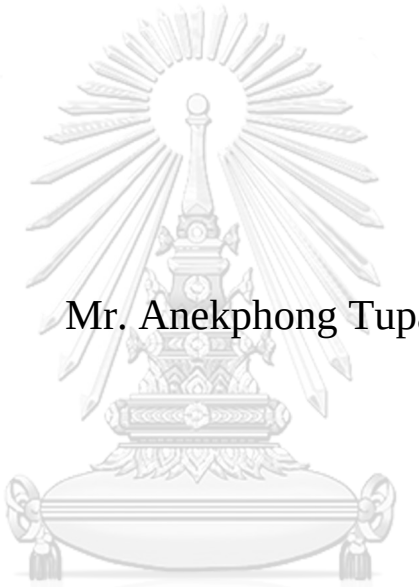
Does the Policy Rate have a significant effect on the NPL level of SMEs during the past 17 years (2002-2019) in Thailand?

Mr. Anekphong Tupan



An Independent Study Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Arts in Business and Managerial Economics
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อัตราดอกเบี้ยนโยบายมีผลอย่างมีนัยสำคัญต่อระดับ NPL ของ SMEs ในช่วง 17 ปีที่ผ่านมา (พ.ศ. 2545-2562) ในประเทศไทยหรือไม่?

นายเอนกพงศ์ ตู๋ปาน

สารนิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
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By	Mr. Anekphong Tupan
Field of Study	Business and Managerial Economics
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Accepted by the FACULTY OF ECONOMICS, Chulalongkorn University in Partial Fulfillment of the Requirement for the Master of Arts

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เอนกพงศ์ ตู่ปาน : อัตราดอกเบี้ยนโยบายมีผลอย่างมีนัยสำคัญต่อระดับ NPL ของ SMEs ในช่วง 17 ปีที่ผ่านมา (พ.ศ. 2545-2562) ในประเทศไทยหรือไม่?. (Does the Policy Rate have a significant effect on the NPL level of SMEs during the past 17 years (2002-2019) in Thailand?) อ.ที่ปรึกษาหลัก : ผศ. ดร.รติดนัย หุ่นสวัสดิ์

ABSTRACT (THAI)

ช่วงหลังวิกฤต “ต้มยำกุ้ง” ธนาคารแห่งประเทศไทยใช้อัตราดอกเบี้ยนโยบายเป็นเครื่องมือทางการเงินเพื่อรักษาระดับการเติบโตของเศรษฐกิจให้มั่นคงโดยการปรับลดปรับเพิ่มหรือรักษาระดับอัตราดอกเบี้ยภายใต้กรอบการกำหนดอัตราเงินเฟ้อที่ยืดหยุ่นเพื่อให้บรรลุอัตราเงินเฟ้อเป้าหมาย การกำหนดอัตราดอกเบี้ยนโยบายมีผลต่อต้นทุนในการดำเนินธุรกิจของ SME ผ่านช่องทางสินเชื่อ ดังนั้นงานวิจัยนี้จึงมีจุดประสงค์เพื่อที่จะศึกษาหาความสัมพันธ์ของการกำหนดอัตราดอกเบี้ยนโยบายว่ามีความสัมพันธ์กับระดับหนี้เสียธุรกิจในระบบการเงินหรือไม่ การวิเคราะห์ผลของงานวิจัยจะใช้ OLS model เพื่อศึกษาสาเหตุและผลกระทบของตัวแปรเศรษฐกิจ ในช่วงปี 2545-2562 การวิจัยเผยให้เห็นว่าการเติบโตทางเศรษฐกิจ อัตราการว่างงาน และดัชนีความเชื่อมั่นภาคธุรกิจมีความสัมพันธ์กับระดับหนี้เสียของธุรกิจในระบบการเงิน อย่างมีนัยสำคัญ อย่างไรก็ตามการกำหนดอัตราดอกเบี้ยนโยบายไม่ได้มีความสำคัญต่อระดับ NPL ของ SMEs ในบริบทประเทศไทยอย่างมีนัยสำคัญ

สาขาวิชา	เศรษฐศาสตร์ธุรกิจและการจัดการ	ลายมือชื่อนิสิต .....
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Anekphong Tupan : Does the Policy Rate have a significant effect on the NPL level of SMEs during the past 17 years (2002-2019) in Thailand?. Advisor: Asst. Prof. RATIDANAI HOONSAWAT, Ph.D

ABSTRACT (ENGLISH)

During the post “Tom Yum Kung Crisis”, the bank of Thailand used monetary policy interest rate as a financial instrument. To keep economic growth and stability by raising, maintaining, or lowering the policy interest rate, under a flexible inflation targeting framework to achieve inflation. The determination of monetary policy interest rate is influencing the cost of SMEs operating through the credit channel. Consequently, the purpose of this research is to explore the relationship between the determination of monetary policy interest rate and Non-performing Loans (NPLs) in the SME sector. The OLS regression is used to analyze the cause and effect of macroeconomic variables during 2002 - 2019. The research reveals the economic growth, unemployment rate, the business confident indicator is a significant factor to describe NPL level in the SME sector. However, the determination of monetary policy interest rate is not found to be significant to the NPL level of SMEs in the Thailand context.

Field of Study:	Business and Managerial Economics	Student's Signature .....
Academic Year:	2020	Advisor's Signature .....

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This independent study (IS) research on the relationship between the monetary policy rate and non-performing loans (NPLs) of small and medium businesses (SMEs). It had been accomplished by the cooperation of various professional people. Let me begin with my advisor, Assistant Professor Ratidanai Hoonsawat, Ph.D., the researcher has to say special thanks to the advisor for critical advice that is useful for research improvement, and sincere gratitude for the patience of the advisor to follow up the IS research progress.

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The researcher hopes this dissertation paper can contribute usefulness of knowledge to academic fields and those who are interested in this dissertation paper and hopeful to generate new knowledge for society.

Anekphong Tupan

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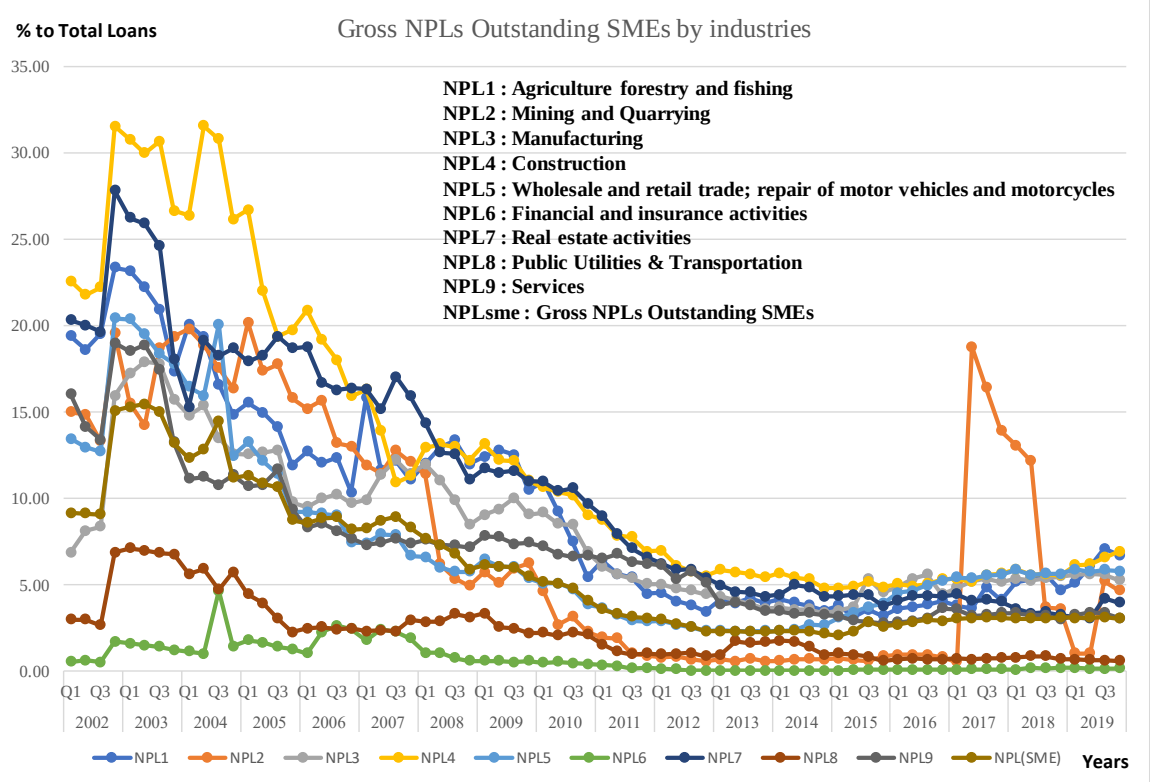
Chapter 1: Introduction

