Determination of Corporate Credit Ratings:

Vietnamese Evidence

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Abstract:

The global economies have been experiencing a process of rapid financial integration and globalization since the 1980s. Consequently, individual economies are increasingly under the influences of a wide range of factors at home and abroad, which generate not only more opportunities for trade and investment but also more risks for domestic firms. The twentieth century witnessed numerous, and in many cases, spectacular corporate default and insolvency cases in both the developed and emerging economies. The credit rating agencies have been playing an increasingly important role in the risk monitoring and risk management system, but recently, they were under criticism for failures in various aspects.

In the case of Vietnam, the transformation into an open economy since the 1990s has enhanced the development of the credit market and the commercial banking system. Credit-related activities are one of the most profitable and fastest-growing areas, but such activities face a rising level of challenges due to the increasingly open and competitive business and economic environment. Consequently, Vietnamese commercial banks invest an enormous amount of financial resources in improving credit quality measurement and risk management procedures. Although the State Bank of Vietnam, since 2002, has developed the Credit Information Centre (CIC) providing corporate credit ratings and financial information to support banking systems and other enterprise investors, the rating procedures of both Vietnamese commercial banks and the CIC are still at the early developmental stage. Moreover, there is little practical research concerning how and to what extent the corporate credit ratings of Vietnamese firms are affected by corporate, market, and macroeconomic conditions.

Despite reservations about the quality of the credit ratings, the ratings by the CIC and the commercial banks in Vietnam are the only comprehensive measures of corporate credit ratings in Vietnam. Keeping this caveat in mind, the primary purpose of this study is to examine the impact that various organizational, financial, and macroeconomic variables

have on credit ratings for Vietnamese corporations. By working closely with the CIC, a comprehensive dataset is constructed that contains the credit ratings for 500 Vietnamese firms and a wide range of potential determinants of corporate credit ratings over four years from 2011 to 2014. Considering the potential limitations in the dataset and given the general lack of relevant research in the Vietnamese context, a triangulation approach to the determination of credit ratings of Vietnamese firms is undertaken.

The main task is to identify the main determinants of corporate credit ratings and estimate their impacts. The specification of the model is based on a comprehensive review of relevant literature and considers the credit rating determinants in four aspects, including firm-specific financial ratios, macroeconomic factors, earnings management practice, and capital structure. Following a series of tests, the model is estimated using GMM for an Arellano-Bond dynamic panel (or GMM-IV) model. The GMM-IV model is further complemented by other models that focus on how earnings management affects the impacts of financial ratios on credit ratings using the ordered-probit model and how macroeconomic and firm-specific factors determine credit rating transition into a financial distress status using the Cox hazard model.

The key findings confirm the significance of a wide range of financial ratios for the determination of corporate credit ratings. However, the current financial ratios are limited for identifying those firms that are in financial distress, and various macroeconomic variables are additionally useful for examining the deterioration in corporate financial status. Earnings management practices break the link between key financial ratios and credit ratings and thus makes credit rating baseless.

The research has contributed to the academic literature and rating practice in Vietnam. It provides a close analysis of several determinants that have significant impacts on Vietnamese corporations' credit ratings but have not been explicitly explored in the rating process of the CIC. The research also proposes to Vietnamese commercial banks

enhanced procedures for improving their credit analysis which is currently mainly based on qualitative methods.

Keywords:

Credit ratings; financial distress; ordered-probit model; dynamic panel model; financial ratios; macroeconomic factors; Vietnamese corporations.

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ABBREVIATIONS AND ACRONYMS

CRA	Credit Rating Agencies
SBV	State Bank of Vietnam
CIC	Credit Information Centre
MDA	Multiple Discriminant Analysis
GMM	Generalized method of moments
IPI	Industrial Production Index
SOCBs	State-owned commercial banks
CAR	Capital adequacy ratio
SMEs	Small and medium-sized enterprises

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Before the 1980s, Vietnam operated under a command economic system. Despite the negative real interest rate, since all the loss would be covered by the national budget and all the loans provided to the state-owned corporations were decided and approved directly by the government, the national bank did not have any incentive to pay attention to risk management seriously. Furthermore, at this period, the only bank in Vietnam was the State Bank of Vietnam so that there was only one assessing and controlling procedures, which reduced the default risk to the borrowers. The Decree 53/HDBT/1988 issued in March 1988 allowed the appearance of commercial banks besides the State Bank of Vietnam which ended the uniform credit assessing process that had existed for many years. The Decree 53/HDBT/1990 issued on 24th May 1990 officially allowed the operation of investment banks as well as other kinds of financial intermediaries which made the credit market more complicated. The consequence of the expanded financial market is that the deposits with the banks increased significantly. In response to the rise in the medium- and long-term deposits, the medium- and long-term lending also expanded. Moreover, an increasing share of the total amount of credit has flown into the non-state owned companies which are considered to be more vulnerable to financial distress. Subsequently, following the introduction of stricter rules and regulations concerning financial intermediation, the reported credit quality seemed to be improved according to the State Bank of Vietnam.

However, according to Moody's analysis that is quoted in the IMF staff country report for Vietnam in 2010: Article IV of consultation, the non-performing loans in Vietnam could be up to three times those under Vietnamese Accounting System since loan classification in Vietnamese Accounting Standards focuses on past-due status and is less strict than IFRS while IFRS puts more emphasis on individually assessed loans on the borrowers' financial situation. Another noticeable feature of the Vietnamese financial

intermediaries is that some of the overdue debt which relates to the law cases will be erased out of the report and put in another report under the name of "waiting-to-be-solved account." Consequently, the reported non-performing debts seem to be under-estimated.

From 1994 to 2000, the credit rating and corporation analysis were mostly done by the state-owned commercial banks. Subsequently, facing the increasing possibility of corporate financial distress and the changes in the financial market, many new requirements and documents were issued to adjust and make the borrowers' financial distress prediction and control procedure of the banks stricter.

Since the credit rating system in Vietnam is still at an early stage and currently undergoing rapid changes, there are many deficiencies in the current system. Such deficiencies include limited information availability, generally poor quality of information, limited information sharing, and a lack of consistent rating procedures across different rating banks and agencies. It can be argued that the lack of knowledge and a sound rating framework can lead to biased conclusions about the financial distress possibility of the corporations and hence inaccurate credit rating can be applied to enterprises – the primary borrowers of the banks.

Hence, both commercial banks and credit rating agencies in Vietnam have been being sharply criticized for the role they played and are accused of wrong assessments and inaccurate credit ratings of the corporations. Although since 2010, regulatory authorities started to introduce closer supervision of rating agencies and regulatory requirements which are expected to more precisely define the use of credit ratings; it is still early to see any game-changing results.

Currently, although the CIC and the state-owned commercial banks in Vietnam do attempt to assess and estimate the credit ratings of the Vietnamese corporations, there is no systematic examination of such ratings and how the ratings are affected by the corporate, market, and macroeconomic factors. Although some attempts have been made to examine corporate financial distress in Vietnam, there is a general lack of systematic

investigations of the broad corporate financial status and how it is affected by different factors. Since corporate credit ratings provide a much more comprehensive indication of the financial health of the corporate firms than the conventional measures of financial distress, there is an urgent need to conduct systematic research into the general patterns of the corporate credit ratings and the critical determinants of credit ratings in Vietnam.

An excellent standardized credit rating system is essential to any economy as well as the corporations themselves. At the country level, developing countries may have to rely on foreign investors to purchase the debts, and those investors rely heavily on the credit ratings given by the external rating agencies. The benefits of good credit rating for an economy include access to funds from abroad and attraction to other forms of investment to the country. At the corporation level, credible ratings can ease the difficulties in accessing external sources of capital, which is one of the main issues faced by almost all business entrepreneurs, especially the small ones. Furthermore, crucial components of creditworthiness including less perceived business risk and transparent information highlight the importance of informationally efficient markets. Informational efficiency contributes to a more efficient allocation of resources thereby improving long term economic growth. The Vietnamese market needs a transparent and effective credit rating system starting with the definition, measurement, and determination of corporate credit ratings in Vietnam.

1.2 Research aims and objectives

As the next few chapters will make it clear, there is an urgent need for risk measurement and management in a developing country like Vietnam in the context of increasing globalization, and the corporate credit rating system plays a critical role. However, the current policy and practice in Vietnam suffer many deficiencies, both conceptual and empirical (again, details of the deficiencies will be discussed in some later chapters). Currently, there are little systematic attempts to investigate such issues in the context of developing countries and Vietnam. Given various conceptual and empirical difficulties

for researching this area, the examination of the corporate credit ratings and their determinants can only be approached on an exploratory basis and by using a variety of perspectives and methods, so that the findings from different perspectives can be compared and triangulated.

This study aims to provide a systematic and rigorous examination of the patterns and main determinants of the corporate credit ratings of the Vietnamese firms, paying particular attention to the possibility of corporate financial distress. Specifically, this study attempts to achieve the following research objectives:

- To reveal the main patterns of the corporate credit ratings of the Vietnamese firms
- To empirically determine the effects on the rating status, and more specifically the financial distress possibilities, of Vietnamese corporations arising from a set of critical variables regarding corporate financial ratios, earnings management practices, corporate capital structure, and macroeconomic conditions
- To enhance the practical procedure for commercial banks in the pre-issue assessment, controlling process, determination of credit-termination time, and credit risk assessment.

1.3 Summary of research methodology

The relevant literature for the current research covers several areas and mainly deals with developed economies. To construct the conceptual framework and empirical procedures for determining the influence of a wide range of variables on the financial health of Vietnamese corporations, the current study adopts both qualitative and quantitative approaches that are informed by a comprehensive literature review of the relevant concepts, theories, techniques, and existing empirical studies. In the qualitative analyses, we examine the general economic and financial situations in Vietnam, the current credit rating systems, and the general trend in corporate financial health. For the quantitative analyses, we construct a comprehensive dataset for 500 Vietnamese firms that contain information on their credit ratings as well as a wide range of potential firm-level and

macroeconomic determinants. We then employ various modeling techniques such as the ordered-probit model, GMM-IV model, and the Cox proportional hazard model to determine the influences of corporate financial ratios, macroeconomic factors, earning management and capital structure on the firms' credit ratings or the rating transitions to financial distress. The full procedure of credit checking is suggested for the case of Vietnam.

1.4 Research steps and thesis organization

A structured research process is developed to address the research goals and objectives. The research is divided into four main parts: (1) theory, assumptions and background literature review; (2) variables and hypotheses chosen; (3) operational measurement and model estimation; and (4) interpretation and discussion of results.

The organization of the thesis is as below:

- The first chapter provides an introductory overview of the current situation in Vietnam, research goal and objectives, and a summary of the research methods.
- The second chapter presents the background of the current study. The critical issues of interest include the increasing integration of the Vietnamese economy into the global economy, hence the rising level of opportunities and also risks for Vietnamese firms; the increasing level of macroeconomic instability and structural changes in the economy; the accelerating growth in the banking and financial activities in Vietnam; the operation and competition among Vietnamese commercial banks; the Vietnamese credit market condition; the legal basis for credit assessment; and evidence of macroeconomic instability in Vietnam.
- The third chapter provides the literature review concerning the theories related to corporate risk, default risk and the measurement of financial distress which is the focus of credit rating system as well as the specific field of credit rating. It introduces the key features of various credit rating systems and reviews a wide range of studies related to the measurement and determination of credit rating.

- The fourth chapter reviews the credit rating systems in Vietnam.
- Chapter five introduces the methodologies in the current research and presents the selection of the dependent and independent variables for various models. It explains how the independent variables are chosen; the characteristic of the sample selected and discusses the rationales and procedures for different models.
- Chapter six documents the detailed procedures for implementing the estimations of the various models using different techniques. It also presents and interprets the main empirical results.
- The last chapter discusses the main research findings and summarizes critical research contributions. It discusses the research limitations and suggests further directions for the future.

CHAPTER 2: VIETNAMESE REALITY

This chapter provides the background knowledge about the recent conditions of the Vietnamese economy, including economic growth and structural changes; the current state of Vietnamese corporations, banking system, and the credit market; and the legal basis in Vietnam as well as the level of unhealthy competition among commercial banks. It is motivated by the Structure-Conduct-Performance Paradigm that stipulates that corporate financial performance is the outcome of their conduct, which in turn depends on the external competitive environment.

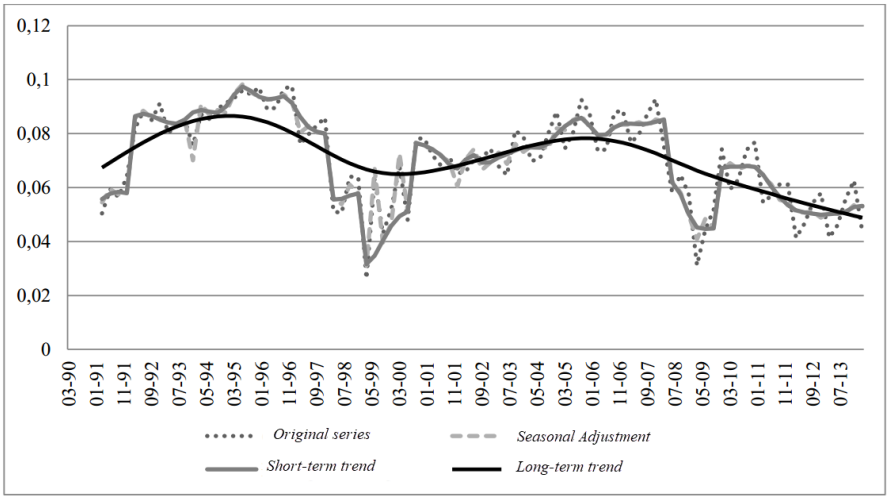
2.1 Overview of the Vietnamese economy

2.1.1 The recent economic condition in Vietnam

After the war with the USA in the 1960s, Vietnam remained a closed economy with the government being in control of all major economic activities. Economics and political reforms under Doi Moi, which was launched in 1986, have spurred rapid economic growth and development as well as transformed Vietnam from one of the poorest nations in the world to a lower-middle-income country. Since 1990, Vietnam has gradually opened its economy to the rest of the world and, as a result of the external influences and internal adjustments, economic activities have become more volatile, and the cyclical patterns have emerged. The socialist-oriented market economy of the Socialist Republic of Vietnam is currently the 45th largest economy in the world measured by nominal Gross Domestic Product (GDP). Figure 2.1 shows a general cyclical pattern in the growth rates of GDP from 1990 to 2013.

Figure 2.1 Vietnamese Economic cycle 1990-2013 (based on GDP growth rate)

Source: Vietnamese Statistic Department Reports from 1989-2014



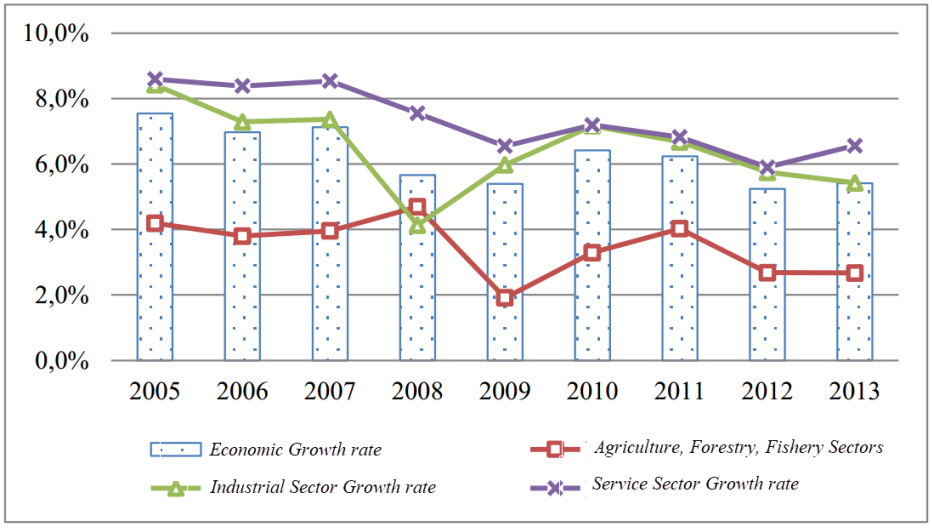
The longest expansion was from 1991 to 1997 following the opening of the Vietnamese market. While the country shifted toward a more market-oriented economy, the Vietnamese government continues to hold a tight reign over the major sectors, including the banking systems and foreign trade. The next three years were the slowdown phase of Vietnamese economy due to the influence of the Asian economic crisis. The Bilateral Trade Agreement between the United States and Vietnam in 2000 is a significant milestone since economists expected Vietnam to transform into a manufacturing-based and export-oriented economy. From 2004 to 2007, Vietnam had a 3-year expansion phase before being negatively affected by the global financial crisis in 2008. In 2009, the Vietnamese government started the economic stimulus package, which boosted the whole economy in subsequent years. The recent reforms over the last two decades create a significant boom in the Vietnamese stock market as confidence in the Vietnamese economy increased dramatically. Despite the rapid construction booming contributed to economic growth, there is also “bubble” in the marketplace.

Figure 2.2 shows a sectorial breakdown of the growth pattern in Vietnam. From 2005 to the end of 2013, the Vietnamese economic growth fluctuated and followed a general

downward trend. This pattern of fluctuation and slowdown was observable across the main sectors of the economy, but particularly so in the primary industry.

Figure 2.2 Vietnamese Economic growth rate (based on annual GDP growth rate)

Source: Vietnamese Statistic Department Reports from 2005-2014



The figure also shows that as the economy develops, the services sector and the industrial sector consistently grow faster than the primary industry. Therefore, the economy has undergone significant structural changes with manufacturing and services becoming increasingly dominant over the period.

Table 2.1 shows the sectoral contribution to GDP from 2004 to 2013. A clear pattern has emerged from the table: the primary sector's share followed a general downward trend; the percentage of the industrial and construction industry remained mostly constant, and the services sector enjoyed a slightly rising share and became the most significant sector by 2013. As can be seen, Vietnam became a services-dominant economy at the early stage of industrialization.

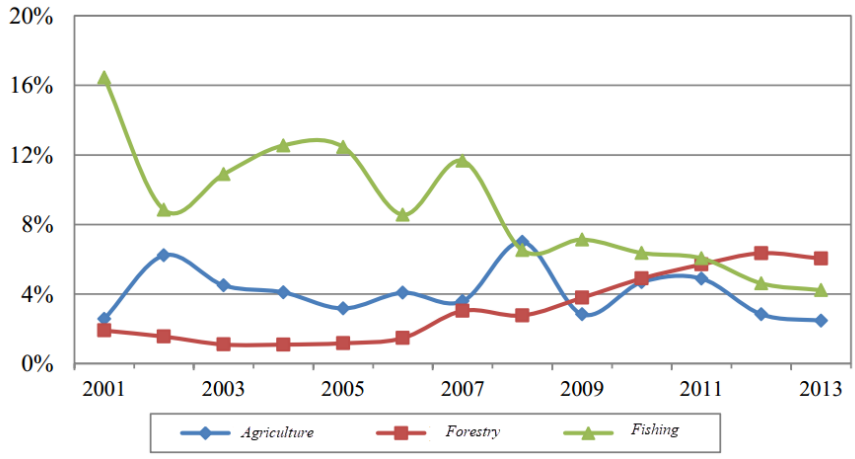
Table 2.1 Sectoral Contribution to National GDP from 2004 to 2013

Year	Agriculture, Forestry, and Fishery	Industrial and Construction	Services
2004	20.0%	37.5%	42.5%
2005	19.3%	38.1%	42.6%
2006	18.7%	38.6%	42.7%
2007	18.7%	38.5%	12.8%
2008	20.4%	37.1%	42.5%
2009	19.2%	37.4%	43.4%
2010	18.9%	38.2%	42.9%
2011	20.1%	37.9%	42.0%
2012	19.7%	38.6%	41.7%
2013	18.4%	38.3%	43.3%

Source: Vietnamese Statistic Department Reports from 2003 to 2013

There have also been noticeable changes in the sub-sectors of the Vietnamese economy. The Agriculture, Forestry, and the Fishing sector are this sector contributes one of the most critical areas in Vietnam as most of the Vietnamese employment is provided by these sectors.

Figure 2.3 Vietnamese Agriculture, Forestry and Fishing Sector Growth Rate



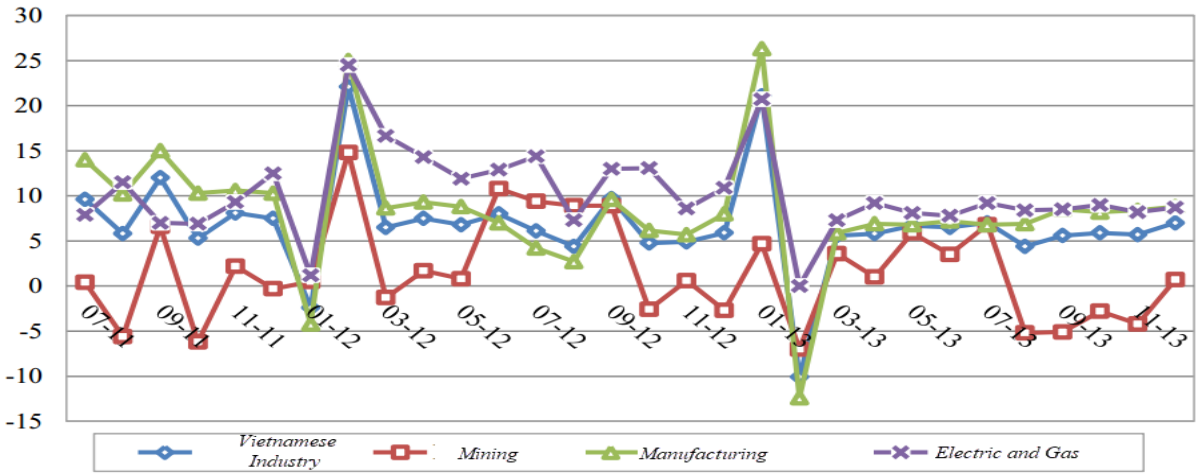
Source: Vietnamese Statistic Department Reports 2014

More than 50% of the Vietnamese workforce is employed in these sectors, yet the growth rates in two of the sub-sectors were mediocre from 2001 to 2013. The Fishing sector

experienced a particularly noticeable fall in the growth rate over the period. The Forestry sector enjoyed an overall growth trend in the period due to the increase in the demand for wood.

Developing the manufacturing industry is one of the Vietnamese government's priorities in the period of 20 years from 2005 to 2025. However, this sector and the sub-sectors experienced significant fluctuations in its performance.

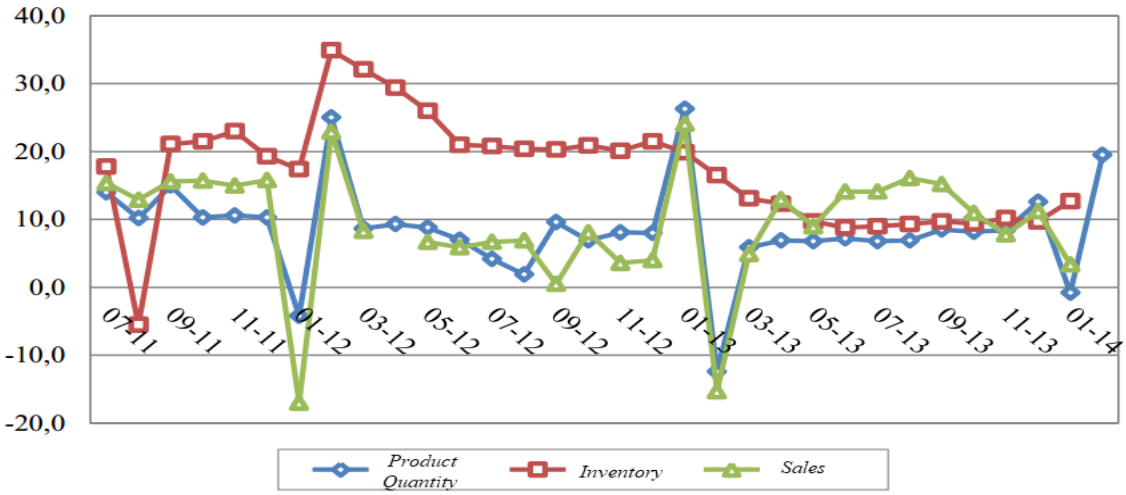
Figure 2.4 Vietnamese Industrial Production Index (IPI) from 2011 to 2013



Source: Vietnamese Statistic Department Reports 2014

From figure 2.4, most of the sub-sectors in manufacturing shared the same trend of development during the period. In 2013, the industrial production index (IPI) of the whole sector reached a peak of 5.9%, mostly due to the noticeable growth of manufacturing which contributed 90% to the general development of the entire industry. The following figure gives a closer look inside one of the essential sub-sectors: Manufacturing.

Figure 2.5 Percentage of Changes in Manufacturing Output From 2011 to 2014



Source: Vietnamese Statistic Department Reports 2014

As can be seen from figure 2.5, inventory of manufacturing has reduced gradually from 2011 to 2014. Hence, sales have been improved. Manufacturing sales were boosted since Vietnamese export for these sectors was enhanced and supported by the government during this period.

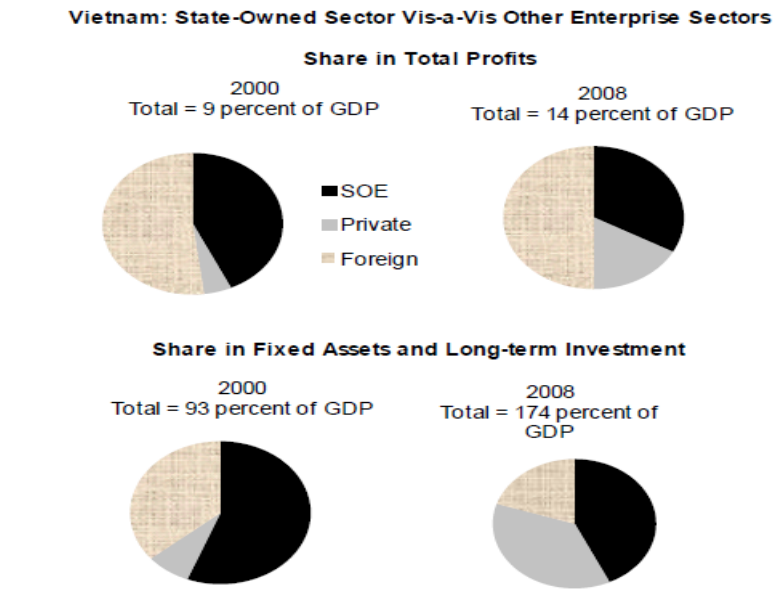
As a summary, ever since Vietnam opened its economy to the international community, its economy has enjoyed a general trend of growth, albeit with some fluctuations. The sectoral composition of the economy has also shifted gradually towards the manufacturing and services sectors. The growth of the Vietnamese economy creates a favorable environment for corporate development. To take advantage of this opportunity, it is essential for Vietnamese corporations to maintain good financial health.

2.1.2 Vietnamese corporations

Vietnam is considered to be one of the emerging markets in the world. In its recent history, Vietnam was at war with several foreign powers. Consequently, up until the end of the 1980s, the resources were minimal and strictly controlled by the government. All the credit came from the national budget and government bonds. The credit in this period

was issued due to the corporations' demand to create the "usual credit to erase the gap between the owners' equity and the financial leverage." However, in this period, the interest rates were estimated and administered by the government without considering the inflation rate, which resulted in the negative real interest rates. Before 1988, the corporation assessment was not strictly operated as mentioned; financial distress was considered as impossible as the government was always ready to bail out any failing company. Nevertheless, the Decision 172/HDBT/1982 issued on 9th October 1982 of the Government marked an early step towards a system that requires the different interest rates to be applied to the "good" or "not good" corporations and the State Bank to classify the corporations into these two groups. The last decade has seen an enormous decline in the share of state-owned companies in terms of both assets and profits, as represented in Figure 2.6.

Figure 2.6 State-owned Sector vis-a-vis other enterprise sectors



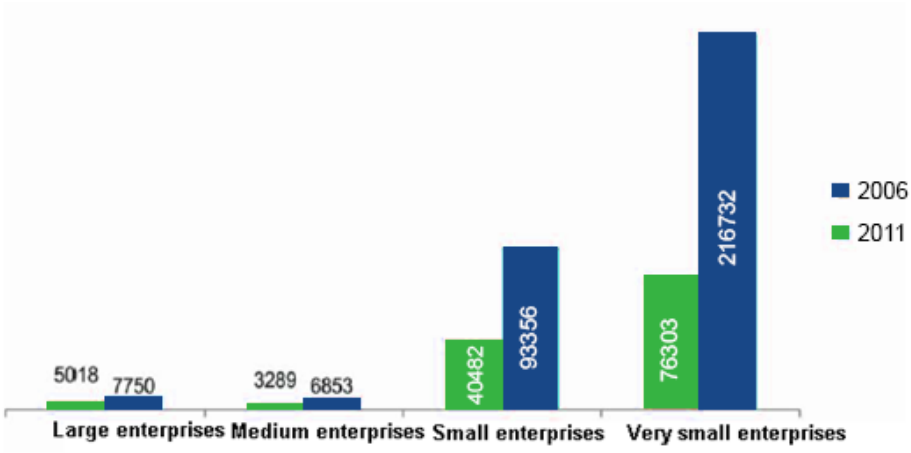
Source: Enterprise Survey 2008. **IMF staff country report 2010**

In Figure 2.6, the growth of enterprises in the private sector is substantial in terms of its share in total profits, fixed assets, and long-term investment. Since private corporations

are not backed and secured by the government, there is an urge for a rigorous control system to be developed, especially for safeguarding corporate financial health.

Additionally, the number of small and very small enterprises (based on the value of the assets) increases noticeably according to the report of the National Statistical Office shown in Figure 2.7.

Figure 2.7 Enterprises structure in Vietnam



According to the report on Vietnamese enterprises from 2006 to 2011 issued by the National Statistical Office (table 2.2), although the very small enterprises account for more than 66.8% of the total number of enterprises and require much of loans from banks, these companies have not shown the profitable financial performance. During the period from 2009 to 2011, the economic loss was substantial.

Table 2.2 The revenue of very small enterprises in billion VND

(Source: National Statistical report on enterprises in the period from 2006 to 2011)

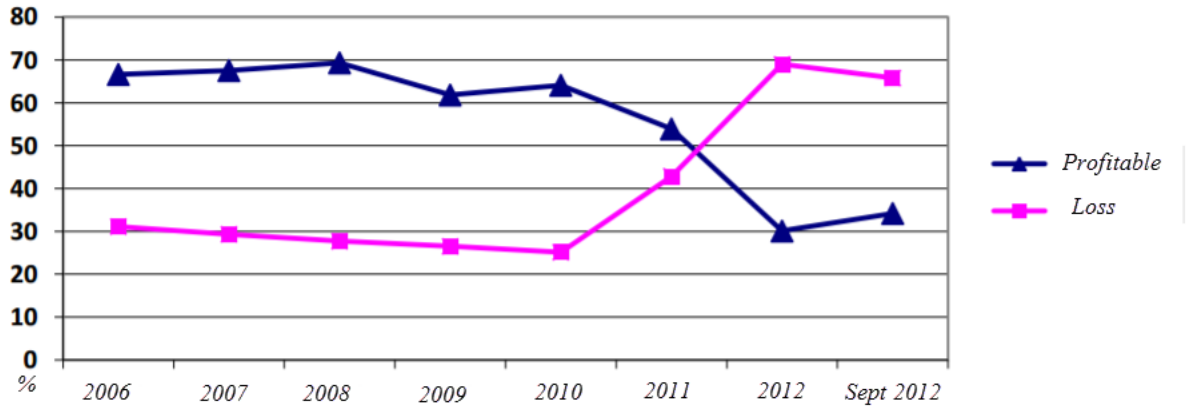
	Total capital	Equity	Loans	Profit	Pre-tax revenue
2011	1,658,651	956,724	701,927	1,148,955	-15,517
2010	1,315,502	560,786	754,716	1,014,804	-2,293

2009	919,371	447,720	471,651	853,036	-7,275
2008	511,646	242,533	269,113	808,404	-8,305
2007	311,386	187,726	123,660	363,996	1,399
2006	177,403	106,575	70,828	287,545	406

A similar trend was recorded for most of the corporations during the study period as the profitability of most of the corporations decreased (figure 2.8).

Figure 2.8 % of Vietnamese corporations suffering poor financial performance

Source: National Financial Department Report 2013



As can be seen from Figure 2.8, due to the economic slowdown, the proportion of corporations suffering financial loss increased significantly from 25.14% in 2010 to 65.8% at the end of 2012. The generally poor performance in revenue is also shown in the table below (Table 2.3). The fall in revenue in a significant proportion of firms makes such firms face a rising possibility of financial distress. This fact raised the alarm bells on the creditworthiness of the firms among the banks that provided the credit. (It is worth noting that not all the corporations' financial reports are recorded in this period due to the lack of regulation in financial statements reports). The corporations' revenue and growth rate can further be analyzed in table 2.3:

Table 2.3 Vietnamese corporations' average revenue and revenue growth rate (Classified by industries) from 2008 to 2011

Source: National Statistic Department Report 2012 and National Financial Department Report 2011

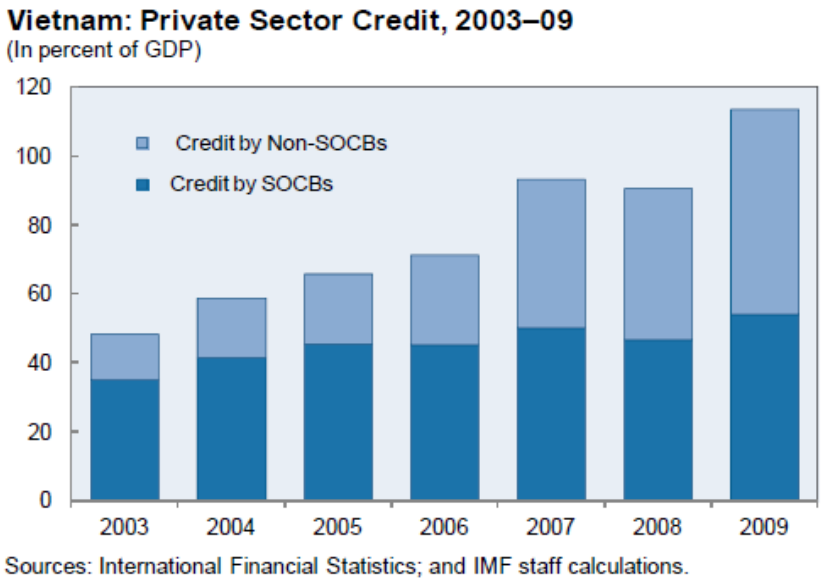
	2008		2009		2010		2011	
	Revenue (million VND)	Revenue growth rate	Revenue (million VND)	Revenue growth rate	Revenue (million VND)	Revenue growth rate	Revenue (million VND)	Revenue growth rate
Agriculture	3,974	-68.9	3,917	-1.4	4,392	12.1	4,696	6.9
Manufacturing	25,783	-15.5	25,769	-0.1	25,969	0.8	23,118	0.6
Utilities and Mining	4,707	51.6	13,004	176.3	16,608	27.7	18,679	12.5
Construction	7,850	-16.3	8,435	7.4	7,494	-11.2	7,380	-1.5
Trading	17,564	6.6	13,758	-21.7	12,705	-7.7	13,826	8.8
Logistic	13,683	22.9	11,254	-17.7	9,337	-17.0	8,350	-10.6
Hotel Services and Restaurant	3,847	-12.6	3,400	-11.6	3,261	-4.1	3,111	-4.6
Financial and Banking	28,672	23.3	33,074	15.4	28,429	-14.0	32,544	14.5
Technology, Media, Education and Medical	3,121	-0.1	3,272	4.8	2,916	-10.9	2,241	-23.1
Services	999	-15.2	2,553	155.6	1,460	-42.8	976	-33.2
Others	8,561	-7.8	10,021	17.0	7,941	-20.8	6,548	-17.5
Total	**14,852**	**-7.3**	**13,548**	**-8.8**	**12,392**	**-8.5**	**12,507**	**0.9**

From table 2.3, it is noticeable that the revenue growth rates of the manufacturing sector were either negative or slightly positive, whereas the revenue growth rates of banking and finance were mostly positive. The total revenue growth rate of Vietnamese corporations was generally bad despite a slightly positive growth rate in the most recent year of the study period.

The Decree 53/HDBT/1988 issued in March 1988 allowed the formation of commercial banks besides the State Bank of Vietnam, which replaced the uniform credit assessment process that had existed for many years. The Decree 53/HDBT/1990 issued on 24th May 1990 officially allowed the operation of investment banks as well as other kinds of financial intermediaries which made the credit market more complicated. According to

the staff report of the IMF shown in figure 2.9 below, the credit growth in recent years has been quite active in the private banks as they are expanding their balance sheet far more rapidly than the state-owned commercial banks (SOCBs). The IMF staff report in 2010 also noted that some of the small joint-stock commercial banks have faced some liquidity pressure and are closely monitored for any early signal of financial distress.

Figure 2.9 Vietnam: Private Sector Credit. 2003-09



2.2 The Vietnamese banking system and credit issued

The development of the Vietnamese banking system and credit market started in 1951 with the appearance of the State Bank of Vietnam. However, the very first commercial banks started operating in 1990 with the change of the Vietnamese economy from a closed to an open market. The most famous landmarks of the Vietnamese Banking system can be summarized in table 2.4:

Table 2.4 Vietnamese Banking system landmarks of development

Year	Landmark
1991	Commercial Banks were allowed to operate under the control of the State Bank of Vietnam. Foreign Banks could enter the Vietnamese market by having branches in Vietnam or cooperate with Vietnamese Banks.
1993	State Bank of Vietnam started to have cooperation with the IMF and the World Bank.
1997	The Vietnamese government approves the law on State Bank of Vietnam and Law on Credit Institutions.
1999	Establishment of Deposit Insurance of Vietnam
2000	Vietnamese Banking system reforming
2001	Bilateral Trade Agreements with the United States
2002	The floating interest rate is allowed by the State Bank of Vietnam
2003	Vietnamese Banking system reforming
2010	The Vietnamese government approves the law on State Bank of Vietnam and Law on Credit Institutions' amendments.
2016	Vietnamese Banking system reforming

As can be seen from table 2.4, in 25 years, the Vietnamese banking system and credit market have undergone significant changes. The development of Vietnamese commercial banks is influenced by a host of different factors, including changing political ideology as Vietnam is a socialist/communist country with really Vietnam-specific characteristics, the development of the legal system as a hybrid system in the wake of two wars, and the internal factors of commercial banks. The overview of the development of Vietnamese

retail banking will be approached by two periods: before and following the participation in the WTO.

Before the participation in WTO

Before the participation in WTO in 2006, the development of Vietnamese commercial banks was based on the development of legal systems under the control of the State Bank of Vietnam. As the country gradually adopted the open market system that permits free trade and investment since 1986, the demand for capital has increased substantially. However, the capital supply from state-owned banks could not satisfy the requirement, so the development of financial intermediaries was adversely affected in the following periods. At the end of 1989, there were approximately 500 credit funds, 17 non-state-owned banks, and 7000 other financial intermediaries (Vietnam National Statistic Department's report data source, 1989). Since the legal system was at its infant stage, the constitutional violation issue and credit fraud became common phenomena, and most of the non-state-owned organization had to confront with the bankruptcy situation. At the end of 1990, only 18 healthy credit funds were operating in Vietnam. In the same year, the Bank Decree was issued to clarify the functions of State Banks and set legal requirements for other financial intermediaries. In 1997, the Commercial Banks and Financial Intermediaries Law was approved and became the fundamental legal basis for the operation of commercial banks in Vietnam. The adjustment in 2004 reduced the number of commercial banks to 33 at that time.

In this period, the competition among commercial banks was low since every transaction and business operations were entirely controlled by the State Bank of Vietnam.

Following the participation in WTO

After 12 years of negotiation, on 7th November 2006, Vietnam became the official member of WTO. Since then, the competitive pressure has been raised in Vietnam even though the government tried to limit the access of foreign organizations into the domestic

banking industry. International organizations are banned from setting banking branches in Vietnam and owning more than 30% of local commercial banks.

Due to the implementation of all the agreements of WTO and the booming activities of all industries, the number of commercial banks and credit intermediaries snowballed. To ensure the safety of commercial banks, the Decree 141/2006/ND-CP dated 22nd November 2006 requires commercial banks to have minimal equity of 3,000 billion VND. The new requirement put the pressure on small commercial banks to issue more stocks and attract more deposits, which leads to the fluctuation in the interest rate.

The Decree 59/2009/ND-CP in 2009 regulates the structure and operating system of commercial banks, which has made a massive change in the organization of numerous banks in this time. Circulation 13/2010/TT-NHNN dated 20th April 2010 with the adjustment by the circulation 19/2010/TT-NHNN regulates the financial safety ratios for the commercial banks. The legal system has been changed and adjusted over the years to match the issues of reality.

