.001$. It shows that, any changes in average current ratio will give a big impact on the operational risk or it can clearly state that, when average current ratio increase, the operational risk is also increase. This is because, when the companies is unable to meet their short term debt obligation due to the investor that unable to convert cash quickly with minimum loss, it will make the operational of the companies face a problem too. Companies that does not have enough current asset in order to pay its short term obligations when it's due were face a liquidity risk. Next, beta shows a weakly negative and significantly correlated to the operational risk of the company with $p < 0.05$. Beta is used to calculate the market risk. This indicate that, when the market risk decreases, operational risk will influence with the minimal effect. Meanwhile, average collection period also negative and significant correlated with operational risk with $p < 0.05$. This mean that, when average collection period increase, the operational risk also increase. This is because, when customer default to pay their money to the companies, the companies will having a problem in term of they don't have a enough funds for operational use.

## 4.9 Coefficients

**Table 4.3 Table of multiple regression coefficients**

| Coefficients[a] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | | Collinearity Statistics | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Tolerance | VIF |
| 1 | (Constant) | .382 | .387 | | .987 | .340 | -.447 | 1.211 | | |
| | ACR | -.109 | .170 | -.152 | -.638 | .534 | -.474 | .257 | .183 | 5.478 |
| | ACP | -.005 | .002 | -.866 | -2.888 | .012 | -.009 | -.001 | .116 | 8.655 |
| | INDXS | .422 | .369 | .137 | 1.144 | .272 | -.369 | 1.212 | .723 | 1.383 |
| | INFLA | -.013 | .016 | -.088 | -.837 | .417 | -.048 | .021 | .949 | 1.054 |
| | BETA | -.052 | .047 | -.242 | -1.122 | .281 | -.152 | .048 | .224 | 4.462 |
| a. Dependent Variable: OPR | | | | | | | | | | |

Based on the use of coefficients, the independent variables that has influence on the operational risk can be determined through the identification of significant level of 5% with p-value. P-value < 0.001 indicates that the independent variable has the most influence on the dependent variable. P-value < 0.05 indicates a moderate influence of independent variable on the dependent variable while variable that has p-value < 0.10 has the least influence.

According to Table 4.3 above, corporate governance (INDXS) is positive and mostly significantly influence operational risk with p-value < 0.001, t = 1.144. From the table also it can be seen that average collection period (ACP) is negative but moderately significant influence the operational risk with p-value < 0.05, t = -2.888. This signify that

a decrease in the average collection period will increases the operational risk of the companies.

Besides that, Beta was found to be negative and has the least significant influence on the operational risk with p-value < 0.10, t = -1.122. Since Beta is used to calculate the market risk, it means that when the risk of the market decreases, it will also influence the operational risk but with a minimal effect.

## 4.10 Model Summary

**Table 4.4 Model summary result**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .924[a] | .854 | .802 | .06168460764 | .622 |
| a. Predictors: (Constant), BETA, INDXS, INFLA, ACR, ACP | | | | | |
| b. Dependent Variable: OPR | | | | | |

**Table 4.5 ANOVA result**

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | .313 | 5 | .063 | 16.429 | .000[b] |
| | Residual | .053 | 14 | .004 | | |
| | Total | .366 | 19 | | | |
| a. Dependent Variable: OPR | | | | | | |
| b. Predictors: (Constant), BETA, INDXS, INFLA, ACR, ACP | | | | | | |

According to Table 4.4 above, the adjusted R Square is equal to 80.2 %. This implies that by using all the internal and macro variables in Equation 3 (Model 3) which known as Average-collection period (ACP), Operational ratio (OPR), Index score (INDXS), Inflation (INFLA), and Beta shows that, the variables used in the model able to explains 80.2 % of the variance in the operational of manufacturing industry companies consist of Daimler Company, Siemens, BMW and Adidas. While the remaining of 19.8% of the adjusted R Square remain unknown, this implies that, the remaining of 19.8% of the adjusted R Square shows that the variance in the liquidity risk of the five company in manufacturing industry are unable to be explained by the both of the internal and macro variables for the Equation 3 (Table 4.4). This gives an opportunity to researchers to conduct a future research regarding the unknown factor. The model summary in Table B.4 (refer appendix B) is a result obtained from firm specific factors only as the independent variable of the equation 1 (model 1).