Since the Asian financial crisis in July 1997, known as Tom Yum Kung Crisis, many countries in the Southeast Asian had financial crises since the Thai government announced to change the exchange rate system due to the lack of foreign currency by allowing the exchange rate to float rate in July 1997, which Thai currency was pegged to the U.S. dollar before. Soon after the Thai government was announcing the exchange rate system to float the Thai currency. The Thai currency exchange rate continues to be weak by comparison to foreign currency. From an economic boom at a high growth rate, then the Thai economic breakdown, the financial system collapsed immediately, unemployment rose to high levels due to small and medium-sized enterprises (SMEs) or even the big manufacturing sector was closed. The impact of the severe Thai economy break down was led to increasing in non-performing loans (NPLs) ratios in Thai commercial banks. Especially in business loans that continued to rise enormously during 1997 – 1998 in every sector and continuously. At the end of 2002, NPLs ratios in the business sector started to decline every year. All the industries have almost the same trend line, except mining and quarrying, has a higher default rate than other industries due to the enactment of minerals act B.E. 2560 (2017), business operating in gold and silver have stopped. The details are shown in the graph below.



Source: Researcher's own creation using data from Bank of Thailand

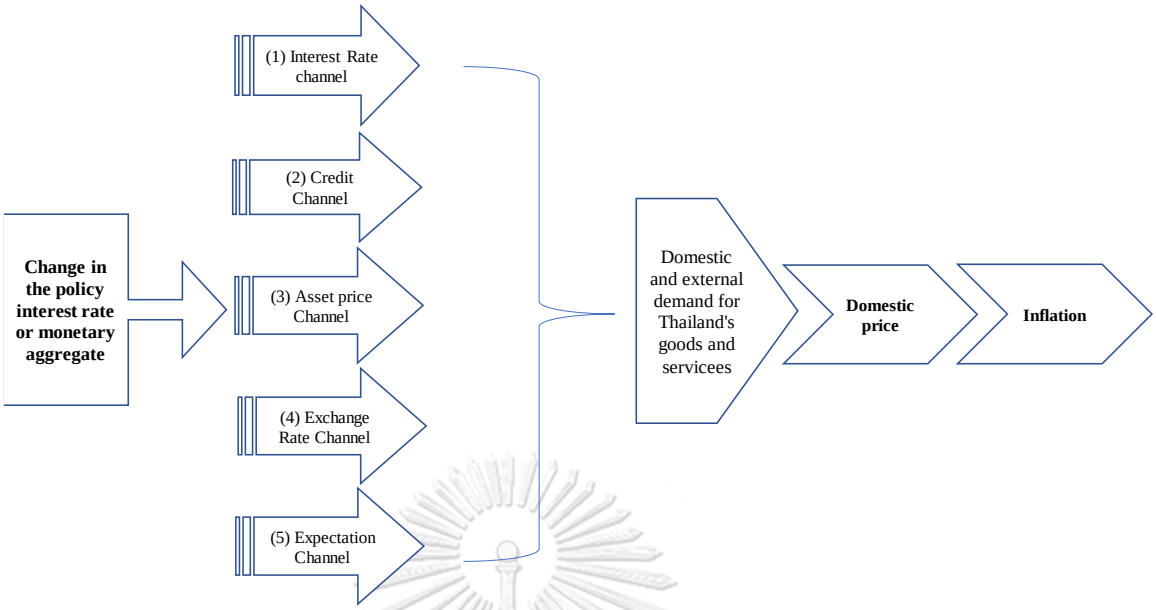
Figure 1: *Gross NPLs of business loan.*

The previous events, before the financial crisis started in 1997, were the main cause of “Tom Yum Kung Crisis” is considered that a bubble burst in the financial system and the collapse of property industries after Thailand has long time increase in private debt and more subprime customers in personal consumptions debt without control from government and wrong monetary policy. At that time, The Bank of Thailand (BOT) was an open market for the capital mobility alongside with the pegged exchange rate to the foreign currency. Intended for encouraging outside borrowing to invest in the domestic that eventually led to overwhelming foreign debt and devaluation of Thai baht, but Bank of Thailand had to maintain Thai exchange rate by using the foreign currency reserves to protect the value of Thai exchange rate. Until the time of the foreign currency reserves held by the Bank of Thailand was run out of reserves to protect Thai currency. Suddenly, the Thai government had to float the Thai baht exchange rate owing to the lack of foreign currency reserves. The exchange rate was going to continuously devaluate the Thai currency. Thailand had lost the ability to repay foreign debt as a reason for devaluation in the Thai exchange rate. During that time, numerous Thai investors went to the insolvency, some of the financial institutions went to bankruptcy and closed. Due to operating with enormous foreign capital to loan out and invest but unable to get repayment back from their customers, in combination with devaluation of the exchange rate, increased a foreign debt burden to repayment. Then local finance companies had to close, and in the end, the Thai economy had escalated into a big financial crisis situation called “Tom Yum Kung Crisis” (Wikipedia, 2020). After the financial crisis in 1997, Thai government entities and Bank of Thailand realized about the problems and were concerned about reviving the financial system to face economic downturn. For readiness and protection, government entities and Bank of Thailand established many new institutions as instrumental to quickly stabilize the financial system and release severe economic contraction, and that is also the foundation for the sustainability in the Thai financial system and to ameliorate the Thai financial system during economic downturn. For example, Thai government was setting up of Asset Management Company (AMC) aims to purchase Non-Performing Loans (NPLs) from closed financial institutions for restructuring to become Performing Loans and absorb Non-Performing Assets (NPAs) in real estate market. The National Credit Bureau (NCB) aims to collect credit information as a center for financial institutions and financial customers. Thai Institute of Director (IOD) aims to promote Good Corporate Governance (CG) to generate intrinsic company value for sustainable growth. The Real Estate Information Center (REIC) aims to gather and develop real estate information to provide real estate outlook for customers, investors, and business. The Deposit Protection Agency (DPA) aims to protect money that is deposited in a commercial bank registered in Thailand during the financial system is unstable and sustain depositors’ sentiment in the financial system.

Especially, the Bank of Thailand (BOT) is the main institution to conduct and watch out for the economic situation all the time. For the sake of real economic stability, the Monetary Policy Committee (MPC) working under the Bank of Thailand’s supervision, to formulate monetary policy as under flexible inflation targeting framework to achieve an inflation target by raising, maintaining, or lowering the policy interest rate, which the central bank’s monetary policy committee is comprised of 3 internal BOT members, 4 external BOT members and BOT Governor will be act as Chairman that aim to

provide a balance of opinions before determine policy decisions. In general, Monetary Policy Committee (MPC) will determine the policy interest rate to achieve inflation targeting is between 1.00 percent and 4.00 percent per year. In addition, the monetary policy committee will be considering more the circumstances of real economic expansion (Chantapong & Phongpiyaphaiboon, 2017).