Figure 2.10 Number of Banks in Vietnam

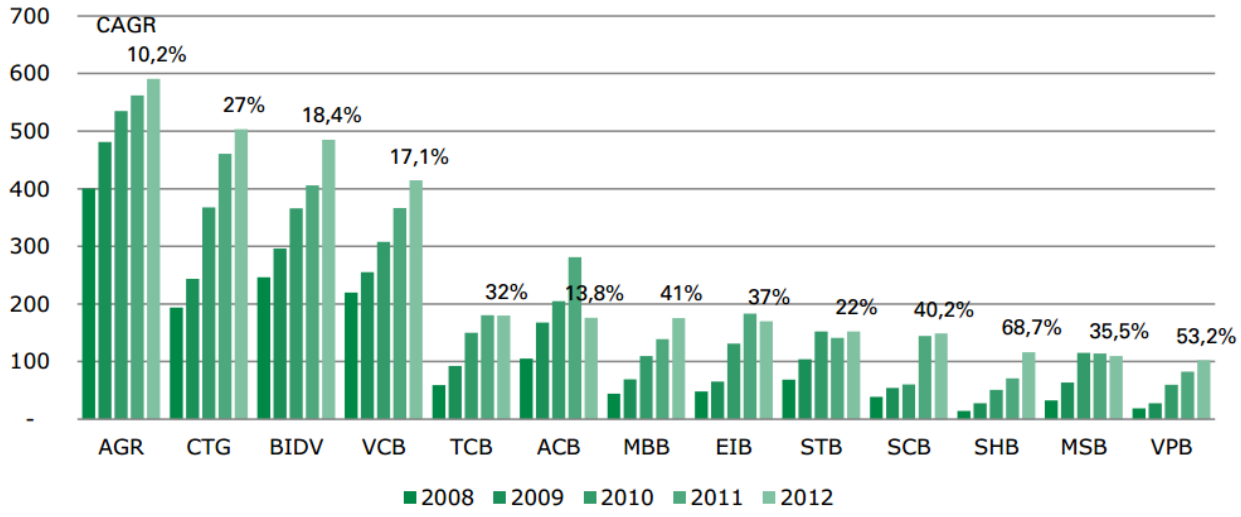
Source: National Statistic Department Report 1990-2014

According to Figure 2.10, the number of state-owned commercial banks remained unchanged since 1991, with five big ones, including VCB, CTG, BIDV, Agribank, and MHB. In contrast, the number of non-state-owned commercial banks increased dramatically in the first five years to reach nearly 50 banks and then reduced due to the reforming and re-construction of the banking system. During the last decade, the M&A activities in the Vietnamese banking system is specifically noticeable. Therefore, the number of commercial banks may change every single year. The State Bank of Vietnam has also increased the number of its branches to control the domestic banking system strictly. In contrast, the number of foreign banks in Vietnam is tiny over the last ten years due to the legal boundaries.

In addition to the increase in number, the Vietnamese banking system also experienced substantial growth in total assets and equity. From 2007 to 2010, the total assets of the Vietnamese banking system doubled from 1,097 trillion VND to approximately 2,690 trillion VND (Vietnamese National Statistic Department's Report 2011). In 2013, the total assets of the system reached the level of 5,637 trillion VND. Leading commercial banks serve as typical examples of high overall assets growth rate.

Figure 2.11 Total Assets Growth of Vietnamese banks 2008-2012 (trillion VND)

Source: Vietnamese Commercial Banks' Annual Reports 2008-2012



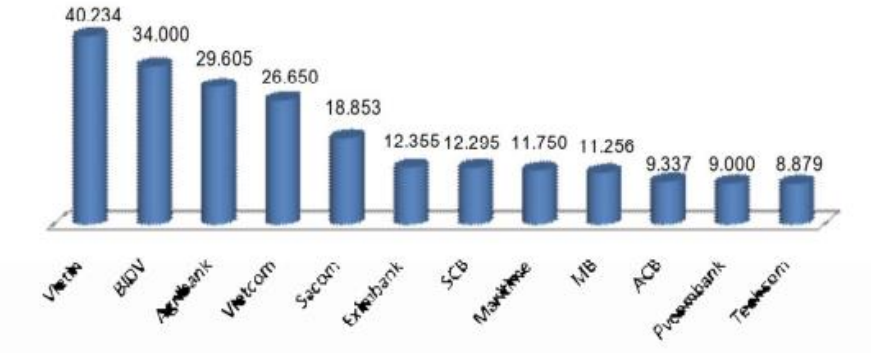
According to Figure 2.11, from 2008 to 2012, the joint-stock commercial banks experienced more impressive growth compared to the state-owned ones since the joint-stock banks have smaller total assets value hence may reach a higher growth rate. However, the compound annual growth rate of the whole system dropped during the study period. The steep but unstable total assets growth rate of some commercial banks presented higher risks.

A similar trend is recorded in the commercial bank's equity. The Decree 141/2006/ND-CP dated 22nd November 2006 is a noticeable legal document supporting the rapid development of the capital of commercial banks in Vietnam. There are several reasons for that development since 2007:

- The equity of Vietnamese commercial banks is much lower than others in South-East Asia, which limited the competitive advantages.
- The Decree 141/2006/ND-CP dated 22nd November 2006 requires all commercial banks operating in Vietnam to ensure the minimal equity of 3,000 billion VND and minimum reserve of 1,000 billion VND with the deadline of 2008.
- The Decision 456/2005/QD-NHNN and Circulation 13/2010/TT-NHNN require all the commercial banks to raise CAR to a minimum of 9%.
- Since the State Bank of Vietnam does not allow the credit issue for an individual customer to be more than 15% equity of the commercial bank, most of the commercial banks try to increase the amount of their capital to expand their credit market share.

Commercial banks intend to expand branches and investment and to update the technology as well as infrastructure to support the participation in the WTO.

Figure 2.12 Total Equity of some Vietnamese banks at the end of 2016 (billion VND)



Source: Vietnamese Investment Forum' Annual Reports 2017

According to a report by the Vietnamese Investment Forum (VIF, 2017), most of the Vietnamese commercial banks reached the required equity as regulated in Decree 141/2006/ND-CP dated 22th November 2006 of the Vietnamese government. It secures the financial safety of the banks operating in Vietnam. Furthermore, since the end of 2010, most of the Vietnamese commercial banks have had the Capital Adequacy Ratio of 9% as required by the government.

The growth of commercial banks led to the bloom in the amount of credit issued, especially to the corporations, as is shown in Table 2.5:

Table 2.5 Total credit issued by Vietnamese banks (2012-2017, thousand billion VND)

Banks	**Credit issued**					
	2012	**2013**	**2014**	**2015**	**2016**	**2017**
State owned Banks	1,465	1,615	1,836	2,215	2,624	3,070
Commercial Banks	1,019	1,166	1,421	1,623	1,977	2,362
Sum	**2,484**	**2,781**	**3,257**	**3,838**	**4,601**	**5,432**
	Credit issued to corporations					
State owned Banks	1,068	1,148	1,281	1,474	1,670	1,846
Commercial Banks	623	729	849	940	1,131	1,359
Sum	**1,691**	**1,877**	**2,130**	**2,414**	**2,801**	**3,205**

Source: Vietnamese State Bank's Annual Reports 2012-2017

As can be seen from Table 2.5, the amount of credit issued by the Vietnamese commercial banks rose dramatically from 2012 to 2017. Although the state-owned banks always have the advantages of substantial assets and an enormous amount of equity with valuable customers of domestic cartels, commercial banks have their market based on their flexibility, innovative technologies, and excellent service quality. Most commercial banks' customers are small and medium-sized enterprises (SMEs). The evidence can be seen in Table 2.6:

Table 2.6 Credit issued of Vietnamese banks from 2012-2017

	Credit issued (thousand billion VND)					
Corporations	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Small	524	582	660	748	868	994
Medium	542	601	682	801	896	1,025
Large	625	694	788	865	1,037	1,186
Sum	**1,691**	**1,877**	**2,130**	**2,414**	**2,801**	**3,205**
	The growth rate of credit issued amount (%)					
Small		11.0	13.4	13.3	16.0	14.5
Medium		10.9	13.5	17.4	11.9	14.4
Large		11.0	13.5	9.8	19.9	14.4

Source: Vietnamese State Bank's Annual Reports 2012-2017

Even though the SMEs represent a potentially substantial market and could provide huge revenue to the banks, they have higher financial risks compared with the state-owned cartels. Hence, it is crucial to control the credit rating and financial health of these corporations.

As a result of a host of changes in the Vietnamese economy and the banking market, including the rapid expansion of the credit market, more freedom that the corporations enjoy in their decision-making, and the continuous rise in deposit amount and the termination of the practice of loss covering by the government, the financial distress possibility of the corporations has significantly increased. This issue will be discussed in detail in the followed section.

2.3 Non-performing loans and bad debts

2.3.1 Definitions and back run

Definition of non-performing loans

In Vietnam, the non-performing liability is defined in Decision No. 493/2005 dated 22nd April 2005 by the State Bank of Vietnam. In the Decision, the non-performing loans can be explained by the time overdue of the loans or the repayment ability of the borrower(s). There are three groups of non-performing loans that are named as Group 3 (sub-prime loans); Group 4 (Loans in doubt), and Group 5 (Loans with principal loss possibility) as shown in Table 2.7:

Table 2.7 Non-performing loan groups

Group	Article 6 (overdue time)	Article 7 (repayment ability)
3	90-180 days	Loss part of the interest and/or principle
4	181-360 days	High possibility of loss
5	More than 360 days	Unable to collect

Management of non-performing loans by the commercial banks

According to Basel II, the management of non-performing loans by the commercial banks involves the whole process of developing and operating the strategies, policies and business activities that ensure the safety requirements, efficiency targets, and stable development. Commercial banks are expected to prevent and to solve the non-performing loans so that they can increase revenue, reduce costs, and improve the service quality in both the short term and long term.

Non-performing loans management is part of risk management, which is a crucial obligation of the commercial banks in Vietnam. It is required to minimize the loss for the

bank itself and improve the overall safety of the whole system with reasonable and efficient activities.

Four necessary steps in non-performing loans management in Vietnam are applied in almost all the commercial banks (State Bank's report data), including identification, measurement, prevention, and resolution.

The reality of non-performing loans management in Vietnamese commercial banks

The empirical evidence on the non-performing loans in the Vietnamese commercial banks is collected from the available reports of five leading commercial banks in Vietnam, including Vietinbank, Vietcombank, BIDV, VBARD, and ACB. The general situation is presented in the data tables and charts below. The data series covers the period from 2005 to 2012. Data for subsequent years are still regarded as confidential and thus unavailable.

Non-performing loans in commercial banks

There are considerable fluctuations in the amount of non-performing loans among commercial banks in the period from 2002 to 2011due to the approval of Decision 493 mentioned above concerning the identification and resolution of non-performing loans by the State Bank of Vietnam as well as the economic crisis in 2008.

Table 2.8 Non-performing loans of commercial banks (million VND)

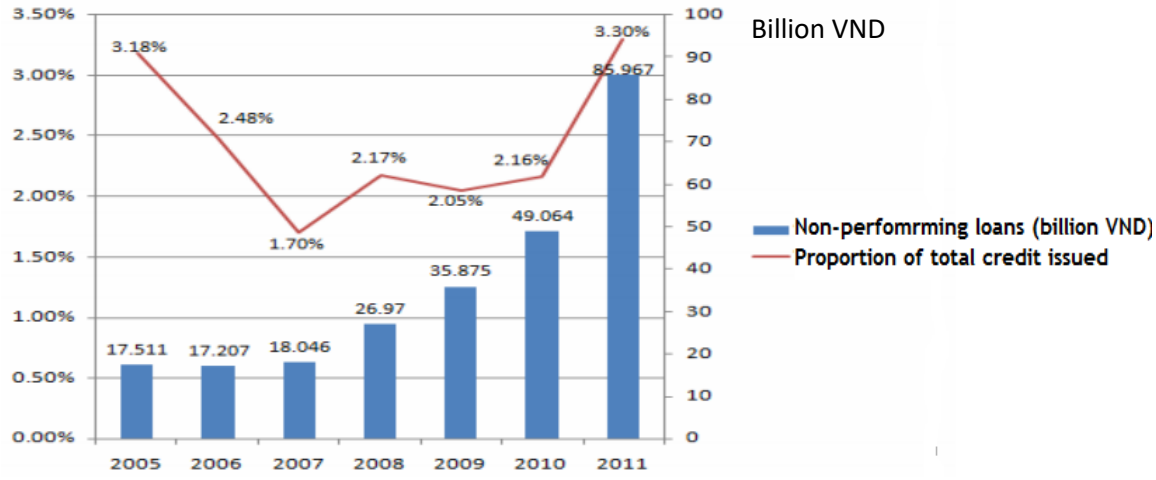
Year	2005	2006	2007	2008	2009	2010	2011
Total bad debts	17,511	17,207	18,046	26,970	35,875	49,064	85,967
Total credit issued	550,673	693,834	1,061,551	1,242,857	1,750,000	2,271,500	2,504,91
Proportion(%)	3.18	2.48	1.7	2.17	2.05	2.16	3.3

Source: State Bank's report data)

As can be seen from table 2.8, from 2005 to 2011, the proportion of bad debts was quite high, which should be marked as a bad signal for the banking system.

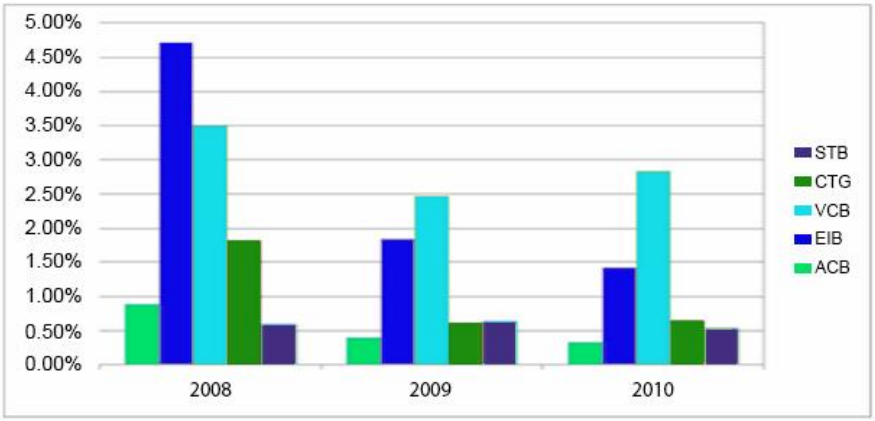
Figure 2.13 Non-performing loans in commercial banks

(Unit: billion VND. Source: State Bank's report data)



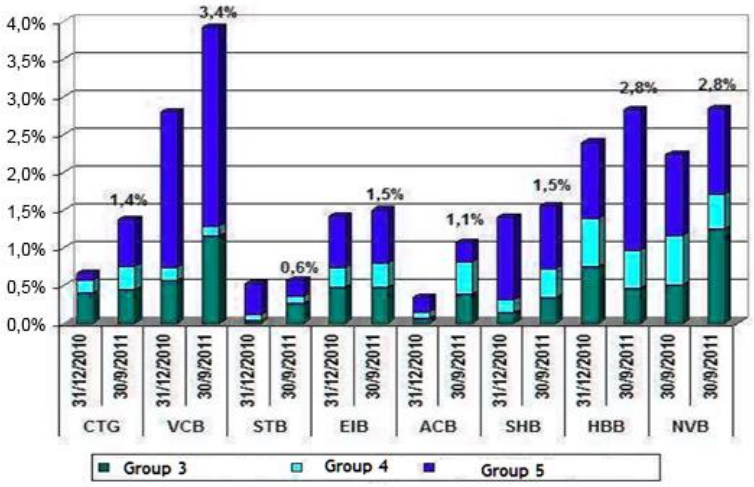
In Figure 2.13, the proportion of total bad debts over total credit issued in the years of 2008 to 2011 increased substantially since this was a tough period for the whole Vietnamese economy. Non-performing loans became a severe concern of the banking system as various banks, especially commercial ones, suffered high proportions of this undesirable type of loans. The evidence is shown in figure 2.14 and 2.15:

Figure 2.14 Non-performing loans in five commercial banks in Vietnam



Source: *www.stox.vns (5/2011)*

Figure 2.15 Non-performing loans/Total credit issued by some listed commercial banks



Source: *Diễn đàn doanh nghiệp, " Mổ xẻ nợ xấu của 8 ông lớn ngân hàng"(T10/2011)*

For the five leading commercial banks, the reality is as follow (unit: million VND):

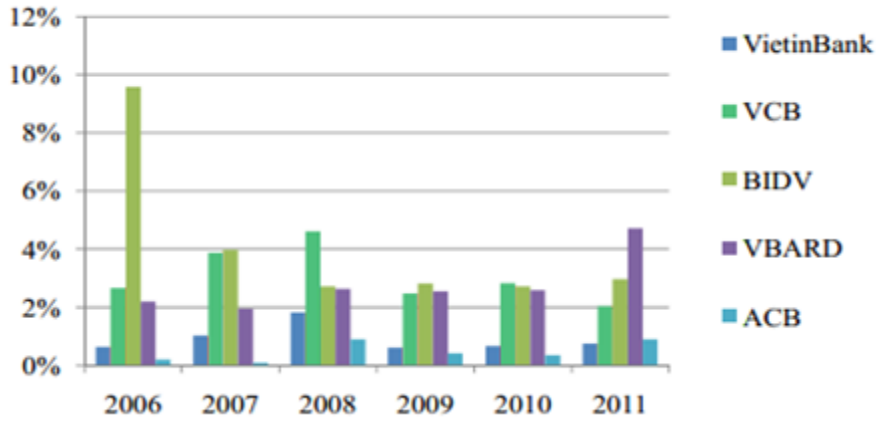
Table 2.9 Non-performing loans in five Vietnamese commercial banks

	Banks	Total non-performing loans	Total credit issued	Proportion (%)
2006	Vietinbank	504,959.0	80,152,334.0	0.63
	VCB	1,860,700.0	70,024,632.0	2.66
	BIDV	8,689,403.0	90,580,693.0	9.59
	VBARD	3,502,797.0	161,105,364.0	2.19
	ACB	33,162.0	17,014,419.0	0.19
2007	Vietinbank	1,042,277.0	102,190,640.0	1.02
	VCB	3,597,054.0	92,845,054.0	3.87
	BIDV	4,756,408.0	119,558,890.0	3.98
	VBARD	4,708,797.0	243,222,998.0	1.94
	ACB	26,565.0	34,810,857.0	0.08
2008	Vietinbank	2,187,345.0	120,752,073.0	1.81
	VCB	5,202,045.0	112,792,965.0	4.61
	BIDV	4,183,234.0	154,473,141.0	2.71
	VBARD	7,853,521.0	298,936,520.0	2.63
	ACB	308,714.0	34,832,700.0	0.89
2009	Vietinbank	1,000,809.0	163,170,485.0	0.61
	VCB	3,498,684.0	141,621,126.0	2.47
	BIDV	5,568,605.0	197,594,780.0	2.82
	VBARD	9,522,552.0	372,574,628.0	2.55
	ACB	245,680.0	62,357,978.0	0.41
2010	Vietinbank	1,538,538.0	234,204,809.0	0.66
	VCB	5,147,552.0	176,813,906.0	2.92
	BIDV	6,424,486.0	237,081,832.0	2.71
	VBARD	11,308,177.0	435,700,430.0	2.59
	ACB	292,806.0	87,195,105.0	0.34
2011	Vietinbank	2,204,171.0	293,434,312.0	0.75
	VCB	4,257,959.0	209,417,633.0	2.03
	BIDV	8,122,689.0	274,303,554.0	2.96
	VBARD	19,664.3	417,459.2	4.71
	ACB	917,967.0	102,809,156.0	0.89

In Table 2.9, the alarming percentage of non-performing loans in the top five Vietnamese commercial banks reflects the health of the banking system. A high percentage of such loans represents the banks' difficulties in collecting interest and principal on their credits, which may lead to fewer profits for the banks and possibly bank closure.

Figure 2.16 Non-performing loans of five big commercial banks

(Source: Annual reports of the banks)



From Figure 2.16, from 2006 to 2011, almost all Vietnamese commercial banks suffered from bad debts and other types of non-performing loans. Although the situation was helped by the Vietnamese State Bank's control and support, the overall performance of the commercial banks was still weak, and it took time to recover from this challenging period.

2.3.2 Non-performing structure

Insofar as the non-performing structure by industries and customer groups is concerned, data is only available for two banks, including Vietinbank and VBARD.

Non-performing loans by industries/sectors

For the non-performing structure by industry, we have the tables for two banks (all the data are collected from the internal reports of the banks):

Table 2.10 Non- performing loans in Vietinbank 2012 by industries

Industry	Percentage of the total non-performing loans (%)
Construction and transportation	23
Heavy Industry	25
Services and Trading	19
Agriculture	9
Financial services	18
Others	6

According to the Vietinbank's internal annual reports shown in Table 2.10, at the beginning of 2012, the heavy industry had the highest non-performing loans, followed by construction and transportation. These industries are the ones with high risks with a long period of the product cycle and suffering from fluctuations in the input prices. In 2011, the price of steel and cement increased rapidly, which contributed to the difficulties of the industries above. In contrast, Agriculture usually has a low level of non-performing loans due to the regular support of the government.

Table 2.11 Non-performing loans in VBARD by industries (%)

	2007	2008	2009	2010	2011
Agriculture	4.43	3.85	4.46	4.1	3.9
Seafood	2.63	3.1	5.8	4.21	4.01
Coffee	3.2	3.5	3.3	3.8	3.3
Industry	0.54	0.79	1.68	1.7	1.8
Services	0.39	0.57	1.1	1.8	1.98
Financial	0.5	0.7	0.3	1.08	1.53
Others	1.3	1.46	1.8	2.3	2.4

In contrast to Vietinbank, as can be seen in Table 2.11 the amount of non-performing loans in VBARD mainly concentrated in the Agriculture, Seafood, and Coffee sectors as the bank had to support corporations in these industries due to the decision of the government.

Non-performing loans by types of customers

Table 2.12 Non- performing loans in Vietinbank by customer groups (%)

	2008	2009	2010	2011
State-owned corporations (SOC)				
Bad debts/ Debts for SOC	1.83	2.95	0.97	1.53
Bad debts/ Total debts issued	0.66	1.05	0.33	0.57
Other corporations				
Bad debts/ Debts for non SOC	0.56	1.18	0.43	0.74
Bad debts/ Total debts issued	0.36	0.76	0.29	0.45

Table 2.13 Non-performing loans in VBARD by customer groups (unit: billion VND and %)

	2008	2009	2010	2011
Total bad debts	4709	7853	9522	11308
Individuals and households	2686	4560	4106	3233
Corporations	2033	3293	5416	8075
Bad debts/ Total debts issued for the group				
Individuals and households	2	3	2.2	1.5
Corporations	1.7	2.34	3.1	3.7

It is clear that for both banks from Table 2.12 and 2.13 above, the proportion of corporate non-performing loans was considerable and seemed to increase over the study period.

2.3.3 The legal base for managing non-performing loans in Vietnam

Before 2004, the management and classification of non-performing debts were based on Decision 488/ QD-NHNN only. However, this decision was adjusted and changed to the new version of the Decision 493/QD-NHNN in which all the loans are classified into five groups and re-negotiated loan cannot be put into the "good" groups. The decision 18/2007/QD-NHNN dated 25th April 2007 makes the regulations on non-performing loans even more strict with the detailed guidance of solution suggestion and reports.

Other critical legal documents used in managing non-performing loans include:

- Decision 1627/2011/QD_NHNN dated 31st December 2001 by the President of the State Bank regarding the regulation of the primary legal documents on credit issued and all other adjustments.
- Decision 127/2005/QD-NHNN dated 3rd February 2005 adjusting the Decision 1627/ 2001/QD-NHNN.
- Decision 783/2005/QD-NHNN dated 31st May 2005 by the President of the State Bank permitting the commercial banks to actively manage debt renegotiation based on their financial status and repayment ability of the customers.
- Decision 457/2005/QD-NHNN dated 19th April 2005 concerning the safety ratios in the operation of commercial banks and financial intermediaries.
- Decision 493/2005/QD_NHNN dated 22nd April 2005 regulating non-performing loans classification, and preservation of commercial banks and financial intermediaries.
- Decision 59/ 2006/QD_NHNN dated 21st December 2006 regulating the loans trading of commercial banks and financial intermediaries.
- Decree 163/ND-CP dated 29th December 2006 by the government regulating guarantees.

- Decision 03/2007/QD_NHNN dated 19th January 2007 amending the decision 457/2005/QD_NHNN.
- Decision 118/2007/QD_NHNN dated 25th April 2007 adjusting the non-performing loans classification and reservation setting in all previous documents.
- Circulation 146/2007/TT_BTC dated 6th December 2007 by the Ministry of Finance with detailed guidance on operating Decree 109/2007/ND_CP mentioned above.
- Circulation 13/2010/TT-NHNN dated 20th May 2010 regulating strict management for safety ratio of the commercial banks.
- Circulation 19/2010/TT-NHNN dated 27th September 2010 adjusting some article of the Circulation 13/2010/TT-NHNN.

This sequence of legislation, regulation, and amendments have gradually laid a solid legal foundation for the monitoring and management of non-performing loans in Vietnam.

2.3.4 Statistical data on non-performing loans in 5 leading commercial banks in Vietnam

Table 2.14 Non-performing debts classifications in 5 leading banks

(Source: Bank's internal annual report and researcher's classification)

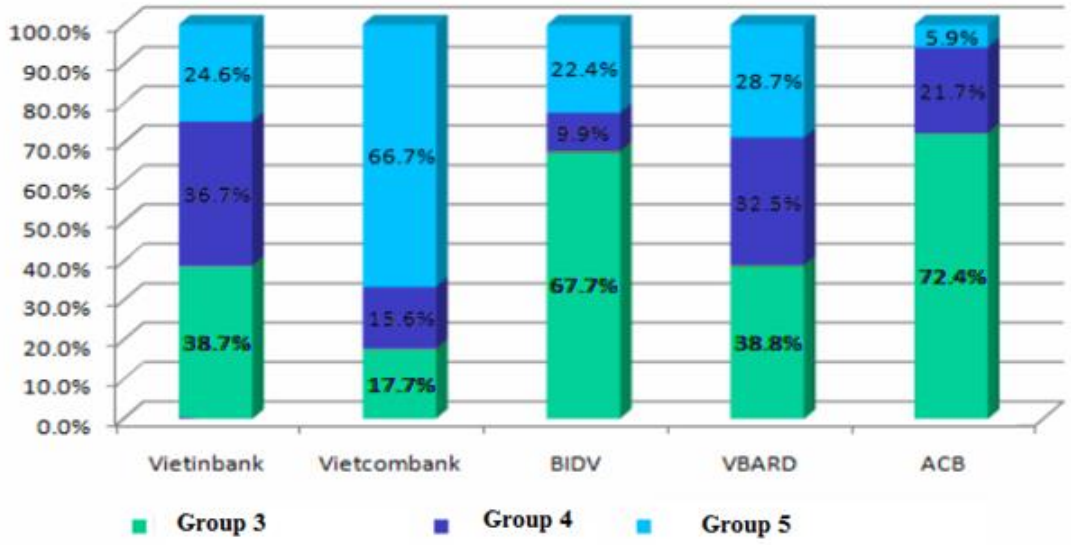
	Bank	Group 3	Group 4	Group 5	Sum
	Vietinbank				**504,959**
	VCB	546,512	437,093	87,095	1,070,700
2006	BIDV	6,231,741	333,121	2,124,541	8,689,403
	VBARD				
	ACB	13,041	9,006	11,115	33,162
	Vietinbank	419,054	367,086	256,137	1,042,277
	VCB	1,038,498	847,829	1,710,727	3,597,054
2007	BIDV	3,426,703	212,096	1,117,609	4,756,408
	VBARD				0
	ACB	9,167	7,078	10,320	26,565
2008	Vietinbank	846,985	803,542	536,818	2,187,345

	VCB	921,191	813,087	3,467,767	5,202,045
	BIDV	2,832,544	413,369	937,321	4,183,234
	VBARD	3,050,609	2,556,242	2,246,671	7,853,522
	ACB	223,605	66,982	18,127	308,714
	Vietinbank	230,305	332,955	437,549	1,000,809
	VCB	440,649	394,977	2,663,058	3,498,684
2009	BIDV	3,531,482	864,493	1,172,630	5,568,605
	VBARD	3,041,239	2,553,475	3,927,838	9,522,552
	ACB	24,776	88,502	141,402	254,680
	Vietinbank	924,605	410,692	203,241	1,538,538
	VCB	1,164,353	390,534	3,592,665	5,147,552
2010	BIDV	3,597,664	819,244	2,007,578	6,424,486
	VBARD	2,091,574	3,248,190	5,968,413	11,308,177
	ACB	64,759	58,399	169,648	292,806
	Vietinbank	1,071,421	220,213	912,537	2,204,171
	VCB	125,745	653,072	2,347,430	3,126,247
2011	BIDV	5,244,120	420,305	2,458,264	8,122,689
	VBARD	7,929	3,459	8,276	19,664
	ACB	294,973	345,655	297,339	937,967

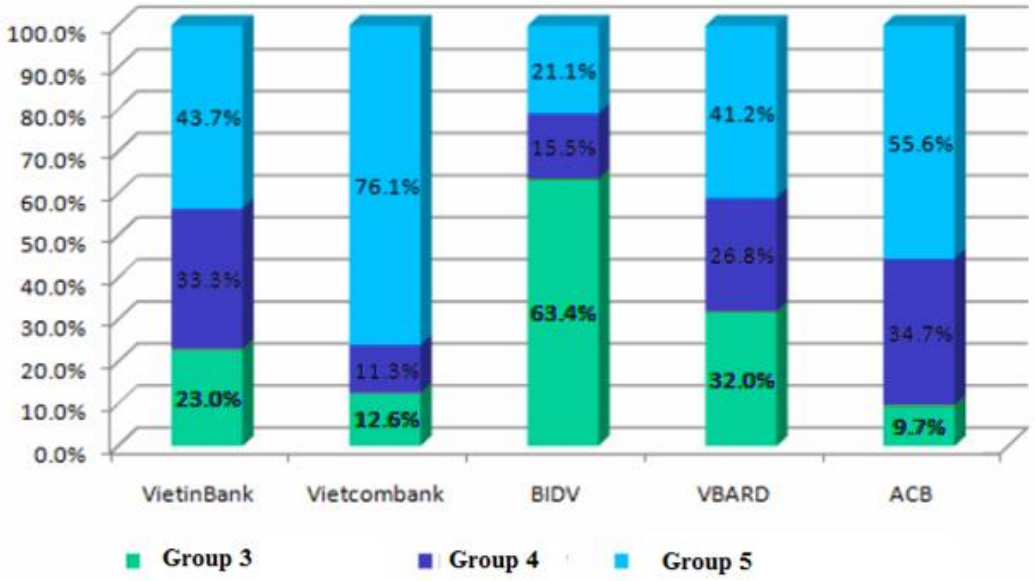
Figure 2.17 Non-performing debts classification in 5 leading banks

(Source: Bank's internal annual report and researcher's classification)

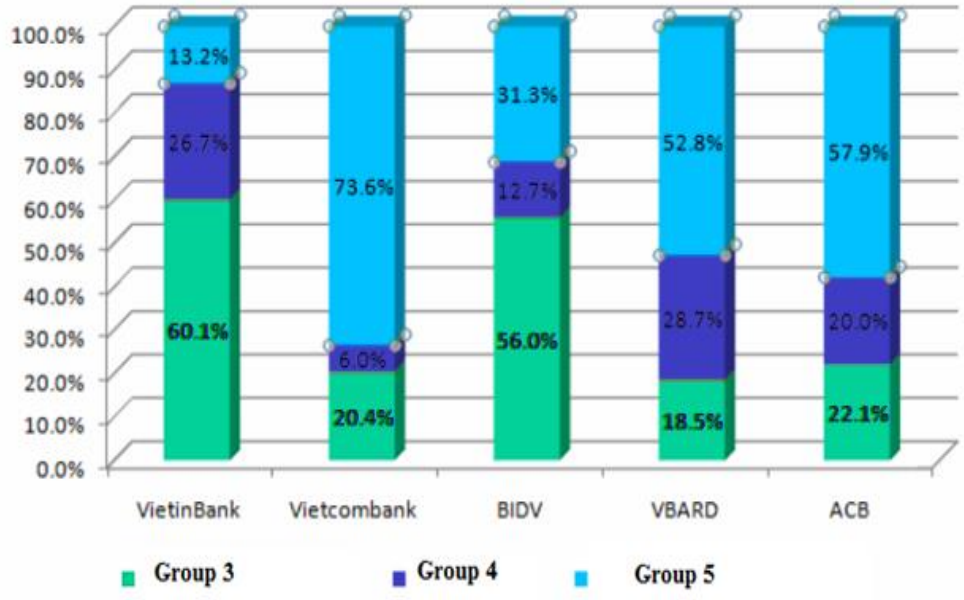
The year 2008



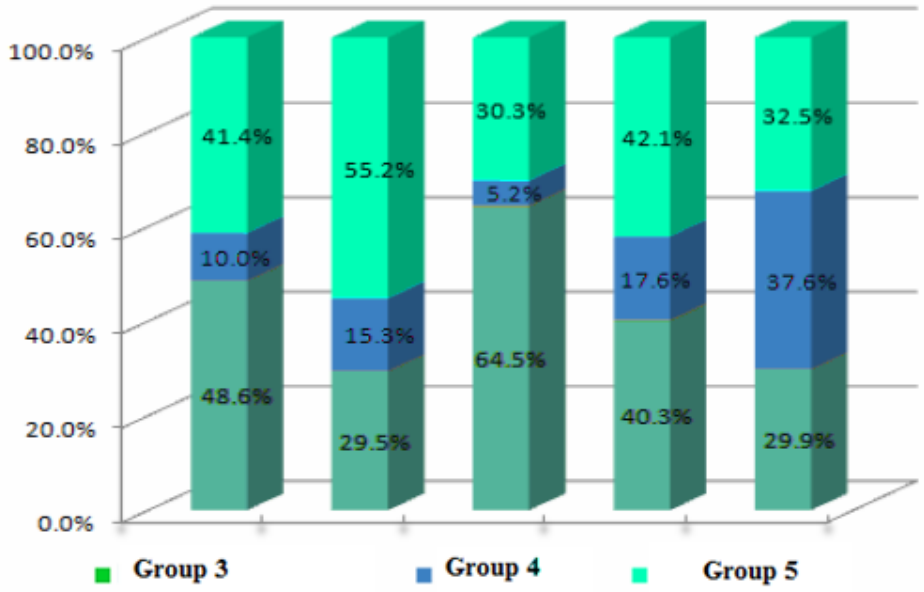
The year 2009



The year 2010



The year 2011



From the table and figures above, the amount of non-performing loans in the five leading commercial banks in Vietnam is substantial with a growing trend during the four years from 2008 to 2011. Group 5 was not the biggest problem of the system in 2008. It, however, became the most significant danger to the system in the next three years. It may be due to the inefficient debt control system of Vietnamese commercial banks.

The amount of non-performing loan recently

The number of overdue debts of state-owned banks was surprisingly high compared to the commercial banks' ones in the period from 2012 to 2017.

Table 2.15 Overdue debts of Vietnamese banks from 2012-2017

Source: Vietnamese State Bank's Annual Reports 2012-2017

Banks	Overdue debts /Total credit issued (%)					
	2012	2013	2014	2015	2016	2017
State owned Banks	4.7	3.6	4.7	3.4	2.8	0.2
Commercial Banks	2.5	3.1	2.4	1.8	2.1	0.2
	Overdue debts of corporate customers/Total corporate credit issued (%)					
State owned Banks	5.1	4.3	5.3	3.8	3.3	0.3
Commercial Banks	4.2	3.3	2.4	1.9	2.0	0.2

As can be seen from Table 2.15, the quality of corporate debts has deteriorated over the last few years. It is necessary to consider the contributing factors to the poor corporate credit quality to have strict control of this issue. Even with or without collateral, corporations' debts still confronted with the possibility of becoming bad debts.

Table 2.16 Overdue debts of Vietnamese banks from 2012-2017: with and without collaterals (million VND)

Source: Vietnamese State Bank's Annual Reports 2012-2017

Banks	Overdue debts amount (with collaterals)					
	2012	2013	2014	2015	2016	2017
State-owned Banks			77,577,643	68,597,209	65,213,864	65,282,036
Commercial Banks			216,028,235	220,831,027	237,483,160	49,068,005
Sum			**293,605,878**	**289,428,236**	**302,697,024**	**114,350,041**
	Bad debts amount (with collaterals)					
State owned Banks	69,715,228	59,257,109	10,083,941	5,923,426	8,555,324	5,175,453
Commercial Banks	169,779,083	177,625,486	223,214,357	227,449,299	279,928,285	100,299,665
Sum	**239,494,311**	**236,882,595**	**233,298,298**	**233,372,725**	**288,483,609**	**105,475,118**

Banks	Corporate customers' bad debts amount (with collaterals)					
	2012	**2013**	**2014**	**2015**	**2016**	**2017**
State-owned Banks			59,033,063	52,444,490	48,793,146	52,871,127
Commercial Banks			149,068,502	152,037,901	166,842,011	28,495,348
Sum			**208,101,565**	**204,482,391**	**215,635,157**	**81,366,475**
	Corporate customers' bad debts amount (with collaterals)					
State owned Banks	55,491,202	48,904,849	875,187	5,047,978	7,819,426	4,348,531
Commercial Banks	129,287,283	133,759,095	170,986,319	174,971,340	217,544,847	69,458,279
Sum	**184,778,485**	**182,663,944**	**171,861,506**	**180,019,318**	**225,364,273**	**73,806,810**

As can be seen from Table 2.16, the growth of bad debts in both categories (with and without collaterals) increased considerably. Specifically, the amount of corporations' bad debts without guarantees has the most significant proportion of the whole banking system. Hence, it can be stated that corporate customers' debts without collateral pose the most dangerous credit risk for the banks.

There are several reasons for the increasing amount of overdue and bad debts of the Vietnamese banks. Firstly, regarding the source of information for assessing corporate financial status, most of the state-owned and non-state-owned banks currently use only the financial statements of one or two previous years for the assessment. The other alternative sources of information or references for the financial evaluation are mostly based on subjective opinions of the assessing staff, the unqualified previous assessment of another bank without re-checking process, and the summary credit history bought from the Credit Information Centre. Therefore, the lack of comprehensive and impartial information usually led to biased conclusions about the financial distress possibility of the corporations that represented the primary borrowers of the banks.

Secondly, most of the information for financial status assessment is not updated frequently. Based on the internal procedures in banks, most of the data is updated only once a year.

Thirdly, the benchmarks provided by the banks are not uniform, usually inconsistent, and lacking the support of reasonable evidence.

Fourth, the banks only focused on the financial status of the corporations themselves while other factors including the industry situation, the efficiency of the market and the relationship among several banks or between the bank and the borrowing corporations can also have an essential influence on the financial distress possibility of the corporations.

Fifth, the banks' internal documents show that most of the assessment criteria are qualitative, and the quantitative ones stop at fundamental financial ratios.

Sixth, since the Vietnamese stock market only started operation in July 2000, the quality of information, in terms of information efficiency and transparency, to external assessors and investors was still inadequate. Consequently, accurate external assessment of the financial status of the companies was challenging to achieve. In reality, there are some notable legal documents regulating information disclosure in the security markets of Vietnam including Law on securities 2006 dated 29th June 2006 by the National Assembly (officially came into effect on 1st January 2007); Decree 12/2007/NDCP dated 19th January 2007 by the government to provide in details the implementation of some articles of the aforementioned Law; Decision 13/2007/QD-BTC dated 13th March 2007 in the form of prospectus; Decision 59/QD-TTGD TP.HCM dated 8th June 2007 regulating the rules on the information disclosure in Ho Chi Minh City stock exchange (HOSE); Decision 322/QD-TTGDHN dated 9th November 2007 governing information disclosure in Hanoi Securities Trading Centre; Decree 85/2010/ND-CP dated 2nd August 2010 on administrative penalty related to securities and security markets to replace the Decree 36/22007/ND-CP dated 8th March 2007; Law on the Amendment of and Supplement to

articles in the Law on Securities 2006 dated 24th November 2010 (came into effect on 1st July 2011); and Circular 52/2012/TT-BTC issued on 5th April 2012 on information disclosure in the security market.

Thus, the first Law concerning the security market was not issued until 2006 even though the security market had already started operation in 2000. The significant delay in the enactment of the Law and regulations reduced the effectiveness of the Law and created opportunities for disclosure manipulation and information asymmetry. Also, the Law did not distinguish the public from the listed companies. What is more ironical is the fact that the penalty for violations is unusually low and relaxed in comparison with the benefits that corporations could enjoy from the breaches.

Finally, the legal boundaries and accounting standard in Vietnam are still not strict enough to regulate the uniform statements from corporations. The financial results are considered to be usually manipulated despite being audited by auditing companies. According to the Report of the Vietnam Association of Certified Public Accountants No 191-2013/VACPA dated 25th June 2013, the number of auditing companies in Vietnam is only 155 with 4 foreign companies, 5 joint venture companies, 145 Joint-stock companies, and 1 merged company while there are 106,616 enterprises according to the National Statistical Report in 2013. It can be questioned whether the auditing quality of the financial statements is reliable.

2.4 State of competition among Vietnamese commercial banks

There is a rich literature on the relationship between the market structure, firm conduct, and performance (the so-called SCP paradigm of thinking on firm competitiveness). The essence of the literature is that firms' financial performance depends on their conduct, that is, their output and pricing decisions, which in turn depends on the structure (usually measured by the number of competing firms, their market share, and the substitutability of their products) of the market within which the firms operate. However, insofar as the link between competition among banks to the financial distress possibility of the firms is

concerned, the literature is still vague, indirect and do not provide explicit theoretical guidance on the directions of the relationship. Empirical studies on this relationship, especially in the context of the developing countries, are even rarer in the literature.

One line of argument is that as the competition among banks increases, the rate of financial distress for the borrowers may also increase, which leads to a rise in the default risk possibility. In research on deposit insurance, risk, and market power, Keeley (1990) stated that increased competition might have reduced the banks' incentives to act prudently about risk-taking. Therefore, the assessment and control process to the projects of the borrowers may be less carefully conducted, which consequently leads to the higher possibility of financial distress. In support of this argument, Peterson and Rajan (1994) argued that competition among the banks not only attracts riskier applicants due to the adverse selection effect but also influences borrowers to choose more hazardous projects due to the incentive or moral hazard effect. In subsequent research, Petersen, and Rajan (1995), the monopolistic bank was found to experience the higher possibility of offering more credit and at lower rates to immature or distressed firms compared to the other types of creditors. They also pointed out that the incentive of helping those types of firms at difficult times is to build up and maintain the relationships in the future to prevent the customers from going to the competitor banks. However, the banks cannot expect the firms' surplus shortly and will be forced to charge a higher premium to cover the risks which may lead to the excessive burden to the firms and increase the possibility of financial distress.