The adjusted R square value of 0 .805 indicates that 80.75% of the independent variables explain the model. While another 19.25% shows that the equation 2 (model 1) is unable to be explained by the firm specific factors. In contrast with Table C.4 (refer appendix C), the equation 2 (model 2) use independent variables that only consist of macroeconomics factors. The R-square value of 0.700 indicates that 70.00% of the equation 2 (model 2) are able to be explained by the macroeconomic variables. Based on the value of adjusted R square obtained by model 1 and model 2, it shows that, the firm specific factor explain the variance in the operational of five companies more than the macroeconomic factors. This implies that the firm specific factors are the main factor that can explain the variance of the operational of the five companies. Besides that, the ANOVA table above shows a significant value of 0.000 which is below the alpha value ($p < 0.05$). It indicates that the variable is perfectly significant to represent the model. Thus, the significant value above is an acceptable value that indicates the model of the study are acceptable and reliable.

# CHAPTER FIVE

# DISCUSSION AND CONCLUSION

## 5.1 Introduction

This study aims to determine the firm's operational risk and its determinants among 5 companies in manufacturing industry in Germany. To achieve this objective, firm-specific factors (operational risk, credit risk, liquidity risk and corporate governance) and macro-economic factors (market risk, gross domestic product, inflation, unemployment rate and interest rate) were used in this study. Hence, in this chapter the discussion will be based on the findings in chapter four. Conclusion and recommendations for future research are included in this chapter.

## 5.2 Discussion of result

This study aims to determine the firm's operational risk and its determinants among 5 companies in manufacturing industry in Germany. This study is done to achieve the research objectives as below:

1. To investigate the influence factors of firm's performance effect towards operational risk.
2. To investigate the macro-economic factors towards operational risk.
3. To investigate the influence factors of firm's performance and macro-economic factors towards operational risk.

Based on the table of both correlation (Table 4.1) and coefficient (Table 4.3), there are evidence showing that operational risk has been influenced and affected by firm-specific factors in terms of average collection period and beta. The correlation table show that average collection period is positive and significantly correlated to operational risk with p-value $< 0.001$. It indicates that when average collection period increases, the

operational risk increase. Based on coefficient table, average collection period (ACP) is negative but moderately significant influence the operational risk with p-value < 0.05, t = -2.888. It indicates that any changes in the average collection period will influence the level of operational risk. Thus, both value implies that an increases in average collection period will result increase in company's operational risk. This is because companies need to keep a lot of asset such as cash and account receivable to meet their operational needs.

Macro-economic factors was found to be influencing the operational risk of figure 4.4 in Germany. Based on the coefficient table (refer Chapter 4, Table 4.3), the value shows that beta (a market risk elements) influence the operational risk with table there is evidence showing that operational risk is significantly influenced by beta with p-value < 0.10, t = -1.122. Beta is calculate the level of risk of a firm based on the volatility of their share prices. Overall, it can be conclude that both firm-specific factors and macro-economic factors influence the operational risk of a firm. The model summary (Table 4.4) shows that 100% of the model is explained by various from firm-specific and macro-economics. The ANOVA table that shows a significant of 0.000 indicates that the model is reliable. However, the firm-specific has more impact towards the company which will affect the operational level of the company heavily. So, macro-economic factors does not impact much on the company.

## 5.3 Recommendations

Apart from that, average collection period also has significant relationship with operational risk. There are several ways companies can manage their accounts efficiently. One way is to establish a clear credit policy. Credit policies help companies track their account debtors consistently that reduce the collection period. These credit policies outline the conditions that customers must follow in terms of the amount of refunds and the time that they have to pay the money. Furthermore, before giving out a customer loan, the company must first make a careful examination of the credit history of the customer. Customers with bad credit history such as unanswered payments or weak credit should not be allowed for credit purchases. This will reduce the risk of partnerships for companies. Companies can also set payment terms so customers will know when the payment is

accurate (William, 2016). It is very important for a company to ensure that their company manages their account receivable to avoid operational risk. , the average collection period is said to have a close relationship with operational risk. This is because, if a company fails to earn enough money with the full amount of repayment from the customer, it will be a reason that the operation of the company cannot run due to absence adequate financial resources to finance the operation.