According to Bank of Thailand (2020), the increasing, decreasing or even maintaining policy interest rate of MPC will be affecting the economic activities through five main transmission mechanism channels. Firstly, Interest Rate channel, when the central bank's MPC announce to cut the monetary policy interest rate, money market and commercial bank interest rates will be responding to drop both on the borrowing and lending sides, encourage households' sector to spend or invest more in other type of investment instead of deposit money in account, and encourage businesses sector to invest more due to capital is inexpensive that stimulate economic activities and inflation rate. On the other hand, increasing the monetary policy interest rate would cause a decline in activity in the economy and leading to a decline in the inflation rate. Secondly, Credit Channel, when the central bank's MPC cut the monetary policy interest rate, money market and commercial bank interest rates will be performing to drop both on the borrowing and lending sides, which reduces interest burden for businesses and lowering interest rate burden would help to lower default risk of repayment. In addition, businesses will be expanding their investment for the reason that the capital fund cost is inexpensive, which stimulates economic activities and inflation rate. If the central bank's MPC raises the policy interest rate, it would lead to an increase in the supply of loanable fund and allows financial institutions to extend more loans to the economic activities, but the central bank's MPC raising the policy interest rate would raise the interest burden for businesses sector that affects to high default risk of loan repayment for businesses. Thirdly, Asset price Channel, during the central bank's MPC announces to cut the policy interest rate, the interest rate of a commercial bank decreases to low, saving in a bank account would be less attractive in comparison with other investments. Consequently, the central bank's MPC cut the policy interest rate would encourage demand and price for the other type of investment such as stocks, bonds, and property. Therefore, the value of stock, bond, property, and wealth of businesses increase during announcing low policy interest rate. An increase in wealth could lead to higher consumption, which eventually stimulates economic activities and increases the inflation rate. Fourthly, Exchange Rate Channel, the duration of the central bank's MPC announces to cut the policy interest rate, the interest rate in the money market and commercial bank is low, low return, investing in Thailand looks less attractive in comparison with foreign assets. A low return leads to capital outflow to invest in the other part of the world. More capital outflow leads to Thai Baht depreciation, foreign goods and services are expensive, Thai goods and services are inexpensive for foreign countries. Finally, Expectation Channel, the public expectations on the future economic situation. For instance, when the central bank's MPC announces to cut the policy interest rate, businesses and households foresee an improvement in economic situations going forward, they will be more confident to consume and invest, the expected inflation rate could rise. However, if the businesses and households' sector do not believe that the central bank's MPC can raise the inflation rate, the inflation rate still may decline until public confidence is recovered.



Source: Researcher's own creation using data from Bank of Thailand

Figure 2: *The 5 main channels of monetary policy rate.*

All the above five main transmission mechanism channels of monetary policy interest rate, the transmission would need a period of time, the time period can vary depending on economic circumstance and financial situations. In the past, previous research has shown that a complete transmission usually takes around 6-8 weeks (Monetary Policy, 2020). The policy interest rate of Monetary Policy Committee (MPC) affects the businesses and households by five main transmission mechanism channels. In this study, trying to analyze the effect of policy interest rate on businesses by focusing on policy interest rate affects to Non-Performing Loans (NPLs) of Small and Medium-sized Enterprises (SMEs). The researcher questions whether the determination of policy interest rate through credit channel has a significant effect on the NPL level of SMEs in the financial context of Thailand or not. By using the secondary data during 2002 - 2019 collected by the Bank of Thailand with the regression analysis. Besides that, this study aims to understand more about Non-Performing Loans (NPLs) and how the policy interest rate works. To realize how a fact small and medium-sized enterprises situation in the context of Thailand. From the research question, the study research can be hypothesized as the Thai monetary policy interest rate has a negative effect on non-performing loans (NPLs) level of Small and Medium-sized Enterprises (SMEs).

The various beneficiaries of this research will contribute new knowledge to the scholars who are interested in knowledge of NPL in a sector of SMEs and policy interest rate in the Thailand context. Banker, management of financial institutions use cause and effect of the empirical data in this research to predict the trend of NPL and include the research data as a factor for loan approval in the SMEs sector. In the government sector or Bank of Thailand, the policy makers use the empirical research to decide appropriate monetary policy in the decision-making process. For Asset

Management Company (AMC), uses the empirical data from this research to determine the qualified NPL of SMEs before acquiring debtor to manage or debt restructuring process. Finally, the researcher of this paper will gain knowledge to a better understanding of the NPL in SMEs sector in more details and understand the policy interest rate, transmission mechanism of policy interest rate, knowledge in monetary policy in Thailand context.

This IS research paper organizes the structure as follows: the first chapter, introduction, will introduce an overview about NPL of SMEs in the Thai context after the big financial crisis in Asian during 1997-1998, transmission of monetary policy interest rate, as well as research question and contribution. The second chapter, literature review, includes various of the previous studies that related to the default of debt repayment. Third chapter, theoretical framework part, this part includes profit maximization theory to describe the default of debt repayment. Fourth chapter, empirical framework, this chapter shows conceptual framework and a model to use in this paper. Fifth chapter, data collection and analysis, this part includes the source of data to use in this paper. Sixth chapter, estimation result, part to show the result of the regression model. The conclusions and recommendations will be in the seventh chapter. The references and others will be in the final part of this paper.

Chapter 2: Literature Review

A Non-Performing Loan (NPL) is known as a loan in which the borrower is defaulting in debt repayment over more than 90 days and if the default in debt repayment is not over 90 days but at least 30 days past due. It is namely the special mentioned loans (SM). Generally, NPLs level will show in a percentage form, the percentage of NPLs is calculated by sum up debt default volume that lasts longer than 90 days and divided by total outstanding loans in the financial system (Nualsri et al., 2014). Debt default volume is big concern in every country, according to Narigis (2019) has said in her research: Link between non-performing loans (NPL) and economic growth--evidence from an emerging economy, various the previous studies about a non-performing loans (NPLs) level have found that NPLs is barrier for the economic growth and a significantly increase in NPLs level will declining debt quality in the financial institution and then leading to financial crisis.

According to Dao and Phan (2020), they found that until now there is no theory which perfectly describes the Non-Performing Loans (NPLs) level directly. This part of the literature review will only review theory that is the most properly related to the research question and able to describe the elements that have an effect of NPLs level in

the SMEs sector, and there are four properly theory that are most related to NPLs, such as, Stakeholder theory, Risk management theory, Adverse Selection theory, Moral Hazard theory.

A Stakeholder theory, this approach is knowledge about organizational management concepts and business ethics concepts with focus on morality and core value of the company. The original concept is presented in 1984 by R. Edward Freeman in the book by Strategic Management: A Stakeholder Approach. In the book, it has been discussed about costs and benefits of related parties as stakeholders. Focusing on stakeholders will benefit both business and other related parties (Freeman, 2004). According to Nguyen et al. (2018), conclude the relationship between stakeholder approach and default risk in his research: Stakeholder Governance Orientation and Bank Default Risk during the Credit Crisis, they found empirical evidence from sample data in U.S. bank available during 2006-2008, that stakeholder governance benefits to firms, by lower leverage and lower asset volatility that mitigating risk in operational part and financial part.

A Risk Management theory**:** According to ISO 31000[1] (2018), risk management is the identification, evaluation, and prioritization of something bad that will be happening, followed by an applied and economical approach to monitor, minimize, and control the probability of risk to maximize the opportunities. According to Meyer (2000), describe risk management is part of banking business, the survivors are those who realize risk management and respond to the issue quickly, and the others who ignore risk management, grow loans more than the ability of the debtor to payback, can lead to vulnerable financial institutions; for instance, Tom Yam Kung Crisis in 1997. In 2018, Lundqvist and Vilhelmsson did research to find the relationship between the enterprise risk management and default risk in topic of Enterprise Risk Management and default Risk: Evidence from the baking industry, by using panel data from 78 banks sample around the world to run OLS regression, discovered that the degree of risk management is significance to default risk in a negative way – Lower the degree of risk management implementation leading to increase in default risk, the awareness of risk

[1] ISO 31000 is a group of standards relating to risk management codified by the International Organization for Standardization. ISO 31000 provides principles and generic guidelines on managing risks faced by organizations.

management can defined by default risk (Lundqvist & Vilhelmsson, 2018). Dao and Phan also find the empirical result by using pooled regression model to analysis data in Vietnam since 2009 to 2018 in their research: Empirical analysis of Non-performing Loans of Listed Banks in Vietnam, risk management is a significant point to consider for debt management, which means the organization with the inefficient risk management causes the debt default in a positive way (Dao & Phan, 2020).

Adverse selection theory: According to The Economics of Money, Banking, and Financial Markets was written by Mishkin (2016), describe the adverse selection theory as how it is a difficult situation to separate between a good borrower and a bad borrower. The incompletion of borrower's information "asymmetric information" before lending the loan out. Because incomplete information will lead to the wrong decision to lend out the loan, which is to increase debt default. Borrowers who take a loan out as a regular transaction, are most likely to be the potential borrower to pay back the loan (Mishkin, 2016). In addition to the papers that Batabyal and Beladi (2010) have also researched "adverse selection" on the topic of "A model of microfinance with adverse selection, loan default, and self-financing" by using a game theoretic model to analyze it. They found "adverse selection" that leading to default risk can be mitigated by self-financing or collateral requirement. According to Berger et al. (2010), they also researched "adverse selection", on the topic of "Why do borrowers pledge collateral? New empirical evidence on the role of asymmetric information" by using econometric methodology to analyze the sample contains observations of U.S. large banks data during 1993: Q1-1997: Q4 collected by small business credit scoring (SBCS). They found that the attenuation of adverse selection problem by the adoption of small business credit scoring (SBCS) innovation or the center combines data on the owner credit history of small business with firm financial data to generate a ''score" which reflects the chance of default risk probabilities provides for the banks. The decrease of the information gap between borrowers and lenders of SBCS innovation improves the efficiency of the lending market, reduces lender cost, reduces borrower cost and reduces the incidence of collateral (Berger, Espinosa-Vega, Frame, & Miller, 2010).