The issue of banking competition was also examined in the research conducted by Hellman et al. (2000). He considered the increasing competition among banks as the consequence of financial market liberalization. The competition, according to Hellman, will erode profits; lower profits imply lower franchise values, which lead to lower incentives for making good loans, increasing moral- hazard problems. The insufficient control and monitoring process from the banks will allow corporations to find it desirable to gamble. Similarly, in their book concerning comparison among different financial

systems, Allen and Gale (2000) found that competition among financial intermediaries may be undesirable because it can undermine the intermediaries' ability to provide inter-temporal smoothing as well as increasing the possibility of financial distress of the borrowers. Repullo (2003), in his study about market power and risk-taking in banking, confirmed that bank competition eroded the present value of banks' future rents and reduced their incentives to behave prudently which led to the higher possibility of financial distress of the borrowers after receiving the fund from banks.

Even though a large body of evidence shows a positive relationship (though indirectly) between the extent of banking competition and the financial distress possibility of the firms, counter-arguments are also abundant. One of the noticeable studies is the research featuring moral hazard on the part of entrepreneurs based on a model of bank risk-taking designed by Boyd and De Nicolo (2005). In their study, the authors pointed out that the declining competition in the market created incentives for the banks earning more rents in the loans market by charging higher loan rates using their market power. As a consequence, the borrowers will have to confront with higher interest costs, which lead to lower profits and the possible result of adjusting the business in riskier investments. The lack of competition among banks can lead to socially undesirable outcomes in the forms of failures, runs, and panics as a result of moral hazard (as stated in Stiglitz and Weiss, (1981)). The prediction of the mentioned model was explored and supported by the later empirical research of Boyd et al. in 2006.

A further study on the risk-shifting effect identified in the research of Boyd and De Nicolo (2005) was explored by Repullo and Martinez-Miera (2007) by allowing imperfect correlation across individual firms' default probabilities. They found a U-shaped relationship between banking competition and risk-taking. That is, as the number of firms increases, the likelihood of bank default first declines and then starts to increase once a certain threshold of competition has been reached.

Another research conducted by Koskela and Stenbacka (2000) showed that greater competition among banks could lead the corporations to remain solvent and repay their loans. Lending support to this conclusion, De Nicolo and Loukoianova (2007) presented a model of the banking industry with heterogeneous banks that predicts the relationship between banks' risk of failure, market structure, bank ownership, and banks' screening and bankruptcy costs. The model shows that there is a reliable and significant positive relationship between market concentration, which is commonly interpreted to be negatively associated with the level of market competition, and the risk of bank failure. The negative link between the bank competition and financial distress possibility of the corporations is also drawn in the study of Jimenez et al. (2007) in which the relationship between these variables was tested to find out whether it is U-shaped or linear.

Therefore, there is a certain degree of ambiguity in the literature discussion of the relationship between banking market competition and corporate financial distress. The literature so far does not provide clear-cut conclusions about whether the rising level of banking competition leads to higher or lower levels of corporate financial distress. Therefore, insofar as the Vietnamese situation is concerned, this relationship remains an unexplored empirical matter.

2.4.1 Legal basis for identifying the unhealthy competition

To detect unhealthy competition among commercial banks in Vietnam, we refer to the definition of unhealthy competitive practices that are adopted in two primary legal documents: the Competition Law No. 27/2004/QH11 dated 3rd December 2014 and the Law for Commercial Banks and Financial Institutions dated 16th June 2010.

The Competition Law No. 27/2004/QH11 dated 3rd December 2014 defines unhealthy competition as the activities that present conflicts to a healthy business ethical standard and have the possibility of harming the government’s benefit and/or the legal rights of other business institution(s) and/or consumer(s). Article 39 suggests that unhealthy competitive activities include:

- Intention to misguide
- Unethical access to confidential business information
- Undue business pressure
- Rumor creation
- Harmful activities to other business institutions' operations
- Unhealthy competitive advertisement
- Offers with unhealthy competitive purposes
- Discrimination
- Illegal multi-level marketing
- Other unhealthy competitive activities

Articles 40 to 48 of this Law also provide detailed guidance to identify harmful competitive activities.

Article 9, sub-article 2, Law for Commercial Banks and Financial Institution dated 16th June 2010 bans all the unhealthy competitive activities that have harmful effects on the monetary policies of the government, safety of the whole system and the government's benefit and/or the legal rights of other business institution(s) and/or individual(s).

2.4.2 Unhealthy competition in credit activities

One example of uncompetitive practice by the banks is that commercial banks violated the State Bank's regulation on the interest rates. At the beginning of 2008, Vietnam had experienced a high inflation rate, and the State Bank had to apply tightened monetary policies. Therefore, commercial banks experienced difficulties in liquidity. The inter-bank offered rate was continuously raised and reached a peak of 14% on 11th June 2008. As the maximum interest rate must not be more than 150% of the interbank offered rate, commercial banks could only apply a maximum interest rate of 21% for the credit issued. However, the commercial banks still charged higher interest rates through private extra cost collection, for example, capital arrangement fee, collateral evaluation fee, collateral

management fee, financial advice fee, credit redepositing with a low-interest rate, an investment fee, commission fee and charges on repayment before the due date, etc.

Secondly, commercial banks issued sub-prime loans without any conditions, collateral or adequate legal documents, which increased the possibility of credit default. The commercial banks also unofficially issued credits to customers by issuing a credit card with an expanded limit.

Third, commercial banks usually offered a wide range of credit to close customers (State Bank's report data). One example is the credit default of 356 billion VND by An Khang Joint Stock Company as the Head Director is the close customer of several commercial banks including Techcombank-Can Tho branch, An Binh Bank, DongA Bank, Vietnamese development bank- Can Tho branch. This case is investigated by the State Bank of Vietnam.

Fourth, commercial banks issued excessive credits over the allowed amount. In 2010, the State Bank of Vietnam regulated all banks with the growth rate of credit issued of no more than 30%. In 2011, this maximum level was set to be 20%. In 2012, this level was lowered to 16%. However, according to the annual report of State Bank, several commercial banks still exceeded the regulated level by buying corporations' bonds and stocks and buying and selling debts.

The State Bank of Vietnam investigated the competitive conduct of 60 commercial banks and branches in 2013. The following tables summarise the main findings of the survey:

Table 2.17 Proportion of 60 Vietnamese banks involved in unhealthy competition (State Bank's investigation 2013)

No.	Time	Proportion
1	Before WTO participation	64.8%
2	After WTO participation	29.6%
3	Others (unable to specify the exact time)	5.6%

As can be seen, before participating in WTO and having to obey the WTO's rules and obligations, unhealthy competition among banks in Vietnam is a crucial issue. The restriction of WTO helps to reduce this problem significantly. (Data below based on Vietnamese State bank's reports over the years).

Table 2.18 Unhealthy competitive activities

(State Bank's investigation 2013)

No.	Unhealthy competition activities	The proportion of cases (%)
1	Misguide	63
2	Business confidential information approach	51.9
3	Business pressure	53.7
4	Rumor creation	77.8
5	Harmful activities to other business institutions' operations.	40.7
6	Unhealthy competitive advertisement.	75.9
7	Offers with unhealthy competitive purposes.	100

8	Discrimination.	24.1
9	Illegal multi-level marketing.	22.6
10	Other unhealthy competitive activities.	62.3

The above table is conducted based on the State Bank's investigation in 2013 with the data, including 60 commercial banks. The total amount is much more than 100% since banks under investigation conducted more than one unhealthy competition activities. Since the law code for banking activities is not adequately strict in Vietnam, almost all the banks provide offers to customers with harmful competitive purposes as well as using unhealthy competitive advertisement on media. Furthermore, each bank has their credit assessment systems to ensure the revenue of themselves. Hence, the creditability of those systems is not guaranteed. All the confidential information that may harm the credit ranking of corporations can be hidden to encourage the amount of credit issued. Consequently, there is indeed a need to have a uniform assessment system for Vietnamese corporate credit quality.

Table 2.19 Objective causes of unhealthy competitive activities (1 is the lowest level, 6 is the highest level)
(State Bank's investigation 2013)

Objective Causes	Level (proportion of each level)					
	1	**2**	**3**	**4**	**5**	**6**
1. Lack of legal regulations	31.8	15.9	11.4	15.9	15.9	9.1
2. Objective characteristics of banking industry	9.3	4.7	14	23.3	20.9	27.9
3. Young credit market	15.6	20	8.9	24.4	11.1	20
4. Inadequately strict management by the Government.	27.9	16.3	7	9.3	27.9	11.6
5. Limited awareness of the borrowers	2.5	22.5	25	17.5	17.5	15
6. Inadequately strict sanction	13.5	10.8	32.4	10.8	10.8	18.9

Figure 2.18 Objective causes of unhealthy competitive activities (%)

(State Bank's investigation 2013)

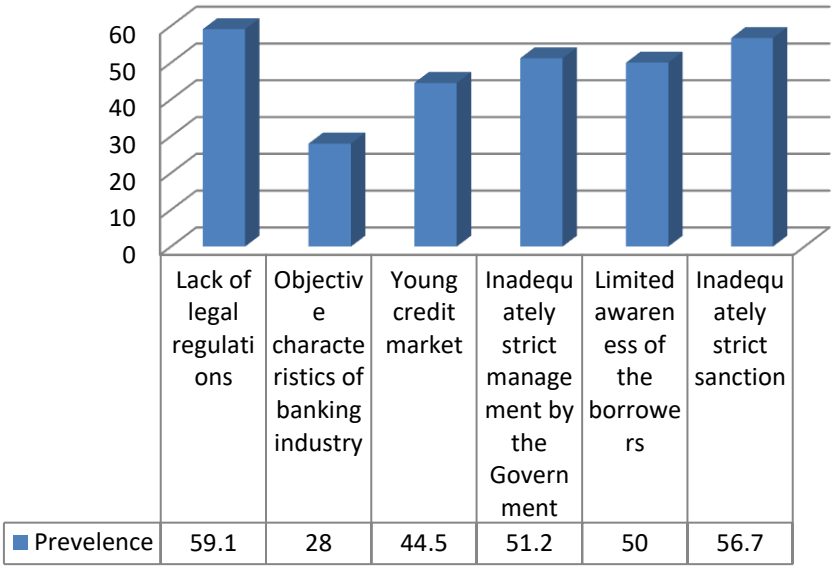


Table 2.20 Subjective causes of unhealthy competitive activities (1 is the lowest level, 4 is the highest level)

(State Bank's investigation 2013)

Subjective causes	Level (with %)			
	1	**2**	**3**	**4**
1. Limited in competitive advantages	46.7	26.7	22.2	4.4
2. Business strategies	14.9	40.4	25.5	19.1
3. Lack of internal regulation	19.1	12.8	40.4	27.7
4. Limited management ability	17.5	15	12.5	55

From table 2.19, 2.20, and Figure 2.18, we can blame the legal system for inadequate sanction that leads to unhealthy competition among Vietnamese banks. The tables and figure show that Vietnamese commercial banks quite often engage in uncompetitive practices such as manipulating the interest rates and charges to attract customers (even

sub-prime customers) at the potential consequence of raising the default risk. Therefore, how to effectively monitor and regulate the conduct of the commercial banks remains a significant policy challenge for the Vietnamese government.

2.5 Macroeconomic instability

Generally speaking, there is no official definition for macroeconomic instability, especially in an emerging economy as Vietnam. The term macroeconomic instability is usually used to describe the fluctuation in one or more macroeconomic factors such as inflation rates, growth rates or monetary policies, etc. As macroeconomic stability is the prerequisite of a growing economy, both internal and external balance of the macro-economy must be ensured. The inner balance can be broken in situations of the high inflation rate, high unemployment rate, and low real GDP growth. The external imbalance occurs when there is an imbalanced current account with a gap between investment and saving. The macroeconomic instability happens when internal imbalance and/or external balance happens (Trinh Quang Long et al., 2009).

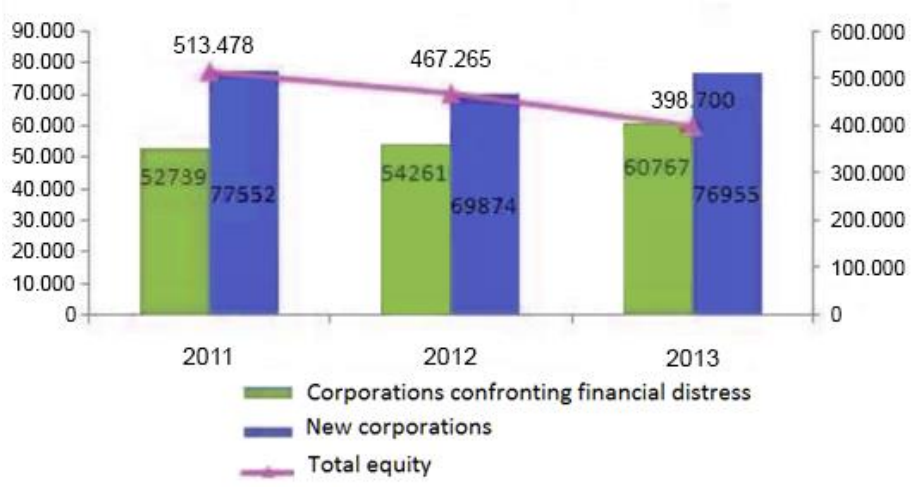
Macroeconomic instability arises from numerous macroeconomic factors and is usually accompanied by severing financial distress for corporate firms. The Great Depression in the period from 1929 to 1933 started with a substantial reduction in real GNP in several countries. The high unemployment rate, difficulties in liquidity, unexpected increases in bad debts, and the spread of bankruptcy can be listed as some of the consequences. In America, productivity fell by 54% in 1932 compared to 1929. As various corporations went bankrupt, the unemployment rates reached the level of 25 to 30%. The unemployment rates of America's commercial partners were also very high at 25% for German, 20% for Britain and 27% for Canada. In the debt crisis in the 1980s of North American countries, the inflation rates reached an enormously high level such as 80% in Mexico in 1982, 500% in Brazil in 1986 and 1700% in Peru in 1989.

The Asian financial crisis in 1997 started in Thailand with weak macroeconomic policies. Other Asian countries, including Malaysia, Indonesia, Korea, Japan, Singapore, and

Russia soon began to be contaminated, leading to the bankrupt corporations and depreciated currencies. As trying to balance the current account, public debts were overused by most countries. The short term debts of Thailand increased from more than 24 million USD in 1990 to more than 45 million USD in 1996. In 1998, the amount of debt of Indonesia was 137.45 billion USD. This level is 70.18 billion USD in Korea.

In Vietnam, the unstable macroeconomic condition has many drawbacks to the Vietnamese corporations, except the big ones with the active support of government due to the distinctive character of the economy under the government's control. According to the Decree 56/2009/NĐ-CP dated 30th June 2009, most of the corporations are small and medium-sized entrepreneurs as 95% of Vietnamese corporations have equity less than 100 billion VND (National Statistic Department's report 2015). As those corporations encountered difficulties in decreasing their operation scales in unfavorable macroeconomic conditions, and because they depend mostly on bank loans as primary financial sources, the lack of financial support together with the lack of operational diversification put those corporations under severe financial distress. Considering the year of 2013 in which the macroeconomic factors were reported to be unstable (Vietnam State Bank's report 2013), according to the release of National Statistic Department, 60,737 corporations encountered financial distress (increase by 11.9% compared to 2012) including 9,818 corporations going bankrupt (increase by 4.9% compared to 2012), 10,803 suspended corporations (increase by 3507% compared to 2012) and 40,116 corporations under exceptional control (increase by 8.6% compared to 2012).

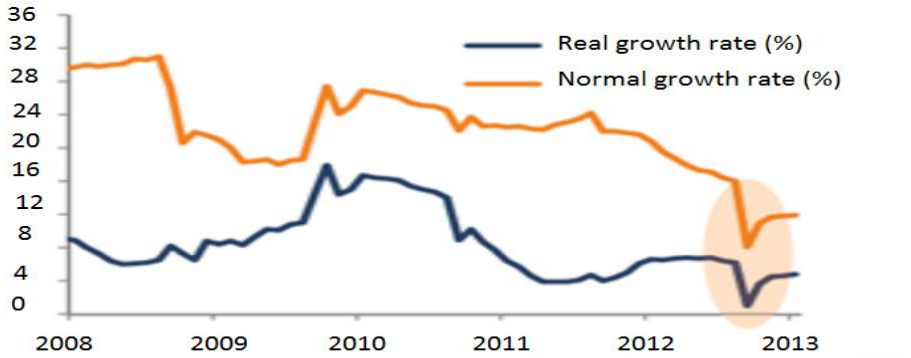
Figure 2.19 New corporations from 2011 to 2013



Source: Vietnam National Statistic Department Report 2013

As can be seen from the chart above, the macroeconomic instability also makes new corporations hesitate to enter the market as the total equity invested in decreased remarkably to 398,700 billion VND in 2013. Since the number of new corporations increases slightly, the average equity of newcomers seemed to decline enormously. Furthermore, the sales growth rate of corporations also dropped to a deficient level in 2013.

Figure 2.20 Vietnamese GDP growth rate



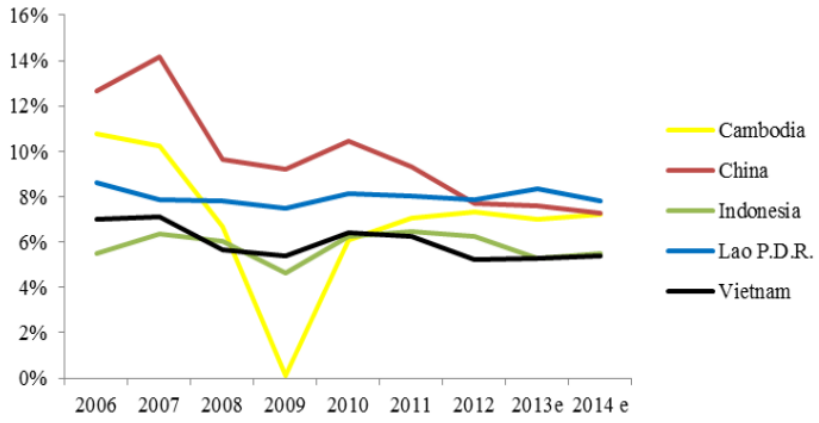
Source: World Bank Report for Vietnam 2013
(Vietnam State Bank)

Since sales remained in unfavorable conditions, corporations focused on reducing inventories instead of expanding their operations. Therefore, credit growth rates were also low.

Macroeconomic instability in Vietnam

In the period from 2005 to 2007, Vietnam experienced an impressive economic development with the average growth rate of 8% (Vietnam National Statistic Department annual reports). Following the international financial crisis in 2008, despite the noticeable recovery pace, the Vietnamese economy encountered various difficulties as the growth rate decreased to 6% annually. In 2011, 2012 and 2013, the growth rate of Vietnam was much lower than other Asian countries such as China, Thailand, Cambodia, Indonesia, Lao, and Myanmar.

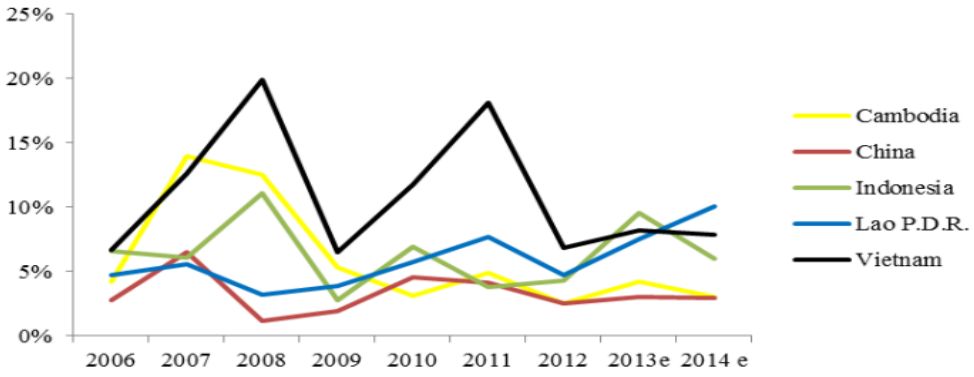
Figure 2.21 Economy growth rate of Asian countries



Source: World Economic Outlook 2014

According to the IMF's forecast, the Vietnamese economic growth rate in 2016 is expected to be only 5.5%. In 2011, Vietnam suffered a high inflation rate of 18.13% because of loosening monetary policies and consequently became the highest inflation level among Asian countries.

Figure 2.22 Inflation rate of Asian countries

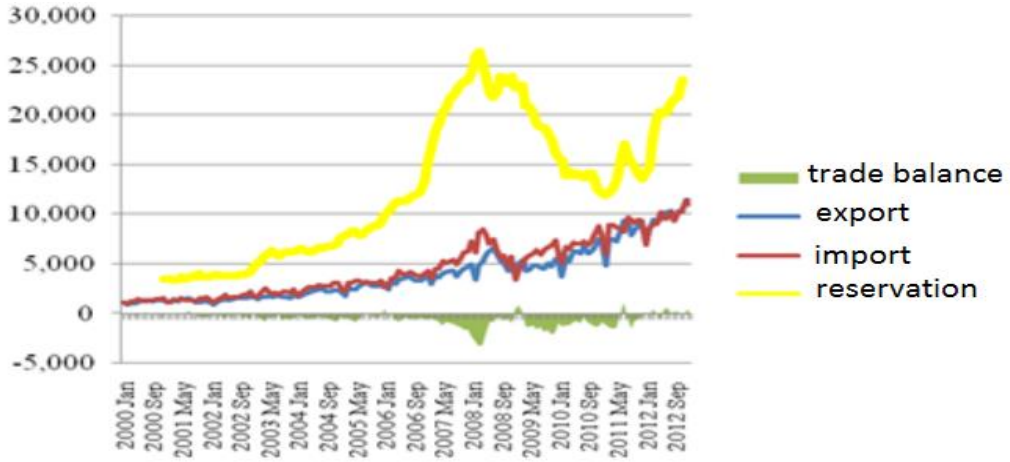


Source: World Economic Outlook 2014

To control high inflation rates, according to the Decree No 11/ NQ-CP dated 2nd May 2012, the government decided to tighten monetary policies and raised the interest rate to high levels. As a result, the amount of credit issued decreased substantially leading to difficulties in approaching financial sources of corporations, and the aggregate demand fell. Due to the pressure from high costs and competitive selling prices, many corporations had to shut down.

Since the participation in WTO in November 2006, Vietnam usually experienced trade deficits since the number of imports was noticeably larger than exports. Consequently, the foreign currencies reserve was reduced, which led to the depreciation of VND. Besides, due to the fierce competition from imported goods, sales by domestic corporations were also depressed.

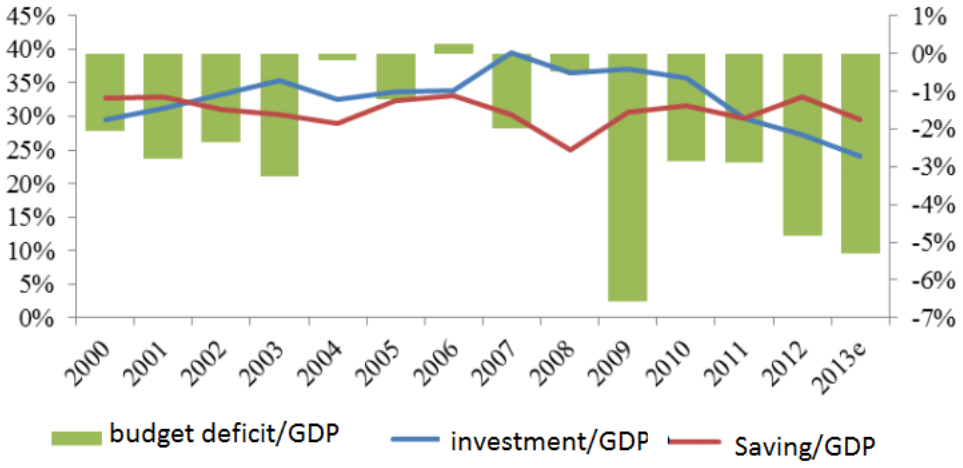
Figure 2.23 Vietnamese trade balance



Source: Vietnam National Statistic Department Report

The macroeconomic conditions were particularly unstable during the period from 2007 to 2010 because of the imbalance between savings and investment. The budget deficit in this period was high and remained at a high level in the subsequent years.

Figure 2.24 Vietnamese fiscal balance



Source: World Economic Outlook 2013

2.6 Summary

This chapter has presented an overview of the recent macroeconomic and market conditions that underpin the corporate conduct and performance in Vietnam. In general, since the open-market economic reform that started in the 1990s, the Vietnamese economy has become more integrated into the world economy. This integration has brought about significant opportunities and benefits for funding, technology, market access, growth, as well as risks and volatilities. The Vietnamese macroeconomy has enjoyed considerable growth rates and also volatilities in recent years. The economic structure has changed towards services and manufacturing dominance, a development that paves the way for the banking and finance services to flourish. Indeed, the banking and financial services sectors have enjoyed a rapid growth process with substantial growth in both financial assets and liabilities. The non-financial corporations have also been exposed to increasingly fierce competition both at home and abroad. As a result, the financial performance of Vietnamese firms has become more volatile. To ensure that both the banking and financial institutions as well as the non-financial corporate firms operate in a fair and transparent environment, the Vietnamese government and the Central Bank have issued numerous decrees and established a credit rating system for the corporate firms. However, formal assessments of the credit ratings of Vietnamese firms are still at the nascent stage, and this study aims to contribute in this regard.

CHAPTER 3: LITERATURE REVIEW

This chapter provides a comprehensive review of the relevant literature on the definition, measurement, and determination of financial distress and credit ratings of corporations in both the developed and developing countries.

3.1. Analytical methods for financial distress measurement

Risk is one of the most critical issues for all the stakeholders of the business, including investors, debtors, and managers. There are many types of risks that a company has to confront. According to Andrew, H. (2002), the primary examples of risks for business include strategic risk, business/financial risk, program and project risk, operational risk and technological risk. Before understanding the default risk, which is the more severe type of credit risk, it is necessary to understand its literal components which involve: "risk" and "default."

As the financial markets become increasingly sophisticated in every aspect, the need for understanding, measuring, and managing risk is ever more urgent. All the financial decisions related to this issue have to be based on the risk measurement. However, in the absence of the definition of "risk," it would be vague what precisely those measurements reflect. Furthermore, risk assessment itself may become a "risky business" if the definition itself is ambiguous. "Risk" contains a wide range of meanings, depending on the perspectives of the analysts and on the fields of investigation.

Generally speaking, "risk" is the potential that a chosen action or inaction can lead to an undesirable outcome(s) (Concina, 2014). The undesirable outcome(s) can include an unexpected loss. Moreover, the chosen action(s) also have potential influences on the existing result (s) or the forthcoming outcome(s). Even the unexpected losses themselves can be called "risk." Consequently, to have a more in-depth look inside the term "risk," it is essential to have an analysis of all the related aspects of the past, present, and the future.

The definition and measurement of risk have evolved over the centuries. The noticeable milestones can be marked including the introduction of bond duration in 1938, Markowitz mean-variance framework in 1952, Sharp's capital asset pricing model in 1963, Multiple factors model in 1966, Black-Scholes option pricing model in 1973, risk-weighted assets for banks in 1988, Value at risk in 1993, Risk Metrics in 1994, Credit risks Metrics and Credit Risk+ in 1997, the integration of credit risk and market risk in 1998 and risk budgeting in the same year of 1998.

In the scope of this research, risk is not analyzed in the general sense. The research will focus on a typical kind of risk which is considered to be essential in finance. In finance, the definition of risk may be broader and different from the general definition of 'risk' in other fields. Risk, from investors' point of view, is the likelihood that return received on investment is different from the expected return. Therefore, this definition of risk is not restricted to the adverse outcomes only because the returns may be either lower or higher than the expected returns. The former is termed downside risk while the latter is upside risks, which are both considered in measuring financial risk.

Financial distress measurement has a long history of development with many related lines of research. A substantial amount of literature reviews can be found in Zavgren (1983), Jones (1998), Agarval and Taffler (2007) and Bellovary, Giacomino and Akers (2007), to name a few. Before the development of quantitative methods, in America, various well-known companies were established to provide qualitative assessments and information of the creditworthiness of particular firms such as the forerunner of the famous Dun & Bradstreet, Inc which was organized in 1849 in Cincinnati, Ohio to supply independent credit investigations. Roy A. Foulke (1961) provides the early systematic assessments and discussions about the development of credit agencies and financial measures of corporates' performance. The most famous qualitative method is the expert system in which the corporations are evaluated against their distinctive characters including the reputation, its willingness to repay, its repayment history and the age of the firm; the capital of the corporation; the capacity to repay which reflects the volatility of the

borrower's earning; the collateral and the business cycle conditions. The qualitative assessment, however, is not sufficiently informative. Additionally, the expert system faces the issue of consistency as it is hard to determine the essential common factors to analyze across different types of borrowers. Another problem confronting the expert system is subjectivity as it is challenging to identify the optimal weights to apply to the chosen factors. Therefore, more formal methods for quantifying business failure have been subsequently developed.

Insofar as quantitative methods are concerned, the roots of financial distress modelling can be traced back to the early 19th century with Woodlock's book (1900) named The Anatomy of Railroad Report in which financial data was used for the first time to assess the corporate value in the section "The percentage of Operational Costs to Gross Retained Earnings" (Imazadeh, Maran-Jouri, and Sepehri, 2011). More than one century later, Lubben (2004) used the railroad bankruptcy with the same timeframe of 1900-1937 as evidence to develop a bankruptcy model that is applicable to strong owner-manager companies. According to Kevin (2006), in the early thirty years of the 19th century, there were raging debates among academics about the effectiveness of financial ratio analysis as compared with financial market analysis. The very early studies about financial distress of the corporations dated back to the 1930s. In 1930, organized studies using financial ratio analysis in bankruptcy prediction was conducted and funded by the Bureau of Business Research (Bellovary et al., 2007). In these studies, after considering 24 groups of financial ratios of 29 firms to determine common characteristics of failing firms, 8 were selected to be the indicators of firms' financial distress (including Working Capital to Total Assets, Surplus and Reserves to Total Assets, Net Worth to Fixed Assets, Fixed Assets to Total Assets, the Current Ratio, Net Worth to Total Assets, Sales to Total Assets and Cash to Total Assets). Bellovary et al. (2007) provides a historical summary of bankruptcy prediction studies and cites an earlier comparative study by Fitzpatrick (1932) on healthy and solvent firms, which leads to the results of unfavorable Net Worth/Debt and Net Profits/Net Worth ratios in cases of insolvent firms. These two ratios

are considered to be the most predictive ones besides the potential predictive capability of Current and Quick Ratios.

R.F. Smith and A.H. Winakor (1935) reveal that failing firms experienced noticeably different ratio measurements of financial distress compared with continuing firms. They analyzed 183 American firms that failed between 1923 and 1931 which represented 25 percent of the massive industrial failures in this period with capital in excess of $100,000. The study shows that the four ratios including current ratio, quick ratio, working capital ratio, and worth-to-debt ratio had declined persistently for an appreciable period before the eventual failure of those firms occurred. Among the four ratios, the current ratio was the weakest in predicting failure as it declined continuously for only three years before failure. However, the issue does not exist when the sample was broken down into smaller industry groups.

Similarly, in a study covering over 900 firms to compare the discontinuing firms with the continuing ones, Merwin (1942) confirmed the predictive strength of Net Working Capital to Total Assets, Net Worth to Total Debt and Current Ratio. Merwin' study (1942) is subsequently expanded by Chudson (1945) who provides further evidence of ratio clusters regarding the possibility of firms' profitability being maintained. The research of Chudson is then followed by Jackendoff (1962) in which the Current Ratio and Working Capital/ Total Assets are found to be indicative of potential insolvency. Subsequently, Hickman (1958) paid special attention to the financial ratios of corporations with large assets and discovered that such firms exhibited difficulties in meeting the fixed indebtedness obligations.

Many studies have examined firms' operating conditions before financial difficulties on the basis of the posterior analysis of financial ratios. One of the most prominent examples is the study of Beaver (1966) that compares a list of individual ratios for failed firms with that for a matched sample of surviving firms. Beaver proposed two analytical methods, namely the profile analysis and the univariate discriminant model on the basis of

examination of single variables. Based on the observed evidence for five years before the occurrence of corporate failure, Beaver accurately classified 78% of his sample before their actual failure; he came to the conclusion that ratio analysis can be useful in the prediction of corporate failure. This conclusion was supported by the result of M. Tamari's research (1966) in the same year with the attempt to weight ratios arbitrarily. The risk index model of Tamari's is just a simple and intuitive point system including various ratios with higher total points indicating a better financial situation of the firm. The advanced aspect of this model compared to the previous ones is that the points are located appropriately, so the most critical ratios have higher weights.

The work of Beaver (1966) is then explored again by Wilcox (1973). In this research, Wilcox provides an explanation of Beaver's result using a stochastic process and further builds a binomial model of bankruptcy prediction. Wilcox's model achieved a prediction accuracy of 94% and 88% one year and four years prior to the actual occurrence of a corporate failure. This record compares favorably with the 71% accuracy over all time frames in Beaver's study.

Ohlson (1980), who is believed to be the first to develop a model using Multiple Logistic Regression, differentiates his study from most of the previous ones by creating a new model rather than validating or trying to improve the previous studies. He questions the validity of the basic assumptions of these predictive models. He raises consideration of the statistical requirements imposed by the model. Ohlson also considers the time bias that is contained in the financial statements since in reality, in spite of being released one year before bankruptcy, they are provided after the official filing for bankruptcy protection of the corporations is completed. Ohlson considers this fact as an explanation for the discrepancies in the predictive ability of the previous models in one year ahead predictions.

A significant criticism of the early risk index model is that the choice of weights for different financial ratios is subjective. Moses and Liao (1987) present another risk index

model in which optimal cutting points are determined for each of the composing ratios based on univariate analysis as in Beaver's study. The difference lies in the creation of a dichotomous variable for each of the ratios and the assigned score of one in the case where the value of the firm's ratios exceeds the optimal cut-off point. The sum of the values of the dichotomous variables generates the index with a higher score indicating a financially healthier situation.

Generally speaking, at this early stage of financial distress analysis, most of the research is based on the accounting ratios which are categorized in different groups covering the firm's profitability, liquidity, solvency, management ability, etc... Their order of importance, however, is still vague since different studies cited different groups of ratios as the most important ones in predicting the financial health of the firms. The inconsistency among studies calls for new methods which can efficiently discriminate the unhealthy corporations from the continuing ones. In addition, the financial difficulties prediction methods based on single variable analysis as in Beaver and Tamari's studies only consider one financial ratio at a time. In other words, the financial ratios are analyzed individually. Consequently, if different ratios or groups of ratios are used for prediction for a firm, a conflict for a different conclusion may appear. The solution to this issue is multivariate analysis.

Altman (1968) pioneered the multi-discriminate analysis (MDA) method. His Z-score model is a multivariate linear discriminate function with five financial ratios containing information about liquidity, cumulative profitability, productivity, market dimension, and sales-generating ability of the firms. This model proves to be significantly better than the single variable discriminant model in predictive power in predicting bankruptcy as Altman's result was 95% effective in-sample prediction of actual bankrupts.

Several caveats about the MDA method, however, are noteworthy. It should be noted that there is a possibility that insignificant variables on the univariate basis supply significant information in the multivariate context, or some coefficients had unexpected, counter

institutive signs (Ooghe and Verbaere, 1985). Deakin (1972), in a study on the discriminant analysis of predictors of business failure, examined Altman's model and showed that the predictive ability of the model declined rapidly as the number of years before failure increased. Surprisingly, the discriminant model even led to more misclassifications than Beaver's dichotomous test. Although Taffeler (1963) in a Z-score model with UK data predicted 99% of corporate failures one year before the failure, it is noted by Altman himself (1977) that MDA reduces the analyst's spatial dimensionality by using cut-off points. Although MDA is called a "continuous scoring system, a discriminant score is an ordinal measure allowing the ranking of the firms. It should be stressed that the coefficients of the MDA are unable to indicate the relative importance of the composing variables; neither can such coefficients be interpreted as the coefficients in a regression. (Altman (1968); Blum, (1874); Joy and Tollefson, (1975); Taffler, (1983)). According to Zavgren (1985), the attempt to assess the role of the individual coefficient is inappropriate given the purpose of the MDA.

Furthermore, the MDA method used by Altman produces linear regression combination of various independent variables on the assumptions of multivariate normal distribution and equal variance matrices for every independent variable involved. If the sample data cannot meet all the assumptions, the result may be suspicious. The assumption of multivariate normality is one of the assumptions which are violated the most (Deakin (1976); Taffler and Tisshaw (1977); Barnes (1987). The obvious consequences are the significant bias in the error terms in statistical tests (Eisenbeis (1977); Richardson and Davidson (1984); Mcleay and Omar (2000)). Another issue with the MDA is the assumption of multicollinearity. This issue is controversial. Despite the fact that in some studies, the assumption of multicollinearity is considered to be irrelevant (e.g., Eisenbei (1977); Altman and Eisenbeis (1978)), other researchers point out that the violation of this assumption may cause unstable parameter estimation and misleading model accuracy (Edmister, (1972); Joy and Tollefson (1975); Joy and Tollefson (1978), Ooghe et al., (1994); Doumpos and Zopudinis, (1999)).

In spite of its drawbacks, primarily due to its ease of application and interpretation, the MDA and the subsequent Zeta score models have remained the models of choice for bankruptcy prediction for many years (Keasey and Watson (1987), Wood and Piesse (1988)). Altman et al. (1977) adjusted the original Z-score model into a "better performing model" named Zeta analysis, but due to commercial reasons, details of the model are publically unavailable. Until the 1980s, the MDA method dominated the literature on business failure prediction. After that, although the use of MDA has decreased (Dimitras et al., (1996)), it remains an accepted standard technique and baseline for comparative studies (Altman and Narayanan, 1997)).

The use of financial ratios in predicting financial distress is also promoted by the American Federal Deposit Insurance Corporation Improvement Act in 1991 in which the six-part rating system named CAMELS is used to indicate the safety and soundness of the institution. CAMELS evaluates banks and firms regarding Capital Adequacy, Asset Quality, Management expertise, Earning strength, Liquidity, and Sensitivity to market risk. Although the system can provide regulators with essential information, Cole and Gunther (1995), in their review of the system, report that CAMELS rating decays rapidly. It is also necessary to stress that the accounting ratios-based models do not control the changes occurring in the information content of accounting data because of the recession (Richardson et al., 1998)). The accounting ratios also exclude external information which is fundamentally essential such as interest rate, business cycle, the availability of credit, and the prospects of the industry. Swanson and Tybout (1988) point out that macroeconomic and industry-specific variables including changes in the interest and the occurrence of credit shocks may have impacts on business failure. Although the internal variables may have already captured the effects on the corporate performance of external variables, explicit inclusion of the latter variables in the analysis may add additional power in explaining and predicting corporate failure.

Following Beaver and Altman, the statistical methodologies in financial distress prediction have developed rapidly. For example, the quadratic discriminate analysis is

proposed for heterogeneous variance-covariance matrices while the linear regression analysis is for homogeneous variance-covariance matrices only. The quadratic MDA model can help to ensure the assumption of equal dispersion matrices which is rarely satisfied by the data in the standard MDA research resulting in biased significant tests (Joy and Tollefson, 1975; Eisenbeis, 1977; Zavgren, 1983). However, quadratic MDA is complex and outperform linear MDA only in the case of large samples, a small number of independent variable and substantial difference in dispersion matrices (Taffler, (1982)). Moreover, both linear discriminant analysis and the quadratic version are sensitive to deviation from multivariate normality (Laitinen and Laitinen (2001), Richardson and Davidson (1983), Karels and Prakash (1978), Zmijewski (1984)).

Alternatively, the Logit model does not assume multivariate normality. Instead, it gives a crisp relationship between explanatory and response variables based on statistical data. One of the first pioneers of the Logit linear probability model is Ohlson (1980). Still based on the financial ratios of the accounting statement, Ohlson tries to describe the relationship between the financial status of the corporations and their accounting ratios using Logit function which transforms the dependent variable of financial distress probability into a continuous one to ensure the suitability of linear regression analysis. He suggests that the Logit model is "more rational than the MDA model for the prediction." Continuing to develop logistic function in financial distress prediction, in research issued in 1985, Zavgren adopts factor analysis for selecting the independent variables in the Logit model. Tseng and Lin (2005) propose a quadratic interval model that combines the Logit model and quadratic interval regression to solve "a fuzzy relationship between explanatory and response variables" to provide an appropriate tool for financial distress prediction based on practical application to the bankruptcy of UK companies. Their result indicates that the new Logit model, with the combination with quadratic programming approach out-performs the MDA, improves the financial distress prediction, and provides more information. The Logit model does not require the independent variables to follow the normal distribution and equal covariance as well as offering the flexibility of allowing

a non-continuous dependent variable. It, however, still requires non-multi-co-linearity among independent variables. The Logit model also involves the consideration of the cost of type I and type II errors when defining the optimal cut-off point. Steele (1995) considers this issue as the subjectivity of misclassification costs.

In practice, some researchers such as Zavgren (1985), Koh (1992), and Hseih (1993), attempt to minimize the total error and consequently implicitly assume equal misclassification costs. Last but not least, even though the logit function does not require the condition of normal distribution, the study of McLeay and Omar (2000) still shows evidence of the model' sensitivity to non-normal distribution at an extreme value. Despite the mentioned drawbacks, the Logit model is still used widely in the last decade with the combination and comparison of different methods. Kolari et al. (2002) have developed an Early Warning System based on the logit analysis and Trait recognition for the cases of large American banks. The system efficiently classified more than 96% of the failed bank one year before the failure events and more than 95% of the two-year timeline. The study concluded that regarding type I and type II errors, the trait recognition outweighs Logit model. In 2004, Jons and Hensher (2004) proposed the comparison between the mixed logit model and multinomial Logit models for firm distress prediction and concluded that the Mixed Logit obtained significantly better predictive accuracy. By combining Discriminant analysis, logistic regression, Probit regression, and principal component analysis, Canbas et al. (2005) presented an integrated early warning system (IEWS) to explain the changes in the financial condition of banks and detect the banks with serious problems. According to their conclusion, the IEWS experiences more prediction ability compared to other models.

The subsequent studies have tried to find out the superior methods for financial distress prediction to solve the issues in the previous models. In one of the most current studies, Serrano- Cinca and Gutierrez- Nieto (2013) adopt used partial least square discriminant analysis (PLS-DA) for the prediction of 2008- 2011 USA banking crisis and conclude that the results are similar to linear MDA and Support Vector Machine (SVM) results.