Apart from that, beta also has significant relationship with operational risk. Beta is one of the determinant of market risk. When a company is able to buy a lot of shares for their company, it will have a direct impact on the company's own operations. This is because, the quantity of shares owned by a company represents that the company is able to attract investors to buy their company shares. This will indirectly increase the operations within the company as the company receives substantial financial funds as a result of the sale of shares. With the financial funds, all operating activities of the company are running smoothly, such as company rent payments, payroll to employees and buy a raw material. Thus it shows that, more company shares sold to investors, the lower the operational risk.

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# APPENDICES

## A. Financial Risk Data

**Table A.1 Operational ratio for each company for 5 years**

| YEARS | SIEMENS | DAIMLER | BMW | ADIDAS |
|---|---|---|---|---|
| **2012** | 0.4132 | 0.0940 | 0.1080 | 0.4132 |
| **2013** | 0.4232 | 0.0956 | 0.1050 | 0.4232 |
| **2014** | 0.4268 | 0.0977 | 0.1134 | 0.4268 |
| **2015** | 0.4309 | 0.0850 | 0.1041 | 0.4309 |
| **2016** | 0.4283 | 0.0882 | 0.0997 | 0.4283 |

**Table A.2 Liquidity ratio for each company for 5 years**

| YEARS | SIEMENS | DAIMLER | BMW | ADIDAS |
|---|---|---|---|---|
| **2012** | 1.2304 | 1.1488 | 1.0430 | 1.5722 |
| **2013** | 1.2395 | 1.1917 | 1.0426 | 1.4491 |
| **2014** | 1.3136 | 1.1519 | 0.9622 | 1.6782 |
| **2015** | 1.3003 | 1.1916 | 0.9427 | 1.3977 |
| **2016** | 1.2892 | 1.2083 | 0.9835 | 1.3135 |

**Table A.3 Average collection period for each company 5 years**

| YEARS | SIEMENS | DAIMLER | BMW | ADIDAS |
|---|---|---|---|---|
| **2012** | 69.9806 | 85.3691 | 96.7371 | 40.8305 |
| **2013** | 70.4657 | 84.6616 | 101.9005 | 44.9379 |
| **2014** | 72.7108 | 96.7036 | 105.7668 | 48.2015 |
| **2015** | 76.0685 | 92.4313 | 110.0703 | 43.6086 |
| **2016** | 73.6191 | 100.6596 | 115.3740 | 41.0554 |

**Table A.4 Market risk elements in Germany for 5 years**

| YEARS | GDP (%) | INFLATION RATE (%) | UNEMPLOYMENT RATE (%) | INTEREST RATE (%) |
|---|---|---|---|---|
| **2012** | 1.1 | 2.1 | 5.5 | 1 |
| **2013** | -0.4 | 1.6 | 5.4 | 0.75 |
| **2014** | 1.5 | 1.4 | 5.1 | 0.25 |
| **2015** | 1.9 | -0.4 | 4.8 | 0.05 |
| **2016** | 1.3 | 0.5 | 4.4 | 0.05 |

**Table A.5 Index score for each company 5 years**

| YEARS | SIEMENS | DAIMLER | BMW | ADIDAS |
|---|---|---|---|---|
| **2012** | 0.89 | 0.89 | 1 | 1 |
| **2013** | 0.89 | 1 | 1 | 1 |
| **2014** | 1 | 1 | 1 | 1 |
| **2015** | 1 | 1 | 1 | 0.89 |
| **2016** | 1 | 1 | 1 | 1 |

**Table A.6 Beta for 5 years**

| YEARS | SIEMENS | DAIMLER | BMW | ADIDAS |
|---|---|---|---|---|
| **2012** | 1.673735 | 1.565613 | 1.834627 | 0.328352072 |
| **2013** | 1.429683 | 1.255431 | 1.195692 | 0.392151807 |
| **2014** | 1.63863 | 1.228826 | 1.487439 | 0.342360332 |
| **2015** | 1.1063638 | 1.785134 | 2.506165 | 0.3175598 |
| **2016** | 0.861819 | 1.872310 | 2.124187 | 0.53266235 |