Moral Hazard theory: According to The Economics of Money, Banking, and Financial Markets was written by Mishkin (2016), Mishkin describes the moral hazard theory as "asymmetric information" situation after taking on a loan transaction. The

chance of borrowers to use debt in the wrong object and relative to engage in activities that are undesirable (immorality) and have more chance of borrower to default risk probability. With high moral hazard of borrowers, it causes higher debt default and increases the chance of high NPLs in the financial system.

In general, Adverse selection theory and Moral Hazard theory, both theories are based on the "asymmetric information", but moral hazard theory is generally more about morality and immorality of borrowers. Within the banking literature, according to Cincinelli and Piatti (2017), have research moral hazard effect to NPLs, in topic of Non-Performing Loans, Moral Hazard Supervisory Authority: The Italian Banking System, by using 2,682 observations in 298 banks within Italian banking during 2006 to 2014. They found that moral hazard in the banking industry affects higher growth rate in NPLs compared to loan outstanding. For instance, the US sub-prime crisis in 2008, financial institutions of the US loan money out for the subprime customer without considering the loan object, which led to default risk in US financial institutions and ended up with the global financial crisis (Cincinelli & Piatti, 2017).

All the previous paragraphs are theories to describe the default risk, and every theory is related to bank-specific factors or loan-specific factors. After reviewing them, the researcher is more understood about specific factors that cause high default risk, and the research paper has more aspects in factors that cause debt to default besides macroeconomic factors that cause debt to default.

All the four theory descriptions above: stakeholder theory, risk management theory, adverse selection theory and moral hazard theory are the approach to describe the debt default. This approach is most related to describing the NPLs level. According to Chantapong and Phongpiyaphaiboon (2017), they write the article about "20 years of Asian financial crisis in 1997: lesson for Economic growth and Sustainable" to describe financial crisis in Thailand called "Tom Yum Kung Crisis", Tom Yum Kung crisis is the best instance for four theories above and among the four theory above (Stakeholder theory, Risk management theory, Adverse Selection theory and Moral Hazard theory) can be explained by the cause of Tom Yum Kung crisis. For instance, the management in an organization without Corporate Governance (CG) and no responsibility to related parties, over-leverage on the ground that vulnerable risk management in household, private and public sector, and incomplete information of

ability debt repayment between the financial institution (Chantapong & Phongpiyaphaiboon, 2017).

The four theory descriptions above are factors to describe the cause of default risk factors that relative to Non-Performing Loans (NPLs) level. In general, there are many factors that cause and effect the NPLs level. According to Badar and Javid (2013), Messai (2013), Nargis (2019), and Dao and Phan (2020), have divide the group of variables that affect NPLs into two factors, which are macroeconomic factor and microeconomic factor (Bank-specific factors, internal manageability). However, in this study paper will be focusing on macroeconomic factors that cause NPLs level for the sake of limitation of bank-specific factors data. The researcher will only focus on macroeconomic factors, those that are more relative to the research question in this independent study (IS) paper. There are various variables of macroeconomic factors that cause NPL level, but from various empirical previous research that the researcher has reviewed, macroeconomic factors that affect the Non-Performing Loans (NPLs) level are listed and described as follows.

Kalirai and Scheicher (2002) researched under the topic of Macroeconomic Stress Testing: Preliminary Evidence for Austria. To investigate the influence of macroeconomic variables to the loan loss provisions (LLP) of the loan portfolio in the banking system of Austrian during 1990 to 2001. By using the ordinary least squares regressions (OLS) model to analysis. They found that a fall in the business confidence index. The decrease in industrial production has an inversely effect on the Loan loss provisions (LLP). On the other hand, the higher business confidence index will force default risk to go down. Similarly, Golitsis, Fassas, and Lyutakova (2019) also researched the topic of Credit Risk Determinants: Evidence from the Bulgarian Banking System. To find the influence of macroeconomic variables on the banks' credit risk of the loan portfolio of the Bulgarian banking system from January 2001 to December 2015. By using Ordinary Least Squares regressions (OLS) model, Vector Autoregressive (VAR) model, and Autoregressive-Distributed Lag (ARDL) model. They found that the business confidence index is significantly affected in determining the credit risk of banks in the emerging market. From the empirical research, the researcher should include the business confidence index as an independent variable in the research model.

In Thailand's context, the Bank of Thailand is namely the "business confidence index" as Business Sentiment Index (BSI). This index shows the business confidence during each period. The index is below 50 means the business confidence is lower than before, but the index is more than 50 means the business confidence is higher than before or the business situation expands. In the case of the index, which is equal to 50, it means business confidence does not change, the business situation is stable (Bovornsantisuth, 2015).

According to Omoruyi (2014) researched under the topic of "Determinants of non-performing loans in the Nigerian banking sector: Evidence from macroeconomic factors". To explore the influence of macroeconomic determinants of NPLs in Nigeria (time-series data from 1980 to 2012 was obtained by the Central Bank of Nigeria). By using the ordinary least squares regressions (OLS) model. Omoruyi found that Non-performing loans (NPLs) is inversely affected by the real GDP growth rate. The GDP coefficient is -3,474.322. If real GDP increases by one unit, the non-performing loan will be declined by -3,474.322. Similarly, Mohaddes et al (2017) also researched under the topic of "Can Italy grow out of its NPL overhang? A panel threshold analysis". To find a tipping point appears for real GDP growth in Italy in which Non-Performing Loans (NPLs) fall significantly during the period 1997–2014 by using a heterogeneous dynamic panel–threshold model. Mohaddes and team found GDP growth rate and changes in NPL level have an inverse relationship. By statistical analysis of growth threshold effects on NPL level, shows the significant result that if GDP growth rate is above 1.2 percent, it will lead to a decline in the NPL level. However, there is still contrary research, according to Nargis (2019), research under the topic of "Link between non-performing loans (NPLs) and economic growth -- evidence from an emerging economy", to explore the linkage between GDP growth rate and non-performing loans (NPLs). Nargis used the sample data during the period 1990-2018 collected by Bangladesh Bank and World Bank. Analyze with the ordinary least squares regressions (OLS) model. Nargis found that non-performing loans (NPLs) can be significantly influenced by the inflation rate, unemployment rate, real interest rate, and NPLs with one period lag, but non-performing loans (NPLs) have a positive relationship with GDP growth rate but not significantly influenced. After reviewing the correlation between non-performing loans (NPLs) level and GDP growth rate, the result

can be both negative and positive correlation. Then the researcher will use GDP growth rate as a predictor variable in the model and conclude the correlation between GDP and NPL of SMEs in the Thailand context.

In regards to the relationship between the inflation rate and non-performing loans (NPLs). Khan et al. (2018) researched under the topic of "The Impact of GDP, Inflation, Exchange Rate, Unemployment and Tax Rate on the Non-Performing Loans of Banks: Evidence from Pakistani Commercial Banks". To study macroeconomic determinants of NPLs in Commercial Banks of Pakistani. By using 20 sample banks during 2006 to 2016 and analysis with ordinary least squares regression (OLS) model. They found that between non-performing loans (NPLs) and the inflation rate has a positive relationship. If Pakistan's government wants to keep low in NPLs, they must control the inflation rate to stabilize the ability to repay the debt of borrowers. Khan also found GDP growth rate has inversely affected the NPLs rate and tax rate, unemployment rate. The exchange rate has positively affected the NPLs rate. However, there are a contradictory research, Mazreku et al. (2018) studied macroeconomic determinants of NPLs level in Albania, Armenia, Bosnia, Herzegovina, Bulgaria, Croatia, Hungary, Kosova, Macedonia, and Romania during 2006 to 2016. Under the research topic of "Determinants of the Level of Non-Performing Loans in Commercial Banks of Transition Countries". By using Pooled OLS, Fixed Effects, Random Effects and Arellano Bond to analyze the result. In the research, they found the inflation rate has inversely affected the NPLs level significantly. They describe the result as an increase in the general price, it reduces the real burden of repayments. Mazreku et al. (2018) also found GDP growth rate has an inverse relationship with NPLs level and found that unemployment has a significant positive relationship with NPLs level. Both research papers have different empirical results in the relationship of NPL level and inflation rate, but the reason behind those research. It can be used as a description in this research paper. The researcher will also use an inflation variable in the model to correlation in the Thailand context.