The benefit of this method is that it is unaffected by multi-collinearity and it builds a model by sequentially adding data points, so those model parameters are continuously updated.

Apart from trying to improve the techniques used, some studies endeavored to figure out which type of financial ratios were the better financial distress indicators. The original Z-score model selects five ratios out of a total of 22. Gentry et al. (1985, 1987) and Declerc et al. (1990) suggested that it may be useful to use cash-flow based ratios. Gombola and Ketz (1983) and Sharma and Iselin (2003) showed that cash-flow based ratios might outweigh accrual-based financial ratios in improving discriminating accuracy.

According to Hand (2004), in general, the classical statistic financial distress prediction models ignore some significant sources of uncertainty in classification problems including the arbitrary definition of failure, non-stationary and data instability, the arbitrary choice of the optimization criteria and sampling selectivity. For the first issue, it is obvious from the literature as discussed in the previous section- the definition of financial distress- that the criterion of failure is chosen arbitrarily while the juridical definition of financial distress is used. It is a fact that the juridical definition of failure is usually used and popular in the literature (for example Ooghe and Joos, (1990); Ooghe et al. (1993), Ooghe et al. (1995), Charitou et al., (2004)) since it suggests an objective criterion allowing firms to be separated easily into dichotomous failing and non- failing categories and provides an objective way to define the moment of failure. The problem lies with the way in which the definition of failure is applied to classify a firm as failing or non- failing. As the definition is chosen and applied arbitrarily among studies, the separation between failing and non-failing firms is artificial and considered to be mutually exclusive within the selected period for sampling selection despite the fact that it is not always true. If the dichotomizing failure is inappropriate, the classical statistic models which are based on the dichotomy assumption seem to be applied inappropriately. The predictive accuracy of a sample consisting of many different kinds of firms, especially the one in ‘grey zone,' may be deteriorated. Owing to Tafler (1983) and

Shumway (1999), the application of failure definition for an arbitrarily chosen period may lead to selection bias and contaminated populations. Although Ooghe et al. (1993) suggested the use of extended time frame to solve this problem, Back et al. (1997) rejected this option as well as suggesting the exclusion of all types of non-failing firms even if they possess various failing characteristic.

The second issue of data instability comes from the incentives of unhealthy firms to manipulate or manage their annual account figures (Degeorge et al., (1999); Rosner, (2003)). According to Keasey and Watson, (1986, 1987), the annual account in many firms, especially the small ones are unreliable due to the lack of internal control. Charitou and Lambertides (2003) showed another reason for the auditors' adjustments for the annual account as the bankruptcy filing firms coming near to presenting accommodated annual accounts. As a result, the practical usefulness of most of the models based on financial ratios may be limited. Furthermore, due to the occurrence of extreme ratio values, errors and missing values, Moses and Liao (1987) show that model results could be strongly contaminated. The missing values may be caused by the absence of annual accounts at the end of the failure process since many corporations stop producing the annual account before the failure moment or delay publishing their statements as they approach bankruptcy (Deakin (1977)). However, Tucker (1996) presented a possible solution for this issue by trimming the ratios with extreme values at certain percentiles and replacing the missing values by mean or random values.

As can be seen from the classic models, there is a dependence of financial distress probabilities on the explanatory variables which are unable to model directly the incentives or ability of the corporations to repay their debt. This issue is solved by the structural models of default timing, which endeavor to estimate the time span as assets drop to lower level than the total current liability. Based on the geometric Brownian motion (***for more details see Appendix about Brownian motion***), Black and Scholes (1973), Merton (1974), and Leland (1994) calculate the market value of firm's assets and the annual assets growth. At the time the assets level falls below the accounting-based

liabilities, the firm is considered default. The default time is purely determined by the distance to default which is the number of the annual assets growth standard deviation. The idea of distance to default is later observed and adopted in industry practice by big companies as Moody's, and JPMorgan. These companies then used the distance to default to develop the credit ratings of the firms.

Based on the credit ratings observed from the aforementioned companies and other famous rating companies such as S&P, assuming that the intensities of the credit migration depend on unobservable factors, Delloy, Fermanian, and Sbai (2005); Koopman, Lucas, and Monterio (2008) have developed the frailty models of default. However, since the credit ratings are incomplete and involve various lagging indicators, the rating based models may experience significant frailty. Also, JPMorgan further developed the Credit Metric model for the credit rating migration by incorporating the structural approach. Black and Scholes (1973) and Merton (1974) propose a structural model for corporate default prediction as well as bond pricing as derivatives of a firm's assets based on the theory of option pricing. The original model of Merton pays close attention to three variables including assets value, assets volatility and its expected returns. One trend of this model development in literature is to consider assets' expected returns as an independent variable while the other two parameters are the results of an equation system. This trend is first proposed by Jones et al. (1984) and then developed by Ronn and Verma (1986), extended by Campell et al. (2008). Differently, Duan (1994) develops the Maximum likelihood method based on the joint estimation for all three assets related variables. This structural credit risk model is then developed by Ericson and Reneby (2005).

The effectiveness of structural models calls for the attention of various researchers. Hence, they try to combine these models with accounting variables to create hybrid models which are proved to be influential in predicting corporate financial distress (Agarwal and Taffler (2008); Wu et al. (2010); Li and Miu (2010); Bauer and Agarwal (2014)). As looking at the literature review for the Merton model, it is crucial to mention

one of the significant benchmarks among studies using structure analysis: KMV (Kealhofer, McQuown, and Vasicek) model. KMV model is a commercial extension of the Merton model using market-based data. KMV's specifications were adopted in numerous researches in the literature (Keenan and Sobehart (1999); Crosbie and Bohn (2003); Soberhart et al. (2000); Vassalou and Xing (2004); Campbell et al. (2008); Aretz and Pope (2013)).

Apart from the classic models, due to the development of the technology and after the Basel II recommendations issued by the Basel Committee on Banking Supervision in 2004, the regulatory requirement for banks and financial institutions to utilize the advanced credit scoring model with the purpose of enhancing the capital allocation efficiency become popular. According to Crook et al. (2007), the research on the adequacy, applicability, and validity of the adopted system is set to be a Cardinal research initiative because of the crucial effects of Basel II. Consequently, the sophisticated techniques belonging to the field of soft computing are widely employed besides the classical approaches employing statistical methods including discriminate analysis, linear, logistic and probit regression, multivariate adaptive regression splines, classification and regression trees, non-parametric smoothing, survival analysis; or operations research models including linear programming, quadratic programming, and dynamic programming. Despite the criticisms about the requirement of major computation effort and the continuation to be relatively unknown by financial and business analysts (Fensterstock, (2005)), the computational intelligence approach is still considered to enable or facilitate credit scoring system in a complex and changing environment. The mechanisms can include various fields such as artificial intelligence, paradigms, algorithms, and implementations with the special ability to learn or adapt to new situations, or to generalize, abstract, discover and associate. In applying to credit scoring, the most basic single computational mechanism used is artificial intelligence including sub-methods: the neural network (NN), evolution algorithms (EA), rough set (RS), case-based reasoning (CBR), support machine vectors (SMV), decision trees

(DT)...The noticeable advantage of artificial intelligence methods is that they are not subject to the stringent assumptions required for statistical methods.

3.2. The early credit classification: credit scoring model

Altman Z-score model is a predictive model designed by Professor Edward I. Altman in 1986. In general, the model is a powerful diagnostic tool measuring the financial abilities of the firms and forecasting the financial distress possibility of them within a period of two years. Specifically, the model is a linear combination of five measures reflecting the financial profile of the firms with the measures being objectively weighted and summed up to provide the overall score that will be used as the basis for classifying the corporations into the distressed or non-distressed group. The work of Altman was predicted by the research of Beaver (1967) as he found that the corporations' bankruptcy possibility can be forecasted using the financial ratios up to 5 years before the distress event. In Altman's model, the predictive of the financial ratios are improved by extending the single univariate model to a multivariate model using a number of financial ratios. The Z-score model is significantly accurate in predicting bankruptcy with the average reliability ranging from 72% to 80%. (Altman E.I.,1968). In tests covering three different time periods from 1968 to 1999, the method correctly forecasted 80-90% of distress cases one year prior to the actual occurrence of bankruptcy.

Altman Z-score model has broadly been accepted by various accounting systems and database systems in several countries for financial analysis, loans evaluation and corporation assessment (Eidleman, 1995). Many studies have been conducted on the fundamental of this model to develop specific models for different business environments in different economies.

Being aware of the essential roles of credit scoring system in risk management at the firm level and financial and economic development more generally, several Asian countries have constructed credit scoring models to meet the requirement of stakeholders and creditors. Most of the credit scoring research in Asia was conducted during and after the

economic recession in the late 1990s when all Asian countries endured. The discriminant analysis for Singapore reached the accuracy up to 82.1% in which 76.6% financial distressed corporations and 87.5% of healthy firms were correctly classified (Zulkarnain Muhamad Sori and Hasbullah Abd Jalil, 2009). The study in Japan (Ko, 1982) with 41 pairs of bankrupt and nonbankrupt firms from 1960 to 1980 produced similar models to the one of Altman's with three common variables and yielded 82.9% classification accuracy.

In the case of Malaysia, a bankruptcy prediction model for listed and traded firms was built for the Malaysian economy by the Cardiff University (Zulkarnain Muhamad Sori and Nor Aziah Abu Kassim, 1999). In this model, the data included the financial ratios calculated from the financial statements of 48 industrial firms listed on the Kuala Lumpur Stock Exchange for 16 years from 1980 to 1996. In addition to the paired sample design technique, discriminant analysis was conducted with a dichotomous dependent variable and 64 independent variables. Another model developed in the case of Malaysia was the study conducted by the University Utara Malaysia (Abd. Halim, Ahmad and Md. Rus, 2008). The sample included 26 distressed and 26 healthy listed corporations in the Bursa Malaysia Behard. Those groups of firms were matched regarding industries and assets value. Similar to the mentioned model, 64 independent variables were used. However, they were classified into different sets of ratios including the leverage, profitability, cash flows, size, and growth. Cash flow to total liabilities, sales to current assets and total liabilities to total assets had been proved to have the strongest ability in predicting financial distress events. The overall accuracy of 80% was encouraging.

Korea was considered specifically in a study conducted by Altman, Kim, and Eon in 1995. Linear discriminant analysis technique was employed to build the discriminant functions. There are two versions of the financial distress prediction model including a version for either public or private firms and one special version for the publicly traded corporations using data from 43 failed firms and 61 non-distress ones.

For the case of Vietnam, the researches covering the subject of credit scoring are rare and most do not go beyond simple descriptive discussions of the issues of ineffective assessment procedure and some general qualitative suggestions. One of the most comprehensive papers was carried out by Dinh and Kleimeier (Dinh T.T.H. and Kleimeir S., 2006) focusing on the construction of a credit scoring model for Vietnamese retail banking market. The study involved a significant amount of data on all retail loans that were outstanding on a given day in 2005 extracted from the database of one Vietnamese commercial bank. 22 variables including 9 qualitative and 13 quantitative ones were selected to build the model using the stepwise method. The stepwise method allows moving in with direction, dropping or adding variables at various steps. The study presented 16 significant variables in which the most important predictors were time with the bank, gender, number of loans and loan duration. The adjusted R-square was improved gradually in the stepwise process to reach 57.8%.

Other studies for the Vietnamese economy concerning corporate financial distress, unfortunately, were carried out on a relatively small sample size of 30 to maximum 40 companies divided into two groups over five or six quarters.

As a summary, existing studies of financial distress in the Asian developing economies are largely based on the original Z-score models. Nevertheless, the adoption of different financial ratios leads to significantly different predictive power and classification outcomes in different economies. Therefore, a properly designed study of financial distress in each economy requires country-specific models and variables.

3.3. The development of credit rating

Credit ratings are ordinal ranking assigned to firms which represent firms' financial worthiness and exposure to credit risk. It can be defined as a relative measure of creditworthiness despite the fact that it does not correspond to certain default probabilities overtime under consideration. According to Standard and Poor's guidelines (Standard and Poor's, 2008), credit ratings provide issuers' opinion of "the obligor's

overall capacity and willingness to meets its financial obligations as they come to due whether rated or not."

Besides the rating system developed internally by a bank for its use (Treacy and Carey, 2000), credit rating agencies also build up rating systems providing impartial characterization and analysis of the credit risk associated with a financial instrument or a financial entity to assess the debtor's ability to pay back its debt. The credit rating models differ from other default prediction models as they do not focus on the probability of default only but to provide a more comprehensive characterization of the corporate financial situation. The inability of debt payment includes delays, negotiations, lack of respect for specific clauses and default, etc. Hence, rating system, whether using empirical or conceptual models, always end up classifying objects into the specific interval of the rating scale.

Credit rating systems originated from the early pioneers' attempt to provide forward-looking opinions on the creditworthiness of the debt or equity issuers based on their proprietary of knowledge in the mid-19th century. The rating system gradually becomes one of the most important innovations in the banking industry. The first written source of credit quality assessment is "Poor's manual of the railroads of the United States" published in 1868 (Poor, H.V. (1868)) sketching the railroad industry's rise, progress and influence as well as its financial statements' information. Following the publication of Poor's creditworthiness information in 1914, John Moody started his standardized rating system covering American cities and municipalities issuing bonds (Moody's, 1914)). Moody's bond rating agency is considered to be a fusion of credit reporting agency, specialized financial press and investment banker (Sylla, 2002). The subsequent period experienced the wave of new credit rating agencies mostly inside the boundary of the United States as financial regulators enhanced the role and power of credit rating agencies (CRAs). In 1930, the American Federal Reserve System implemented a new system based on the credit ratings for the risk assessment of banks' entire bond portfolio. In 1975, SEC also relied on credit rating to decide the level of a write-down on brokers'

balance sheet for securities deemed risky. In the early 1980s, SEC also limited money market funds to investments in high ranked securities rated by at least two Nationally Recognized Statistical Rating Organizations.

The most substantial development of credit rating was recorded since the 1990s when its first conceptual framework of the philosophy was found in the working paper of Basel Committed in 1999 (BCBS, 1999) outlining a general scheme for the validation of the rating systems. Credit rating is currently defined precisely as an innovative tool which is widely spread and crucial for investment decision making, bank management, and bank-firm relationship management. It contains reliable and effective elements in the credit process remarkably contributing to credit measurement and review both in "multipurpose banking group and within commercial banks" themselves (Berger et al., 2005).

Before the introduction of credit rating systems, the bank lending decisions were mostly binary based on the measure of the distance from insolvency. Gradually, the statistical techniques of scoring have replaced the approach based on the unit costs of the credit production supporting (Albareto et al., 2008). Nowadays, the relationship between the rate charged and the economic dimension of the borrower is well-defined. The interest rate charged by the bank will be determined by the credit ranking of the borrowers. The credit rating has also reached a widespread diffusion which consequently leads to the intense activity carried out by the banking risk management department (De Laurentiis and Maino, 2009).

3.4. The importance of credit ratings

Credit rating is vital since various studies on rating trends show a clear correlation between credit ratings and the likelihood of subsequent default (Choy, Gray, and Ragunathan, 2006). Since the debt issuers tend to increase the cost of debts as the rating deteriorates, corporates' managers have to consider the impacts of ratings in financing decisions. Consequently, credit ratings have a significant influence on the corporate's cost of debts, hence its financial structure and it's trading ability. In the surveys

conducted by Graham and Harvey (2001), credit ratings are the second most crucial factor to chief financial officers after financial flexibility maintenance in debt issuing decisions. Another importance of credit ratings is suggested in the research of Kang and Liu (2007) that constant monitoring of corporate governance that is exercised by rating agencies acts as an effective mechanism for disciplining managers to pursue the best interest of the shareholders.

From the perspective of investors and lenders, as CRAs usually have access to the confidential information and the market often suffers from information asymmetry, Pinches and Singleton suggest that "ratings are the principal source of information about the quality and marketability of various bond issues" (Pinches and Singleton, 1978). Jorion, Liu, and Shi (2005) agree on this point of view and express the potential consequence of increasing credit ratings' value to the public. Although firms intentionally or are obliged to disclose accounting and financial information, external credit ratings provide impartial, more structured, and more concise measures of corporate financial status. Investors and lenders in the market may base on the ratings to certify corporates' existing financial condition and the signal of changes in firms' current financial status (Poon and Chan, 2008).

In addition to investors, lenders and the corporations themselves, ratings also benefit regulators in saving resources for credit evaluation as they help to reduce information gathering costs and facilitate securities market operations (Creighton, Gower, and Anthony, 2007). Cantor and Packer (1997) found that ratings are employed by regulators to set thresholds for capital charges and investment prohibitions on portfolio holdings. Papaikonomu (2010) confirms this point and adds that credit ratings can also be used as a reference for capital requirement calculation. Furthermore, it cannot be denied that credit ratings play a crucial role in insolvency monitoring systems of insurance regulators as enhancing the screening and monitoring activities (Adams, Burton and Harwick, 2003).

3.5. The credit rating methods of the credit rating agencies and organizations worldwide

There are numerous Credit Rating Agencies (CRA) all over the world such as S&P, Moody's and Fitch. CRAs play an essential role as providing a forward-looking review on the willingness and ability of the corporate obligator to honor its debts within the required time frame (Al-Sakka, R. and ap Gwilym, 2009). Credit ratings are also affirmed to represent the views of the independent CRAs concerning the sovereign's ability to pay the debt obligations at the due date (Afonson et al., 2011). CRAs possess unbelievable power in assessing the credit quality with large-scale customers including AIG, Citigroup, and Lehman Brothers, etc. Furthermore, they are also involved in assessing the credit quality of the whole countries. Exceptionally, the leading CRA can include the political aspects into its assessment. For example, S&P increased the credit quality in foreign currency of Ukraine from CCC+/C to B-/C after the political risks in these countries are recorded to reduce. Pakistan, Sri Lanka, and Vietnam are also ranked by S&P at the end of 2008. Fitch Ratings reduced Korea from stable level to a negative level since the Korean economic condition slumped dramatically at that time. Malaysia shared the same downgrading from the positive to the stable level. One of the most famous cases is the downgrading of Greece made by S&P in which the credit rating was reduced from A- to BBB+ in only one month leading to a crisis in the financial market. These big CRAs also involve in rating other countries including the United Kingdom, Canada, Hong Kong, China, Philippines, Cambodia, Mongolia, etc. Besides, those CRAs not only take part in macro level but also offer credit rating services to the corporations with demand.

Among those agencies, S&P and Moody are two professional credit rating agencies in America with a high profit and trust. In the corporate assessment process, Moody and S&P consider both business risk and financial risk which affect corporation as a whole. The business risk is reflected through several aspects such as the individual characteristics of the industry, Owner's equity, corporation organization style (business

operation model, re-construction history…). Among such aspects, the corporation size and owner's equity are the two most important factors in the rating procedure of Moody and S&P. According to their argument, the larger the firm is, the greater the scope is for the corporation to diversify its business activities and consequently to reduce the business risk; while the greater the owner's equity becomes, the more advantages the corporation has in approaching different types of financial resources during the operation process and acquiring new technologies that usually cost a huge amount of investment. Risks related to owners' equity contain both systematic risks and unsystematic risks. The systematic risks mostly come from the overall risks in the industry and the competition inside the industry whereas the unsystematic risks are the specific risks that are different among corporations. Also, S&P and Moody assess the financial risks of the corporations through financial ratios being classified into different groups which show different characteristics of the corporations. They mainly focus on the revenue ratios, leverage ratios, operation efficiency, cash flow management and liquidity ratios of the corporations. The financial ratios are proved to have not only the linear relationship but also the non-linear relationship with the financial status of the corporations. As a result, S&P and Moody use the various quantitative techniques to clarify the marginal effects of the financial ratios toward the financial health of the corporations to find out the candidate variables to put into their credit rating models such as the Probit, Altman, Merton and Moody's, etc. The expected default frequency is calculated and followed by putting the results into the related ranking levels.

The basic comparison among the credit rating methods of Moody's, S&P and Fitch can be stated as below:

Table 3.1 Credit ratings of Fitch, S&P and Moody's

Fitch	S&P	Moody's
There is a combination of quantitative and qualitative methods in all three agencies.		
• Assessing the ability of debt repayment. • Based on the historical data in at least 5 years. • Providing the forecast for future events. • Making a comparison among corporations inside an industry. • Analyzing the elasticity of the corporations towards required factors. • Providing analysis of revenue making the ability of the corporations.	• Assessing the default risk of the corporations. • Providing analysis of the priorities in debt repayment and liquidated value of the corporations in case of bankruptcy. Providing analysis and differentiation between debts with collaterals and the risky ones. • The factors such as the possibility of continuing to operate or the bankruptcy process are not considered in the assessment of S&P.	• Assessing the corporations based on the expected loss, not the default possibility. • Considering the default possibility as one single factor in the whole assessing process. • Paying attention to the consequences of the bankruptcy event.

Despite disclosing the basic elements of their credit rating methodologies including the process used and the relevant factors, the quantitative method and potential weights are not publically available. There is no specific available quantitative information on the exact procedure of credit rating to safeguard the CRA's market dominance although they are expected to provide precise and truthful information due to potential reputation cost in case of inaccurate ratings.

3.6. Controversial issues of credit ratings

The credibility of the rating systems is contested by the "regulatory license" view (Partnoy, 1999). According to this view, the valuation of ratings does not come from their

accuracy and credibility, but their potential beneficiary prospect of reducing costs that are associated with regulation. This issue may lead to the competition among CRAs for selling a homogenous product of regulatory licenses and attributing high rating to attract issuers. Consequently, the informational content of ratings is decreased. The competition from Fitch serves as a typical example since it led Moody's and S&P's to decrease the information content by publishing a higher rating (Becker and Milbourn, 2011).

The plausible credit rating inconsistencies also need consideration. Due to the inconsistency in full information disclosure, the same firm may roughly receive equivalent ratings from different agencies (Beattie and Searle, 1992; Moon and Stotsky, 1993; Cantor and Packer, 1994). The consideration of asset opaqueness and information asymmetry as the causes of slit ratings is also suggested by Jewell and Livingston (1998) and Livingston et al. (2007). Another inconsistency exists in the sense that two firms with identical financial ratios but located in different countries will not necessarily receive identical ratings. This phenomenon is recorded in the literature. In comparing the credit ratings for the US and non-US corporations that have received speculative-grade ratings from Moody's, Cantor and Falkenstein (2001) find that foreign firms have overly harsh ratings form this rating agency. The American turbulent economic conditions are blamed for the discrepancy to occur. In another investigation of Moody's transition matrices for issuers in various countries conducted by Nickell et al. (2000), the tendency of Japanese corporations to change ratings is remarkably less than their US and UK counterparts. Country-specific variables are also indicated to affect credit rating determinants and credit ratings in the literature (Porta et al., 1998; Purda, 2003; Poon, 2003; Ferri and Liu, 2004; Caporale et al., 2011; Bellotti et al, 2011).

During the global financial crisis in 2008, several arguments were presented against the large credit rating agencies as such agencies were susceptible to the conflict of interest problem by paying attention only to their benefit when ranking the stocks in the financial market. The EU leaders raise the concern that the credit ranking activities of S&P, Moody's and Fitch may make the crisis worse. Consequently, the trust level of the

communities and their big customers is reduced. Several cases illustrate the negative impact of biased credit quality assessment, and in the long term, it contributes to the trust reduction towards credit rating agencies. Real cases serve as evidence that some derivatives based on the BB or worse rated corporations were ranked AAA and consequently the inadequate ratings led to a financial loss to the investors. The biggest American employees' retirement system Calpers sued S&P, Moody's and Fitch for providing biased credit quality assessment which led to a loss of more than 1 billion USD. There are also numerous cases that the credit quality ranking of the corporations is dropped dramatically in a short period without any noticeable changes during the long term of recording.

The 2008 global crisis started in the US real estate market, and the direct reasons are considered to relate to the over-confidence in the whole market towards the assessment provided by the credit rating agencies that overused the pure quantitative and mathematical models with limited historical data. The restrictive selection of the relevant factors creates an opportunity for the sub-prime mortgage lending to spread. A large number of people even with poor credit history borrowed from the banks to buy houses for the speculative purpose. Consequently, this wide-spread speculative behavior led to the drying-up of liquidity in the money market, which caused a contagion to the whole capital market and resulted in a substantial decrease in production industries, consumption, import, and export. Furthermore, the sub-prime loans are securitized and put into the stock markets so that not only American but also international investors in US securities were affected by the crisis. After a long time of the investigation, several researchers blame the bias in the credit default swap market with the enormous default loans for the crisis. The credit rating agencies usually depend mostly on the quantitative methods for their credit quality assessment. Rajun, Seru, and Vig (2008) present an analysis of the significant bias in default prediction caused by applying the pure quantitative methods with many assumptions ignoring the existence of unquantifiable

information. The variables involved in the quantitative models may not fully reflect all the causes of the default events.

Another issue of the Credit Rating Agencies that was identified after the crisis in 2008 is the ethical standard. Moody's and S&P are blamed for prioritizing debt holders who are willing to pay for the ranking systems to reserve favorable ranking results (Burns, 2008). In the report for the investigation lasting ten months toward Fitch, Moody's and S&P, SEC confirmed the fact that many Wall Street investors had questioned the accuracy of those credit rating agencies' assessment since they mainly focus on their benefit when conducting their rating of the trading stocks. The Credit Rating Agencies, however, denied SEC's report and argued that the small biases were the inevitable consequence of the rapid increase in both the amount and complicated level of the stocks they assessed. Overall, the gullible investment behavior of the investors, the monopolistic power of the credit rating agencies and the irresponsibility of the market were considered as some of the main reasons for the occurrence of the crisis.

Nevertheless, despite the identified deficiencies, the credit rating systems still improve information and efficiency of allocating investor's and lenders' fund. First, there is a conflict between funds providers and institutional investors so that CRA's credit ratings can improve allocative efficiency through information content and regulatory constraint. Secondly, due to the potential for inefficient equilibria of the economy to occur, the credit rating system of CRA explores its ability to coordinate investors and issuers toward the most efficient equilibrium (Boot et al., 2006; Manso, 2011; Elendner, 2012).

The reliability of CRAs's credit rating is crucial as bond and stock prices react to ratings through the information channel. The reliability of CRAs' credit ratings depends on its information acquisition technology, its internal ability to map the private information into its rating and the rating disclosure rights. However, the incentives of CRA to invest in gathering information and to publicize through its rating may vary depending on the agency's ability to commit ex-ante to a given rating method. Due to the partial

information about criteria used to translate the CRA's information into ratings, it is questionable about CRA's ex-ante commitment to a rating policy and whether they issue the rating that maximizes their continuation payoffs. Therefore, it is essential to determine the determinants defining the credit ratings issued to understand and identify the credibility of the ratings fully.

3.7. Empirical studies on credit ratings

The prediction of credit ratings is far more sophisticated as compared to the financial distress prediction. First of all, there are much more than two categories of distress and non-distress firms. Both Moody's and S&P's use a scale with nine major grades. The multiple-grade scale is also used by Vietnamese Credit Information Center and various Vietnamese banks. Hence, the credit rating analysis would examine numerous credit rating which leads to the inappropriate use of binary discriminant analysis. Furthermore, credit ratings are based on both quantitative and qualitative information so the relationship between financial data and corporate credit rating is difficult to map.

There are two main streams of the research concerning credit ratings including examination of the reliability of ratings and exploration of the determinants of ratings for both banks and corporations.

In the first stream of research, Altman, and Saunders (2001) question the accuracy of traditional agency ratings and argue that relying on ratings could "produce cyclically lagging rather than leading capital requirements, resulting in an enhanced rather than reduced degree of instability in the banking and financial system."(Altman and Saunder, 2001, page 43). The current risk-based proposal is proved to lack a sufficient degree of granularity. The sensible risk-based weighting of capital requirements, however, is considered to be in the right direction. The study of Amato and Furfine (2004) tries to examine whether rating agencies are excessively procyclical in their assignment of ratings using annual data on all American corporations rated by S&P's. The tightening of rating standards is considered to be not vigorous enough to fully accommodate

macroeconomic changes. Iannotta (2006) examine the disagreement among ratings obtained from different agencies in Europe to question whether banks are relatively less transparent than non-banking corporations. Shen et al. (2012) propose an information asymmetry hypothesis to assess the diversity of bank credit ratings among countries with similar financial ratios.

In the second stream of research, a substantial body of literature explores the potential determinants of credit ratings and progresses with the development of econometric techniques analyzing categorical and ordinal dependent variables. It is noticeable that a significant number of research conducted in the literature pay special attention to the financial ratios as essential determinants of credit ratings. Pogue and Soldofsky (1969) determine the probability that a bond will have a higher rating between two of four categories available at that time using the regression-based method. The function is constructed with the measures of leverage, profitability, and size of the corporations. As avoiding the ordinal data by comparing each pair of rating categories, the study does not make the full use of all available information. Differently, two-stage approach including factor analysis and multiple discriminant analysis is used in the research by Pinches and Mingo (1973). They consider the subordination, issue size, three financial ratios, and years of consecutive dividends. Although their model reaches the accuracy level of 69% for rating assigned, the MDA method treats each rating category as a different outcome and hence is impossible to capture the ordinal nature of credit ratings. This problem is later solved as subsequent empirical studies try to quantify the relationship between credit ratings and explanatory variables using ordered probit technique that is able to analyze discrete and ordinal dependent variables. The ordered probit regression is early used in the research conducted by Kaplan and Urwitz (1979) on bonds with stable Moody's ratings and another sample of newly issued ones. Several financial ratios, market beta, subordination, and corporate size are considered as independent variables. Bonds ratings are also examined in the study of Monlinero et al. (1996). A similar technique is employed in the research by Blume, Lim, and Mackinlay (1998) on the sample of bonds

rated by S&P's. However, they also use panel data to study changes over time. Later, Poon et al. (1999) develop a system of models to capture bank financial strength ratings produced by Moody's. Accounting variables and financial ratios are explanatory variables in the factor analysis and ordered probit analysis.

In the more current research, advanced techniques are applied, but financial variables are still playing a crucial role as independent variables. Using two techniques including ordered probit/ logit models and support vector machines, Bellotti et al. (2011a; 2011b) make a comparison of the two methods in modeling and predicting bank credit ratings. They put financial variables and country-specific dummy variables into the test employing bank ratings produced by Fitch. The ordered choice models are proved to unambiguously identify the significant determinants of credit ratings. Öğüt et al. (2012) explore the sample of 18 Turkish bank ratings by Moody's using 26 financial and operational ratios and multiple techniques including data mining (supporting vector machine and artificial neural network) and multivariate ones (multiple discriminant analysis and logit model). Ordered logistic regression is found to outperform another classifier, and efficiency, profitability, and proportion of loans are the most important determinants. A more recent study, however, comes back to the ordered probit model due to its efficiency in dealing with data possessing natural order. Bissoondoyal-Bheenick and Treepongkaruna (2011) use an ordered probit model to analyze quantitative determinants of bank ratings by Moody's, S&P's and Fitch. Several financial ratios are used besides market risk and macroeconomic variables.

More literature related to the use of an ordered probit model to identify the determinants of credit ratings is reported in the following table:

Table 3.2 Selective literature on ordered-probit and related models of credit ratings

Authors	Method	Sample	Significant determinants
Bouzouita and Young (1998)	**Ordered probit models to test for a down ship in the average ratings**	US insurance companies rated by A.M. Best in 1989-1992.	Profitability, Growth in surplus, Leverage, Line mix, Liquidity, Size, Organizational Form
Bhojraj and Sengupta (2003)	**Ordered probit model, three-stage least square estimator regression**	Ranked industrial bond issues from 1991-1996.	Institutional ownership, Proportion of the board consisting of outsiders, Concentrated Ownership, Debt/Equity, Profit Margin, Total Assets, Market value of common equity/Book of common equity
Adams, Burton and Hardwick (2003)	**Panel data, trichotomous logit model, and ordered probit model**	UK insurance firms that received a rating from the A.M. Best and S&P from 1993-1997	Capital adequacy, Profitability, Liquidity, Growth, Size, Reinsurance, Organizational form, Business Activity
Kim and Gu (2004)	**Ordinary least square model based on five years weighted average values**	25 casino and hotel firms rated by Moody's from 1996-2001.	Debt service coverage, Profitability, Size
Roje (2005)	**Logistic and probit regression**	Rated US firms from 1998-2002.	Return on Assets, Return on Equity, Profit, Market Value of equity, Tangible book value/Assets, Leverage, Long term debt/Total assets, Projected benefit obligation-pension plan assets/Total assets,

			Volatility of earnings
Graver and Pottier (2005)	**Ordered Probit Regression**	80 publicly traded insurance holding companies for the year ended December 31, 1997	Equity/ Assets, Debt/ Equity, PLL- Reserves Assets, Cash/Investments, Cash Flows/ Assets, Stock/Investments. Reinsurance/ Assets, Income/ Assets, Investment Income. Investments, Losses& Expenses/ Premiums, Devidends/ income, Ln Assets
Ashbaugh-Skaife, Collins, and LaFond (2006)	**Ordinary regression and speculative grade analysis**	2000 firms with different strong corporate governance levels rated by S&P and profiles on 22,000 individual directors.	Number of outside block holders, Quality accruals, Timeliness of firms' earnings, Independence of board, CEO power, Percentage of shares held by officers or directors, Board expertise, Leverage, Return on Assets, Net income before extraordinary items, Size, Subordinated Debt, Interest coverage
Sih (2006)	**Generalized Estimating Equations model considering a panel structure**	Firms that operate in the USA.	Industry, Cash, Market value
Gray, Mirkovic and Ragunathan	**ordered probit models**	Australian firms rated by S&P from 1995 -2002.	Interest coverage, Leverage, Profitability, Industry concentration

(2006)

Sales (2006)	**Ordered probit models**	44 Brazilian banks.	Total assets, Equity, Deposits, Gross Profit, Net profit, Operating profit
Bone (2007)	**Ordered logit rating forecast model**	Only Petrobrás oil and gas firms(2007).	Interest coverage, Short-term debt/Total debt
Shiu and Chiang (2008)	**Ordered probit regression and ordered logit model for robustness check**	Firms that make up the Lloyd's Market.	Leverage, Reinsurance, Concentration index, Profitability, Liquidity, Growth, Size
Matousek and Stewart (2009)	**Ordered probit model applied with dynamic**	681 international banks.	Equity/Total Assets, Liquidity, Size, Net interest margin, Operating expense/Operating Profit, Return on assets
Bone (2010)	**Ordered logit models and ordered probit models**	Only Repsol-YPF (2010).	Interest coverage, Short-term debt/Total debt

As can be seen from the above table, the ordered probit model has been widely used through the literature with various choice of independent variables. This technique can outperform the OLS (ordinary least square) model. Since ratings are discrete and ordinal in nature, the traditional OLS techniques on a linear representation of the ratings are inappropriate. The OLS simply assumes that the difference between any two adjacent categories is always equal. This assumption is not hold all the time. Furthermore, the presence between the top and bottom categories, the estimations of the coefficient are biased. Currently, the literature has also applied artificial intelligence techniques as such techniques are shown to provide superior predictions of bond ratings as compared with

standard ordered choice models (see the Appendix about the AI techniques in more detail).

3.8. The use of financial ratios

Since the 1920s, banks have used financial ratios as a comparative tool to assess their short-term credit. However, in more recent periods, financial ratios are used as the formal financial analysis tool as well as prediction factors (Horrigan, 1965). The numerous studies differentiate themselves by using a different set of variables or employing different statistical or machine learning-based techniques. The short literature review on financial ratios used in the analysis are reported below:

Table 3.3 Literature review on the use of financial ratios

Researcher	Main research idea
Bliss (1923)	The basic relationship within the business can be analyzed by the financial ratios.
Justin (1924)	Provide Scientific ratio analysis to gather industry data and calculates averages.
Rasmer and Foster (1931)	Use eleven ratios to examine and conclude that successful firms have higher ratios than an unsuccessful one.
Foulke (1931)	Create an own set of financial ratios successfully. Serve as a prominent group of ratios.
Fitzpatrick (1932)	Analyzes 13 types of financial ratios on 120 failed firms and univariately test each ratio's prediction power.
Marwin (1942)	Use financial ratios to find out the trend of successful and unsuccessful corporations and proves the prediction power of current ratio, networking to total assets ratio and net worth to debt ratio.
Walter (1957)	Include cash flow items in ratio analysis.
Hickman (1958)	Prove the prediction power of times interest earned ratio and net profit ratio on a corporate bond.
Saulnier (1958)	Find out the trend of low current ratio and debt ratio on default firms.

Moore and Atkison (1961)	Prove the relationship between payment capacity and financial ratios performance of the firms.
Sorter and Becker (1964)	Examine the relationship between psychological model and the corporate personality of financial ratios.
Beaver (1967)	Test five groups of financial ratios (30 financial ratios). After that, he extended the scope and found out that the market prices predicted failure sooner than individual financial ratios.
Horrigan (1968)	Provides a series of empirical research to prove the significant role of financial ratios. Simultaneously, he points out the issues related to the distribution of financial ratios, the selection bias due to high cash holding and other statistical problems such as co-linearity. Horrigan suggests that the incorporation of time into the model can improve the accuracy as allowing the involvement of new information. The price to book and price to earnings ratios are highly recommended.
Altman (1968)	Test 33 bankrupt and 33 non-bankrupt companies from 1946-1965. The last five chosen present the liquidity, reinvestment of earning, profitability, financial structure or leverage, and sales generating ability of the assets measures. The cut-off point was determined to minimize the overlap. As applying the scaled vector to determine the relative contribution of each variable, EBIT to total assets contributed the most. After that, he developed the beta model using MDA and quadric structure.
Pinches and Mingo (1973)	Classify the financial ratios into groups: financial leverage, short-term capital intensiveness, and return on investment ad long term intensiveness.
Steven (1973)	Group financial ratios into four groups: activity, liquidity, leverage, and profitability.
Pinches, Mingo and Caruthers (1973)	Categorize financial ratios into groups and point out seven important types: receivable turnover, short-term liquidity, capital turnover, inventory turnover, and return on investment, cash position and financial leverage.
Libby (1975)	Point out five divisions of financial ratios: liquidity, activity, cash

	position, profitability and assets balance.
Deakin (1976)	Testing 32 failed firms and matched with 32 non-failed firms from1964 to 1970. An original model contains 14 financial ratios, and then was included only five ratios that can predict the failure best five years before the bankruptcy event. First, the dichotomous classification test was applied (like Beaver's). Then MDA and scaled vector were adopted (like Altman's). He concluded that the MDA could be used to predict failure three years in advance with high accuracy.
Dambolena and Khoury (1980)	The main purpose is to test the stability of the financial ratios as explanatory variables of failure prediction. 19 ratios were tested. The sample contains 46 firms from 1969-1975. Four measurements were taken: the standard deviation of the ratios over three years period. The standard deviation over four years period, the standard error of estimate around a four linear trend, the coefficient of variation over four years period. They conclude that the inclusion of stability of ratios in the analysis improved the ability of a discriminant function to predict failure.
Chen and Shimera (1981)	Examine published studies and find out seven factors that are usually replicated and change the name: cash position, financial leverage, inventory turnover, short-term liquidity, return on investment, receivable turnover and capital turnover.
Richard Taffler and Howard Tisshaw (1982)	Developed a Z model for prediction of both company insolvency and the evaluation of corporate creditworthiness by banks, investment houses and credit controllers. The sample contains 46 filed firms and 46 non-filed ones matched by size and industry. 80 different ratios were calculated. Four final ones were chosen.
Gombola and Ketz (1983)	Conclude that the profitability ratios are unable to provide good information as cash flow ratios.
Cochrane (1997)	Conduct OLS study including financial ratios and finds out that dividend ratios can predict dividend growth and stock return in the long run.

Wiersema (1998)	Finds out that high inventory turnover ratio provides information about high cash flow and thriving business indirectly.
Frederikslust (2001)	Predict failure based on the testable financial theory of corporate failures defining failure as a negative cash balance. The prediction variables include liquidity, profitability, solvability, industry variables, and general economic variables. The sample contains 20 Dutch failed firms from 1954-1974 and a matched set of solvent firms from the Amsterdam Stock Exchange based on industry and size.
Trenvino (2002)	Suggest that price-earnings ratio is highly correlated with future stock return though it is subjective as providing the investors' expectation.
Arnott (2003)	Find out the high correlation between increasing earnings per share and increasing pay-out ratios from1946 to 2001.
Lewellan (2004)	Show that financial ratios are still a valid tool for stock price prediction in the recent economic environment.
Alfaro et al. (2008)	Using an alternative method to corporate failure prediction to provide an empirical comparison of AdaBoost and neural networks.
Uyar and Okumus (2010)	Investigate the impact of the recent global financial crisis on publicly traded Turkish industrial enterprises using financial ratios.
Yu and Wenjuan (2010)	Use decision trees to examine the financial ratios that have a strong influence on the profit growth of logistics companies.

A wide range of techniques and models have been adopted in the research with financial ratios:

Table 3.4 Models used in the research with financial ratios

Models	**Researchers used**
Univariate analysis	Beaver (1967a)
Risk index models	Tamari (1966)

	Moses and Liao (1987)
MDA models	Altman (1968)
	Deakin (1972)
	Edmister (1972)
	Blum (1974)
	Altman et al. (1977)
	Deakin (1977)
	Taffler and Tisshaw (1977)
	van Frederikslust (1978)
	Bilderbeek (1979)
	Dambolena and Khoury (1980)
	Taffler (1982), a model from 1974
	Ooghe and Verbaere (1985)
	Taffler (1983)
	Micha (1984)
	Betts and Belhoul (1987)
	Gombola et al. (1987)
	Gloubos and Grammatikos (1988)
	Declerc et al. (1991)
	Laitinen (1992)
	Lussier and Corman (1994)
	Altman et al. (1995)
Conditional probability models	Ohlson (1980)
	Swanson and Tybout (1988)
	Zavgren (1983)
	Zmijewski (1984)
	Gentry et al. (1985a)
	Zavgren (1985)
	Keasey and Watson (1987)
	Peel and Peel (1987)
	Aziz et al. (1988)
	Gloubos and Grammatikos (1988)
	Keasey and McGuinness (1990)

	Platt and Platt (1990)
	Ooghe et al. (1993)
	Sheppard (1994)
	Lussier (1995)
	Mossman et al. (1998)
	Charitou and Trigeorgis (2000)
	Becchetti and Sierra (2002)
	Charitou et al. (2004)

(Source: Balcaen, S., & Ooghe, H. (2006). 35 years of studies on business failure: an overview of the classic statistical methodologies and their related problems. *The British Accounting Review*, *38*(1), 63-93.)