## B. SPSS output for Model 1

### Table B.1 Descriptive statistics

| Descriptive Statistics | | | |
|---|---|---|---|
| | Mean | Std. Deviation | N |
| OPR | .1934550000 | .13876143281 | 20 |
| ACR | 1.2325000000 | .19435440498 | 20 |
| ACP | 78.5576250000 | 24.45716547347 | 20 |
| INDXS | .9780000000 | .04514304749 | 20 |

### Table B.2 Pearson correlation table

| Correlations | | | | | |
|---|---|---|---|---|---|
| | | OPR | ACR | ACP | INDXS |
| Pearson Correlation | OPR | 1.000 | .798 | -.897 | -.048 |
| | ACR | .798 | 1.000 | -.889 | -.057 |
| | ACP | -.897 | -.889 | 1.000 | .235 |
| | INDXS | -.048 | -.057 | .235 | 1.000 |
| Sig. (1-tailed) | OPR | . | .000 | .000 | .421 |
| | ACR | .000 | . | .000 | .406 |
| | ACP | .000 | .000 | . | .159 |
| | INDXS | .421 | .406 | .159 | . |
| N | OPR | 20 | 20 | 20 | 20 |
| | ACR | 20 | 20 | 20 | 20 |
| | ACP | 20 | 20 | 20 | 20 |
| | INDXS | 20 | 20 | 20 | 20 |

**Table B.3 Multiple regression coefficient**

| Coefficients[a] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | | Collinearity Statistics | |
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Tolerance | VIF |
| 1 | (Constant) | .206 | .361 | | .572 | .575 | -.558 | .971 | | |
| | ACR | -.100 | .168 | -.141 | -.597 | .559 | -.457 | .256 | .185 | 5.414 |
| | ACP | -.006 | .001 | -1.068 | -4.411 | .000 | -.009 | -.003 | .175 | 5.712 |
| | INDXS | .600 | .341 | .195 | 1.760 | .097 | -.123 | 1.322 | .834 | 1.198 |
| a. Dependent Variable: OPR | | | | | | | | | | |

**Table B.4 Model Summary**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .914[a] | .836 | .805 | .06125147908 | .704 |
| a. Predictors: (Constant), INDXS, ACR, ACP | | | | | |
| b. Dependent Variable: OPR | | | | | |

**Table B.5 ANOVA**

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | .306 | 3 | .102 | 27.171 | .000[b] |
| | Residual | .060 | 16 | .004 | | |
| | Total | .366 | 19 | | | |
| a. Dependent Variable: OPR | | | | | | |
| b. Predictors: (Constant), INDXS, ACR, ACP | | | | | | |

## C. SPSS output for Model 2

### Table C.1 Descriptive statistics

| Descriptive Statistics | | | |
|---|---|---|---|
| | Mean | Std. Deviation | N |
| OPR | .1934550000 | .13876143281 | 20 |
| INFLA | 1.0400000000 | .90982936515 | 20 |
| BETA | 1.2739370581 | .64207268572 | 20 |

### Table C.2 Pearson correlation table

| Correlations | | | | |
|---|---|---|---|---|
| | | OPR | INFLA | BETA |
| Pearson Correlation | OPR | 1.000 | -.003 | -.849 |
| | INFLA | -.003 | 1.000 | -.120 |
| | BETA | -.849 | -.120 | 1.000 |
| Sig. (1-tailed) | OPR | . | .495 | .000 |
| | INFLA | .495 | . | .307 |
| | BETA | .000 | .307 | . |
| N | OPR | 20 | 20 | 20 |
| | INFLA | 20 | 20 | 20 |
| | BETA | 20 | 20 | 20 |

**Table C.3 Multiple regression coefficient**

| Coefficients[a] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Unstandardized Coefficients | | Standardized Coefficients | | | 95.0% Confidence Interval for B | | Collinearity Statistics | |
| Model | | B | Std. Error | Beta | t | Sig. | Lower Bound | Upper Bound | Tolerance | VIF |
| 1 | (Constant) | .447 | .046 | | 9.817 | .000 | .351 | .544 | | |
| | INFLA | -.016 | .019 | -.106 | -.837 | .414 | -.057 | .025 | .986 | 1.015 |
| | BETA | -.186 | .027 | -.861 | -6.800 | .000 | -.244 | -.128 | .986 | 1.015 |
| a. Dependent Variable: OPR | | | | | | | | | | |