About the relationship between the interest rate and non-performing loans (NPLs). The study conducted by Siddiqui (2012) focused on interest rate volatility influencing non-performing loans in Pakistan. Under the research topic of "Impact of Interest Rate Volatility on Non-Performing Loans in Pakistan", using quarterly data

during 1996 – 2011 collected by the State Bank of Pakistan. Siddiqui found that a one-unit increase in weighted average interest rate could significantly lead to an increase in non-performing loans level by 42.24 percent, but the increasing non-performing loans level in Pakistan not solely impacted by the interest rate, the interest rate play a little role to describe non-performing loans level in Pakistan because the regression model only just shows an r-squared value equal 13.24 percent, that means the non-performing loans levels level in Pakistan can be influenced by interest rate only 13.24 percent. (Siddiqui, 2012). Recently, the research conducted by Ogundipe el al. (2020) under the research topic namely: "Interest Rates and Loan Performance of deposit money banks in Nigeria". To find the relationship between interest rates and Non-performing Loans (NPLs). The relationship between a bank's non-interest income (NIN) and loan loss provision (LLP). The relationship between the monetary policy rate (MPR) and capital adequacy. The relationship between bank liquidity (LR) and non-performing loans in Nigeria. By using the secondary data from the selected Bank of Nigeria which was collected from 2010 to 2015. Analyzed by using the multiple regression model in estimating the relationship. Ogundipe el al found only the significant result that interest rate has a negative influence on loan repayment due to the inability to loan repayment with a higher cost of the loan. If the interest rate increase by 1 percent could increase the chance of the default in loan repayment by 1.56 percent. Following the empirical evidence, Ogundipe and team research have recommended that Banks should keep stay lower interest rates to release default risk pressure and to prevent high level in non-performing loans (NPLs). Both research papers have empirical results to describe the correlation between non-performing loans level and interest rates. The researcher can use the empirical result to describe that the interest rate affects non-performing loans (NPLs) level in a positive way. The interest rate variable will be used in the regression model in this paper to analyze the relationship to NPL in the Thailand context.

Regarding the correlation between unemployment rate and non-performing loans (NPLs), the research conducted by Sandica and Dudian (2017) emphasized on that the macroeconomic determinants affect to the non-performing loans (NPLs) level in Romanian banking sector during the period 2003-2015 by using the vector autoregressive (VAR) model to estimate the empirical results. Under the research topic namely Key Determinants of Non-Performing Loans in Romanian Banking Sector,

Sandica and Dudian found that unemployment and credit cycle have a positively correlated with non-performing loans (NPLs) level in Romanian banking sector, or we can say that during the unemployment rate is lower, the non-performing loans (NPLs) level will stable or lower than during high unemployment. Another conclusion in their paper is that the GDP growth rate is negatively related to the non-performing loans (NPLs) level in the Romanian banking sector. In the same year, the research conducted by Kupčinskas and Paškevičius (2017), under the research topic namely "Key Factors of Non-Performing Loans in Baltic And Scandinavian Countries: Lessons Learned in The Last Decade", they also studied key factors that affect the non-performing loans (NPLs) level in Denmark, Estonia, Finland, Latvia, Lithuania and Sweden during years 1998-2014, by dividing two groups of the countries into the Nordic and the Baltic region with using the multiple linear regression model to estimate the results. They found that the unemployment rate and non-performing loans (NPLs) level in both the Nordic and the Baltic region's group are positive correlation, significance level at 1 percent. If the job losses in both the Nordic and Baltic regions group are increase by 1.00 percent, it reduces the abilities to repay debt or non-performing loans (NPLs) level is increase by 0.60 percent. Especially, in the Baltic country, if the unemployment increases by 1.00 percent, leading to reducing the ability to repay debt or non-performing loans (NPLs) level is increased by 1.40 percent. In this research, they also found that the real GDP growth rate is a significant factor that has a negative correlation with non-performing loans (NPLs) level in both the Nordic and Baltic regions. Kalluci (2018) investigated macroeconomic factors that influence non-performing loans (NPLs) level in Albania during 2005: Q4 - 2017: Q4 collected by Bank of Albania and INSTAT websites and using the Ordinary Least Squares method to estimate the results. Under the research topic namely "The Explanatory Variables of Non-Performing Loans in Albania, During and After the Financial Crisis", Kalluci found that the unemployment is the most significant macroeconomic determinant that positively affect to the non-performing loans (NPLs) level. an increase in unemployment rate could affect to higher non-performing loans (NPLs) level after two quarters or we can conclude that the unemployment rate is increased by 1.00 percent in two quarter later, the non-performing loans (NPLs) could increase level around 0.20 percent. In the research paper also describe an increase in unemployment, which would influence the

ability to repay debt of borrowers. That is why higher non-performing loans (NPLs) level is a positive correlation with unemployment rate. In the same paper, Kalluci also found GDP growth rate is positive relationship with non-performing loans (NPLs) level that contrary to general research's result. Kalluci describes the ambiguous result as a booming in GDP growth rate during the period under analysis, not enough to affect the NPL decrease. The researcher can use the empirical result to analyze the relationship in the Thailand context and put the unemployment rate in the model of this research paper as an independent variable to describe Thai non-performing loans (NPLs) level.

Last but not least, regarding the correlation between the policy rate and non-performing loans (NPLs). The research topic is namely "Dynamic Relationships between Macroeconomic Indicators and Non-Performing Loans in the Turkish Financial Industry" conducted by Eren and Dube (2012). Eren and Dube focused on the influence of macroeconomic factors on the non-performing loans (NPLs) level in Turkish. By using the data during the period of 2004: Q1 - 2010: Q4. Analyzed with the vector autoregressive (VAR) approach and cointegration analysis to estimate the results. Eren and Dube found that an increase in the policy interest rate has decreased the non-performing loans (NPLs) level in the first five quarters (negative relationship), after which the relationship between the policy interest rate and non-performing loans (NPLs) level become a positive relationship. The empirical result in Turkish is still ambiguous. Eren & Dube only concluded that the strongest predictor to forecast non-performing loans (NPLs) level is the previous values of the non-performing loans (NPLs) level (Eren & Dube, 2012). Asaiama and Amoah (2019) also research the effect of monetary policy on the non-performing loans (NPLs) level. Under the topic research is namely "Non-performing loans and monetary policy dynamics in Ghana". Use data collection during 2000: Q1 and 2016: Q4 to analyzing with autoregressive distributed lag (ARDL) econometric model to estimate the monetary policy rate effect on non-performing loans (NPLs) level. Asaiama and Amoah found that in short run the monetary policy rate effect on non-performing loans (NPLs) level not clearly the effect but in the long run the monetary policy rate is found to be 5 percent significant in explaining non-performing loans (NPLs) level if the monetary policy rate increased by 1 percent will increase on non-performing loans (NPLs) level by 0.62 percent. Asaiama and Amoah explained the cause and effect as a change in monetary policy rate

influences non-performing loans (NPLs) level through interest rate and inflationary pressures, and monetary policy rate plays a major role in non-performing loan growth rate in Ghana's economy. The researcher can use previous studies as an instance to analyze the effect of monetary policy on non-performing loan level in the Thailand context and include empirical evidence from the Ghana economy to answer the topic question in the study research. The researcher also uses empirical evidence from Ghana's economy to hypothesize the result of the monetary policy rate effect on non-performing loans (NPLs) level.

Those macro-variables in the literature review are important factors and influencing factors to describe the NPL level. Hence, including influencing variables that relate to the questioning topic in the analysis process will lead to the right answer. Furthermore, the various literature reviews are the best way to reduce bias to do research.