The financial ratios frequently used in the literature are summarised in the table below.

Table 3.5 Financial ratios frequently used in literature

Research	**Variables used**
Ahn, Cho, and Kim (2000)	Cash flow/total liabilities, current assets/current liabilities (current ratio), inventories turnover, net income/total sales, net income/total assets, networking capital/total assets, owners equity/total assets, (total borrowings + bonds payable)/total assets
Alam, Boot, Lee and Thordarson (2000)	Net income/total assets (return on assets (ROA)), net loan losses/adjusted assets, net loan losses/total loan, (net loan losses + provision for loan losses)/income, non-performing loans/total assets)
Altman, Marco, and Veretto (1994)	Common equity/total capital (capitalization), cumulative profitability, debt services, the stability of earnings, roa, liquidity, size
Andres, Landajo, Lorca(2005)	Debt cost, debt quality, growth, indebtedness, share of labor costs, short-term liquidity, size, turnover of assets

Atiya (2001)	Book value/total assets, cash flow/total assets, gross operating income/total assets, ROA, price/cash flow, rate of change of cash flow per share (ROC), rate of change of stock price, stock price volatility
Back, Lejtinen and Sere (1996)	Cash/current liabilities, cash/net sales, cash/total assets, cash flow/current liabilities, cash flow/total assets, cash flow/total debt, current ratio, current assets/net sales, current assets/total assets, current liabilities/equity, earnings before interest and taxes, (EBIT)/total interest payments, equity/fixed assets, equity/net sales, inventory/net sales, long-term debt/equity, market value of equity/book value of debt, net income/total assets, net quick assets/inventory, net sales/total assets, operating income/total assets, quick assets/current liabilities, quick assets/net sales, quick assets/total assets, rate of return/common stockholders, retained earnings/total assets, return on stock, total debt/equity, total debt/total assets, working capital/equity, working, capital/net sales, working capital/total assets
Back and Cho (2003)	EBIT/total assets, market capitalization/total debt, retained earnings/total assets, sales/total assets, working capital/total assets
Barniv, Aurag, and Leach (1997)	The complexity of capital structure, the degree of competitiveness, firm age, fraud, intangible assets/net sales, natural log of total assets deflated the gross domestic product, ROA, ownership concentration, past losses, resignation, secured interest-bearing debt/ total liabilities, total interest-bearing debt/total liabilities
Bell (1997)	Agricultural loans/total assets, commercial real estate loans/total assets, construction loans/total assets, income before extra items, large time deposits/total assets, insiders loans over net loans, natural log(total assets), net charge-offs/total loans, ROA, net interest income/total assets, net loans/total assets, non-interest income/total assets, non-performing loans/primary capital, non-performing loans/total assets, past due loans/gross loans, primary capital/adjusted assets, provision for loan losses/total assets, restructured loans/gross loans, return on equity, security gains (losses) and extra items/total assets, short-term assets less large liabilities/total assets, total capital/total loans, total equity capital,

	total overhead expenses/total assets, undivided profit and capital reserve to total assets, yield on total assets
Bian and Mazlack (2003)	Cash flow/total debt, current ratio, current liabilities/total debts, gross profit/sales, net income/stockholders' equity, roa, sales/ total assets
Bryant (1997)	Cash/current liabilities, cash/total assets, cost of goods sold/inventory, current ratio, current assets/total assets, current assets/total sales, current liabilities/total assets, EBIT/total assets, inventory/sales, net income/net worth, net income/sales, ROA, quick assets/sales, quick assets/total assets, retained earnings/inventory, retained earnings/total assets, sales/cash, sales/net worth, sales/total assets, total assets/gross national product (GNP) price-level, total liabilities/net worth, total liabilities/total assets, working capital/sales
Canbas, Cabuk and Kilic (2005)	Quick ratio, income ratio, interest expenses/average non-profitable assets, interest expenses/average profitable assets, interest expenses/total expenses, interest income/interest expenses, liquid assets/(deposits + non-deposit funds), liquid assets/total assets, net working capital/total assets, (salary and employee benefits + reserves for retirement)/no of personnel, (shareholder's equity + total income)/(depreciation + non-depreciation funds), (shareholder's equity + total income)/total assets, (shareholder's equity + total income)/(total assets + contingencies and commodities), standard capital ratio
Cielen, Peeters, and Vahoof (2004)	Cash/restricted current assets, equity ratio (equity/total assets), expired taxes, retained earnings/total assets, inventories, gross return, coverage of debt, net return, current ratio, quick ratio, debt ratio
Dietrich and Kaplan (1982)	Abnormal increase in inventory and receivables, quick ratio, current ratio, debt/equity, dividend, funds flow ratio, ROA, net worth, sales/total assets, total assets, the trend in net income, working capital/total assets

Dimitras, Slowinski, Susgama, and Zopounidis (1999)	Current ratio, current liabilities/total assets, gross profit/total assets, inventories/working capital, (long-term debt + current liabilities)/total assets, net income/gross profit, ROA, net worth/(net worth + long-term debt), quick assets/current liabilities, working capital/net worth
Fletcher, Gross (1993)	Quick ratio, current ratio, income ratio (income/working capital)
Frydman,Altman and Kao (1985)	Cash flow/total debt, current ratio, current assets/total assets, EBIT/total assets, log (interest coverage + 15), log (total assets), market value of equity/total capitalization, ROA, quick assets/current liabilities, quick assets/total assets
Gorzalczany and Pissa (1999)	Working capital/total assets, retained earnings/total assets, EBIT/total assets, market value of equity/total assets, sales/total assets
Greco, Matarazzo, and Slowinski (1998)	EBIT/total assets, net income/net worth, total liabilities/total assets, total liabilities/cash flow, interest expenses/sales, general and administrative expensive/sales, managers' work experience, firm's market niche position, technical structure facilities, organization-personnel, competitive advantage of firms, market flexibility
Haslem, Scherga, Bedingfield and James (1992)	Domestic cash, domestic investment securities, foreign cash, foreign investment securities, net domestic loans, net foreign loans, net income, total assets, total domestic interest-bearing deposits, total domestic non-interest-bearing deposits, total equity capital, total foreign interest-bearing deposits, total foreign non-interest-bearing deposits
Ignizio and Soltyas (1996)	EBIT/total assets, market value of equity/total debt, retained earnings/total assets, sales/total assets, working capital/total assets
Jones and Hensher (2004)	Net operating cash flow to total assets, cash resources to total assets, cash flow cover (net operating cash flow to annual interest payments), sales revenue to total assets, total debt to total equity, total debt to gross operating cash flow, working capital to total assets (WC = current assets – current liabilities)

Karels and Prakash (1987)	Gross profit margin ((net sales-cost of goods sold)/net sales), market value of common stock, natural logarithms of tangible asset turnover, (net income + depreciation)/number of shares, (cash flow per share), net income/total of common equity (earnings per share), sales/cash, sales/inventories, sales/receivables, total debt/total assets, total debt/total capital, working capital/total assets
Kiviluoto (1998)	Equity ratio (equity/total assets), net income before depreciation and extraordinary items, net income before depreciation and extraordinary items of the previous year, operating margin
Kolari, Glennon, Shin and Capto (2002)	Allowance for loan losses/total assets, bank holding companies total assets, total bank assets/bank holding co. (BHC) total assets, certificate of deposit/total deposits, maximum change in assets/mean assets, maximum change in assets/mean change assets, maximum change in loans past due at least 90 days/mean of numerator, net income after taxes/total assets, net interest income/total assets, net loan charge-offs/total assets, non-deposit liabilities/total liabilities, provision for loan losses/total assets, sum of key asset accounts/total assets, total assets, total equity/total assets, total loans and leases/total assets, total securities/total assets
Lacher, Coasts, Sharma and Fantc (1995)	EBIT/total assets, market value of equity/book value of debt, retained earnings/total assets, sales/total assets, working capital/total assets
Lam (2004)	Capital expenditure, common shares traded, consumer price index, current account balance/gross domestic product, current assets/common shareholder's equity, depreciation expenses, dividend/share, earnings/share, effective exchange rate, federal budget/gross domestic product, government spending/gross domestic product, (long-term debt + short-term debt)/total assets, market capitalization, money supply, net income/net sales, net sales/total assets, pre-tax income/net sales, purchase price of crude oil, relative strength index, research expenses, short-term interest rate, spread between short-term and long-term interest rate, tax deferral and investment credit, total sources of fund/ total uses of fund, trade balance/gross domestic product

Lee, Han, and Kwon (1996)	Quick ratio, cash flow/sales, cash flow/stock holder's equity, cash flow/total assets, cash flow/total borrowings and bond, change in payable/receivables, change in Inventory/current assets, change in inventories turnover, change in payables/current liabilities, current ratio, current ratio trend, debts ratio (days) (debtors * 365 days/sales), dividend/capital stock, financial expenses/sales, fixed assets/(stockholder's equity + long-term liabilities), fixed assets turnover, fixed asset composition, fixed liability ratio, fixed ratio, gross profit/sales, growth rate of fixed asset, growth rate of net income, growth rate of ordinary income, growth rate of sales, growth rate of total liabilities, growth rate of total assets, interest coverage ratio, interest ratio, Inventory/current assets, inventories turnover, net income/capital stock, net income/sales, net income/stockholders' equity, net income/total assets, net working capital/total assets, net working capital turnover, operating income/sales, ordinary income/business capital, ordinary income/sales, ordinary income/stockholder's equity, ordinary income/total assets, payable/current liabilities, payables/inventories, payables/receivables, stockholders equity/total assets, stockholders equity turnover, total assets turnover, (total borrowings + bonds payable)/total assets, total liability composition.
Lee, Nooth, and Alam (2005)	EBIT/total assets, market capitalization/total debt, retained earnings/total assets, sales/total assets, working capital/total assets

Leshno and Spector (1996)	Average market equity/total capital, auditor, auditor opinion, bond rating, book equity/total capital, quick ratio, cash flow/fixed charges, cash flow/share, cash flow/total debt, cash flow margin, capital expenditure/share, capital lease, cost of goods sold/sales, current ratio, current liabilities/total liabilities, dividend, earnings/5 years maturity, earnings/total debt, earnings before interest and taxes (EBIT) drop, EBIT/Sales, EBIT/share, EBIT/total assets, EBIT/total tangible assets, fixed charge coverage, interest coverage, inventory turnover, log (interest coverage), log (total assets), long-term debt/equity, margin drop, market equity/total capital, market value/total liabilities, net available for capital/total capital, net available for total capital/sales, ROA, net income/total debt, net profit margin, number of employees, operating income/sales, price/earnings ratio, quick assets/sales, receivables turnover, retained earnings/total assets, retained earnings/tangible assets, sales/cash, sales/gross fixed assets, sales/receivables, sales/total assets, sales/total capital, sales/total tangible assets, standard deviation (EBIT/total assets), standard deviation (log (EBIT/total assets)), total debt/total assets, total debt/total capital, total investment, working capital/long-term debt, working capital/total assets, worth/total debt

Lin, McClean (2001)	Average salary/employee, borrowing ratio, quick ratio, cash ratio(cash and market securities/total liabilities), cash earnings/share, cash flow margin, capital employed/employee, capital gearing, coverage debt, creditors ratio (days)(creditor * 365 days/cost of sales), creditors turnover, current ratio, debts ratio (days)(debtors * 365 days/sales), debts turnover, earnings margin, financial debt ratio, gross return, income gearing, inventories, net profit margin, net return, operating profit margin, operating profit/employee, pre-tax profit margin, preferences and loan/equity and reserves, quick assets/total assets, return on capital employed, return on long-term capital, return on net fixed assets, return on shareholder's capital, return on shareholder's equity, sales/employee, stock ratio (days), stock turnover, tax ratio, trading profit margin, turnover/assets employed, turnover/fixed assets, turnover/net current assets, working capital/total assets
Marais, Patel, and Wolfson (1984)	Auditor opinion, audit qualification, cash/total assets, cash/current liabilities, commercial paper rating, current ratio, current assets/net sales, current assets/total assets, debt rating, funds flow/total liabilities, net income/total assets, net worth, number of years of financial statements in database, number of consecutive years negative net income, number of consecutive years sales decline, quick assets/current liabilities, sales, sales/total assets, sales/working capital, standard deviation of common stock rate of return, stock exchange, total liabilities/net worth, total liabilities/total assets, working capital/total assets, yearly dividend

Martin (1977)	Charge-offs/(net operating income + loss provision), commercial and industrial loans/total loans, dividends/net income, equity capital/adjusted risk assets, gross capital/adjusted risk assets, gross capital/risk assets, gross charge-offs/(net operating income + loss provision), liquid assets/total sources of funds, loans/total assets, loans and leases/total sources of funds, loss provision/(loans + securities), roa, net income/total assets, net interest margin/earning assets, net interest margin (taxable equivalent)/earning assets, net liquid assets/total assets, non-interest expenses/operating revenue, operating expenses/operating revenues, total assets, total operating expenses/operating revenue
McKee (2000)	Accounts receivables/sales, cash/total assets, current ratio, current assets/total assets, current assets/sales, inventory/cost of goods sold, long-term debt/total assets, ROA
McKee and Lensberg (2002)	Cash/current liabilities, investment cash flow/net income, firm size, ROA
McKee (2003)	Cash/current liabilities, coded to indicate opinion type, current ratio, dividends/net income, firm size, investment cash flow/net income, leverage, ROA, Operating cash flow/net income, retained earnings/total assets, sales/total assets
Micheal, Georgios, Nicolaos and Constantin (1999)	Current ratio, current liabilities/total assets, gross profit/total assets, inventories/working capital, (long-term debt + current liabilities)/total assets, net income/gross profit, net income/net worth, ROA, net worth/net fixed assets, net worth/(net worth +long-term debt), quick assets/current liabilities, working capital/net worth

Min and Lee (2005)	Break even point ratio, bonds payable, cash flow/interest expenses, cash flow/(previous years short-term loan), cash flow/short term loan, cash flow/total debt, cash flow/total loans, capital stock turnover, depreciation ratio, EBIT/sales, fixed assets/(stockholder's equity + long-term liabilities), fixed assets turnover, fixed ratio, gross value added/(property, plant and equipment),gross value added/sales, gross value added/total assets, growth rate of tangible assets, interest coverage ratio, interest expenses/total borrowings, interest expenses/total expenses, interest expenses/sales, inventories turnover, net income/sales, net income/stockholders' equity, ROA, net interest expenses/sales, operating assets turnover, ordinary income/ordinary expenses,ordinary income/sales, ordinary income/stockholder's equity, ordinary income/total assets, payable turnover, productivity of capital, solvency ratio, stockholders equity/total assets, stockholders equity turnover, tangible assets turnover, total assets turnover, (total borrowings + bonds payable)/total assets, variable cost/sales
Ohlson (1980)	Current liabilities/current assets, funds provided by operations/total liabilities, log (total assets/GNP price-level index), net income/total assets, one if total liabilities exceed total assets, zero otherwise, one if net income was negative for the last two years, otherwise zero, total liabilities/total assets
Park and Han (1997)	Cash flow/total loans, coverage debt, current assets/total assets, current assets-cash/total assets, net income/loans, ROA, net income/total equity capital, reserves/loans

Park and Han (2002)	Quick ratio, financial expenses/sales, fixed assets/(stockholder's equity + long-term liabilities), gross value added/tangible fixed assets, gross value added/sales, growth rate of property, plant and equipment, growth rate of sales, growth potential, firm history, industry position, industry reputation, international competitive advantage, market niche/trend, operating assets turnover, operating income/total assets, ordinary income/total assets, past payment record, personnel and staff hiring policy, pricing competitive advantage, profit perspective, quality of management, relationship between labour and capital, size, stockholders equity/total assets, technology development and quality innovation, total assets turnover, (total borrowings + bonds payable)/total assets, working conditions and welfare facilities
Pendharkar and Rodger (2004)	Current ratio, EBIT/interest expenses, EBIT/total assets, market value of equity/book value of debt, retained earnings/total assets
Piramuthu, Ragavan, and Shaw (1998)	Cash at year end/total debt, cash flow/total debt, charge in inventories, charge in net financials, charge in net other assets and liability, charge in other current assets, charge in other current liabilities, charge in payables, charge in receivables, current ratio, current ratio trend, dividend, earnings trend, fixed coverage expenditure, long-term debt/net worth, net income/sales,ROA, net investment flow, net operating flow, quick assets/current liabilities, quick assets/sales, sales trend (number consecutive years of sales decline, total debt/total assets, trend of cash flow/total debt, trend of net income/sales, trend of net income/total assets, trend of working capital/sales, working capital/sales
Rahimin, Singh, Thmmachote, and Virmani (1996)	EBIT/total assets, market value of equity/total debt, retained earnings/total assets, sales/total assets, working capital/total assets

Ryu, and Yue (2005)	Cash/current liabilities, cash/total assets, cash flow/total assets, cash flow/total debt, current ratio, current assets/total assets, current assets/total sales, current liabilities/equity, EBIT/total assets, equity/sales, inventory/sales, market value of equity/total capitalization, market value of equity/total debt, ROA, net income/total capitalization, quick assets/current liabilities, quick assets/total assets, quick assets/total sales, retained earnings/total assets, sales/total assets, total debt/total assets, working capital/sales, working capital/total assets
Slchenberger, Mine and Lash (1992)	GAAP (generally accepted accounting principles) net worth/total assets (GNWTA), repossessed assets/total assets (RATA), net income/gross income (NIGI), net income/total assets (NITA), cash securities/total assets (CSTA)
Serrano-Cina (1996)	EBIT/total assets, market value of equity/total debt, retained earnings/total assets, sales/total assets, working capital/total assets income/operating expenses, retained earnings/total assets, stock holders' equity/total assets, value added/total cost
Specht (1990)	Current ratio, EBIT/interest expenses, EBIT/total assets, market value of equity/book value of debt, retained earnings/total assets
Swicegood (2001)	Allowance for loan losses/total loans, asset growth, branch or unit bank, charter, core deposits/total assets, deposit insurance, earning assets/total assets, federal reserve bank member, gains (losses) from sale of securities/total assets, holding company affiliation, interest income/total assets, (non-interest expenses-salary)/total assets, non-interest income/total assets, nonperforming assets/total assets, off-balance sheet commitments/total assets, provision expenses/total loans, regional geographical region, salary/total assets, total equity/total assets, total interest expenses/total assets, total loans/total assets, total securities/ total assets, volatile liabilities/total liabilities

Tam and Kiang (1992)	(Agriculture production and farm loans + real estate loans secured by farmland)/net loans and leases, (cash + US Treasury and government agency obligations)/total assets, capital/assets, commercial and industrial loans/net loans and leases, (federal funds sold + securities)/total assets, (interest and fees on loans + income from lease financing)/net loans and leases, loans to individuals/net loan and leases, net charge-offs/average loans, ROA, provision for loan losses/average loans, return on average assets, total expenses/total assets, total income/total expenses, total interest paid on deposits/total deposits, total loans 90 days or more past due/net loans and leases, total loans and leases/total assets, total loans and leases/total deposits, total non-accrual loans and leases/net loans and leases
Tay and Shen (2002)	(Agriculture production and farm loans + real estate loans secured by farmland)/net loans and leases, (cash + US Treasury and government agency obligations)/total assets, capital/assets, commercial and industrial loans/net loans and leases, (federal funds sold + securities)/total assets, (interest and fees on loans + income from lease financing)/net loans and leases, interest income/ total assets, loans to individuals/net loan and leases, net charge-offs/average loans, net income/total assets, provision for loan losses/average loans, real estate loans/(net loan & leases), return on average assets, total expenses/total assets, total interest paid on deposits/total deposits, total loans 90 days or more past due/net loans and leases, total loans and leases/total assets, total loans and leases/total deposits, total non-accrual loans and leases/net loans and leases
Tung, Quek, and Cheng (2004)	After-tax profit/total assets, cash/total liabilities, working capital/operational expenditure
Vapnik (1998)	(Average tangible fixed assets-average construction in progress)/number of employees, current ratio, interests, discounts and bond issue expenses/sales, interests, discount expenses/value added, liquid assets/current liabilities, non-operating expenses/sales, operating capital/number of employees, operating income/operating capital, ordinary income/sales, value added/operating capital

Varetto (1998)	Asset (loan) quality, earnings, liquidity, management, miscellaneous
West (1985)	(Cash + US Treasury securities + federal funds sold and securities purchased under agreements to resell)/total assets, (certificate of deposit over $100,000 + federal funds sold and securities purchased under agreements to repurchase)/total assets,commercial and industrial loans/total loans, doubtful loans/total capital, equity capital/total assets, (finance agriculture loans + farmers loans + real estate loans secured by farmland)/total assets, loans believed to be uncollectible/total capital, loans to individuals for household, family and other personal expenditure/total loans, net income/equity capital, ROA, real estate loans secured by 1–4 family residential properties/total loans, real estate loans secured by non-farm non-residential properties/total loans, substandard loans/total capital, total time and savings deposits/total deposits, total assets, total interest paid on deposits/total deposits, total loans/(equity capital + reserve for loan losses), total loans/savings, total operating expenses/total assets
Wilson (1994)	EBIT/total assets, market value of equity/total debt, retained earnings/total assets, sales/total assets, working capital/total assets
Yang, Platt, and Platt (1999)	Current liabilities/total debts, exploration expenses/total reserves, net cash flow/total assets, total debt/total assets, trend in total reserves
Zadeh (1994)	Debt/gross cash flow, earnings after abnormal /total assets, pay-out on operating profit before abnormal and tax, pre-tax profit/total assets, working capital/total assets
Zhang, Hu, and Patuwo (1999)	Current ratio, EBIT/total assets, market value of equity/total debt, retained earnings/total assets, sales/total assets, working capital/total assets
Zmijewski (1984)	Current ratio, ROA, total debt/total assets

(*Source with adjustments: Ravi Kumar, P., & Ravi, V. (2007). Bankruptcy prediction in banks and firms via statistical and intelligent techniques–A review. European Journal of Operational Research, 180(1), 1-28.)*

Although the above studies are successful in predicting bankruptcy outcomes to varying degrees, most of them lack clear identification and explanation of the characteristics of the factors that can be used as determinants of the corporate performance or corporate credit ratings. Apart from the ratios in the above table, more recent researches have adopted even more financial ratios to investigate firms' financial performance. Examples include Ho and Wu (2006) which uses up to 59 ratios, Uyar and Okumus (2010) in which 15 ratios are explored and Karaca and Cigdem (2012) who use 24 ratios to explain the effects of the financial crisis in 2008 on Turkey. Although we can see many commonly used ratios that appear in several mentioned studies, there seems to be no universally agreed-upon list regarding the type, calculation methods and the suitable number of financial ratios used in such studies. There is empirical evidence in earlier studies that the structure of financial ratio patterns may differ among different type of firms (Gombola and Ketz, 1983). Furthermore, the country that the corporations are located also impact the financial structure (Cinca et al., 2005). Therefore, it is useful to include a wide range of potential financial ratios of Vietnamese firms as well as macroeconomic variables to see if they have a significant influence on the corporations' credit ratings.

3.9. Incorporation of earning management in credit status analysis in the literature

Financial reports play key roles in providing information for the owners, managers, and creditors in making decisions on investments, credits offering and trading activities (Spiceland, Sepe and Tomassini, 2007). The information environment is crucial in determining the extent, and in designing the mechanism of mitigating the agency conflicts (Jensen and Meckling, 1976). Thus, there are several practical accounting professional standards to ensure the accounting report quality. Ironically, in spite of numerous guidelines that standardize and guide the practices of financial reports, accounting distortions, especially earning management behavior, still exist (Roychowdhury, 2006; Yang 2013). The level of information asymmetry also has enormous influence on the financial ratios which are widely and usually used in many

credit rating and credit risk assessment models, especially in emerging countries (Shen, Huang, Hassan and Iftekhar, 2012). As mentioned in the literature review part of credit default prediction models, the most commonly used models in the literature are mainly categorized as accounting based, and price-based ones which differ from each other primarily in the critical factors used to predict corporations' default. While price-based models are constructed on capital market prices, accounting models which are mainly applied in this research use items in firms' financial statements. The latter models thus may be significantly affected by information bias. In an inefficient market such as Vietnam, investors and creditors are unable to identify the effects of earnings management and incorporate them into the pricing process. Thus, it is crucial to assess and adjust the effects of earning management.

Earnings management can be defined as the manipulation of accounting numbers within the limit and scope of the accounting principle (Jackson and Pitman, 2001). There are two main reasons for the adoption of this practice: either the information is disclosed inadequately and inaccurately by the firms, or accounting standards, as well as legal requirements, might not be strict enough to assure fair and transparent disclosure. This issue may lead to the late detected collapse of the corporations (Yap et al., 2012). Issues occur as the manager's judgments in financial reporting or in structuring transactions so that financial statements can be altered. Consequently, stakeholders would be misled by the underlying performance of the corporation and the managers also benefit from the contractual outcomes depending on the accounting reports (Healy and Wahlen, 1999). There are several studies of earning management under the influence of capital market transactions and surrounding the gap between corporate performance and analysts' or investors' expectation (Burgstahler and Eamers, 1998; Abarbanell and Lehavy, 1998; Kasznil, 1999). The points of time that are considered to be sensitive to earning management activities include financial acquisitions (Erickson and Wang, 1998), initial public offering (Teoh, Welch, and Wong 1998; Teoh, Wong and Rao, 1998); and follow on offering (Teoh, Welch and Wong, 1998). Besides misleading purposes, contracting

motivations are also the reason for earning management as reported accounting numbers are used to align the incentive of management. Lending contracts are also criticized for creating incentives for earnings management since it seems to be more expensive for the compensation committee or the creditors to reverse the earning management.

In addition to the managerial intervention in the accounting accruals and estimation, a number of studies showed that real activities can serve as earning management. Operational activities departing from normal practice but motivated by managers' desire to mislead the financial statements information and meet the reporting goals can be considered as manipulation though they may not contribute to corporate value. Graham et al. (2005) confirm the idea that managers are willing to manipulate real activities to reach all the targets or analysts' forecasts even though the manipulation can deteriorate the firm's value. The research also points out that earnings management that is conducted through real activities is preferred to accounting accrual methods since accounting methods entail more risk of drawing auditor or regulatory scrutiny. Healy and Wahlen (1999), Dechow and Skinner (2000) and Fundernberg and Tirole (1995) blame operational decisions in the acceleration of sales, maintenance expenditures, cost manipulation, delivering schedule alterations, and research and development delay as earning management. The research and development delays, in particular, are centered on several studies. The evidence consistent with the reduction of expenditures on research and development are found in reports of Bens et al. (2002, 2003); Dechow and Sloan, (1991); Bushee (1998); and Baber et al. (1991). Other activities are also used in earnings management including assets sales (Bartov, 1993), and overproduction (Thomas and Zhang, 2002), sales manipulation (Roychowdhury, 2006). Recently, earning management can be categorized into four types (Gunny, 2010) including myopic investment in research and development; selling, general and administration expenditures cut down; long-term assets and investment disposition timing; and sales acceleration by production cost reduction or overproduction.

In the case of Vietnam, it is essential to assess the accounting report standards quality in advance to ensure that earning management comes from managers' motives or because of the inadequate accounting quality. The substantial development of the Vietnamese stock market since its opening time in 2007 requires the simultaneous development of Vietnamese accounting standards (VAS) in order to assure transparency, wide publicity and stable market development. Currently, most of the financial statements of listed companies are prepared on the basis of the instructions of VAS, Vietnamese stock market Law 2010 and decree number 52/2012/TT_BTC dated 5th April 2012 about the information publishing on the stock market. Despite the endeavor in enriching the reporting standards, drawbacks still exist.

There were180 violations with the penalty of 11 billion VND in 2012. In 2013, in spite of the attempt to tighten the law and control of Vietnamese Stock Commission, there were 84 violations recorded for incorrect publishing process, covered internal trading, stock manipulation, and off-balance activities records, etc. Specifically, according to the internal report of Vietstock, there were only 29 law-abiding corporations over a total of 694 listed ones (approximately 4.18%). One of the most common law violations of the listed corporations is late reporting as over the period from 2012 to 2014; 59 to 98% listed companies had their quarterly financial reports submitted late (Financial Ministry internal report, 2014). Another noticeable issue is the unreliable information of the financial reports as the difference between the original reports and the audited reports by the Supervisory department of the State Bank of Vietnam could be as large as 150%. The Stock Act was implemented in 2006 and was amended by Decree 85/2010/ND-CP in 2010. However, the content has not been widely published and introduced to either the investors or the corporations. Furthermore, the only sanction of administrative violation is applied hence investors and corporations still violate the law to earn noticeable benefit.

For the accounting quality in Vietnam, the Vietnam National Economics University's research conducted in 2014-2015 for corporations listed on Hochiminh stock exchange states that the accounting quality of the Vietnamese corporations is average with several

drawbacks such as lack of substance over form principle, lack of requirements for quarterly financial reports, the violation of consistency principle in inventory cost calculation, lack of annual fix assets reassessment, and the inclusion of financial income to operating profit, etc. .

In this research, we would examine the possibility of financial distress with the corrective action toward earnings management. The earning management will be adjusted for four main related ratios as they are usually used in literature and are mainly affected by the earning bias. The four ratios used include liquidity ratio, profitability ratio, productivity ratio, and leverage ratio.

3.10. Incorporation of macroeconomic factors in credit status analysis in the literature

The most widely used and accepted methods in financial distress explanation and prediction are models using financial ratios derived from the corporations' financial statements. The financial ratios' accuracy in predicting and explaining credit issues is also proven in the literature. Nevertheless, financial ratios depend heavily on the accounting figures which can influence the firm's position due to the inconsistent practice of financial reporting. This issue is studied by Leuz, nada and Wysocki (2003) in 31 countries among which Asian countries including Malaysia, Hong Kong, and Singapore experience the worst earning management or creative accounting compared to European common law countries and America. The earnings management can make the conventional Z-score model fail (Cho, Fu, and Yu, 2012). Therefore, besides the necessity of adjusting the financial ratios used, it is crucial to consider other non-firm-specific factors. Trujillo-Ponce, Samaniego_Medina, and Cardone-Riportella (2012) suggest that the accounting and the non-financial factors complement one another and thus a comprehensive model including both types of variables appears to be the better option.

There is a large theoretical and empirical macroeconomics literature pointing to the importance of macroeconomic conditions and its stability on firms' financial distress possibility. Carty, L. V., & Fons, J. S. (1993), in their research on the changes of corporations' credit quality in Moody's special report for the investment service confirm the importance of macroeconomics factors besides the microeconomic and industrial ones. There are also several considerable pieces of evidence that macroeconomic conditions have an enormous impact on the probability of default (Farma (1986), Duffie and Singleton (2003)). If the economy experiences downturns, the possibility of corporate default increases substantially as the default premium rises in the money market (Fama, 1986; Koopman & Lucas, 2005). Bangia, Diebold, and Schuermann (2000) and Nickell, Perraudin, and Varotto (2000) provide evidence in their research that there is a relationship between the macroeconomic and industry effects and the rating transitions. More specifically, during downturns in the economy, there are more likely to have rating downgrades and default events. The differences in default rates during different phases of the economic cycle are also pointed out in the study of Carey (1998). The apparent relationship between the macroeconomic conditions and the default probability is also confirmed in the research conducted by Altman and Brady (2001). Giesecke (2003) study a model that integrated the structural and reduced form approaches to find out the correlation between the firm's assets and the macroeconomic factors. This conclusion is supported by the previous research by Barnhill and Maxwell (2002) in which assets distribution is conditional on macroeconomic status. Systematic exposures increase as credit quality deteriorates. Back in time, Gersbach and Lipponer (2000) find out that the correlation between default probabilities is always less than the correlation between asset values. By measuring interest rate shocks, they also examine the impact of macroeconomic shocks on default correlations for loan portfolios and confirm that macroeconomic shocks increase the positive default correlations. Zhou (2001) finds stronger macroeconomic effects for low credit quality firms than for high credit quality ones. This is confirmed by the research of Das et al. (2001) that default correlations increase as credit quality improves. Longin and Solnik (2001) imply that the default

correlations should increase during economic downturns, but it does not necessarily happen during the upturn period.

The explanatory capacity of macroeconomics factors are confirmed in numerous researches and are considered to be very useful in modeling the default risk of corporations. In the study of Nickell, Perraudin, and Varotto (2000) employing ordered probit model, the rating transposition probabilities depend on numerous factors, and the industry factors and the business cycle are proved to be important determinants. Bangia, A., Diebold, F., Kronimus, A., Schagen, C., & Schuermann, T. (2002) propose that macroeconomic volatility is a key part of a conceptual framework for testing the credit portfolio. There is a special linkage between the underlying macroeconomic conditions and asset quality. By separating the economy into two stages including expansion and contraction along with conditioning the migration matrix on the mentioned regimes, it is concluded that the loss distribution of credit can be significantly affected by the concomitant level of economic capital to be assigned. Allen, L., & Saunders, A. (2003) survey both academic and proprietary models to examine the relationship between macroeconomic as well as systematic risks and credit risk exposure. They consider the correlation between the probability of default and cyclical factors and try to find out how to incorporate macroeconomic conditions into measures of financial distress. Carling, K., Jacobson, J., Lindé, J., & Roszbach, K. (2007) estimate a duration model to explain the survival time to default for corporate borrowers of a major Swedish bank over the period of 1994 to 2000 and take both firm-specific characteristics and the prevailing macroeconomic conditions into account. The condition of economic development is proved to possess significant explanatory power to the default risk of firms. As taking the macroeconomic factors under consideration, the model is also able to account for the absolute level of risk.

It is an obvious fact that the financial distress possibility of corporations can be triggered because the idiosyncratic shock passes over the default threshold in a given regime. There is another case that financial distress happens because of a change in the value of

aggregate shock. Hackbarth, Miao, and Morellec (2006) point out that the aggregate shocks provide a rationale for clustering existing decisive observations in several markets.

Various macroeconomic indicators have been selected for explaining corporate credit ratings in the literature. Back in 1997, Fridson, Garman, and Wu (1997) tried to find out the correlation between the macroeconomic conditions and the corporations' probability of experiencing a default. By using the structural model, they found that the assets value decrease which rooted from the increase of interest rate led to the increasing probability of default. There is two years' lag in the interest influence due to the existence of cushion of cash reverses or a lag until debt payment date allowing distressed firms to delay default. The negative correlation coefficient is also recorded in the research by Barnhil and Maxwell (2002). The research of Fridson, Garman, and Wu (1997), furthermore, revealed a positive correlation between the overall stock market index with the probability of default. Geroski, P. A., & Gregg, P. (1996) contribute to the research on the effects of economic cycle besides other macroeconomic indicators including interest rate, unemployment rate and growth in aggregate retail sales on corporations' profitability, gearing, cash flows and thereby the firms' failure possibility. The effects of changes in the interest rates on the corporate default probability are examined in the research conducted by Young (1995) and Wadwani (1996). Firms are found to be especially vulnerable to the move of real interest rates. As simulating the financial statements of the British corporations and contingent on the macroeconomic conditions, Goudie and Meeks (1991) provide evidence on the significant asymmetric and non-linear effect of the exchange rate upon the financial distress possibility of corporations. Similarly, empirical evidence is also observed by Koopman and Lucas (2005) of the business level and the default possibility of firms. In 2001, Bakshi, Madan and Zhang (2001) studied a three-factor credit model using the observable economic factors including risk-free interest rate and its stochastic long-run mean as well as the firm-specific variables including the leverage, book to market, probability, lagged credit

spread and scaled equity price. In this research, the interest rate factors are proved to be an important determinant of credit spread.

Not only the macroeconomic indicators themselves but also the variations in the macroeconomic environment have a significant influence on corporate financial performance. The incorporation of changes in the macroeconomic environment is important in two main respects: it adds a dynamic element to the models that act to adjust risk in fluctuating operating environment and models should have built-in facility to stress test the default probability across the portfolio (Mare, 2012; Qu, 2008; Nam, Kim, Park, and Lee, 2008). As lenders are usually less willing to lend their money in unfavorable macroeconomic conditions with high instability (Greenwald and Stiglitz, 1990), firms may face financial distress providing that there is the presence of credit constraints. Furthermore, the increasing credit constraints on firms may be asymmetric according to the researches of Bernanke and Gertler (1989); Kiyotaki and Moore (1997). The dependence of firms' financial health on the macroeconomic conditions, particularly macroeconomic instability, is further confirmed in the study of Bhattacharjee et al. (2009) on corporations' experiences through bankruptcies and acquisition in both US and UK markets. Higson, C., Holly, S., Kattuman, P., & Platis, S. (2004) showed that the effects of aggregate shocks, positive and negative, are more pronounced for firms in the middle range of growth. The business dynamics are considered to be as important as the firm level factors. Machin, S., & van Reenen, J. (1993) present a study on some empirical models of profitability using panel data covering 709 large UK corporations between the 1970s and 1980s in which they focus on the importance of aggregate demand shocks in shaping the financial distress possibility of firms.

Various techniques have been used to integrate macroeconomic factors for the estimation of credit risk. In the early literature, Wilson (1997) points out the general principles of Mckinsey's proprietary portfolio credit risk assessment model named Credit Portfolio View which incorporates a set of macroeconomic variables in a multi-sector logit model. Carey (1998) uses Monte Carlo resampling methods to generate unconditional portfolio

credit loss distributions regarding macroeconomic conditions. Nickell et al. (2000) study the effects of macro dummies in an ordered probit model for corporate bond rating transitions. Bangia et al. (2002) use transition matrices to generate the relationship between assets quality and macroeconomic conditions. The corresponding migration probabilities are referred to as conditional. As separating the economy into two phases including expansion and contraction, the loss distribution of credit portfolio is shown to differ greatly which is similar to the changes in the concomitant level of economic capital to be assigned. Alternatively, Pesaran et al. (2005) use Merton-type credit risk model to draw the linkage between macroeconomic variables including equity indices, interest rates, inflation rates, real money balances, oil prices and output to the firm-specific returns. In research later in 2006, they extend the model to see the credit risk diversification.

In order to choose a reasonable approach in the case of Vietnam in this research, it is crucial to figure out the possibility of the application subject to data availability. It is challenging to value all the components of the real corporate complex capital structure to model their dynamics or estimate them empirically to identify the default threshold; it seems difficult to use the structural approach to model corporate default in a developing country like Vietnam, especially with the ambitious purpose of introducing additional macroeconomic variables. An alternative to the structural approach is the reduced form approach. The reduced form approach has been used as an alternative in several types of research in the literature (Jarrow, Lando, and Turnbull, 1995; Duffie, Saita, and Wang, 1997; Koopman et al., 2008; 2009). Applying the reduced form approach, financial distress is treated as a random event that can happen to any firm at any time. Due to the time lag in the effects of macroeconomic factors, the financial distress possibility can be considered as the downgrade in the credit ratings. However, firms in the same credit rating class may not be homogenous depending on whether it enters its current rating by an upgrade or downgrade (Hamilton and Cantor, 2004). Due to the effects of internal and external factors including macroeconomics ones, within class distress rates as represented

by rating transitions possibilities vary considerably over time (Bangia, Diebold, Kronimus, Schagen, and Schuermann (2002) ; Nickell et al. (2000); Mann, Hamilton, Varma and Cantor (2003); Fledelius, Lando and Nielsen (2004); Hamilton and Cantor (2004)).

Following Dufie at al. (2007), Shumway (2001), Figlewski, Frydman, and Liang (2009), macroeconomic factors can be grouped into three broad classifications. The first class presents the general macroeconomic conditions such as the inflation, unemployment rate, and the recession rates, etc. The second group provides the ideas about the economic movements such as real GDP growth rate or changes in the consumer sentiment. The last group contains information about the financial market conditions such as interest rates and stock market returns.

3.11. Leverage structure and the corporate credit status in the literature

The first and one of the most crucial theories concerning corporate capital structure is developed by two Nobel Prize winners: Franco Modigliani and Merton Miller (Stern and Chew, 2003). Modigliani, F. and Miller, M. (1958) demonstrate the irrelevance of financial structure assuming frictionless capital market with no taxes, transaction costs or bankruptcy expenses. Later in 1963, they included the influences of taxes into their model to make it closer to reality. According to their publications (Modigliani, F. and Miller, M. 1958, 1961, 1963), the corporate capital structure and dividend policy have no effect on its total market value while there is a positive relationship between the cost of equity and the debt-equity ratio. Modigliani and Miller consider asset profitability and risk as determinants of the company's value (Popescu and Sorin, 2011). The theory can be denoted as $V_L=V_U$ (Pan, 2012) in which V_L is the value of an unlevered firm and V_U is the value of a levered firm. As for including the effects of taxes, the M&M theory's equation can be denoted as $V_L=V_U + T_CD$ (Pan, 2012) in which T_C is the tax rate and D is the debt value. The inclusion of tax effects makes the theorem closer to reality as

corporations find it convenient to have a levered capital structure as they can take advantages from the tax shield (Alifani and Nugroho, 2013).

Modigliani and Miller's theorem is praised as fundamental economic research. The prepositions in their publications have a great impact on financial economic theory literature (Stern and Chew, 2003). The theorem is one of the first researches formally use no-arbitrage argument. Moreover, Modigliani and Miller have also described in detail the capital structure and its importance with the assumptions about neutral taxes, effective capital market, equal access to the credit and financial information of the firms.

Although the Modigliani and Miller theorem is considered to be revolutionary by many economists (Breuer and Gürtler, 2008), it is still criticized to be unrealistic. Stern and Chew (2003) cite the evidence in the last 30 year to show that indeed capital structure has significant effects on the corporate value and hence its credit risk. The assumptions of the theorem are also considered to be doubtful. Stiglitz (1969) suggests that Modigliani and Miller’s assumptions are based on partial equilibrium analysis instead of general equilibrium analysis. According to Stiglitz (1969), the capital market is not always efficient so that there are different rates for individuals and firms; and the event of bankruptcy does exist and can cause much more damages to the corporations than being assumed by Modigliani and Miller. Baker and Wurgler (2002) suggest the addition of the effects of market timing on the capital structure to improve the Modigliani and Miller’s theorem.