**Table C.4 Model Summary**

| Model Summary[b] | | | | | |
|---|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
| 1 | .855[a] | .731 | .700 | .07606230778 | .913 |
| a. Predictors: (Constant), BETA, INFLA | | | | | |
| b. Dependent Variable: OPR | | | | | |

**Table C.5 ANOVA**

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | .267 | 2 | .134 | 23.117 | .000[b] |
| | Residual | .098 | 17 | .006 | | |
| | Total | .366 | 19 | | | |
| a. Dependent Variable: OPR | | | | | | |
| b. Predictors: (Constant), BETA, INFLA | | | | | | |

## D. SPSS output for Model 3

### Table D.1 Descriptive statistics

| Descriptive Statistics | | | |
|---|---|---|---|
| | Mean | Std. Deviation | N |
| OPR | .1934550000 | .13876143281 | 20 |
| ACR | 1.2325000000 | .19435440498 | 20 |
| ACP | 78.5576250000 | 24.45716547347 | 20 |
| INDXS | .9780000000 | .04514304749 | 20 |
| INFLA | 1.0400000000 | .90982936515 | 20 |
| BETA | 1.2739370581 | .64207268572 | 20 |

### Table D.2 Multiple regression coefficient

| Coefficients[a] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Unstandardized Coefficients | | Standardized Coefficients | | | 95.0% Confidence Interval for B | | Collinearity Statistics | |
| Model | | B | Std. Error | Beta | t | Sig. | Lower Bound | Upper Bound | Tolerance | VIF |
| 1 | (Constant) | .382 | .387 | | .987 | .340 | -.447 | 1.211 | | |
| | ACR | -.109 | .170 | -.152 | -.638 | .534 | -.474 | .257 | .183 | 5.478 |
| | ACP | -.005 | .002 | -.866 | -2.888 | .012 | -.009 | -.001 | .116 | 8.655 |
| | INDXS | .422 | .369 | .137 | 1.144 | .272 | -.369 | 1.212 | .723 | 1.383 |
| | INFLA | -.013 | .016 | -.088 | -.837 | .417 | -.048 | .021 | .949 | 1.054 |
| | BETA | -.052 | .047 | -.242 | -1.122 | .281 | -.152 | .048 | .224 | 4.462 |
| a. Dependent Variable: OPR | | | | | | | | | | |

**Table D.3 Pearson correlation table**

| Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | OPR | ACR | ACP | INDXS | INFLA | BETA |
| Pearson Correlation | OPR | 1.000 | .798 | -.897 | -.048 | -.003 | -.849 |
| | ACR | .798 | 1.000 | -.889 | -.057 | .102 | -.811 |
| | ACP | -.897 | -.889 | 1.000 | .235 | -.110 | .858 |
| | INDXS | -.048 | -.057 | .235 | 1.000 | -.175 | .022 |
| | INFLA | -.003 | .102 | -.110 | -.175 | 1.000 | -.120 |
| | BETA | -.849 | -.811 | .858 | .022 | -.120 | 1.000 |
| Sig. (1-tailed) | OPR | . | .000 | .000 | .421 | .495 | .000 |
| | ACR | .000 | . | .000 | .406 | .335 | .000 |
| | ACP | .000 | .000 | . | .159 | .322 | .000 |
| | INDXS | .421 | .406 | .159 | . | .231 | .464 |
| | INFLA | .495 | .335 | .322 | .231 | . | .307 |
| | BETA | .000 | .000 | .000 | .464 | .307 | . |
| N | OPR | 20 | 20 | 20 | 20 | 20 | 20 |
| | ACR | 20 | 20 | 20 | 20 | 20 | 20 |
| | ACP | 20 | 20 | 20 | 20 | 20 | 20 |
| | INDXS | 20 | 20 | 20 | 20 | 20 | 20 |
| | INFLA | 20 | 20 | 20 | 20 | 20 | 20 |
| | BETA | 20 | 20 | 20 | 20 | 20 | 20 |