Chapter 3: Theoretical Framework

In this section, the chance of debt default and bring about to NPL level of firms will be described through the theory of profit maximization. By the economic concept, profit maximization is the theory of firms in a decision to set the price level, the input level of raw material, and the output level of goods that bring firms to get the most out of profit. In general, the behavior of firms based on profit maximization, firms will find the biggest gap between total revenues and total costs, but if there is no room for profit revenue, firms will stop running a business. The firm's profit can be shown in a profit function as the following equation:

$$\text{Profit } (\pi) = \text{Total Revenue (TR)} - \text{Total Cost (TC)}$$

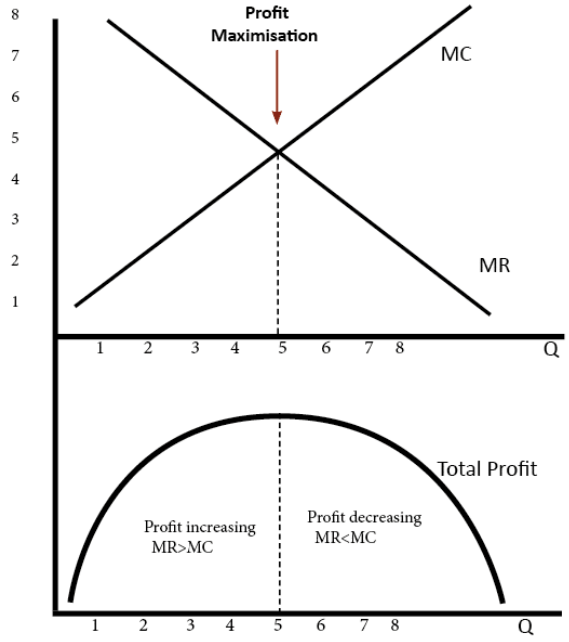
Based on profit function, we can take differential on function of profit (π = TR – TC) to get maximize profit function as follow:

$$\frac{d\pi}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ}$$

$$M\pi = MR - MC = 0$$

$$\textit{Profit maximization} = \textit{Marginal Revenue} - \textit{Marginal Cost} = 0$$

If firm produces goods and services at the condition's level which marginal revenue (MR) equal marginal cost (MC), firm will operating business with maximize profit. The maximize profit function can be simplified by diagram to be easily understand the concept as below:



Source: https://www.economicshelp.org/blog/3201/economics/profit-maximisation/

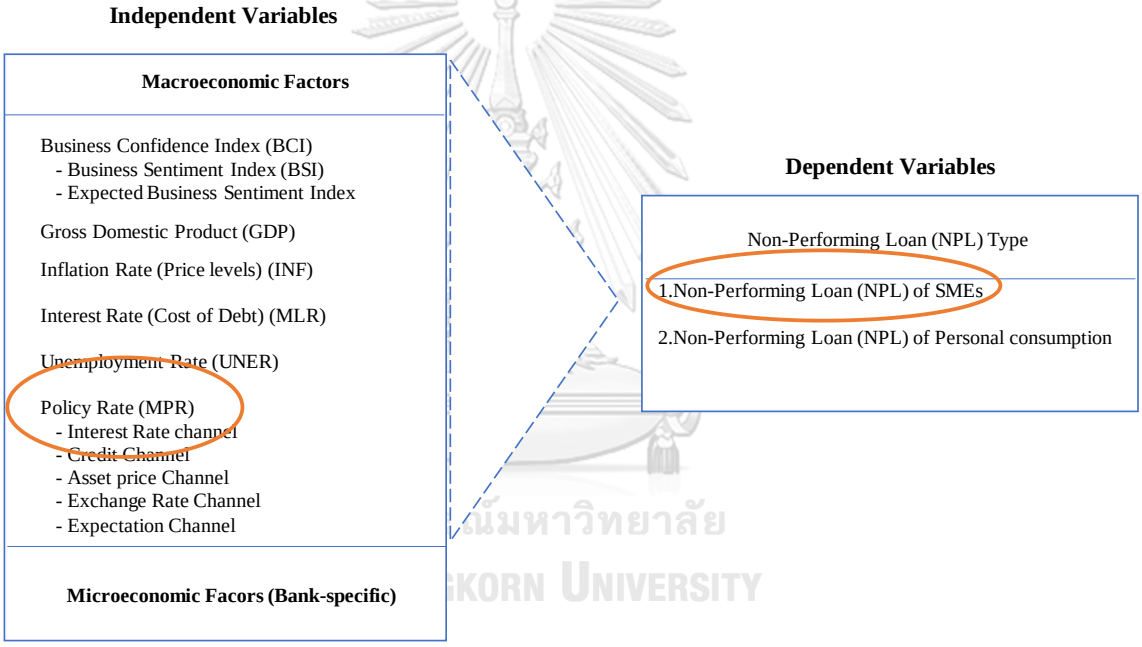
Figure 3: *Diagram of Profit Maximization.*

From the above diagram can be simplified in concept as follow. Firstly, if the firms produce goods and service less than 5 units, marginal revenue is greater than marginal cost. Therefore, firms producing more quantities of output will raise the total profit to firm. Second, if the firms produce goods and service at unit of 5, marginal revenue is equal marginal cost. Consequently, if firms still produce goods and service at this level, firms will always experience with highest total profit. Thirdly, whenever, if firms produce more than 5 units, the marginal cost of the output is greater than the marginal revenue. Therefore, increasing in production will decrease total profit because the cost of output is greater than profit. Firm should stop producing at those level of output greater than 5 units. At the point where marginal revenue is less than marginal cost, businesses have a chance to default in debt repayment, and if debt default is longer than 90 days, debt default will become non-performing loans (NPLs). In the case of the central bank's monetary policy committee has set policy rate, marginal revenue and marginal cost have influenced by the policy interest rate of the Bank of Thailand through five main transmission mechanism channels.

Chapter 4: Empirical Framework

4.1 Conceptual framework

Due to part of the literature reviews, the researcher determines the non-performing loan (NPL) of SMEs as the dependent variable. Business sentiment index (BSI), Expected Business Sentiment Index, Gross domestic product (GDP), Inflation rate (INF), Unemployment rate (UNER), Monetary policy rate (MPR), Minimum lending rate (MLR) are determined as independent variables. The relationship between the dependent variable and those independent variables are shown in the form of a diagram as follows**.**



Source: Researcher's own creation

Figure 4: *Conceptual framework diagram.*

According to the research topic question, the analysis of a cause and effect between the monetary policy rate and non-performing loan (NPL) of SMEs in the section of a conceptual framework. The framework is developed based on profit maximization assumption. Under the profit maximization assumption, the firm maximizes profit by producing goods and services where marginal revenue equals marginal cost. Then the decision to run a business or stop operating is determined by profit maximization. The framework investigates the rising or low in both revenue and

cost of SMEs. From the literature review, the researcher found various factors that cause marginal revenue and marginal cost and those leading to becoming NPL of SMEs (Y), such as gross domestic product (x_1), interest rate (x_2), and inflation (x_3). It can be written in the function as follow.

$$Y = f(X_1, X_2, X_3)$$

For instance, during a high GDP growth rate, firms can provide more goods and service and increase marginal revenue, more gap between total revenues and total costs, in the opposite, during negative growth, firms will be stuck with shrinking in provide goods and service, if there is no more gap between total revenues and total costs, can lead to default risk and NPL in the business sector become high level. One more instance, in the case of the inflation rate, during the countries experience a high inflation rate, the inflation rate raises the cost of borrowing, then inflation will erode abilities to debt repayment. That relation can be described through profit maximization theory.

In the context of this research, the researcher focuses on the announcement of monetary policy rate affecting NPL of SMEs. The investigation, raising in the monetary policy rate will raise the cost of loan capital through interest rate channel and credit channel, the SMEs will be lost abilities to producing goods and services due to the increased cost of operation, the cost of operations will be leading to stop business operating that will increase non-performing loan (NPL) of SMEs in the financial system as things go monetary policy rate increase effect to increase the cost of loan capital then profit maximization will be declined and then non-performing loan (NPL) of SMEs will be increased. Due to profit maximization, rising in cost of operating by increase monetary policy rate, the marginal cost may be excess of the marginal revenue that will be the reason for firms or SMEs to decide to stop business operating.