Theoretically, corporations can totally ignore the use of leverage and rely entirely on equity. In this case, corporations have to confront with only business risk. However, in general corporations currently cannot ignore the use of leverage due to its benefit compared to the pure use of equity as shown in the following table:

Table 3.6 Leverage and equity comparison

		Leverage	Equity
1.	Time	Have due date	No repayment period
2.	Payment obligation	• Interest payment is periodically compulsory. • Unable to repay the debt and interest can lead to default risk	• No interest payment required. • Dividend paid based on the business profit and dividend sharing policies. • Unable to pay a dividend cannot lead to default risk
3.	Tax benefit	Interest payment can reduce the tax burden	The dividend cannot bring tax benefit.
4.	Cost of capital	Low	High

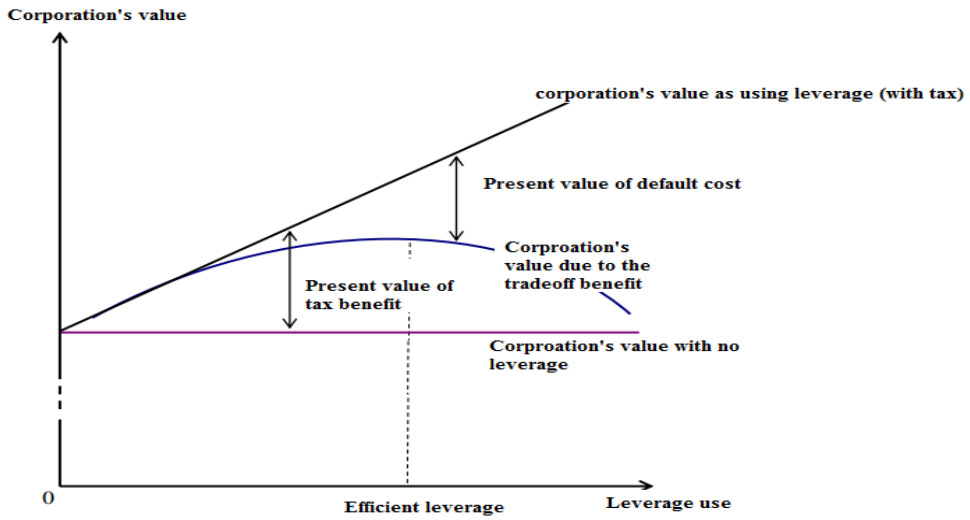
Corporations with the most efficient use of leverage can see the reflection of the trade-off between the tax benefit and default risk (Alan Kraus and Robert H. Litzenberger, 1973). Therefore, in the research in 1984, Stewart C. Meyers concludes that corporations utilizing the trade-off of using leverage will design and gradually adjust their capital structure to reap the benefit from using leverage and prevent default risk simultaneously (Murray and Vidhan, 2007).

Fundamentally, by using leverage, the corporations have to not only ensure the return on equity for the stockholders but also manage the risk of default. Financial distress appears if the corporations are unable or find it difficult to complete all the obligations to the debt issuers (Tran Ngoc Tho et al., 2005). Despite the fact that the difficulties in the financial situation can be temporary for Vietnamese corporations (Phan Thi Bich Nguyet, 2008), it may lead to a series of obstacles in business activitiess as projects can be delayed or terminated, the debt payable to the suppliers can be controlled more strictly and other new expenses for the law issues raised, etc. The cost for that depends on the default

possibility, and the new expenses appeared because of the repayment inability. (Brealey et al., 2008).

Figure 3.1 Corporate value and leverage level

(Source: Brigham and Houston (2009); Brealey et al. (2008))



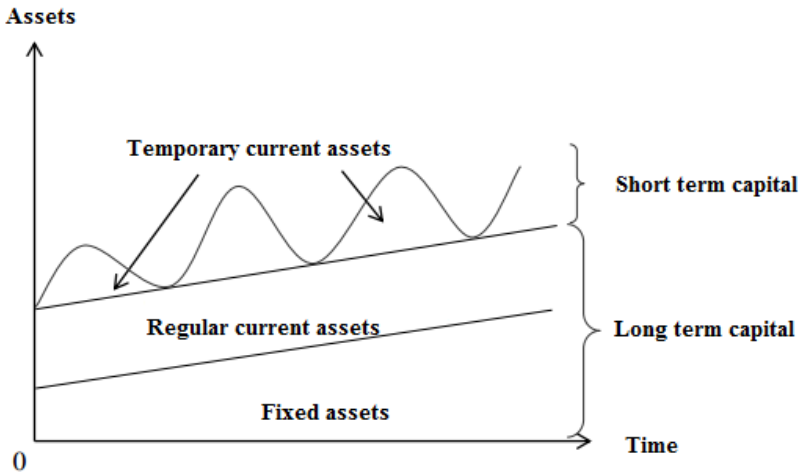
The capital structure puzzle was suggested by Gordon in 1961 and developed by Steward C. Meyers and Nicolas Majluf in 1984 (Murray and Vidhan, 2007). According to this theory, corporations prefer to use internal financial sources to external sources. In the case of selecting external financial resources, corporations will structure their capital to minimize the cost increase because of information asymmetry (Javad and Hamed, 2011; Devinaga and Peong, 2011). Therefore, the priority hierarchy is internal financial sources, debt and new equity raised from new stockholders. The basic assumption of the capital structure puzzle is that there is information asymmetry (Murray and Vidhan, 2007) since managers know more about the development potential as well as risks of the corporation than the investors (in this case, stockholders). The information asymmetry has a crucial influence on the decision of choosing financial sources. Debt is preferred to the new equity since it requires a lower cost of issue and does not reduce the current benefit of existing shareholders. Furthermore, the use of leverage presents the positive effects of high expectations of the invested projects (Brealey et al., 2008; Dinesh, 2005).

In contrast, the new stock issue can provide a negative signal of the investment projects. Investors usually require a lower price for newly issued stocks since they are afraid that the stocks are overvalued, and there is a high possibility that the earning of the corporation will decrease in the future (Dinesh, 2005). Therefore, it may reduce the current price of stocks and negatively affect the current shareholders' benefit. Therefore, each corporation usually builds a planned capital structure for themselves.

Planned capital structure is the financial strategy of corporations for combining different sources of finance in order to maximize shareholders' value and manage the financial risks. The planned capital structure can be adjusted to match to the reality (Brigham and Houston, 2009). Normally, corporations target a capital structure that produces the highest benefit or the lowest cost. The combination of short term and long-term capital can solve this issue.

Figure 3.2 Capital structure

(Source: Terry and John (1998))



In general, a capital structure with high use of debt can increase the default risk of corporation despite the fact that it aims to increase the benefit of shareholders (Mohammad et al., 2013). In fact, the return on equity of the corporation using leverage can be higher, lower or remain unchanged compared to the ones without leverage. The

empirical research of Amalendu and Somnath (2012) reveals that a reduction in return on equity contributes to a rise in the possibility of default risk.

One of the early empirical researches was done by Anup Chowdhurry and Suman Paul Chowdhurry (2010) on the effects of capital structure on the corporation's value with data of 77 non-financial corporations listed in the Bangladesh Stock Exchange. The corporations belong to four industries (including heavy industry, Food, and beverage, fuel and energy, Chemistry and Pharmacy) and the study was conducted using time series analysis with both quantitative and qualitative variables:

- The dependent variable is the corporation's value measured by its stock value.
- The independent variables include (1) corporation scale measured by its equity value, (2) Profit measured by earning per share, (3) Proportion of equity, (4) capital structure measured by debt over total assets, (5) dividend, (6) Operating efficiency measured by assets turnover, (7) development potential measured by the sales growth rate, (8) liquidity measured by current ratio, and (9) business risk measured by degree of operating leverage.

The research reveals that corporations with efficient use of leverage can maximize the shareholder's value and minimize the cost of capital. Consequently, the changes in capital structure can lead to changes in the corporations' value.

Rasa Norvaisiene (2012) investigates the influence of capital structure on the operating efficiency of listed corporations in the Baltic states on the basis of the annual financial reports of 70 corporations in the period from 2002 to 2011. The changes in capital structure as an independent variable are defined by debt over assets, short-term liabilities over total assets, long-term liabilities over total assets and debt with no interest payment over total assets. The dependent variable of operating efficiency is measured by profit over sales, EBIT over sales, sales over total assets, return on equity, current ratio, assets turnover, and fixed assets turnover. The test of Wilcoxon Rank Sign is used to measure the significance of relationships among variables, and multivariate regression is used to

measure the effects of capital structure on operating efficiency. The result reveals that the excessively high use of leverage has negative effects on the operating efficiency of a corporation. The non-interest liabilities can also affect the default possibility. Furthermore, the use of debt has negative effects on the assets turnover while non-interest liability can help to increase this ratio.

Javad Afrasiabi and Hamed Ahmadinia (2011) examined the effects of capital structure for the listed corporations in Tehran Stock Exchange from 2006 to 2009. The corporations under consideration are divided into two groups based on their capital structure: one with higher use of debt and the other with the higher use of equity. Using F Levine and T-student tests, they concluded that there is a vague relationship between capital structure and profit of the corporation. In the case of no tax, the use of leverage can negatively affect earnings. The research also shows that systematic risks of corporations using more equity are much lower than the ones with high leverage. The systematic risk is calculated by employing the capital assets pricing model: $=Cov\ (r_i, r_m) / \theta^2\ (r_m) = \rho_{im} * \theta_i / \theta_m\ \beta$ in which $\theta^2\ (r_m)$ is the market return variance, ρ_{im} is correlation coefficient of return and market share I, θ_i and θ_m is the standard deviation of share returns and market returns as well as market share of risk, β is the systematic risk. This result is explained by the high-interest rate on the debt and the inadequate return on assets of the tested corporations. They conclude that corporations with higher use of equity have a higher return on assets.

Lucy Wamungo Mwangi et al. (2014) investigated the relationship between capital structure and financial status of corporations listed on the Nairobi Stock Exchange, Kenya. The sample includes 42 corporations with financial reports from 2006 to 2012. The panel analysis using FGLS and Hausman test on the return on assets, return on equity, leverage, corporation scale, assets structure and GNP shows that leverage has negative effects on the financial status of corporations. However, financial status can be improved with the higher use of short-term liabilities. The use of long-term debts should be limited.

Previously, the relationship between capital structure and financial status of corporations is also analyzed on the sugar industry of Pakistan in research by Syed Shah Fasih Ur Rehman (2013) using statistical methods. The financial reports of 35 corporations from 2006 to 2011 are used to collect data. The financial status is measured by five aspects including return on assets, return on equity, earning per share, EBIT over sales, and sales growth rates. The leverage level is measured by debt over equity. The research shows a positive relationship between leverage and ROA and sales growth rates while a negative relationship between leverage and ROE, earning per shares and EBIT over sales is recorded. Therefore, the use of leverage can have either a negative or positive effect on the financial status of corporations.

Albert Amponsah Addae et al. (2013) examined the relationship between capital structure and earnings of corporations listed in Ghana from 2005 to 2009 using the regression model and panel analysis. The sample includes 34 corporations with 170 financial reports collected. The log of earning and sales growth rates are used as control variables. The short-term debts have a positive relationship with earnings while long-term debts show a contrasting relationship. Therefore, corporations listed in Ghana are suggested to use more short-term debts.

Tharmila K. and Arulvel K. K. (2013) also analyzed the same relationship in the corporations listed in Colombo from 2007 to 2011. However, the sample included only 30 corporations. The negative relationship between capital structure and financial status reflects the high cost of capital and inefficient capital structure used by the considered corporations. The remarkable development of the bond market in this country explains the overuse of debt in the capital structure.

Nirajini A. and Priya K. B. (2013) analyzed the relationship between capital structure and financial status of commercial corporations listed in Sri Lanka from 2006 to 2010. 11 corporations are included in the samples under the analysis using multivariate regression. The positive relationship between capital structure and financial efficiency is presented

with the significance of 5% and 10%. They suggest that since the capital structure has a crucial influence on the financial status of corporations, it is necessary to find out an optimal capital structure to ensure profit development.

Mahannad Reza Pourali et al. (2013) analyzed the relationship between leverage and default risk of listed corporations on the Tehran Stock Exchange from 2007 to 2011 with a sample of 32 corporations using multivariate regression. The adjusted Altman's Z-score is also used in the research. Using EGLS, Hausman test and MANA test, there is only a vague relationship between the corporations' capital amount and the potential default possibility. However, the strong negative relationship between the extent of leverage and default risk is revealed.

In analyzing the financial risks of listed corporations in Bombay, India, Amalendu Bhnia and Somanth Mukhuti (2012) use the financial reports of 513 corporations from 2010 to 2011 to put into the Alexander Bathory model. In this research, the dependent variable of financial risk is measured by leverage, current ratio, quick ratio, ROA, ROE, inventories turnovers, assets turnover and the equity to fixed assets ratio. The result shows a noticeable negative relationship between financial risk and current ratio, ROA, and leverage ratio.

Yin Yuxuan and GuWenlin (2014) analyze the leverage structure of the pharmaceutical firms by panel data with the financial reports from 119 listed corporations on Shanghai and Shenzhen stock exchanges from 2010 to 2013. The independent ratios including the natural logarithm of assets, assets growth rate, current ratio, assets turnover, collateral over total assets, tax payment to total profit and the proportion of ownership belonging to the three biggest shareholders are used to identify the leverage structure. The F test, Hausman test, and OLS regression are used to clarify the significant role of corporation scales and capital structure to leverage structure among corporations under consideration.

Sorana Vatavu (2013) researches factors affecting the capital structure of the listed corporations in Bucharest Stock Exchange from 2003 to 2012. Using the Pooled OLS, the

OLS regression with dummy variables and panel data research methods, the research present the negative relationship between the intangible assets, sales, and liquidity to the leverage level as well as the remarkable effects of the tax, business risk and the interest rate on the level of short-term liabilities over total assets. Since there are missing data, the research is unable to present the factors affecting long-term liabilities level.

Chandrasekharam C. V. (2012) tries to find out factors affecting the capital structure of listed corporations in Nigeria from 2007 to 2011. Financial reports of 87 corporations are used as the sample in the research. Profitability, tangible assets level, corporation's scale, growth potential and the year of operation are proved to be crucial factors to consider to find out the optimal leverage.

In the case of Vietnam, Phan Lan Trinh (2013) investigated the financial risk of leverage among corporations operating in the building and real estate sector. The data is collected from the financial reports from 2008 to 2012. However, there is not any uniform information for all the financial ratios under consideration. The research mainly focuses on the period of 2 years from 2010 to 2011 and shows that corporations with high leverage level have unreasonable use of capital with a noticeably high proportion of short-term loans. Ninety percent of the analyzed corporations experienced a loss or even default.

Also, for Vietnam, in a study of 517 listed Vietnamese firms from 2010 to 2012, Huu Huan Nguyen and Quynh Huong Nguyen Le (2014) use Panel Threshold Regression Model of Hasen (1999) to determine the optimal capital structure. The result shows a relationship between capital structure and the value of the corporation. However, the thresholds for leverage used or optimal capital structure are not presented in the research.

Quy Thi Vo (2014) has done a research on the Vietnamese real estate trading corporation's behavior in constructing their capital structure using the sample of 31 corporations listed on Hochiminh Stock Exchange from 2007 to 2011 using Shym-Sunder and Myers' model (1999) with the adjustment by the method of Chirinko and

Singha (2000). The corporations in the sample have great use of short-term debts and usually engage in renegotiations with the debt issuers. My Phuong Thi Le (2014) presented research on the factors affecting the capital structure of 40 constricting corporations in Vietnam from 2009 to 2011. Using the regression models, the research shows the significant influence of the liquidity, scales, and regulation on the capital structure of the considered objects.

As can be seen from the literature review, there seems to be a significant relationship between the capital structure and the leverage strategies of the corporations and their financial performance (which is measured in different ways including the default risk). Various internal and external factors affect corporations' decisions on capital structure and its leverage level. Furthermore, financial reports are the main source of data for research on this topic. The evidence from a large number of the developing countries suggests that it is legitimate to analyze the relationship between capital structure, the leverage level of Vietnamese corporations, and their default risk.

CHAPTER 4: CREDIT RATING SYSTEMS IN VIETNAM

This chapter introduces the legal framework for credit rating as well as the essential information concerning the credit rating system in Vietnam.

4.1 The legal decisions in credit assessment in Vietnam

The official credit assessment development decisions of the Vietnamese government are late-coming as compared to other countries despite the crucial role of such a system. The first decision is the Decision 57/2001/QD_NHNN dated 24th January 2002 by the State Bank of Vietnam for the first trial project of credit rating and assessment for the Vietnamese corporations led by the Credit Information Centre (CIC). The corporations involved are the State-owned corporations; FDI companies and Joint-stock companies. According to Article 4 of this Decision, all the related information of Vietnamese corporations' credit quality assessment and ranking are strictly confidential. The information and data are only restrictively shared by the State Bank's departments and legal credit institutions with approved purposes. Furthermore, all the departments and credit institutions are not allowed to share with a third party. In the decision, corporations are marked with the range from 27 to 135 for their credit quality. Basically, the ranking process is based on the corporate financial ratios calculated by using financial statements of the corporations, management assessment, and corporations' financial structure. CIC was criticized by bankers for using solely financial factors to assess the corporations and ignoring almost all other non-financial aspects. The details about credit ranking applied by CIC will be discussed in section 3 of this chapter.

After two years of trial, on 28th April 2004, the State Bank of Vietnam released the decision 473/QD-NHNN to approve the project of Credit Information Centre in which CIC are allowed to collect all the related information about legally registered corporations operating in Vietnam in order to provide Credit Assessment information sold to the State Bank's departments and legal credit institutions only. However, considering the practical requirement of WTO, this decision was then replaced by the

decision 1253/QD-NHNN dated 21st June 2006 allowing CIC to sell the credit information to the legal entities as demand with limited level. A legal individual or even a legal representative of the entity is not allowed to access this kind of information. Article 7 of the decision presents the requirements for provisions and internal credit ranking system for the credit institutions. The decision also requires adjustments and changes of all the internal credit assessment process to match to real operating environments and economy of Vietnam. Since Vietnamese corporate credit information is still strictly controlled by the government, the published process is restricted by law.

4.2 Enterprise Credit Rating Appraisal Science Centre (CRC)

CRC is operated on the basis of the Decision 590/QD-LHH dated 3rd May 2007 by the Congress of Science and Technology Organizations in Vietnam. CRC mainly focus on official social operations of the corporation under the control and approval of the Administrative Police Office.

CRC involves assessing corporate capacity, financial health, human resources management and other aspects by demand. CRC's activities, in general, provide some information about top corporations and involve in policy operation. This center, however, does not focus on predicting or providing warnings about the default possibility of corporations.

4.3 Credit Information Centre (CIC)

CIC is the first legal institution in charge of the detailed credit assessment project by the State Bank of Vietnam with almost full access to the legal reports of corporations in Vietnam based on the decision 57/2001/QD-NHNN.

In general, the corporate assessment of CIC is based on several kinds of data and information resources controlled by the government including the corporate regular audited financial reports, commercial banks' record about the corporations and other non-financial information provided by the National Police Office and Statistic and Data

Ministry. All the corporations under consideration are classified into different groups of different industries and of different sizes simultaneously.

Table 4.1 Industry codes by CIC

Code	Industry
101	Agriculture
102	Seafood raising
201	Mining
202	Processing
203	Electricity, Gas, and Water
301	Construction
401	Trading
402	Hotel and Restaurant
501	Transportation, warehouse, and telecommunication
601	Finance
602	Science and Technology
603	Assets trading and consultancy
604	Government policy and Army
605	Education
606	Medical and social activities
607	Sport and culture
608	Social welfare
609	Household services
610	International institutions

After being marked, corporations are ranked from top to bottom with good groups including AAA, AA, A and the lower groups including BBB, BB, B, CCC, CC, C.

Table 4.2 Credit ratings by CIC-Financial ratios ratings

		Rank				
Ratio	**Weight**	**A**	**B**	**C**	**D**	**lower than D**
Liquidity ratios						
1. Short-term liquidity	2	5	4	3	2	1
2. Quick ratio	1	5	4	3	2	1
Operating ratios						
3. Inventory Turnover ratio	3	5	4	3	2	1
4. Days sales in Accounts receivable	3	5	4	3	2	1
5. Assets Turnover ratio	3	5	4	3	2	1
Leverage ratios						
6. Debts/Total assets	3	5	4	3	2	1
7. Debts/ Equity	3	5	4	3	2	1
8. Overdued debts/ Total debts	3	5	4	3	2	1
Profitability ratios						
9. EBIT/Revenue	2	5	4	3	2	1
10. EBIT/Total assets	2	5	4	3	2	1
11. EBIT/ Equity	2	5	4	3	2	1

In table 4.2, eleven financial factors are divided into four groups representing liquidity, operation, leverage, and profitability. The financial ratios are calculated from the corporate audited financial statements. After assessing those ratios, CIC will give their opinion about individual firms in comparison with the industrial average. Then, an overall explanation is presented for each ratio based on the real annual economic situation.

Table 4.3 Credit rating mark by CIC

Rank	Mark	Comment
AAA	>139	Best
AA	124-138	Excellent
A	109-123	Good
BBB	94-108	Normal
BB	79-93	Acceptable
B	64-78	Need to be considered
CCC	49-63	Need to be concerned
CC	34-48	Weak
C	<33	Need to put under control

Besides these financial factors, CIC also tries to include further non-financial factors such as the time of operation, the managers' experience and the academic qualifications of the managers. However, the factors are quite subjective and have small weights in the whole process. The management capacity, internal environment, relationship with the credit institutes are not considered adequately in the whole assessment.

As can be seen from the ranking process, CIC relies on the expert system to assess corporations with the information collected from both official and informal sources which can be subjective and lead to bias. Secondly, there is no report about either the importance of financial ratios used or the relative relationship between them and the ranking results through statistical data. The credit ranking result of the year 2006 can be served as a typical example as most of the loan decision based on CIC's ranking became bad debts during the next three years based on the State Bank's internal report (2010). Over the total 11 financial ratios used by CIC, only five financial ratios are proved to be significant to differentiate corporations from AAA to C by the Wilks' Lambda test. Those ratios include Debt over Assets, ROA, Due debts over Total Debts, Debts over Equity and Inventory Turnover.

Step	Entered	Wilks' Lambda											
		Statistic	df1	df2	df3	Exact F				Approximate F			
						Statistic	df1	df2	Sig.	Statistic	df1	df2	Sig.
1	DOA	0.415	1	6	101	23.732	6	101	0.0000				
2	ROA	0.196	2	6	101	20.985	12	200	0.0000				
3	DOD	0.13	3	6	101					16.508	18	280	0.0000
4	DOE	0.095	4	6	101					13.742	24	343	0.0000
5	ITO	0.076	5	6	101					11.793	30	390	0.0000

Furthermore, also tested on the data of the year 2006, the Wilks' Lambda test verifies that not all financial ratios in the same group are significant in credit ranking assessment. For example, among the Operating ratios, only sales on receivable accounts can be used whereas inventory turnover, and assets turnover do not show significant results.

Step	Entered	Wilks' lambda					
		Statistics	df3	Exact F			
				Statistic	df1	df2	Sig.
1	Sales/receivables	0.797055	106	4.498254	6	106	0.000425

Among leverage ratios, only Debt over assets and Debt over Equity show significant results. Overdue debts over Total debts should not be included.

Step	Entered	Wilks' lambda					
		Statistics	df3	Exact F			
				Statistic	df1	df2	Sig.
1	DOE	0.362158	106	31.11499	6	106	2.58E-21
2	DOA	0.23467	106	18.626	12	210	4.15E-27

Among Profitability ratios, only ROA and ROE show significant results.

Step	Entered	Wilks' lambda					
		Statistics	df3	Exact F			
				Statistic	df1	df2	Sig.
1	ROA	0.71145	106	7.16525	6	106	1.97E-06
2	ROE	0.564336	106	5.795341	12	210	1.22E-08

Fourth, there is an assessment guide of CIC based on the scale of corporations which may lead to a positive relationship between the amount of equity, number of employees, sales and contribution to the government and risk level of the corporations. There is no evidence or quantitative proof of this assessment method. Furthermore, the definition of corporations' size is still vague and depends mostly on the experts' estimation in comparison to other corporations operating in the same industry.

Fifth, the CIC does not differentiate between short-term and long-term credit of the corporations under consideration.

Table 4.4 Credit rating content by CIC

Rank	Content
AAA	• Very good corporation. • Good profitability and operating efficiently. • Risk-free. • Clear development process.
AA	• Very good corporation • Good profitability and operating efficiently • Very low risk.
A	• Efficient operation • Have development potential • Certain limitation in financial resources and have some potential risks. • Low risk.

BBB	• Effective operation • Have development potential • Appropriate equity • Have potential risks. • Low risk
BB	• Effective operation • Have development potential • Low equity • Have potential risks. • Low risk
B	• A little inefficient operation • Low equity • Potential risks • Average risk.
CCC	• Inefficient operation • Inappropriate financial status • Low equity • High risk
CC	• Inefficient operation • Bad financial status • Low equity • High risk
C	• Suffer from a loss in the long term • Weak financial status • Have the possibility of default • Very high risk

Table 4.4 shows the details about the meaning of corporate ranking. It should be noted that there is no clear differentiation between two continuous categories such as BBB and BB, CCC and C. As a result, investors or banks that approach the CIC's ranking may be confused in making a decision.

4.4 The commercial banks

The general rules applied by commercial banks

Currently, commercial banks in Vietnam create their credit assessment procedure separately. These credit assessment systems provide only the relevant information that is required by the bank itself to issue credit and ignores other international standards.

Besides their internal credit rating systems, BIDV, Vietcombank, and Techcombank hire Moody's to support them in assessing themselves and constructing an effective credit quality assessing systems. However, due to the lack of corporate information and the inability to construct a standardized data report system for corporations operating in Vietnam, the projects of the involved banks have not published any progress yet.

The comparison

Table 4.5 Credit rating comparison

No		BIDV	Vietcombank	Vietinbank	CIC
I	Number of ranks	7	10	10	9
II	Ranks	A*;A;B;C;D;E;F	AAA,AA,A,BBB,BB,B,CCC,CC,C,D	AA+; AA; AA-;BB+;BB;BB-;CC+;CC;CC-	AAA; AA; A; BBB; BB; B; CCC; CC; C
III	Assessment factors				
1	Corporation scale based on	1. Equity 2. Employees	1. Equity 2. Employees 3. Revenue 4. Contribution to the government	1. Equity 2. Employees 3. Revenue 4. Contribution to the government	N/A

2	Industry	1. Agriculture, forest, and seafood 2. Trading and services 3. Construction 4. Other industries	1. Agriculture, forest, and seafood 2. Trading and services 3. Construction 4. Other industries	1. Agriculture, forest, and seafood 2. Trading and services 3. Construction 4. Other industries	1. Agriculture, forest, and seafood 2. Trading and services 3. Construction 4. Other industries
3	Financial ratios	12	16	16	Varied among years
3.1	Liquidity	1. Short term liquidity ratios 2. Acid tests	1. Short term liquidity ratios 2. Acid tests	1. Short term liquidity ratios 2. Acid tests	1. Short term liquidity ratios 2. Acid tests
3.2	Operating	3. Inventory turnover 4. Working capital turnover 5. Assets turnover 6. Receivable turnover 7. Revenue growth 8. Sales growth	3. Inventory turnover 4. Average receivable turnover 5. Sales/Assets	3. Inventory turnover 4. Average receivable turnover 5. Assets turnover 6. Receivable turnover	3. Inventory turnover 4. Working capital turnover 5. Assets turnover
3.3	Leverage	9. Assets/ Equity	6. Debt/total assets 7. Debts/Equity 8. Due debts/Total debts	7. Debt/total assets 8. Debts/Equity 9. Due debts/Total debts	6. Debt/total assets 7. Debts/Equity 8. Due debts/Total debts
3.4	Profitability	10. Revenue/Sales 11. ROA 12. ROE	9. Revenue/Sales 10. ROA 11. ROE	10. Revenue/Sales 11. ROA 12. ROE 13. (Revenue-financial profit)/sales 14. Interest coverage	9. Revenue/Sales 10. ROA 11. ROE

3.5	Cash flow	Not consider	12. Interest coverage in cash 13. Debt coverage in cash 14. Cash flow trend 15. Cash balance 16. Cash and cash equivalence	12. Interest coverage in cash 13. Debt coverage in cash 14. Cash flow trend 15. Cash balance 16. Cash and cash equivalence	Not consider
4	Nonfinancial information	10	25	25	Not consider
		1. Overdue debts 2. Debt renegotiation 3. Loans in correct purposes 4. Short leverage turnover 5. Overdue interest payable 6. Collateral amount 7. Credit relationship to the bank 8. Revenues in bank's account 9. Average deposit 10. Revenue to the bank	1. Management board's experience 2. Managers' experience in the industry 3. Internal control 4. Achievements 5. Profitable possibility of the projects 6. Due debts 7. Debts renegotiation 8. Overdue debts 9. Default frequency 10. Adequacy of information 11. Deposit period 12. Number of banks with deposits 13. Average transaction through/to the bank 14. Total transactions with the bank 15. Average monthly deposit to the bank 16. Industry development 17. Well known 18. Competitive advantages 19. Number of rivals 20. Effects of adjusted legislations on revenue 21. Business diversification 22. Export revenue 23. Dependence on partners 24. Net revenue over years 25. Corporations' position	1. Management board's experience 2. Managers' experience in the industry 3. Internal control 4. Achievements 5. Profitable possibility of the projects 6. Due debts 7. Debts renegotiation 8. Overdue debts 9. Default frequency 10. Adequacy of information 11. Deposit period 12. Number of banks with deposits 13. Average transaction through/to the bank 14. Total transactions with the bank 15. Average monthly deposit to the bank 16. Industry development 17. well known	

			in the industry	18. Competitive advantages 19. Number of rivals 20. Effects of adjusted legislations on revenue 21. Business diversification 22. Export revenue 23. Dependence on partners 24. Net revenue over years 25. Corporations' position in the industry	
5	Reward or punishment marks	10 to 20	N/A	N/A	N/A
6	Ranking system	Corporations can be ranked down	No regulation on rank down	No regulation on rank down	No regulation on rank down
7	Weights	every factor plays the same role	Considering the weights of factors	Considering the weights of factors	Considering the weights of factors

Table 4.5 above explains the credit ranking systems of the three biggest commercial banks in comparison with CIC. It is clear that the credit ranking systems in Vietnam are not uniform. Different financial institutions have different ranking processes with various groups of financial and non-financial factors included. The corporate ranking, hence, is different and the investor may be confused in choosing which system or set of ratings to follow.

The final section of this chapter clarifies the definitions of various relevant concepts used in the legal assessment of corporate default in Vietnam.

4.5 Definitions of some key concepts

i) Default corporation

The default corporations are the objective consequence of the open market economy. The results of corporate default event include the contrariety between the debt issuers and the borrowers, the conflict between the borrower's employees and the employers, the negative effects on the social welfare as well as the political security of the country.

In Vietnam, a clear understanding of the default corporation definition is the basis for establishing any effective preventive and governmental regulatory mechanism. According to the Article 2 of the Vietnamese Bankruptcy Law (VBL) 1993 and the Sub-Article 1_Article 3_Decree 189 of the Vietnamese Government, a corporation is said to face the high possibility of default when one of the following conditions happens:

- Encountering financial difficulties or incurring a loss in business activities
- Incurring loss in two continuous years which lead to the consequences of the inability of paying due debts, or inability of paying salary to the employees in three consecutive years
- Having already applied the necessary financial plans but still being unable to pay the due debts

In practice, the application of the above-mentioned definition is excessively complicated since there is no legal document restrict the application of the financial plan of the corporations and the State-Bank's control over this issue is typically loose. The VBL 2004, therefore, simplified the definition of default possibility. According to Article 3_VBL 2004, the corporations that are unable to solve the due debt according to the debt issuers' requirements are considered to face a certain possibility of default". As can be seen, the new definition is simpler to be applied as it does not depend on the time and the reasons for the default status. It, however, does not mention the amount and the overdue time of the debt and consequently allows the debt issuers to abuse the right to demand the submission of bankruptcy documents from the borrowers.

In some countries, the amount of debts and the overdue time are clearly stated. In Russia, for example, the bankruptcy law requires the debts under consideration to be more than 100,000 RUB for the institution as the lender and 10,000 RUB for the individual lender. In Australia, the Corporation Law requires the smallest amount of debts to be considered is 2,000 AUD, and the corporations must be proved to be unable to pay the debt as it becomes due.

According to Basel II, the possibility of default is considered to be the events related to the borrowers as at least one of the following issues happens:

- The inability of paying the due debts, including the interest and the debt itself.
- The inability to completing the financial obligation within 90 days from the due date.
- The total assets value is smaller than the debt.
- The requirements of the lender for the bankruptcy application.

Therefore, as combining all the best features of each above-mentioned default definition methods, from here and now on, the corporations are considered to face the possibility of default as at least one of the following events happen:

- Inability to fulfill the credit obligation toward their partners.
- Having negative working capital
- The market value of the corporation is less than the debt value.

For the first characteristic, the inability of the corporation to fulfill the credit obligation toward their partners is assessed by the method of using the fraction D of Overdue debt to the total debt (mostly come from the bank loan in Vietnam). If D is positive, the company can be considered the strong signal that the borrower cannot pay the money back on time. Unless they can pay the debt on time, it may lead to the broken of the borrower-lender among us (relationship) and the borrower cannot borrow money from the banks anymore which leads to the postpone in the business activities and the corporation has to face a huge possibility of going bankrupt.

The second characteristic is reflected through the difference between the current assets and current liabilities. There is a positive relationship between the amount of working capital and the financial health of the company. If the working capital is negative, there is a high possibility that the long-term assets of the company are constructed based on the short-term capital coming from short-term borrowing. The imbalance in working capital leads to the consequence of using the long-term assets to cover the due short-term liabilities and put the corporations into the danger of default.

In the third characteristic, the market value of the corporation is assessed by the value of the stocks. In an effective stock market, the market value of the corporation reflects almost all related aspects. In overall, the market value of the corporation is usually higher than the liquidate value or the book value. As the corporation operates well and has a healthy financial status, the corporate stocks will be overvalued and vice versa. Consequently, the lender will reduce the amount of debt they lend out if the market value of the corporation shows negative financial health. Furthermore, the value of the corporation plays the role of collateral to the debt so that the banks will be more careful with their credit decision. In an ineffective market and unpredictable economy of Vietnam, the collateral is the priority in the decision-making process of the bank to issue credit to corporations.

ii) SME

The most popular type of corporations in Vietnam is Small and Medium size enterprises (SMEs). In Vietnam, according to the Decree No 56/2009/NDD-CP dated 30th September 2009, the SMEs are defined to be the legally registered corporations which are classified into three categories including the micro, small and medium-sized enterprises. The categories are constructed based on the total capital of the corporations or the annual average number of employees. In Vietnam, the SMEs include all the corporations with legal registration, no more than 100 billion VND and/ or no more than 300 annual average number of employees.

Most of the SMEs in Vietnam have small management boards with small scales and flexible management style due to the lack of capital and out of date technology. Additionally, the financial records of those corporations lack transparency and do not follow a uniform regulation and format.

CHAPTER 5: METHODOLOGY, VARIABLES, AND SAMPLE SELECTION

From the review of the conceptual and empirical literature concerning the measurement and determination of corporate financial status and more specifically financial distress, there is still no consensus view on the ideal conceptual framework or empirical method in this field. In the context of the Vietnamese economy, the examination is further complicated by the unique macroeconomic and market conditions as well as issues regarding data availability, reliability, and confidentiality. Therefore, the empirical examination of the financial status of the Vietnamese firms can only be exploratory and multi-faceted to provide a triangulated view. In terms of conceptualization of the financial status of the Vietnamese firms, the following issues are critically important: 1) what factors, from macroeconomic to firm-specific, significantly determine the credit ratings of the corporate firms? 2) Do earnings manipulations make a difference to the impacts of such factors on credit rating? 3) Does the capital structure affect corporate financial distress? 4) What factors, again from macroeconomic to firm-specific, significantly determine the shift in corporate credit ratings over time? To examine such issues, various empirical models and methods will be adopted, and the following sections explain the details of such empirical procedures.

5.1 Empirical study design

The first key issue of the current study is to investigate how corporate credit ratings in Vietnam are determined by what factors. Since we are testing the determinants of credit ratings, corporations' credit ratings will be the dependent variable of the analysis. Since the literature on financial distress and corporate financial performance has focused on a wide range of financial ratios, and because the dataset is in a panel form with a large number of cross-sectional units (i.e. N = 500) but a small number of time periods (T = 4), special considerations must be given to specify and estimate the empirical model using valid methods. For the empirical specification, the current study draws from the literature review and includes a wide range of financial ratios that are potentially relevant for

determining the corporate credit ratings in Vietnam. For the estimation of the empirical model, the following critical issues are examined step-by-step.

First of all, we have to pay attention to the issue that the sample includes 2,000 observations coming from 500 companies which are observed in 4 years. Since the Ordinary Least Squares estimation method is the best-linear-unbiased estimator, it is the natural starting point for the estimation process by treating the panel dataset as a pooled dataset. However, OLS makes a strict assumption that all the 2000 observations for the dependent variable and the error term are random draws from independent and identically distributed random processes. In other words, if we present the relationship between the independent variables and dependent variable as $Y_{it}= \mu_i + \beta_i X_{it} +\varepsilon_{it}$, we have to test whether $E(\mu_i) \neq 0$ and unobservable individual firm effects exist. Hence, in the first step we will examine the hypothesis H_0: a pooled OLS model is adequate. To do the test, we will run the panel model with random effects for the panel model and then run the Breusch and Pagan Lagrangian multiplier test for the existence of random individual firm effects. According to the research of Breusch and Pagan (Breusch, T.S, and Pagan, A.R, 1979), the test's null is that the variance of the random effect is zero: $Var(\mu_i)=0$. Effectively, this would mean every observation has the same intercept, and pooled regression can be used. If the hypothesis H_0 is rejected, then we definitely have to pay attention to individual firm's effect in the model.

If the pooled model is rejected which suggests the existence of individual effects, the next step is to distinguish between the Random Effect Model and the Fixed Effect Model.

Fixed effect model (FEM): $Y_{it}= \alpha_i + \sum_{k=1}^{K} \beta_k X_{kit} + \varepsilon_{it}$

Random Effect model (REM): $Y_{it}= (\alpha_0 + \mu_i) + \sum_{k=1}^{K} \beta_k X_{kit} + \varepsilon_{it}$

In which i= 1;…N and t= 1; …; T denoting the cross-sectional and time dimensions respectively. Fixed individual effects are α_i and random individual effects are (α_0 + μ_i) which is assumed to be normally distributed. The Hausman test (Hausman, (1978)) examines whether the constant μ_i and the explanatory variables X_{kit} are significantly correlated. If the answer is yes then the FEM is the valid test. Otherwise, REM will be a

better fitting model. If the null hypothesis H_0: the random effect model is adequate is rejected, then there are fixed effects in the panel data.

Another potential problem with the ordered-probit and other regression models is that the estimated model may suffer both the endogeneity and serial correlation problems, since credit ratings and a number of financial ratios typically affect each other, and credit ratings also tend to show serial correlation over time (i.e. good rating in one year tends to lead to good rating in the following year, and vice versa). Heckman (1977) suggests that estimation of simultaneous equation models in such a situation may result in a complicated and high dimensional joint probability distribution and hence the likelihood function. Since the ordered-probit models assume latent continuous probability distribution suppressing discrete manifestation of the distribution, ordinal endogenous variables involving such distributions will lead to an intractable model. Moreover, as working on a panel structure, ordered-probit models can become exceedingly difficult with the increasing number of categories of the dependent variable and time periods (Baltagi and Pirotte, 2010).

Consequently, in the next step, we will test for serial correlation in the data using the xterial command in Stata (Wooldridge, 2003). The command provides simulation results that the test has good size and power properties in the reasonably sized sample (Drunkker, D.M, 2003). If the test rejects the null hypothesis H_0: no autocorrelation of any order, then there is the existence of autocorrelation.

To test for the potential endogeneity problem, the procedure is to run the modified panel model with instrumental variables (IV) under FEM or REM (depend on the result of the mentioned-above Hausman test). Then, we do the Hausman test with null hypothesis H_0: the original FE (or RE) model is valid. If the test rejects H_0, the result suggests that the financial ratios under consideration are endogenously related to corporate credit ratings.

In the presence of both autocorrelation and endogeneity, Arellano and bond (1991) proposed the use of the generalized method of moment (GMM) estimator for dynamic panel models. The GMM method is extensively used for estimating the dynamic data

structure (Oztekin and Flannery, 2012; Cheng, 2014; Lu et al. 2015). GMM is the best technique for dynamic panel data and generally can be utilized in situations where there may be fixed individual effects, the independent variables are not totally exogenous and the error term, as well as the data sample, has small time periods and large cross-sectional units (Cheng, 2014). Lagged values of the dependent variable will be included in the model as it helps to solve heteroskedasticity and auto-correlation problem.

The study proceeds to examine the potential impact of earnings management on credit ratings. As Shen et al. (2012) show, the influence of financial ratios on credit ratings is significantly affected by the accounting information asymmetries, i.e. the internal accounting practices are generally unobservable to the general public or external stakeholders. Hence, the effects of information asymmetries should be reduced to ensure accurate credit ratings. Cho et al. (2012) illustrate that the ratings' predictive power would be increased as earnings management is adopted, especially in developing markets. Since corrective action is considered to be necessary to adjust the corporate accounting information bias, we should determine whether the accuracy of credit ratings is affected by this action. We investigate the earnings management effects by following Manab et al. (2015) by including various adjusted financial ratios in the ordered-probit model to compare their impacts to the original models that are estimated using the unadjusted variables.