4.2 Empirical Model

From the previous section, under literature review and theoretical framework, the researcher built the regression model through ordinary least squares (OLS) method for testing determinants of the level of non-performing loan (NPL) in SMEs sector. The OLS regression model shows in equation form, which can be written as follow:

$$NPL_{SMEs(t)}=\beta_0+\beta_1(GDP_t)+\beta_2(UNER_t)+\boldsymbol{\beta_3(MPR_t)}+\beta_4(MPR\_1_t)+\beta_5(MLR_t)+\beta_6(BSI_t)+\beta_7(eBSI_t)+\beta_8(INF_t)+\varepsilon$$

Where, t = 1, 2, …, Time. β_0 is constant term or interception. ε defines as the residual or error term of ordinary least squares at time t. NPL_{SMEs} defines as percentage of bank non-performing loans to total gross loans of SMEs in Thailand, dependent variable. From now on, the independent variables are described as follow. GDP is the quarter growth rate in the gross domestic product of Thailand. $UNER$ is rate of unemployment calculated by unemployed people divided by the total workforce that collected by Thai Labor Force Survey. MPR is the monetary policy interest determined by the central bank's monetary policy committee. MPR_1 is the interest policy with one lag time value that one more quarter is equal 90 days because performing loans can become non-performing loans by default in debt repayment over 90 days, MPR and MPR_1 are factors that researcher focus on the answer. The MLR is called the minimum lending rate. It refers to the interest rate at which the lending commercial bank charges to major borrowers on loans with a prespecified period for debt repayment. BSI is the measure of business confidence in overall industries during a period. $eBSI$ is 3-month expected business confidence or business outlook in three months forward. INF is an inflation rate calculated by percent change in the CPI index of the current quarter and the same quarter of the previous year.

Chapter 5: Data collection and Analysis

5.1 Data collection

In this IS research, the researcher will investigate the macroeconomic determinant influencing non-performing loan (NPL) of SMEs in the transition of the Thai economy by using secondary data collected during 2002 Q:1 - 2019 Q:4 with the quantitative

method to analyze the result. From various secondary data reviewing, the researcher collected the data to run a regression from different government entities in Thailand. In detail, the researcher uses non-performing loan (NPL) of SMEs (NPLSME), monetary policy rate (MPR), Minimum Lending Rate (MLR), Business Sentiment Index (BSI), Expected Business Sentiment Index (BSIe) data were collected by Bank of Thailand. The gross domestic product (GDP) growth rate data was collected by the Office of the National Economic and Social Development Council (NESDC). The unemployment rate (UNER) data was collected by The Labor Force Survey, National Statistical Office, Ministry of Information and Communication Technology. The last one is the inflation rate (INF) data was collected by the Ministry of Commerce, Thailand. The researcher concludes the variable details, the expectation of each variable, and the source of data in the form of a table as the following equation:

Variable	Description	Data source	Expected sign
NPLSME	Non-performing loan (NPL) of SMEs, is a dependent variable	Bank of Thailand	+
MPR	Monetary policy rate in Thailand, independent Variable.	Bank of Thailand	+
MLR	Minimum Lending Rate: MLR is the interest rate at which the lending commercial bank charges its most creditworthy major borrowers of loans with pre-specified repayment schedules.	Bank of Thailand	+
BSI	Business Sentiment Index is the instrument to measure the business confidence level during the time	Bank of Thailand	-
BSIe	Expected Business Sentiment Index is the business confidence level looking forward over three months.	Bank of Thailand	-
GDP	Gross domestic product in Thailand.	Office of the National Economic and Social Development Council (NESDC)	-
UNER	Thai unemployment rate in Thailand.	The Labor Force Survey, National Statistical Office, Ministry of Information and Communication Technology	+
INF	Thai inflation rate is calculated by taking percentage change in the quarter CPI, a year on year basis . The formular shows as follow: $\text{Inflation (\%)} = \left(\frac{\text{Current CPI} - \text{Initial CPI}}{\text{Current CPI}}\right) \times 100$ CPI ⟶ consumer price index	Ministry of Commerce, Thailand	-/+

Source: Researcher's own creation

Table 1: *The variable details and source of data.*

5.2 Data analysis

The dependent variable and seven independent variables are simplification by summarize in descriptive statistics table as below:

	NPL(SME)	*GDP*	*UNER*	*MPR*	*MLR*	*BSI*	*eBSI*	*INF*
Mean	6.02	3.99	1.29	2.26	6.46	48.20	53.21	2.08
Median	3.85	3.90	1.13	1.88	6.50	49.37	54.17	1.88
Mode	-	4.50	0.98	1.50	6.03	50.43	55.33	-
Minimum	2.07	-4.30	0.47	1.25	5.50	36.53	40.17	-3.93
Maximum	15.46	15.50	3.23	5.00	7.50	53.07	58.43	8.67
Standard Deviation	0.47	0.36	0.07	0.12	0.07	0.42	0.38	0.24
Kurtosis	-0.25	3.37	1.51	0.61	-1.06	1.03	4.55	1.25
Skewness	0.94	0.25	1.36	1.17	-0.03	-1.14	-1.84	0.34

Source: Researcher's own creation

Table 2: *A descriptive statistics table.*

From the above descriptive statistics table, researcher can infer the data characteristic during 2002–2019 in Thailand that: Non-performing loan of SMEs (NPLSME), the dependent variable, has an average of 6.02 percent. This would mean that every lent-out money to Small and Mid-size Enterprises (SMEs), financial institutions could get the default in repayment by 6.02 percent. In 2003, Thailand had experience with highest NPL in sector of SMEs around 15.46 percent while the NPL of Thai SMEs has lowest level at 2.07 percent in 2015. NPL of Thai SMEs has a negative excess kurtosis (-0.25), reveals that platykurtic distribution, flat tails, small outliers. The skewness of NPL in Thai SMEs sector is 0.94, between -1.00 and 1.00, so NPL of Thai SMEs data is moderately skewed, and mean is greater than median.

According to the gross domestic product (GDP) variable, the independent variable, the researcher can infer that Thailand reached the lowest GDP growth rate at -4.30 percent in 2009 during the global financial crisis, and later on reached the highest GDP growth rate at 15.46 percent in 2012. The skewness of GDP growth rate is between -0.5 and 0.5, GDP growth rate has kurtosis more than 3, so it is called leptokurtic distribution.

Meanwhile, during 2002–2019, Thailand experiences the highest unemployment rate (UNER) at 3.23 percent in 2002 and experiences the lowest unemployment rate at 0.47 percent in 2012. On average, Thai labor forces are unemployed at 1.29 percent. The skewness of unemployment rate is more than 1, it is highly positive skewness, mean is greater than median and mode. The unemployment rate has kurtosis less than 3, so it is called Platykurtic distribution, it indicates the small outliers of the distribution with flat tails.

Monetary policy rate (MPR) has the positively skewed distribution, mean is greater than median and mode. Thai monetary policy committee had announced the highest monetary policy rate at 5.00 percent in 2006 and used to announce the lowest monetary policy rate at 1.25 percent.

Minimum Lending Rate (MLR) or cost of loan have the negatively skewed distribution, median is greater than mean and mode. The Kurtosis is -1.06, Kurtosis less than 3 called a platykurtic distribution with flat tails, small outliers. The past 17 years

(2002-2019), the cost of loan in operating business is around 6.46 percent. The lowest cost and highest cost of debt in business operating are 5.50 percent and 7.50 percent, respectively.

For a character of the Business Sentiment Index (BSI) variable and the 3-month expected BSI variable have a negatively skewed distribution, mode and median are greater than mean. the 3-month expected BSI has large outliers than The Business Sentiment Index (BSI) because the 3-month expected BSI has kurtosis value more than 3.00. Thailand has high business sentiment index at 53.00 - 53.07 during 2011 – 2012 while low business sentiment index at 36.53 in 2008 during the global financial crisis.

Further, lastly descriptive, inflation rate (INF) data distribution with skewness is equal 0.34, between -0.5 and 0.5, called normal distribution. Inflation rate has kurtosis value equal 1.25 less than 3, it is called platykurtic distribution with flat tails, small outliers. Inflation is used to experience highest rate at 8.67 percent in 2008 and later the lowest inflation rate at -3.93 percent in 2009.

Chapter 6: Estimation Result

OLS Model, using observations 2002:1-2019:4 (Greltle program)
Dependent variable: NPLSME (%)

Variables		OLS Model 1	OLS Model 2	OLS Model 3
MACRECONOMIC FACTORS	Constants	9.116	12.561 **	10.336 **
		(1.230)	(6.113)	(2.303)
	GDP	0.272 **	0.361 ***	0.365 ***
		(2.457)	(3.229)	(3.287)
	UNER	4.706 ***	4.852 ***	4.511 ***
		(9.622)	9.754	(9.982)
	MPR	-0.371		
		(-0.3443)		
	MPR_1	0.851	-0.388	
		(0.766)	(-1.094)	
	MLR	-1.507 *		
		(-1.755)		
	BSI	-0.567 ***	-0.290 **	-0.253 ***
		(-2.823)	(-2.530)	(-2.761)
	eBSI	0.471 **		
		(2.423)		
	INF	0.339 *	0.320 **	0.284 *
		(1.853)	(2.254)	(1.990)
	Observations	72	72	72
	R-squared	0.785	0.745	0.718
	Adjusted R-squared	0.757	0.725	0.702

Table 3: *The table of OLS estimation result.*

The result from OLS model 1 describes as the gross domestic product (GDP), unemployment rate (UNER), minimum lending rate (MLR), business sentiment index (BSI), expected business sentiment index (BSIe), and inflation rate (INF) are significant variables except the changing in Monetary policy rate (MPR) and Monetary policy rate with 1 lag time are not significant variables. The OLS model 1 given adjusted R-Squared or goodness-of-fit for a regression model is equal 0.757 that we can conclude the independent variables in this regression model 1 can describe the non-performing loan level of SMEs (NPLSME) in Thailand context about 75.70% and the other 24.30% is still unable to describe the non-performing loan level of SMEs by OLS model 1. Before concluding the results from OLS model 1, the researcher used a correlation matrix table to analyze the multicollinearity problem of each variable, the result is shown as the following table:

GDP	**1.0**	0.2	-0.0	-0.1	-0.1	0.5	0.5	0.3
UNER	0.2	**1.0**	-0.1	-0.0	-0.3	-0.2	-0.2	0.1
MPR	-0.0	-0.1	**1.0**	**1.0**	**0.8**	-0.5	-0.4	0.6
MPR_1	-0.1	-0.0	**1.0**	**1.0**	**0.8**	-0.6	-0.5	0.4
MLR	-0.1	-0.3	**0.8**	**0.8**	**1.0**	-0.3	-0.3	0.2
BSI	0.5	-0.2	-0.5	-0.6	-0.3	**1.0**	**0.9**	-0.2
eBSI	0.5	-0.2	-0.4	-0.5	-0.3	**0.9**	**1.0**	-0.1
INF	0.3	0.1	0.6	0.4	0.2	-0.2	-0.1	**1.0**
	GDP	UNER	MPR	MPR_1	MLR	BSI	eBSI	INF

Table 4: *The table of correlation matrix.*

From the correlation matrix table, the researcher found OLS model 1 has a collinearity problem with three pairs of variables having a high correlation, MPR has a high correlation with MPR_1, MLR has a high correlation with MPR and MPR_1, and BSI has a high correlation with eBSI. The researcher must be analyzing data with OLS model 2 to fix a collinearity problem by omitting some variables that have a high correlation. Then, the researcher still chooses variables that have more chance to be significant or higher in T-stat from OLS model 1. The OLS model 2 includes five variables, which are GDP, UNER, MPR_1, BSI, and INF. After analyzing with OLS model 2, the researcher found every independent variable was significant except monetary policy rate, it was still an insignificant variable. The OLS model 2 given adjusted R-Squared equal 0.725. We can conclude that the independent variables in this regression model 2 can describe the non-performing loan level of SMEs (NPLSME) in Thailand context about 72.50% and the other 27.50% is still unable to describe the non-performing loan level of SMEs by the OLS model 2.

To focus on only significant factors, the researcher must be analyzing data with OLS model 3 by omitting the insignificant factor that is the monetary policy rate. After analyzing data with OLS model 3, the researcher found the selected significant variables are still significant. The OLS model 3 given adjusted R-Squared equal 0.702. We can conclude that the independent variables in this regression model 3 can describe the non-performing loan level of SMEs (NPLSME) in Thailand context about 70.20% and the other 29.80% is still unable to describe the non-performing loan level of SMEs by the OLS model 3. The p-value (F) for the OLS model 3 is equal to 0.000 which is lower than 0.05. The OLS model 3 has been tested for heteroscedasticity and multicollinearity problems through Gretl program stat. The analysis indicates those problems do not exist in OLS model 3.

The results from the OLS model 3 in the above table can be written down as the regression equation. To describe the relationship between economic determinants and the non-performing loan level of SMEs (NPLSME) in the Thailand context. The OLS model 3 is written as the following equation:

$$NPL_{SMEs(t)} = 10.336 + \underset{(2.303)}{0.365(GDP_t)} + \underset{(3.287)}{4.511(UNER_t)} - \underset{(9.982)}{0.253(BSI_t)} + \underset{(-2.671)}{0.284(INF_t)} \quad (1.990)$$

Remark: The number in parentheses indicates the t-statistic value of the coefficient each of variable.

The analysis of macroeconomic determinants affecting the value of non-performing loan (NPL) level of small and medium-sized enterprises (SMEs) in Thailand, data collection from the first quarter, 2002 until the fourth quarter, 2019. The researcher found four macroeconomic determinants that are significant factors to describe loan default in the SMEs sector. There are three factors significant at a 99 percent significant level, which include gross domestic product, unemployment rate, and business sentiment index. The estimation from OLS model 3 indicates that during Thailand's economic growth of 1 percent, the level of non-performing loan (NPL) in the SMEs sector also increases by 0.365 percent. If the unemployment rate increased by 1 percent, it will indicate the level of non-performing loans (NPL) in the SMEs sector also to increase by around 4.511 percent. The business sentiment index has a negative relationship with non-performing loans. If the business sentiment index increased 1 unit, affecting the value of the non-performing loans (NPL) level to decrease by 0.253 percent.

The other macroeconomic factor is that significant at a 90 percent significance level is inflation. The estimation from OLS model 3 indicates that during the inflation increased by 1 percent, it influenced the non-performing loans (NPL) level to increase by 0.284 percent.

Chapter 7: Conclusion and Recommendations

7.1 Conclusion and policy implication

Under economic conditions with high volatility, the economy is in turbulence. The Bank of Thailand will always be the institution that watches over a situation that brings risk to the Thai economy. The monetary policy committee (MPC) working under the Bank of Thailand's supervision to formulate monetary policies through financial instruments to promote monetary stability and less severe during the financial crisis. In general, the main instrument of the monetary policy committee (MPC) is determining the policy interest rate to benchmark for financial institutions and for other financial activities through five main transmission mechanism channels. Determining the policy interest rate influences the operating cost of business. Especially, the operating of small and medium-sized enterprises (SMEs) in which the main working capital relies on loans from financial institutions.

Following the topic question, the researcher tries to answer whether the policy interest rate of Thailand has a significant effect on the NPL level of SMEs during the past 17 years or not. From the research, determining the policy interest rate between 1.25 percent and 5.00 percent of the monetary policy committee does not influence the default of SME loans repayment in a significant way. The gross domestic product (GDP), unemployment rate (UNER) and business sentiment index (BSI) are the most significant factor to use for forecasting the NPL level of SMEs sector in Thailand context. The regression model also shows the result that the NPL level of SMEs can be explained by the inflation rate, or we can indicate that the increase in prices of goods and services influence the default of SME loans repayment.

The empirical result of this paper is usefulness for the asset management company (AMC) and all policy makers to use before the decision making and understood that the monetary policy rate cannot be a significant factor to use for forecasting the NPL level of SMEs in the Thailand context. For forecasting the NPL level of SMEs, we must focus on other macroeconomic factors or some specific factors.

7.2 Limitations and suggestions for further Research

The researcher recognizes that there were some limitations to conduct this research. For the benefit of further research, the researcher would like to mention in this section. First, this research does not cover the period of “Tom Yum Kung Crisis” due to the data limitation. The further research would go for a longer period to cover “Tom Yum Kung Crisis” and further research also includes related factors in the model. The second limitation and suggestion, this research conducted research only on macroeconomic factors due to the difficulty of data accessibility. Next research could conduct specific factors of each financial institution or business sector to be able to capture the new answers to describe debt default. Also, the regression model can include NPL with lag time as an independent variable to explain a dependent variable (NPL). Last but not least, the non-performing loan level has volatility. The changing of non-performing loan levels depends on various factors and takes time. The further research would conduct research by using another suitable methodology. For in-depth analysis, the estimation of the result will be more realistic. That will be more valuable for the further research.

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