The methods that are discussed so far cannot determine whether the corporations' credit ratings will change, especially deteriorate, over time. The next aspect of the study is to examine how macroeconomic factors together with rating-specific factors influence the shifts in corporate credit ratings. This aspect of the study is useful as firms' ratings do shift over time (Altman and Kao, (1992)). Furthermore, a corporation's rating history (by a downgrade or an upgrade) significantly influences its current ratings (MacDonald and Van de Gucht, 1999; Lando and Skødeberg, 2002; Hamilton and Cantor, 2004). Additionally, the corporate credit ratings and the rating drifts are found to be affected by macroeconomic conditions that define various economic regimes (Nickell et al., (2000)).

Several other studies also confirm such findings (Kavvathas, (2001); Couderc and Renault, (2004); Duffie et al., (2007)). In this study, we employ the Cox Hazard model in which independent variables include macroeconomic factors and the corporations' rating history (which is measured as dummy variables). We assume that all the factors related to a firm's financial ratios or capital structures are reflected in corporate credit rating history. The hazard event is defined to be the situation where the corporation is rated C or lower (high probability of default). We examine the effect of each group of macroeconomic factors in conjunction with the ratings-related variables on credit rating transition.

Finally, we examine the effect of corporate capital structure on various indicators of financial distress, which will indirectly affect corporate credit ratings. Various indicators are used to represent financial risks of the corporations (the dependent variable in the regression models), including ROE which shows the profit distribution to the stockholders as well as the current ratio and interest coverage ratio that capture the risk of financial distress in situations where corporations cannot cover the short-term debts or interest expense. The critical independent variable is corporate leverage which represents the firm's capital structure. The control variables include Return on Assets (ROA), cost of debt after tax, log (current assets CA), Return on Investment (ROI) and cost of debt before tax. Due to the panel nature of the data, OLS regression technique is unsuitable (Leamer, 1978). Therefore, we follow the same procedure of tests for the credit rating determination model to select the most appropriate estimation method.

5.2 Variables selection

5.2.1 Financial ratios

From the literature concerning credit risk measurement using financial ratios and credit rating determinants analysis, we select the following variables and establish a number of hypotheses to conduct the empirical tests for this study:

Size: According to the empirical literature, large corporations have better access to credit as they are considered to be important to the whole economy. They also receive aid and

support from the government. Therefore, due to their lower market risk, larger companies usually have higher credit ratings (Bhojrai and Sengupta, 2003). Furthermore, larger corporations can "sustain unfavorable changes in economic conditions" (Bouzouita and Young, 1998). They also have the capacity to minimize the impact of economic, social and political uncertainties. Therefore, the size of the corporations is expected to have a positive relationship with credit ratings (Kim and Gu, 2004). In this research, the natural logarithm of the total assets is used as the proxy for corporations' size. We use the logarithm of the total assets since most of the other variables are ratios and the total assets value is in natural number so that we have to make them uniform to use in the model.

Asset structure: Assets are the resources controlled by the corporations as a result of past events and are expected to generate future benefits for the companies. "The economic benefits correspond to production potential, a possibility for conversion into cash or a reduction in output capacity of funds (cost reduction) that an asset contributes, directly or indirectly to company-specific cash flow." (Liviu, 2005). Therefore, firms with a better asset structure are expected to have higher credit ratings. In general, normal firms are expected to maintain an acceptable level of short-term assets to ensure their liquidity. The ratio of Short-term assets/ Total assets are considered.

Leverage: The financial source of the corporation comes from liabilities and equity. Ceteris paribus, higher leverage makes the corporation riskier. Since the higher debt level increases the probability of financial distress and hence the rating is affected by adverse variations in underwriting and economic conditions (Bouzouita and Young, 1998). A greater level of liabilities may also make the firm less cautious toward any unanticipated fluctuations to its financial sources (Grey et al., 2006). Consequently, high- debt corporations may have high financial uncertainty and high risk of insolvency (Chiu and Chiang, 2008). Therefore, a negative relationship between credit rating and the leverage level of the enterprise is expected. The leverage level of the corporation will be analyzed through the ratio of Debt/Total assets.

Liquidity: Firms with higher liquidity may avoid the circumstance of selling assets at a discounted value to meet the unexpected needs of cash (Bouzouita &Young, 1998). As a result, firms with higher liquidity possess the better capacity of short-term liabilities covering since current assets can be converted into money faster (Rjoe, 2005). In the empirical study conducted by Adams et al. (2003), credit ratings are obtained with various important factors, including corporate liquidity. The current ratio is used to measure liquidity.

Financial coverage: Financial coverage ratios are calculated by divide the corporate income or cash flow by total expenses. Since the financial coverage captures the corporation's ability to generate a resource for expenses payment (Bone, 2007), it is expected to be positively related to credit ratings. Gray et al. (2006) state that credit ratings are highly sensitive to coverage ratio. The short-term payment is analyzed in order to capture all the short-term obligation coverage capacity of the corporations. The short-term payment ratio is calculated by divide the short-term corporate cash flow by total short-term expenses.

Activity ratios: Activity ratios are effective in gauging the corporations' ability to convert their assets into financial benefits. These ratios are expected to relate to the credit ratings positively. Since the credit ratings in the sample are annual ones, short-term assets turnover and equity turnover is taken into consideration.

Profitability: Firms with good profitability will clearly have a greater ability to meet its financial obligations (Grey et al., 2006). Profitability also reflects the management ability to maintain strong operation and fair pricing (Bouzouita and Young, 1998). Therefore, it is expected to have a positive relationship with credit ratings and profitability analysis provides insights into corporations' ability to effectively control expenses (Adams et al., 2003). EBIT/Sales, ROA and ROE are adopted as relevant measures.

Market ratios: The market ratios concern return on investment by shareholders. The great returns prove the good financial condition of the corporation. Consequently, higher market ratios mean better credit ratings. Earnings per share are used in this research.

Growth: Corporate growth can be measured by its growth rate in sales, stock price or equity value. High growth rates indicate strong future corporate performance and higher economic value (Adams et al., 2003). Therefore, corporations with better growth rates usually receive better ratings. This point is confirmed in the study of Bouzouita and Young (1998), which shows that sustained increase in enterprises' surplus leads to a better rating. Sales growth rate, stock growth rate and equity growth rate are in the list of variables.

In the credit ratings determination model, the key determinants are identified from the literature review and include four groups of financial ratios: the financial ability of the corporations including working capital to total assets (capturing liquidity of the corporations); retained earnings to total assets (capturing profitability of the corporations); EBIT to total assets (capturing productivity of the corporations) and equity to total liabilities (capturing leverage level of the corporations).

The financial ratios used in this research, together with the expected sign of impact as suggested by the literature, are summarised in the following table:

Financial ratios group	Financial ratios	Denotation	The expected sign of the coefficient
Size	Logarithm of Assets= log (Total Assets)	*size*	+
Assets structure	Short term assets proportion= Short term assets/ Total Assets	*sta_ta*	+
Leverage	Leverage ratio= Total debts/ Total Assets	*dbt_ta*	-
Liquidity	Current ratio= Current Assets/ Currents Liabilities	*current*	+
Financial Coverage	Short term payment ratio= Short term corporate cash flow/ Total Short-term expenses	*stpay*	+
Activities Ratio	Short term assets turnover= Net Sales/ Short-term Assets	*stasset_to*	+

	Equity turnover= Net Sales/ Total Equity	*equity_to*	+
Profitability	EBIT- sales= EBIT/ Sales	*ebit_sales*	+
	Return on Assets (ROA)= Net Income/Total Assets	*roa*	+
	Return on Equity (ROE)= Net Income/ Shareholder's Equity	*roe*	+
Market ratio	Earnings per Share= Total earnings/ Number of shares outstanding	*eps*	+
Growth rate	Sales growth rate= % changes in Sales	*sales_growth*	+
	Stock growth rate= %changes in stock price	*Stockp_growth*	+
	Equity growth rate= % changes in equity	*equ_growth*	+

The expected sign of the coefficients of the financial ratios is the hypothesized relationship between those ratios and the corporate credit ranking as presented for each ratio.

5.2.2 Macroeconomic factors

Due to the macroeconomic instability in Vietnam and hence the volatile environment for the Vietnamese firms to operate, it is important to investigate the effects of macroeconomic factors on corporate credit ratings. 14 macroeconomic variables are selected and grouped into four categories: general macroeconomic conditions, the direction of the economy, government's policies, and financial market conditions. All the covariates are examined on an annual basis.

In the group of general market conditions, two indicators are examined, including the unemployment rate and inflation rate (calculated by the variation of a Producer Price index (PPI). PPI measures of how much the manufacturers and other businesses receive for their goods and services; or in other words the prices they charge as opposed to what consumers are paying. Changes in PPI are crucial as they tend to lead consumer prices and hence can give advanced warning of the onset of inflation.) In the category of the direction of the economy, real GDP growth rate, change in consumption, change in total investment, the growth of the industrial product, the growth of export and import, and change in the current account are considered. The government's policy for the country's

development is presented by the changes in fiscal balance, changes in public debt and variation in external debt. For the financial market condition, the variation in money supply and long-term interest rate are adopted.

The macroeconomic variables used in this research are summarised in the following table:

Groups	Macroeconomic variables
General Market Condition	Unemployment Rate Inflation (PPI, annual variation in %)
The direction of the economy	Economic Growth (GDP, annual variation in %) Consumption (annual variation in %) Investment (annual variation in %) Industrial Production (annual variation in %) Exports (annual variation in %) Imports (annual variation in %) 11.1 Current Account (% of GDP)
Government's policy	Fiscal Balance (% of GDP) Public Debt (% of GDP) External Debt (% of GDP)
Financial Market Condition	Money Supply (annual variation in %) Policy Interest Rate (%)

5.2.3 Capital structure

The relationship between equity and debt in the capital structure is commonly measured by financial ratios such as the debt ratio, equity to assets, debt to equity, assets/ average equity ratio.

Ratio	Meaning
Debt/Total Assets	Measure the proportion of debt in the total capital. If this ratio is larger than 50%, the capital mainly comes from debt.
Equity/ Total Assets	Measure the proportion of equity in the total capital. If this ratio is larger than 50%, the

	capital mainly comes from equity.
Debt/Equity	One unit of equity has to secure how many units of debt. If this ratio is larger than 1, the capital mainly comes from debt.
Average total assets/ average equity	Total capital equals how many times of equity. If this ratio is larger than 2, the capital mainly comes from equity

In the first aspect of capital structure analysis, the main purpose is to identify the main source of capital. If equity is the main source of funding, the corporation can be considered to be secured with really low financial risk, but the downside is the lack of flexibility and a high cost of capital. In contrast, if the corporation mainly uses debt as a financial source, besides the tax benefit and low cost of capital, the corporation may have to face a rising level of default possibility, especially with a high proportion of short-term debts.

In the second aspect of capital structure analysis, the combination of short-term and long-term debts will be considered.

Ratio	**Meaning**
Short-term debts/ Total assets	Measuring the proportion of short-term debts in the total capital.
(Long term debts+ Equity)/ Total assets	Measuring the proportion of long-term capital.

Corporations with a large amount of fixed assets are usually suggested to maintain a large proportion of long-term capital to ensure the safety level against default risk.

In examining the link between corporate capital structure and financial distress, there are two kinds of financial risks to be considered. The first one is that the negative influence of using debts on the return of the shareholders, which is measured by the effects of leverage using ROA and ROE. However, in this research, we mainly focus on the second aspect of financial risk, which is more commonly related to various indicators of the

possibility of default. Such indicators include the current ratio, interest coverage, and the ability of debt payment from earnings.

Current ratio= current assets/ Current liability.

This ratio measures a firm's ability to meet its short-term (within a year) debt obligations such as accounts payable (payments to suppliers) and taxes and wages with its current assets. Current assets and liabilities on the balance sheet are those that either convert to cash within one year, such as one-year Certificates of Deposit or inventory for sale, or short-term loans due within one year. Currently, most of the leading commercial banks in Vietnam and the Financial Ministry consider 1 to be the acceptable current ratio. However, this level of 1 is quite risky since minor issues such as reduction in product demand, overdue account receivable, etc. can put pressure on the financial status of the corporation. Consequently, the current ratio should probably larger than 1. Simultaneously, corporations should maintain reasonable inventory and receivable level as well as no overdue short-term debt. Ideally, the current ratio of the corporation should be larger than the average of the industry.

Industry-specific characteristics of a firm may require different levels of current assets and current liabilities and hence different current ratios. For example, corporations with long production turnover such as shipbuilders should have a higher current ratio since their inventory and account receivables are usually higher, whilst their cash inflow is more unstable in comparison with other industries. In contrast, corporations with a short product turnover period can receive cash in the short term and acquire longer account payable due period so that they have a lower current ratio. Therefore, corporations under consideration should be divided into different industries and selected from each industry, and healthy corporations with good credit history will be selected to calculate the reasonable current ratio for the industries. The result is used as a benchmark for the assessment process.

One notable point regarding the calculation of inventory is that in the Vietnamese accounting system the inventory level is recorded in real prices, not selling prices.

Interest coverage= EBIT/ Interest payment

The interest charge ratio shows the corporation's ability to pay off interest charges. This ratio depends on the efficiency of capital use as is reflected by the difference between ROA and the bank's interest rate on the one hand and the leverage of the corporation on the other. Currently, the debt of corporations operating in Vietnam mainly comes from bank borrowing. Therefore, most commercial banks expect a high interest coverage ratio to ensure the low possibility of default. However, since the interest rate coverage is mainly based on changes in EBIT, the profit trend should be considered in the assessment process. EBIT is expected to grow over time.

Net Cash flow ratio to due long-term debt= Net Cash Flow from Business activities/ Long-term debts due

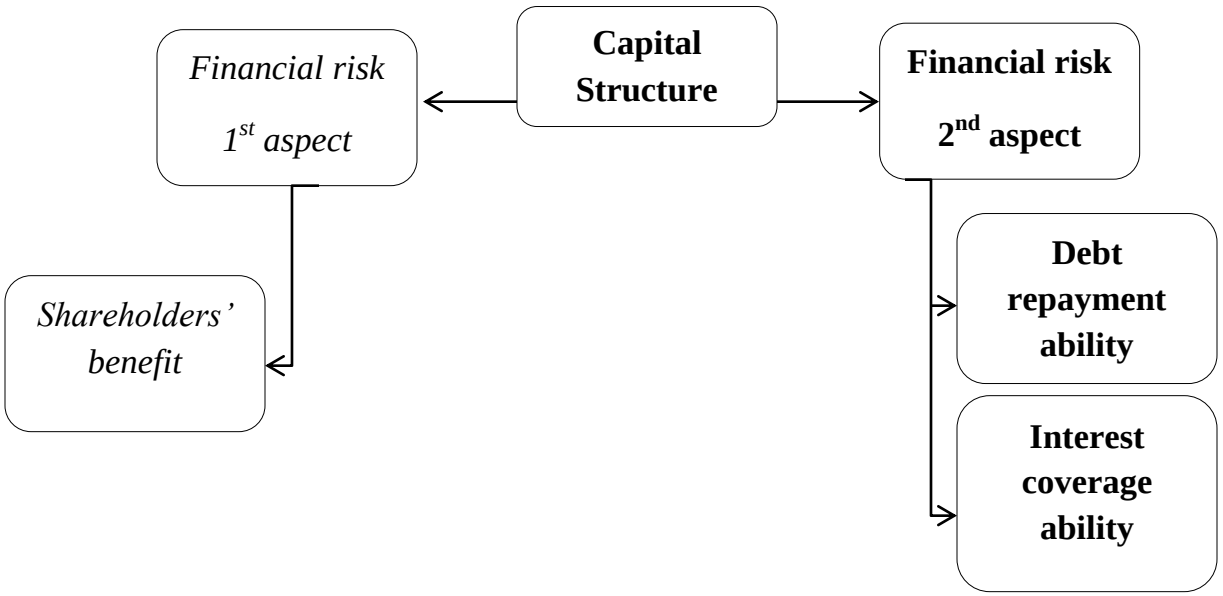
This ratio only considers the cash flow generated from business activities in the analysis period. The ratio is expected to be larger than or equal to 1 in order to ensure that the debts payment due can be met.

Net cash flow from business activities to short-term debts= (Net cash flow from business activities- Due Long-term debts)/ Short-term debts

This ratio makes the payment security stricter as it expects a corporation to not only fulfill the obligation of long-term debt repayment but also ensure paying the short-term debt in the period under consideration. Therefore, this ratio is expected to be larger than 1.

We have the leverage structure approach as below:

Figure 5.1 Capital structure approach



As mentioned above, the focus of the current research is on the 2nd aspect of the financial risk of capital structure. In the empirical model, the dependent variable is the default possibility as measured alternatively by the current ratio CR (to identify the ability of principal repayment) and interest coverage ratio ICR (to identify the ability of interest repayment).

The independent variable is the debt ratio (equal debt to total assets) with the control variables including current assets scale measuring by natural logarithm of current assets for the analysis of principal repayment and profitability of the corporation measuring by Return on Investment ratio ROI, and cost of debts before tax for the analysis of interest repayment. Capital structure (leverage level) of corporations plays an important role in credit ratings. Therefore, it is worth having a further look at the capital structure of corporations

As is mentioned in the literature review in an earlier section, corporations with high current liquidity can reduce the default risk (Amalendu and Somnath, 2012). However, the current ratio and the liquidity of the assets can have a negative relationship to the

leverage level (Rasa, 2012). In contrast, there is a positive relationship between leverage and default risk, representing a trade-off between the benefits of leverage in the form of tax reduction and lower WACC and the costs of leverage in terms of default risk (Amalendu and Somnth, 2012; Mohammad et al., 2013; Javad and Hamed, 2011).

In the case of Vietnam, existing studies show that the increase in leverage can reduce the repayment ability of corporations for both principal and interest (Phan Lan Thi Trinh, 2013). There is also a close relationship between the capital duration structure to the default risk (Tung Hoang, 2011) despite the fact that most of the Vietnamese corporations currently are using short-term debts to support themselves financially (Duc Hoang Quan Vuong, 2014). Furthermore, the bigger the corporation is, the higher leverage they use in the capital structure.

There are some assumptions for the research:

- The short-term debts are assumed to be secured by short-term assets. Therefore, the short-term debts repayment ability depends on not only the capital structure but also the amount of the current assets.
- The interest payment is secured by EBIT which depends on the profitability of the corporation, capital structure and the cost of debt.

Hypothesis

Ho: Capital structure does not have a significant influence on shareholder value H1: Capital structure has a significant influence on shareholder value
Ho: Capital structure does not have a significant negative relationship with the short-term debt payment ability Ha: Capital structure does have a significant negative relationship with the short-term debt payment ability
Ho: Capital structure does not have a significant negative relationship with the interest payment ability. Ha: Capital structure does have a significant negative relationship with the interest payment ability.

As can be seen, all the dependent variables represent the financial risks of the corporations which correspond to the assessment aim of credit ratings. ROE shows the profit distribution to the stockholders. The current ratio and interest coverage ratio present the risk of financial distress in case that corporation cannot cover the short-term debts or interest expense.

The independent variable is corporate leverage which represents the firm's capital structure. Therefore, we can examine the effects of capital structure on the firm's financial distress possibility and hence its credit ratings.

The instrumental variables include Return on Assets (ROA), cost of debt after tax, log(current assets CA), Return on Investment (ROI) and cost of debt before tax.

5.3 Sample selection, methodology and models setup

5.3.1 Sample selection

The sample consists of 500 Vietnamese corporations that have been rated by the Vietnamese State Bank: Credit Information Centre (CIC) between 2011 and 2014. The annual credit rating is obtained through the data center of the CIC with confidential approval. Concurrent and complete financial reports of the analyzed corporations for the period from 2011 to 2014 are provided by the CIC and from the official websites of the corporations themselves. The official credit ratings are commonly released by CIC 12 to 16 months after the balance dates to ensure that all the changes based on the published information are captured in the corresponding rating. Therefore, although the credit ratings are issued after the balance date, we still consider the annual financial report to be contemporaneous with the ratings. Since the CIC started collecting full data and other information from corporations from the end of 2010 and the annual corporate financial statements are allowed to be submitted in a period of 6 months after the financial year, at the time of this research conducted, a full set of data is available only for the period from 2011 to 2014.

Due to the top confidential nature of the credit ratings according to Vietnamese law, the number of corporations in each industry in the sample cannot be equal. Some financial data is classified and is restricted to be published. Since the Vietnamese Industry Classification is quite complicated and most of the corporations in the sample operate in several market sectors, we do not use the Vietnamese Industry Classification system. The industries of the sampled corporations are classified using the Industry Classification Benchmark (ICB) launched by Dow Jones and FTSE in 2005 and currently owned solely by FTSE International. The industries are coded as follow:

Table 5.1 Industry classifications

This table presents the industry classification used in this research based on the ICB standard.

Industry	Code
Petrol, oil, and gas	0001
Basic materials	1000
Industrials	2000
Consumer goods	3000
Healthcare	4000
Consumer services	5000
Utilities	7000
Financials	8000
Technologies	9000

The sample includes 500 Vietnamese firms with ratings ranged from AAA to C in four years from 2011 to 2014. (***For more information about the credit rating system of CIC, see the part of Credit rating systems in Vietnam***). Therefore, in total, we have 2000 observations. All the observations are adjusted by the CIC. The summary by year is presented in panel A, and the summary by industry is presented in Panel B of Table 2 below:

Table 5.2 Distribution of Sample Observations over rating class, time and industry

This table shows the sample of CIC's credit ratings of Vietnamese corporations used in the research. The period is from 2011 to 2014.

	AAA	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**	**CC**	**C**	Total
Panel A: Corporate credit rating by year										
2014	42	126	89	105	68	47	12	3	8	500
2013	32	103	111	92	68	58	21	5	10	500
2012	28	109	90	93	83	67	18	7	5	500
2011	30	102	107	112	88	53	7	0	1	500
Total	132	440	397	402	307	225	58	15	24	2000
Panel B: Corporate credit rating by industry										
Petrol, oil, and gas	4	5	6	1	0	0	0	0	0	16
Basic materials	18	62	69	51	32	15	3	2	0	252
Industrials	34	123	95	137	153	137	41	9	15	744
Consumer goods	35	75	55	54	31	25	4	0	5	284
Healthcare	8	23	13	11	3	1	1	0	0	60
Consumer services	21	49	56	39	11	9	3	0	0	188
Utilities	11	36	27	18	4	0	0	0	0	96
Financials	0	54	63	76	63	38	6	4	4	308
Technologies	1	13	13	15	10	0	0	0	0	52
Total	132	440	397	402	307	225	58	15	24	2000

As can be seen from the above table, most of the observations in the research are rated from BB to AA which means they have low risks and high development potential. High-risk corporations (CCC to C) account for a small proportion of the sample. The corporations are picked randomly by CIC even though they have a similar scale of operation. Hence, the distribution among industries is unequal.

The descriptive statistic by credit rating groups for a range of financial ratios which are expected to be relevant to the credit rating process is presented as follow:

Table 5.3 Descriptive Statistics of financial ratios

This table presents summary statistic information for the 15 financial ratios used in the research according to the rating categories. The sample period used is from 2011 to 2014 using a panel of 2,000 observations.

	Observation	Mean	Standard deviation
AAA			
Short-term assets/Total assets (sta_ta)	132	0.67	0.18
Debt/Total Assets (dbt_ta)	132	0.30	0.12
Current ratio (current)	132	3.07	1.95
Short-term payment ratio (stpay)	132	1.13	1.48
Short-term assets turnover (stasset_to)	132	3.53	3.00
Equity turnover (equity_to)	132	3.47	2.51
EBIT/Sales (ebit_sales)	132	0.14	0.14
ROA (roa)	132	0.16	0.09
ROE (roe)	132	0.23	0.12
Sales growth rate (sales_growth)	132	0.20	0.31
Earnings per share (eps)	132	0.34	0.80
Equity growth rate (equ_growth)	132	0.14	0.18
Cash growth rate (cash_growth)	132	0.39	0.95
Stock price growth rate (stockp_growth)	132	0.23	0.48
Size (size)	132	12.88	1.49
AA			
Short-term assets/Total assets	440	0.62	0.40
Debt/Total Assets	440	0.34	0.30
Current ratio	440	3.32	4.18
Short-term payment ratio	440	1.20	3.33
Short-term assets turnover	440	2.31	2.01
Equity turnover	440	2.23	2.18
EBIT/Sales	440	0.30	1.10
ROA	440	0.12	0.07
ROE	440	0.18	0.10
Sales growth rate	440	0.15	0.41
Earnings per share	440	0.39	1.49
Equity growth rate	440	0.13	0.28

Cash growth rate	440	1.11	6.24
Stock price growth rate	440	0.18	0.54
Size	440	13.05	1.48
A			
Short-term assets/Total assets	397	0.59	0.24
Debt/Total Assets	397	0.48	0.20
Current ratio	397	3.09	7.66
Short-term payment ratio	397	0.74	2.59
Short-term assets turnover	397	2.81	2.87
Equity turnover	397	4.10	5.43
EBIT/Sales	397	0.11	0.16
ROA	397	0.06	0.04
ROE	397	0.14	0.11
Sales growth rate	397	0.43	2.58
Earnings per share	397	1.11	6.56
Equity growth rate	397	0.36	4.13
Cash growth rate	397	0.82	2.81
Stock price growth rate	397	0.14	0.61
Size	397	13.06	1.43
BBB			
Short-term assets/Total assets	402	0.60	0.24
Debt/Total Assets	402	0.53	0.21
Current ratio	402	2.96	12.26
Short-term payment ratio	402	0.36	1.54
Short-term assets turnover	402	1.89	1.74
Equity turnover	402	3.07	3.67
EBIT/Sales	402	0.08	0.37
ROA	402	0.03	0.05
ROE	402	0.09	0.12
Sales growth rate	402	0.49	4.98
Earnings per share	402	-0.97	44.74
Equity growth rate	402	0.10	0.38
Cash growth rate	402	1.28	8.93
Stock price growth rate	402	0.05	0.59
Size	402	13.17	1.59
BB			
Short-term assets/Total assets	307	0.63	0.24
Debt/Total Assets	307	0.60	0.19
Current ratio	307	1.77	2.88
Short-term payment ratio	307	0.14	0.29
Short-term assets turnover	307	1.43	1.38
Equity turnover	307	2.74	3.06
EBIT/Sales	307	-0.47	4.21

ROA	307	0.01	0.06
ROE	307	0.04	0.11
Sales growth rate	307	0.14	0.80
Earnings per share	307	-4.55	41.77
Equity growth rate	307	0.08	0.39
Cash growth rate	307	1.23	7.73
Stock price growth rate	307	-0.09	0.44
Size	307	13.26	1.35
B			
Short-term assets/Total assets	225	0.65	0.20
Debt/Total Assets	225	0.68	0.12
Current ratio	225	1.33	0.89
Short-term payment ratio	225	0.08	0.13
Short-term assets turnover	225	1.03	0.68
Equity turnover	225	2.32	1.81
EBIT/Sales	225	-0.18	1.43
ROA	225	-0.01	0.06
ROE	225	-0.02	0.15
Sales growth rate	225	0.08	1.01
Earnings per share	225	-10.41	91.69
Equity growth rate	225	-0.03	0.17
Cash growth rate	225	0.82	3.77
Stock price growth rate	225	-0.10	0.50
Size	225	13.29	1.26
CCC			
Short-term assets/Total assets	58	0.71	0.16
Debt/Total Assets	58	0.73	0.13
Current ratio	58	1.25	0.52
Short-term payment ratio	58	0.06	0.11
Short-term assets turnover	58	0.68	0.46
Equity turnover	58	2.13	2.27
EBIT/Sales	58	-0.17	0.61
ROA	58	-0.03	0.06
ROE	58	-0.10	0.23
Sales growth rate	58	-0.07	0.62
Earnings per share	58	-37.12	219.44
Equity growth rate	58	-0.01	0.62
Cash growth rate	58	1.45	7.62
Stock price growth rate	58	-0.08	0.45
Size	58	13.52	1.46
CC			
Short-term assets/Total assets	15	0.64	0.21
Debt/Total Assets	15	0.71	0.08
Current ratio	15	1.47	0.72

Short-term payment ratio	15	0.03	0.04
Short-term assets turnover	15	0.65	0.68
Equity turnover	15	1.26	1.18
EBIT/Sales	15	-2.36	8.95
ROA	15	-0.03	0.06
ROE	15	-0.08	0.19
Sales growth rate	15	-0.18	0.34
Earnings per share	15	1.13	9.98
Equity growth rate	15	-0.04	0.16
Cash growth rate	15	0.32	1.58
Stock price growth rate	15	0.04	0.32
Size	15	13.62	1.26
C			
Short-term assets/Total assets	24	0.70	0.17
Debt/Total Assets	24	0.77	0.14
Current ratio	24	1.07	0.30
Short-term payment ratio	24	0.05	0.05
Short-term assets turnover	24	0.60	0.53
Equity turnover	24	2.78	4.72
EBIT/Sales	24	-1.57	7.08
ROA	24	-0.05	0.09
ROE	24	-0.22	0.48
Sales growth rate	24	-0.15	0.38
Earnings per share	24	-9.09	30.19
Equity growth rate	24	-0.14	0.30
Cash growth rate	24	0.88	2.09
Stock price growth rate	24	-0.03	0.30
Size	24	13.34	1.41

From the table above, there are differences in financial ratios among different corporations with different credit rankings. In all the three top classes (A, AA, and AAA) all the financial ratios have positive mean value whereas other classes experience some negative values, especially for the profitability ratios and growth rate ratios. This confirms the belief that healthy companies have positive business ratios reflecting the firms' status.

The capital structure shows a significant level of divergence among the Vietnamese firms. According to the statistic table above, all the top-ranked corporations have quite a low leverage ratio compared to the rest. While AAA and AA companies' capital consist

of around 30% of debts on average, other corporations borrow more than half of their capital. It seems to be the lower the rank is the higher leverage the companies use.

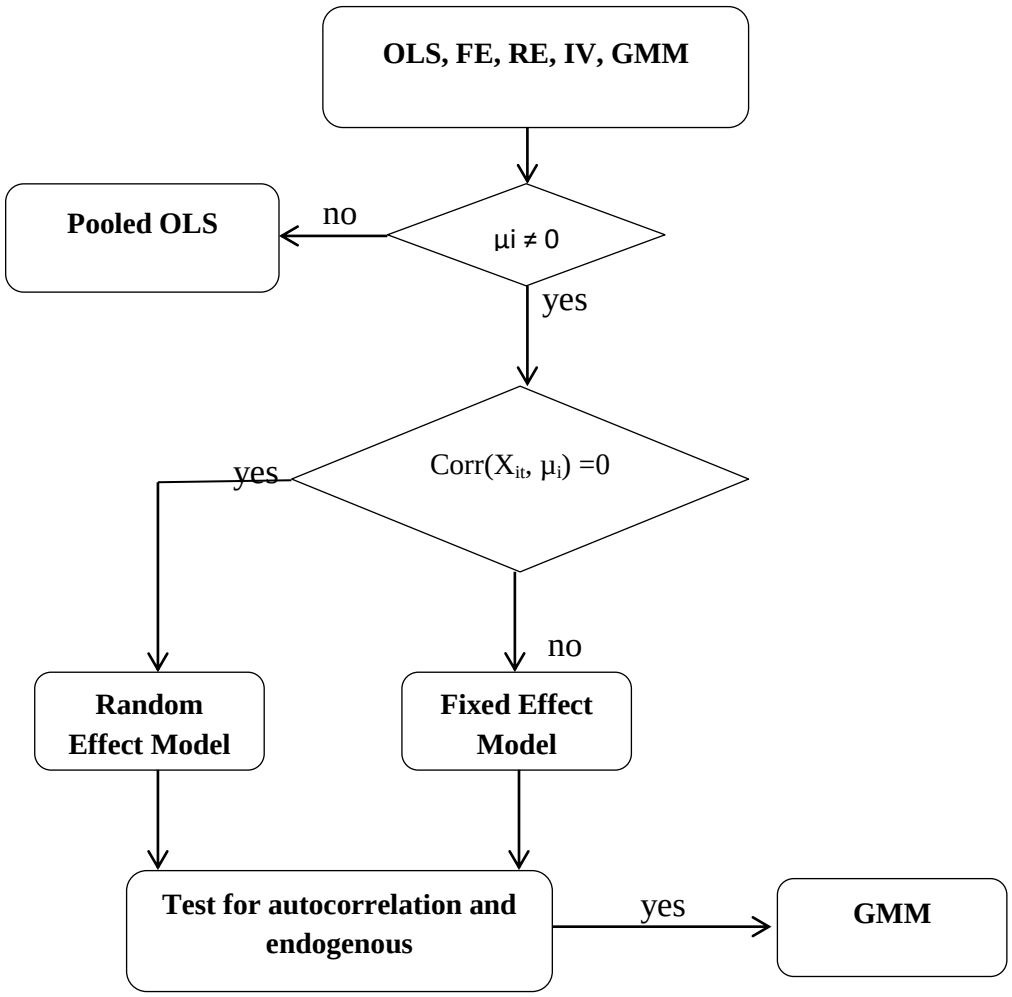
The similarity among firms lies in the assets structure as almost all the corporations, despite being ranked differently, experience the average of short-term assets over total assets of about 0.6 to 0.7.

5.3.2 Methodology and models setup

Since the credit ratings used in the research are obtained from the Vietnamese State Bank: Credit Information Centre with the simple annual rating procedure, it is possible to use the financial ratios on an annual basis without any transformation. (It is different from the literature as most of the studies in the literature are based on American big credit rating agencies that usually used "rating through the cycle process." This is usually implemented considering three-year averages of relevant financial ratios instead of the most recent observations.)

This research seeks to map the credit ratings with several factors that may have a relationship with it. Since the ratings are discrete rather than continuous, standard least-squares techniques are inappropriate. Additionally, the credit ratings possess natural ordering so that multiple discriminant analysis is also inappropriate.

First, we will identify the influences of financial ratios on the corporations' credit rating. The whole steps mentioned in the model set up part are summarized in the following chart:



The GMM model examines the impact of corporate ratios on their ranking:

$$I_{it} = \beta_1 I_{i,t-1} + \beta_3 K_{it} + \beta_4 X_{it} + u_{it}$$

In the above equation, I_{it} are the current corporate rankings while $I_{i,t-1}$ are the one-year-lagged rankings. K_{it} is a matrix of the financial ratios under consideration and X_{it} is a matrix of instrumental variables: lagged value of sales growth rates, lagged value of cash growth rate and lagged value of stock price growth rate as the proxy for the late response of the business to changes in the market and the delayed accounting information recording compared to the changes in financial market. The lagged values also make the variables pre-determined and, therefore, not correlated with the error term in the equation.

As can be seen from the sample description above, the panel dataset has a short time dimension (T=4) and a larger corporation dimension (N=500), Arellano- Bond GMM is used as it is typically designed for small T and large N panels.

As in STATA, it is necessary to first set the dataset as a panel and then use the "xtabond2" command to implement the model.

For the effects of earnings management, we apply ordered-probit models for the chosen financial ratios on the same sample. The ordered-probit approach relaxes the assumption of pooled OLS that all the observations are strictly independent as the probit model considers the effect of the individual firm already, therefore, even we use the same sample of 2,000 observations from 500 firms in 4 years, it can produce the meaningful results.

The credit ratings are not necessarily evenly spaced. One category, consequently, may cover a wider range of independent variables than the others (Kaplan and Urwitz, 1979; Lim ad Mackinlay, 1998). The research we conduct here chooses the ordered-probit model as the method to map the financial ratios, earnings management adjusted financial ratios, and the credit ratings. The model is estimated using unadjusted and adjusted ratios respectively and the results will be compared.

In the research's setting, the dependent variables which are the credit ratings of a corporation i in year t take one of nine values:

$$Y_{it}=\begin{cases} 9 \text{ if corporation is rated AAA} \\ 8 \text{ if the corporation is rated AA} \\ 7 \text{ if the corporation is rated A} \\ 6 \text{ if the corporation is rated BBB} \\ 5 \text{ if the corporation is rated BB} \\ 4 \text{ if the corporation is rated B} \\ 3 \text{ if the corporation is rated CCC} \\ 2 \text{ if the corporation is rated CC} \\ 1 \text{ if the corporation is rated C} \end{cases}$$

The values of Y_{it} have censored data, and they can take only one of the nine possible values. The relationship between Y_{it} and the explanatory variables can be defined as:

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

X_{it} is a vector of explanatory variables, β is the vector of coefficients which will be estimated by the ordered-probit model, and ε_{it} is the standard normal residual which are unobservable factors. The ordered-probit model can be presented as follow with α are the thresholds to be estimated by the model.

$$Y_{it=}\begin{cases} 9 \text{ if the corporation is rated } Y_{it}^{*}\geq\alpha_8 \\ 8 \text{ if the corporation is rated } \alpha_7\leq Y_{it}^{*}\leq \alpha_8 \\ 7 \text{ if corporation is rated } \alpha_6\leq Y_{it}^{*}\leq \alpha_7 \\ 6 \text{ if corporation is rated } \alpha_5\leq Y_{it}^{*}\leq \alpha_6 \\ 5 \text{ if corporation is rated } \alpha_4\leq Y_{it}^{*}\leq \alpha_5 \\ 4 \text{ if corporation is rated } \alpha_3\leq Y_{it}^{*}\leq \alpha_4 \\ 3 \text{ if corporation is rated } \alpha_2\leq Y_{it}^{*}\leq \alpha_3 \\ 2 \text{ if corporation is } \alpha_1\leq Y_{it}^{*}\leq \alpha_2 \\ 1 \text{ if corporation is rated } Y_{it}^{*}\leq\alpha_1 \end{cases}$$

With $\Phi(.)$ is the cumulative density function, we have Y_{it} taking different scale values which are determined as:

Prob $(Y_i= 1|\varepsilon_i)= \Phi(\alpha_1-\beta' \varepsilon_i)$; Prob $(Y_i= 2|\varepsilon_i)= \Phi(\alpha_2-\beta' \varepsilon_i)- \Phi(\alpha_1-\beta' \varepsilon_i)$; …; Prob $(Y_i= J|\varepsilon_i)= 1- \Phi(\alpha_{J-1}-\beta' \varepsilon_i)$.

It is worth mentioning that the vector of coefficients β does not represent the marginal effects on the credit ratings. A positive β only indicates that the entire distribution of Y_i^* will shift to the right as the value of associated explanatory variables increase.

To make it simple, we choose the most popular and important financial ratios from the above-mentioned literature including liquidity ratio, profitability ratio, productivity ratio, and leverage ratio. We will test the effects of those financial ratios on the corporations' credit ratings. Then, the four financial ratios will be adjusted with the earning management factor. The ordered-probit model is going to be applied to identify the influences of the adjusted financial ratios. Comparison between two results will provide information about the impact of earning management event.

Table 5.4 Descriptive Statistics of financial ratios (alternatives)

This table presents summary statistic information for the 4 alternatives financial ratios used in the research according to the rating categories. The sample period used is from 2011 to 2014 using a panel of 2,000 observations.

	Observation	Mean	Standard deviation	Min	Max
AAA					
Liquidity	132	0.36	0.20	-0.10	0.81
Profitability	132	0.13	0.09	-0.07	0.59
Productivity	132	0.17	0.11	-0.06	0.63
Leverage	132	0.66	0.94	0.05	8.12
AA					
Liquidity	440	0.33	0.38	-0.31	6.81
Profitability	440	0.10	0.08	-0.21	0.52
Productivity	440	0.13	0.09	-0.21	0.63

Leverage	440	0.78	0.83	0.02	9.32
A					
Liquidity	397	0.24	0.23	-0.26	0.92
Profitability	397	0.06	0.06	-0.54	0.33
Productivity	397	0.09	0.08	-0.50	0.86
Leverage	397	1.32	1.58	0.00	13.42
BBB					
Liquidity	402	0.20	0.20	-0.28	0.89
Profitability	402	0.03	0.06	-0.37	0.30
Productivity	402	0.06	0.07	-0.37	0.40
Leverage	402	1.74	1.94	0.00	16.15
BB					
Liquidity	307	0.16	0.21	-0.33	0.76
Profitability	307	0.01	0.08	-0.66	0.25
Productivity	307	0.05	0.09	-0.66	0.32
Leverage	307	2.28	2.28	0.01	17.26
B					
Liquidity	225	0.12	0.18	-0.25	0.83
Profitability	225	-0.01	0.08	-0.65	0.14
Productivity	225	0.03	0.08	-0.51	0.20
Leverage	224	2.47	2.17	0.15	23.80
CCC					
Liquidity	58	0.11	0.15	-0.21	0.48
Profitability	58	-0.01	0.06	-0.25	0.17
Productivity	58	0.02	0.06	-0.20	0.23
Leverage	58	3.46	3.15	0.52	22.34
CC					
Liquidity	15	0.14	0.22	-0.17	0.53
Profitability	15	0.00	0.04	-0.12	0.07
Productivity	15	0.03	0.03	-0.02	0.10
Leverage	15	2.38	1.61	0.17	6.24
C					
Liquidity	24	0.08	0.20	-0.26	0.66
Profitability	24	-0.01	0.06	-0.21	0.10
Productivity	24	0.02	0.06	-0.15	0.16
Leverage	24	4.47	3.91	0.75	16.67

Earning management event adjustment is calculated as follow:

Total Accruals of corporation i by time t is:

TA_{it}= Earnings before extraordinary items EB_{it}- Cash Flow from Operation CFO_{it}

We have the regression of Total accruals with changes in Sales, changes in Account Receivables and expense on Plant and Equipment as follow:

$$\mathbf{TA_{it}= \alpha_0 +\alpha_1 (\triangle Sales_{it}-\triangle AR_{it}) +\alpha_2 PPE_{it}+\varepsilon_{it}} \qquad \mathbf{(*)}$$

From the formula above, we can calculate the earning management value for each corporation in the sample:

$$\mathbf{EM_{it}= TA_{it} -[\alpha_0 +\alpha_1 (\triangle Sales_{it}-\triangle AR_{it}) +\alpha_2 PPE_{it}]}$$

(We can see that $\mathbf{EM_{it}}$ is the difference between the real value of $\mathbf{TA_{it}}$ and the value of $\mathbf{TA_{it}}$ from the regression (*))

Then, the earning management factor will be adjusted to the probit-model of financial distress possibility as follow:

Unadjusted: $Rank_{it}$ $= \lambda_0 +\lambda_1$ **liquidity ratio**$+\lambda_2$ **profitability ratio** $+\lambda_3$ **productivity ratio**$+\lambda_4$ **leverage ratio**

$$= \lambda_0 +\lambda_1 \frac{working\ capital}{total\ assets}+\lambda_2 \frac{retained\ earnings}{total\ assets} +\lambda_3 \frac{EBIT}{total\ assets}+\lambda_4 \frac{equity}{total\ liabilities}$$

Adjusted: $Rank_{it} = \lambda_0^* +\lambda_1^* \frac{working\ capital-EM}{total\ assets-EM}+\lambda_2^* \frac{retained\ earnings-EM}{total\ assets-EM} +\lambda_3^* \frac{EBIT-EM}{total\ assets-EM}+\lambda_4^* \frac{equity}{total\ liabilities-EM}$

The dependent variable $Rank_{it}$ is the corporation's credit ratings.

The potential multicollinearity among independent variables is checked using the conditional number and the correlation check in Stata with the result as follow:

cndnmb3 Liquidity Profitability Productivity Leverage

Condition number = 8.37

Variable	VIF	SQURT VIF	Tolerance	R-Squared
Liquidity	1.23	1.11	0.8122	0.1878
Profitability	12.29	3.51	0.0814	0.9186
Productivity	11.53	3.40	0.0868	0.9132
Leverage	1.20	1.09	0.8340	0.166
Mean VIF			**6.56**	

Since the conditional number is 8.37<30 and the mean VIF is 6.56< 10, according to the rule of thumb, there are no multiple correlations among unadjusted variables.

To analyze the rating shift, we use the Cox hazard regression model which is proposed by Cox (1972) and widely used in both medicine and finance (Lane, Looney, and Winsley, 1986; Henerby, 1997; Bueler, Kaiser, and Jaerger, 2006). We assume that if a firm's rating changes from class B to class C, it is regarded as near the level of financial distress with T being the amount of survival time for an issuer in specific rating class. Cox hazard model is usually referred to as the proportional hazards model since the covariates are all calendar time-independent. In the research, we are conducting; however, the ratio of hazard rate change with time t. The cause-specific hazard function can be denoted as:

$\lambda_j(t; Z(t)) = \lim_{h\to 0} h^{-1}P(t\leq T<(t+h); J=j|\ t\leq T, Z(t))$ with j is a type of event among J (jϵJ); $\lambda_j(t; Z(t))$ is the instantaneous hazard rate referring to the length of time since current stage. Then we have:

$\lambda_j(t; Z(t))= \lambda_{0j}(t) \exp[\beta_j' Z(t)]$

where β_j is the vector of regression coefficients with $\exp(\beta_j^p)= \frac{\exp(\beta_j^p\ (Z^p+1))}{\exp(\beta_j^p\ Z^p)}$ and the partial likelihood function for parameter β_j is $L(\beta_j)= \prod_{n=1}^{N} \frac{\exp[\beta_j' Z_n(T_n)]}{\sum_{i\epsilon R_n} \exp[\beta_j' Z_n(T_n)]}$

In the Cox hazard model, we follow the methodology used by Figlewski, S., Frydman, H. and Liang, W., (2012) and incorporate dummy rating related firm-specific covariates. The first ones are Initial rating class good (AAA to BB) and Initial rating class bad (B to C) with the former set to 1 for corporations with initial rating class AAA, AA, A, BBB or

BB and the later set to 1 for corporations initially rated B, CCC, CC or C. We incorporate these variables since "fallen angels" firms tend to behave differently from firms that were initially respected and ranked good. In the literature, bonds that are recently downgraded are more likely to be further downgraded compared to the one whose ratings have not changed or being upgraded (Christensen et al., 2004; Gurttler and Wahrenburg, 2007). Therefore, the dummy variations of Upgrade and Downgrade are added to the list. Altman (1998) also states that newly rated firms are observed to be less likely to change rating within a given year. Consequently, the Year since the first rated is added to capture this trend. The year is entered in log (year).

The summary of dummy variables is as follow:

Dummy Variables	**Yes**	**No**
AAA to BB (good class)	1	0
B to C (bad class)	1	0
Upgrade	1	0
Downgrade	1	0

The key macroeconomic variables are listed as follows:

Table 5.5 Macroeconomic factors from 2011 to 2014

This table contains the macroeconomic data of Vietnam from 2011 to 2014. All factors are calculated on the basis of annual percentage changes.

	2011	**2012**	**2013**	**2014**
Economic Growth (GDP, annual variation in %)	6.2	5.2	5.4	6
Consumption (annual variation in %)	4.1	4.9	5.2	6.1
Investment (annual variation in %)	-7.8	1.9	5.3	9.3
Industrial Production (annual variation in %)	13.5	4.8	5.9	7.5
Unemployment Rate	3.6	3.2	3.6	3.4
Fiscal Balance (% of GDP)	-0.5	-3.4	-4.7	-4.4
Public Debt (% of GDP)	46.7	48.5	52.4	55.5

Money (annual variation in %)	12.1	34.9	4.4	17.7
Inflation (PPI, annual variation in %)	18.4	9.3	5.3	3.3
Policy Interest Rate (%)	15	9	7	6.5
Current Account (% of GDP)	0.2	6	4.6	5.1
Exports (annual variation in %)	33.1	20	16.5	12.6
Imports (annual variation in %)	24.4	7.9	18.2	12.3
External Debt (% of GDP)	44	38	38.5	39

The sample used is the same one containing 500 Vietnamese corporations as above with the financial information extracted from audited financial reports provided by CIC. The rating specific data were provided by CIC directly.

For the leverage structure of corporations, the GMM model is also used to test the effects of the capital structure since the problems of serial correlation and endogeneity are common in this type of models:

Planned GMM-IV model

$$Rit = \alpha_1 R_{i,t-1} + \alpha_2 L_{it} + \alpha_3 X_{it} + u_{it} \quad (1)$$

$$Cit = \mu_1 C_{i,t-1} + \mu_2 L_{it} + \mu_3 X_{it} + ui_t \quad (2)$$

$$ICRit = \gamma_1 ICR_{i,t-1} + \gamma_3 L_{it} + \gamma_4 X_{it} + u_{it} \quad (3)$$

In which:

Equation	Denotation	Meaning
1	R_{it}	ROE of the corporations
	$Ri_{,t-1}$	lagged values of ROE
	L_{it}	leverage of the corporations

	X_{it}	The matrix of instrumental values including ROA and cost of debt using after tax of the corporations
2	C_{it}	The current ratio of the corporations
	$C_{i,t-1}$	lagged values of the current ratios
	L_{it}	leverage of the corporations
	X_{it}	The matrix of instrumental value which is the log value of the current assets
3	ICR_{it}	The interest coverage ratio of the corporations
	$ICR_{i,t-1}$	lagged values of the interest coverage ratios
	L_{it}	leverage of the corporations
	X_{it}	The matrix of instrumental values including ROI (return on investment ratio) and cost of debt using before tax

In the first step, the descriptive analysis of some variables is analyzed.

Table 5.6 Descriptive analysis of ROA and ROE

The simple descriptive statistic of ROA and ROE

Panel A

Variable	Observation	Mean	Std. Dev.	Min	Max
ROE	2,000	0.0979	0.1589	-1.6	0.97
ROA	2,000	0.0521	0.0822	-0.45	0.75

Panel B

	ROE		ROA	
	Observations	Proportion	Observations	Proportion
Larger than 0	1723	86.15%	1627	81.35%
Equal or less than 0	277	13.85%	373	18.65%
Total	2000	100.00%	2000	100.00%

According to the table above, from panel A, we can see the high variation in the corporations' ability for generating returns to invested capital. In general, the average ROE of corporations in the sample is larger than ROA. This fact indicates that the use of leverage benefits the returns on shareholders' investment. Panel B of the table shows that most of the corporations are able to generate revenue and do not suffer any losses after taxes. 86.15% of the corporations have positive ROE whereas the number for ROA is 81.35%.

Table 5.7 Descriptive analysis of leverage

The simple descriptive statistic of leverage

Variable	Observation	Mean	Std. Dev.	Min	Max
leverage	2,000	1.635589	2.012931	0.002	23.797

The leverage structure of the corporations (debt/equity) in the above table shows that most of the corporations use more debt than equity with an average ratio of 1.64. The use of debt creates several opportunities for enterprises with low cost of capital. The use of high debt, however, can propose numerous threats of financial distress unless corporations have effective capital management.

CHAPTER 6: EMPIRICAL ANALYSIS AND RESULTS

6.1 The financial ratios' influence on corporate credit ratings

In selecting the financial ratios as the explanatory variables, we pay particular attention to the similarity and difference between ROA and ROE. ROA represents the returns on total assets, while ROE is cared more by the investors since it represents the earning generated from the investors' fund. Since ROA and ROE are correlated based on DuPont analysis (Soliman, M.T, 2008), these two ratios will be included in the estimated equations separately.

Financial ratios' influence on corporate credit ratings: the model includes ROA

First, we summarize data to have a look at the general information of the variables using the "su" command in Stata:

su rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roa sales_growth EPS equ_growth cash_growth stockp_growth size

Table 6.1 Descriptive Statistic for variables

Variable	Obs	Mean	Std. Dev.	Min	Max
rankcoded	2,000	6.281	1.696903	1	9
sta_tasset	2,000	0.622475	0.2719437	0.03	7.63
dbt_ta	2,000	0.499505	0.2501175	0	5.72
current	2,000	2.624175	6.915493	0	229.58
stpay	2,000	0.59106	2.142237	0	59.23
stasset_to	2,000	2.04602	2.150753	0	22.85
equ_to	2,000	2.935845	3.562711	0	46.97
EBIT_sales	2,000	0.068125	0.2692138	-1.6	0.88
roa	2,000	0.052075	0.0822169	-0.45	0.75
sales_growth	2,000	0.253945	2.566529	-1	93.81
EPS	2,000	-0.26923	5.237862	-37.55	21.02
equ_growth	2,000	0.1355	1.865776	-1	81.94
cash_growth	2,000	1.027575	6.222562	-1	151.36

stockp_growth	2,000	0.066855	0.5531085	-0.91	4.81
size	2,000	13.14398	1.454029	9.364434	17.82454

From table 6.1, we can see that the variable's value quite balances.

Since we have 2,000 observation within 4 years, which means N> T, the panel data should be tested under 99% confidence interval. We will set the whole tests under 99% confidence interval in Stata:

set level 99, permanently

As discussed in Chapter 5, the first step is to test the hypothesis H_0: a pooled OLS model is adequate. To do the test, we will run the panel model with random effects using the "xtreg" command in Stata.

xtreg rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roa sales_growth EPS equ_growth cash_growth stockp_growth size, re

Table 6.2 Panel model with random effects

Random-effects GLS regression	Number of obs	=	2,000
Group variable: FID	Number of groups	=	500
R-sq:	Obs per group:		
within = 0.3488	min	=	4
between = 0.6644	avg	=	4
overall = 0.5991	max	=	4
	Wald chi2(14)	=	1757.97
corr(u_i, X) = 0 (assumed)	Prob > chi2	=	0

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
rankcoded						
sta_tasset	1.565049***	0.1241299	12.61	0	1.245312	1.884787
dbt_ta	-2.95197***	0.1547663	-19.07	0	-3.350621	-2.553318
current	-0.0012075	0.0032403	-0.37	0.709	-0.009554	0.007139
stpay	-0.0026135	0.0115572	-0.23	0.821	-0.032383	0.027156

stasset_to	0.2547314***	0.0207024	12.3	0	0.2014055	0.3080572
equ_to	-0.0150638	0.0122366	-1.23	0.218	-0.0465831	0.0164555
EBIT_sales	0.0866438	0.102666	0.84	0.399	-0.1778062	0.3510938
roa	7.082419***	0.4266916	16.6	0	5.983334	8.181503
sales_growth	0.0131072	0.0076259	1.72	0.086	-0.0065357	0.0327502
EPS	0.0072769	0.0037326	1.95	0.051	-0.0023378	0.0168915
equ_growth	-0.0013759	0.0106238	-0.13	0.897	-0.028741	0.0259893
cash_growth	-0.0020602	0.0029011	-0.71	0.478	-0.0095329	0.0054125
stockp_growth	0.1314419***	0.0309057	4.25	0	0.051834	0.2110498
size	0.0570582*	0.0267277	2.13	0.033	-0.0117879	0.1259043
_cons	5.176528***	0.363137	14.26	0	4.241149	6.111907
sigma_u	0.77706997					
sigma_e	0.67981057					
rho	0.56752055	(fraction of variance due to u_i)				

* p<.05; ** p<.01; *** p<.001

From the R-square part of the table, the R-square overall= 0.5991 implying that the panel model with random effects may explain for 59.91% of the corporate credit ratings, which indicates a very good fitness of the model for a panel dataset. We next conduct the Breusch and Pagan Lagrangian multiplier test to choose between pooled OLS and panel model with random effects. The null hypothesis in the Breusch and Pagan Lagrangian multiplier test is that variances across entities are zero, indicating no significant difference across units. The command used in Stat is “xttset0”.

xttest0

Table 6.3 Breusch and Pagan Lagrangian multiplier test

Breusch and Pagan Lagrangian multiplier test for random effects
rankcoded[FID,t] = Xb + u[FID] + e[FID,t]
Estimated results:

	Var	sd=sqrt(Var)
rankcoded	2.879479	1.696903
e	0.4725744	0.6874405
u	0.6038377	0.77707
Test:	Var(u)=0	0
	chibar2(01)=	894.95
	Prob > chibar2=	0.0000

As can be seen from the test result (Prob> $\overline{X}^2$ =0), the null hypothesis is strongly rejected. Therefore, the estimation of the model must take into account the existence of individual effects, that is, the impacts on credit rating that come from unmeasured and time-invariant individual characteristics.

To choose between random-effects model and fixed effects model, we test the null hypothesis H_0: the random-effects model is adequate. We run the fixed effects model with the "xtreg" command in Stata.

xtreg rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roa sales_growth EPS equ_growth cash_growth stockp_growth size, fe

Table 6.4 Fixed effects model

Fixed-effects (within) regression	Number of obs	=	2,000
Group variable: FID	Number of groups	=	500
R-sq:	Obs per group:		
within = 0.3528	min	=	4
between = 0.6414	avg	=	4
overall = 0.5817	max	=	4
	F(15,1485)	=	57.85
corr(u_i, Xb) = 0.3006	Prob > F	=	0.000

	Coef.	Std. Err.	t	P>t	[99% Conf.	Interval]
rankcoded						
sta_tasset	1.565227***	0.1727723	9.06	0	1.119623	2.010831
dbt_ta	-2.542255***	0.2191572	-11.6	0	-3.107492	-1.977017
current	-0.0021168	0.0033312	-0.64	0.525	-0.0107085	0.0064749
stpay	-0.0043481	0.0123067	-0.35	0.724	-0.036089	0.0273927
stasset_to	0.2194883***	0.0328388	6.68	0	0.1347923	0.3041842
equ_to	0.015033	0.0188844	0.8	0.426	-0.0336726	0.0637385
EBIT_sales	0.1145476	0.1084284	1.06	0.291	-0.1651047	0.3941998
roa	5.945982***	0.4937487	12.04	0	4.672534	7.21943
sales_growth	0.0115197	0.0076776	1.5	0.134	-0.0082819	0.0313213
EPS	0.0090582*	0.0037671	2.4	0.016	-0.0006576	0.018774
equ_growth	-0.0002169	0.0107461	-0.02	0.984	-0.0279326	0.0274988
cash_growth	-0.0002673	0.0029298	-0.09	0.927	-0.0078238	0.0072892

stockp_growth	0.1113564***	0.0308512	3.61	0	0.0317869	0.190926
size	0.0515476	0.0815539	0.63	0.527	-0.1587914	0.2618866
_cons	5.088859***	1.089872	4.67	0	2.277925	7.899793

sigma_u	0.96110537	
sigma_e	0.68744049	
rho	0.66155187	(fraction of variance due to u_i)

F test that all u_i=0: F(499, 1486) = 6.64 Prob > F = 0.0000
* p<.05; ** p<.01; *** p<.001

The result of the fixed effect model is saved using the command "est store" in Stata.

est store fixed

The random-effects model is run one more time using the command "xtreg" in Stata to compare with the fixed effect model.

xtreg rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roa sales_growth EPS equ_growth cash_growth stockp_growth size, re

The result replicates the table 6.2 above.

To choose between two models, we use the Hausman test. Hausman test performs the Hausman's specification test (1978) with the null hypothesis H_0: difference in coefficients not systematic, which means random effects model is appropriate. Using the command "hausman" in Stata:

hausman . fixed

Table 6.5 Hausman test

	---- Coefficients ----			
	(b) fixed	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
sta_tasset	1.517096	1.553048	-0.0359521	0.1184507
dbt_ta	-2.520573	-2.952454	0.4318803	0.1526491
current	-0.001661	-0.0008531	-0.0008078	0.0007499
stpay	-0.0034812	-0.0019496	-0.0015315	0.0041264
stasset_to	0.2084876	0.2525266	-0.044039	0.0251654
equ_to	0.0082196	-0.016859	0.0250786	0.014202
EBIT_sales	0.1614523	0.1230309	0.0384214	0.0343551
roa	5.56428	6.751885	-1.187605	0.2458803
sales_growth	0.0091868	0.0108344	-0.0016476	0.0008361
EPS	0.0077336	0.0057654	0.0019682	0.0004611
equ_growth	0.0029217	0.001256	0.0016656	0.0015694
cash_growth	-0.000431	-0.0022796	0.0018486	0.0003884
stockp_gro~h	0.1826809	0.1981716	-0.0154907	0.0026383
econ_growth	23.76138	23.51797	0.2434135	.
size	0.0178547	0.0538641	-0.0360095	0.0763167

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

chi2(14) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 108.12
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

As can be seen from the test result, the Prob> $\overline{X}^2$ =0.000 strongly rejects H_0. Hence, there are fixed effects in the panel dataset that must be considered.

The serial correlation in Stata is tested using the command "xtserial" with the null hypothesis H_0: no-first order autocorrelation:

xtserial rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roa sales_growth EPS equ_growth cash_growth stockp_growth size, output

Table 6.6 Autocorrelation test

Linear regression

Number of obs	=	1,500
F(15, 499)	=	40.72
Prob > F	=	0
R-squared	=	0.3376
Root MSE	=	0.87644

Std. Err. Adjusted for 500 clusters in FID)

D.rankcoded	Coef.	Robust Std. Err.	t	P>t	[99% Conf.	Interval]
sta_tasset						
D1.	1.418262	0.257667	5.5	0	0.752008	2.084516
dbt_ta						
D1.	-2.30604	0.3262419	-7.07	0	-3.14961	-1.462471
current						
D1.	-0.0045889	0.0022273	-2.06	0.04	-0.0103481	0.0011703
stpay						
D1.	-0.0049575	0.0050723	-0.98	0.329	-0.018073	0.0081581
stasset_to						
D1.	0.1968482	0.0477007	4.13	0	0.0735078	0.3201886
equ_to						
D1.	0.0257018	0.0286536	0.9	0.37	-0.0483884	0.099792
EBIT_sales						
D1.	0.1163198	0.1465957	0.79	0.428	-0.2627352	0.4953748
roa						
D1.	6.266842	0.7252017	8.64	0	4.391675	8.142008
sales_growth						
D1.	0.020071	0.0090473	2.22	0.027	-0.0033228	0.0434648
EPS						
D1.	0.0061068	0.0041541	1.47	0.142	-0.0046345	0.0168481
equ_growth						
D1.	-0.0002778	0.0060805	-0.05	0.964	-0.0160002	0.0154446
cash_growth						
D1.	-0.0021318	0.0029688	-0.72	0.473	-0.0098083	0.0055447
stockp_growth						
D1.	0.0799916	0.0326949	2.45	0.015	-0.0045482	0.1645314
size						
D1.	-0.1949526	0.1110175	-1.76	0.08	-0.4820125	0.0921073

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 499) = 28.535
Prob > F = 0.0000

As can be seen from the result, Prob > F = 0.0000 strongly rejects the null hypothesis that there is no first-order autocorrelation in the panel dataset, suggesting the existence of auto-correlation.

Next, we may test for endogeneity in the panel dataset. The endogeneity in the error term is unobservable. As a result, there is no direct way to statistically test for the issue. Additionally, the exogenous variables in the model are never truly exogenous (Ketokivi and McIntosh, 2017) so we can never ensure that we solve the endogeneity problem completely (Roberts and Whited, 2012). Hence, the choice of indirect tests and precautionary measures can help to have relevant insights. In order to test for endogeneity, we will assume one explanatory variable is endogenous with corporate credit rating. The procedure is to run the modified panel model with IV under fixed-effects models (FEM) and do the Hausman test against the fixed effect model as mentioned above. If we assume ROA is endogenous with corporate credit rating, then the FEM is as follow:

xtivreg rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roa sales_growth EPS equ_growth cash_growth stockp_growth size (roa = l2.(sta_tasset dbt_ta current stasset_to equ_to ebit_sales)), fe

Table 6.7 FEM with IV

Fixed-effects (within) IV regression Number of obs = 1,000
Group variable: FID Number of groups = 500
R-sq: Obs per group:
within = 0.3264 min = 2
between = 0.4520 avg = 2.0
overall = 0.4405 max = 2
Wald chi2(14) = 33931.52
corr(u_i, Xb) = 0.1134 Prob > chi2 = 0.0000

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
rankcoded						
roa	0	(omitted)				
sta_tasset	1.353001**	0.5019998	2.7	0.007	0.0599356	2.646067
dbt_ta	-2.602175***	0.5653921	-4.6	0	-4.058529	-1.145822
current	-0.0006622	0.0043928	-0.15	0.88	-0.0119774	0.010653
stpay	0.0047111	0.0152591	0.31	0.758	-0.0345938	0.0440159
stasset_to	0.1644243**	0.0585987	2.81	0.005	0.0134841	0.3153644
equ_to	-0.0089951	0.0338899	-0.27	0.791	-0.0962898	0.0782995
EBIT_sales	0.0002771	0.1722167	0	0.999	-0.4433237	0.4438779
roa	3.603218***	0.9505216	3.79	0	1.154836	6.051599
sales_growth	0.0607114**	0.0223062	2.72	0.006	0.0032545	0.1181683
EPS	0.0137999**	0.0049346	2.8	0.005	0.0010892	0.0265105
equ_growth	0.2395063*	0.0951235	2.52	0.012	-0.0055157	0.4845283
cash_growth	0.0025673	0.0040789	0.63	0.529	-0.0079393	0.0130739
stockp_growth	0.1325628*	0.0539215	2.46	0.014	-0.0063298	0.2714555
size	-0.2805984	0.1710636	-1.64	0.101	-0.7212292	0.1600323
_cons	9.906128***	2.195231	4.51	0	4.251587	15.56067
sigma_u	1.2589095					
sigma_e	0.59355402					
rho	0.86082689	(fraction of variance due to u_i)				

F test that all u_i=0: F(499,486) = 4.99 Prob > F = 0.0000
* p<.05; ** p<.01; *** p<.001

Instrumented: roa
Instruments: sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roa sales_growth EPS equ_growth cash_growth stockp_growth econ_growth size L2.sta_tasset L2.dbt_ta L2.current L2.stasset_to L2.equ_to L2.ebit_sales

hausman . fixed

Table 6.8 Hausman test

	---- Coefficients ----			
	(b) fixed	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
sta_tasset	1.353001	1.565227	-0.2122258	0.4713317
dbt_ta	-2.602175	-2.542255	-0.0599208	0.5211894
current	-0.0006622	-0.0021168	0.0014546	0.0028635
stpay	0.0047111	-0.0043481	0.0090592	0.0090213
stasset_to	0.1644243	0.2194883	-0.055064	0.0485326
equ_to	-0.0089951	0.015033	-0.0240281	0.0281408
EBIT_sales	0.0002771	0.1145476	-0.1142705	0.1337979
roa	3.603218	5.945982	-2.342765	0.8122214
sales_growth	0.0607114	0.0115197	0.0491917	0.0209433
EPS	0.0137999	0.0090582	0.0047416	0.0031874
equ_growth	0.2395063	-0.0002169	0.2397232	0.0945146
cash_growth	0.0025673	-0.0002673	0.0028346	0.0028379
stockp_growth	0.1325628	0.1113564	0.0212064	0.0442237
size	-0.2805984	0.0515476	-0.332146	0.150372

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

chi2(14) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 43.04
Prob>chi2 = 0.0000

The Hausman test's result above (Prob> $\overline{X}^2$ =0.000) rejects the null hypothesis H_0: difference in coefficients not systematic, hence the financial ratio ROA is endogenously related to credit ratings.

The two above steps can be repeated assuming other financial ratios are endogenously related to corporate credit ratings. We can see that capital structure and stock price growth rate ratios also have the issue of endogeneity.

Endogeneity bias in regression models can cause inconsistent estimates which potentially lead to incorrect inferences, misleading conclusions and interpretation. Ketokivi and Mcinstosh (2017) believe the endogeneity issue may cause so much bias so researchers may get the wrong sign of the coefficient. Importantly, endogeneity can have different origins, and for the panel data, generalized method of moments model (GMM) is used to address it.

In dynamic panel data, the relationship for the underlying phenomena is generally dynamic over time. In order to capture this, GMM in dynamic panel data estimation uses lags of the dependent variable as the explanatory variable. The lagged values of the dependent variable as well as the exogenous variables are hence used as instruments to control for the endogenous relationship exiting in explanatory variables. The GMM model provides consistent results in the presence of different sources of endogeneity (Wintoki, Linck, and Netter, 2012). The endogeneity problem is removed as the GMM model internally transforming the data (Roodman, 2009).

Since the dataset shows both autocorrelation and endogeneity, the Arellano-Bond dynamic panel model is selected. The GMM model in Stata is executed using the command “xtabond2”. In the model, there are three endogenous variables including ROA, capital structure and stock price growth rate. The instrumental variables are the 2-lagged values of all the other explanatory variables :

xtabond2 rankcoded l.rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roa sales_growth EPS equ_growth cash_growth stockp_growth size, gmm(dbt_ta roa stockp_growth) iv(l2.(sta_tasset current stpay stasset_to equ_to EBIT_sales sales_growth EPS equ_growth cash_growth size))

Table 6.9 GMM model

Group variable: FID	Number of obs	=	1000
Time variable : year	Number of groups	=	500
Number of instruments = 27	Obs per group: min	=	2
Wald chi2(15) = 827.20	avg	=	2
Prob > chi2 = 0.000	max	=	2

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
rankcoded						
Rankcoded L1.	0.2524803	0.103023	2.45	0.014	-0.0128894	0.5178501
sta_tasset	0.5124904	0.3590786	1.43	0.154	-0.4124347	1.437415
dbt_ta	-4.247585***	0.7681152	-5.53	0	-6.226119	-2.269051
current	-0.0597318*	0.0304422	-1.96	0.05	-0.1381456	0.018682
stpay	0.1062886	0.0809201	1.31	0.189	-0.1021477	0.314725
stasset_to	0.0935367	0.0638029	1.47	0.143	-0.0708087	0.257882
equ_to	0.0614703	0.0389361	1.58	0.114	-0.0388224	0.161763
EBIT_sales	-0.8831436	0.814387	-1.08	0.278	-2.980866	1.214578
roa	7.199831*	3.321715	2.17	0.03	-1.35634	15.756
sales_growth	0.0703708	0.1438851	0.49	0.625	-0.3002527	0.4409942
EPS	0.0492726	0.0319978	1.54	0.124	-0.0331482	0.1316934
equ_growth	-0.3469878	0.2355241	-1.47	0.141	-0.9536576	0.259682
cash_growth	-0.0022308	0.0444115	-0.05	0.96	-0.1166272	0.1121657
stockp_growth	0.1440676	0.1234285	1.17	0.243	-0.1738631	0.4619983
size	0.0988234**	0.038105	2.59	0.01	0.0006713	0.1969755
_cons	4.670884	0.7425273	6.29	0	2.758261	6.583508

* p<.05; ** p<.01; *** p<.001

Instruments for first differences equation

Standard

D.(L2.sta_tasset L2.current L2.stpay L2.stasset_to L2.equ_to L2.EBIT_sales L2.sales_growth L2.EPS L2.equ_growth L2.cash_growth L2.size)

GMM-type (missing=0, separate instruments for each period unless collapsed)

L(1/3).(dbt_ta roa stockp_growth)

Instruments for levels equation

Standard

L2.sta_tasset L2.current L2.stpay L2.stasset_to L2.equ_to L2.EBIT_sales L2.sales_growth L2.EPS L2.equ_growth L2.cash_growth L2.size

_cons

GMM-type (missing=0, separate instruments for each period unless collapsed)

D.(dbt_ta roa stockp_growth)

Arellano-Bond test for AR(1) in first differences: z = . Pr > z = .
Arellano-Bond test for AR(2) in first differences: z = . Pr > z = .

Sargan test of overid. restrictions: chi2(11) = 19.23 Prob > chi2 = 0.057
(Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
GMM instruments for levels
Sargan test excluding group: chi2(5) = 3.14 Prob > chi2 = 0.678
Difference (null H = exogenous): chi2(6) = 16.09 Prob > chi2 = 0.013
iv(L2.sta_tasset L2.current L2.stpay L2.stasset_to L2.equ_to
L2.EBIT_sales L2.sales_growth L2.EPS L2.equ_growth L2.cash_growth
Sargan test excluding group: chi2(0) = 0.00 Prob > chi2 = .
Difference (null H = exogenous): chi2(11) = 19.23 Prob > chi2 = 0.057

In the beginning part of the table, Prob>chi2 is approximately 0 suggesting that there is at least one explanatory variable is statistically significant.

The Arellano-Bond test has a null hypothesis of no autocorrelation, and this test is applied to the differenced residuals. Since the time dimension of the dataset is small, the Arellano-Bond tests for AR(1) and AR(2) cannot be computed..

The Sargan test of over-identification cannot reject the null hypothesis that the instruments are valid instruments. In other words, the instruments selected are all valid and reasonable.

As can be seen from the coefficient column, not all the relationship between explanatory variables and credit ratings are in the right hypothesized direction. The positive coefficient between short-term assets to total assets follows the expectation as corporations with high liquidity or convertibility are unlikely to experience financial distress. The negative beta of corporations' capital structure confirms the hypothesis that firms with higher debt face a higher risk level. The current ratio has a negative relationship with the credit ratings. This is contrary to the expectation since the current

ratio presents the liquidity of the corporations and firms' ability to pay the bills in the short term. In contrast, the short-term payment ability of the enterprises is in the right direction as better short-term payment is appreciated and expected to attract a higher credit rating. Short term assets turnover is positively correlated with the credit ratings and so does equity turnover. Both ratios are expected to have the same sign since they both represent the corporation's efficiency in using their resources to generate revenue. EBIT/sales, the ratio measure the firm's profitability over a specific period of time, is at the opposite direction to the expectation as in reality, firms with excellent operating efficiency are hypothesized to achieve higher credit ratings. ROA, the critical measure of the firms' efficiency in managing the corporation's assets, are in the right hypothesized direction. Higher ROA contributes to higher credit rating acquired. The sales growth rate has a positive relationship with credit ratings. Corporations with better annual sales improvement are likely to be ranked higher. Differently, the equity growth rate and cash growth rate experience a negative sign of coefficient beta that is opposite to expectation. Corporations that are able to attract more capital from shareholders and generating more cash are hypothesized to achieve better ranks. Earnings per share have positive coefficient which follows to expectation. Stock price growth rate which is expected to capture the economic, industrial and market influence on corporations' experiences a positive relationship to credit ratings. Better-ranked firms are usually preferred by the investors and hence have a higher stock price. The last variable, corporations' size, has the positive coefficient which is similar to the hypothesis that bigger companies are considered to be healthier and less likely to be in distress, hence have higher credit ratings. From the coefficient column, it can be seen that ROA, the capital structure of the corporations, current ratio and the firm's size have the most important effects on their credit ratings.

Financial ratios' influence on corporate credit ratings: the model includes ROE

First we summarize data to have a look at the general information of the variables using the "su" command in Stata:

su rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roe sales_growth EPS equ_growth cash_growth stockp_growth size

Table 6.10 Variables summary

Variable	Obs	Mean	Std. Dev.	Min	Max
rankcoded	2,000	6.281	1.696903	1	9
sta_tasset	2,000	0.622475	0.2719437	0.03	7.63
dbt_ta	2,000	0.499505	0.2501175	0	5.72
current	2,000	2.624175	6.915493	0	229.58
stpay	2,000	0.59106	2.142237	0	59.23
stasset_to	2,000	2.04602	2.150753	0	22.85
equ_to	2,000	2.935845	3.562711	0	46.97
EBIT_sales	2,000	0.068125	0.2692138	-1.6	0.88
roe	2,000	0.097945	0.1589297	-1.6	0.97
sales_growth	2,000	0.253945	2.566529	-1	93.81
EPS	2,000	-0.26923	5.237862	-37.55	21.02
equ_growth	2,000	0.1355	1.865776	-1	81.94
cash_growth	2,000	1.027575	6.222562	-1	151.36
stockp_gro~h	2,000	0.066855	0.5531085	-0.91	4.81
size	2,000	13.14398	1.454029	9.364434	17.82454

Similar to the test including ROA above, we can see that the panel data set contains individual firm's influence and fixed effects. Now we will test for serial correlation in the model using the "xtserial" command in Stata:

xtserial rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roe sales_growth EPS equ_growth cash_growth stockp_growth size, output

Table 6.11 Serial correlation test

Linear regression

Number of obs	=	1,500
F(14, 499)	=	26.59
Prob > F	=	0
R-squared	=	0.2936
Root MSE	=	0.90479

(Std. Err. adjusted for 500 clusters in FID)

	Coef.	Robust Std. Err.	t	P>t	[99% Conf.	Interval]
D.rankcoded						
sta_tasset						
D1.	1.674591	0.2550789	6.56	0	1.015029	2.334153
dbt_ta						
D1.	-2.540807	0.3245906	-7.83	0	-3.380107	-1.701508
current						
D1.	-0.0055583	0.0016585	-3.35	0.001	-0.0098468	-0.0012698
stpay						
D1.	0.0120955	0.0062469	1.94	0.053	-0.0040574	0.0282483
stasset_to						
D1.	0.2521837	0.0517093	4.88	0	0.1184781	0.3858892
equ_to						
D1.	-0.0115824	0.0319334	-0.36	0.717	-0.0941533	0.0709884
EBIT_sales						
D1.	0.3766705	0.1631589	2.31	0.021	-0.0452125	0.7985534
roe						
D1.	1.929775	0.4621872	4.18	0	0.7346891	3.12486
sales_growth						
D1.	0.0186684	0.0077745	2.4	0.017	-0.0014342	0.038771
EPS						
D1.	0.0061349	0.0044153	1.39	0.165	-0.0052819	0.0175517
equ_growth						
D1.	-0.0017365	0.0056583	-0.31	0.759	-0.0163672	0.0128943
cash_growth						
D1.	-0.0017696	0.0022279	-0.79	0.427	-0.0075304	0.0039913
stockp_growth						
D1.	0.081001	0.0349853	2.32	0.021	-0.0094611	0.171463
size						
D1.	-0.0644333	0.110071	-0.59	0.559	-0.3490459	0.2201792

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 499) = 19.406
Prob > F = 0.0000

As can be seen from the result, Prob > F = 0.0000 strongly rejects the null hypothesis that there is no first-order autocorrelation in the panel dataset, suggesting the existence of auto-correlation.

Next, we test for endogeneity in the panel dataset. Similar to the above procedure, the modified panel model is estimated with IV under fixed-effects models (since the panel dataset contains fixed effects and the FEM is more suitable compared to REM) and the Hausman test is conducted. If we assume ROE is endogenous with corporate credit rating, then the FEM is as follow:

xtivreg rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roe sales_growth EPS equ_growth cash_growth stockp_growth size (roe = l2.(sta_tasset dbt_ta current stasset_to equ_to ebit_sales)), fe

Table 6.12 Fixed Effects Model (IV)

Fixed-effects (within) IV	regression	Number of obs	=	1,000
Group variable: FID		Number of groups	=	500
R-sq:		Obs per group:		
within = 0.3079		min	=	2
between = 0.4143		avg	=	2
overall = 0.4041		max	=	2
		Wald chi2(14)	=	53376.8
corr(u_i, Xb) = 0.1324		Prob > chi2	=	0

rankcoded	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
roe	0					
sta_tasset	1.707543***	0.5025153	3.4	0.001	0.4131495	3.001937
dbt_ta	-2.721559***	0.576731	-4.72	0	-4.20712	-1.235998
current	-0.0010216	0.0044923	-0.23	0.82	-0.0125929	0.0105497
stpay	0.0171825	0.0150903	1.14	0.255	-0.0216876	0.0560525
stasset_to	0.1916197**	0.0593269	3.23	0.001	0.0388036	0.3444358
equ_to	-0.0085849	0.0373594	-0.23	0.818	-0.1048162	0.0876465
EBIT_sales	0.2959389	0.1723766	1.72	0.086	-0.1480738	0.7399517
roe	0.3577073	0.3598973	0.99	0.32	-0.5693268	1.284741
sales_growth	0.0514284*	0.0224793	2.29	0.022	-0.0064744	0.1093312
EPS	0.0166295**	0.0050685	3.28	0.001	0.003574	0.0296851
equ_growth	0.289857**	0.0960745	3.02	0.003	0.0423855	0.5373286
cash_growth	0.003158	0.0041374	0.76	0.445	-0.0074993	0.0138153
stockp_growth	0.1649235**	0.0542743	3.04	0.002	0.0251223	0.3047247
size	-0.2268155	0.1729715	-1.31	0.19	-0.6723605	0.2187295
_cons	9.078267***	2.215543	4.1	0	3.371406	14.78513
sigma_e	0.61951744					
rho	0.81607839	(fraction of variance due to u_i)				

* p<.05; ** p<.01; *** p<.001

F test that all u_i=0: F(499,486) 4.91 Prob > F 0

Instrumented: roe

Instruments: sta_tasset dbt_ta current stpay stasset_to equu_to EBIT_sales roe sales_growth EPS equ_growth cash_growth stockp_growth size L2.sta_tasset L2.dbt_ta L2.current L2.stasset_to L2.equ_to L2.ebit_sales

hausman . fixed

	---- Coefficients ----			
	(b) fixed	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
sta_tasset	1.707543	1.761166	-0.053623	0.472559
dbt_ta	-2.721559	-2.700426	-0.021133	0.5338258
current	-0.0010216	-0.0043036	0.003282	0.0030047
stpay	0.0171825	0.0072105	0.009972	0.0086972
stasset_to	0.1916197	0.2611435	-0.069524	0.0495449

equ_to	-0.0085849	-0.0187207	0.0101358	0.0318921
EBIT_sales	0.2959389	0.311862	-0.015923	0.1393327
roe	0.3577073	2.3269	-1.969193	0.2946284
sales_growth	0.0514284	0.0123788	0.0390496	0.0211107
EPS	0.0166295	0.0048429	0.0117867	0.0032806
equ_growth	0.289857	-0.0009593	0.2908163	0.0954647
cash_growth	0.003158	-0.0007619	0.0039199	0.0029036
stockp_gro~h	0.1649235	0.1140762	0.0508473	0.0445363
size	-0.2268155	0.0865559	-0.313371	0.1523385

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

chi2(14) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 111.57
Prob>chi2 = 0.0000

The Hausman test's result above (Prob> $\overline{X}^2$ =0.000) rejects the null hypothesis H_0: difference in coefficients not systematic, hence the financial ratio ROE is endogenously related to credit ratings.

The two above steps can be repeated assuming other financial ratios are endogenously related to corporate credit ratings. We can see that capital structure and stock price and growth rate ratios also have the issue of endogeneity.

As before, the dataset shows both autocorrelation and endogeneity, the Arellano-Bond dynamic panel model is selected. The GMM model in Stata is executed using the command "xtabond2". In the model, there are three endogenous variables including ROE, capital structure and stock price growth rate. The instrumental variables are the 2-lagged values of all the other explanatory variables :

xtabond2 rankcoded l.rankcoded sta_tasset dbt_ta current stpay stasset_to equ_to EBIT_sales roe sales_growth EPS equ_growth cash_growth stockp_growth size, gmm(dbt_ta roe stockp_growth) iv(l2.(sta_tasset current stpay stasset_to equ_to EBIT_sales sales_growth EPS equ_growth cash_growth size))

Table 6.13 GMM model

Group variable: FID	Number of obs	=	1000
Time variable : year	Number of groups	=	500
Number of instruments = 27	Obs per group: min	=	2
Wald chi2(15) = 725.84	avg	=	2
Prob > chi2 = 0.000	max	=	2

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
rankcoded						
rankcoded L1.	0.3069359	0.0771772	3.98	0	0.1081407	0.5057312
sta_tasset	0.7830565*	0.3606468	2.17	0.03	-0.1459081	1.712021
dbt_ta	-3.415921***	0.9812631	-3.48	0	-5.943487	-0.8883544
current	-0.079411*	0.0395884	-2.01	0.045	-0.1813841	0.022562
stpay	0.165458	0.123131	1.34	0.179	-0.1517064	0.4826224
stasset_to	0.1680881**	0.0651639	2.58	0.01	0.0002371	0.3359391
equ_to	0.0153714	0.0438484	0.35	0.726	-0.0975745	0.1283174
EBIT_sales	1.424107	1.188482	1.2	0.231	-1.63722	4.485433
roe	0.4841142	1.723063	0.28	0.779	-3.954201	4.922429
sales_growth	0.0427201	0.1709172	0.25	0.803	-0.3975334	0.4829735
EPS	0.0149134	0.0387396	0.38	0.7	-0.0848731	0.1147
equ_growth	-0.1069057	0.2659983	-0.4	0.688	-0.7920718	0.5782604
cash_growth	-0.0331812	0.0413005	-0.8	0.422	-0.1395642	0.0732019
stockp_growth	0.1283135	0.122817	1.04	0.296	-0.1880422	0.4446692
size	0.0448248	0.0472519	0.95	0.343	-0.0768881	0.1665377
_cons	4.646401	0.6225	7.46	0	3.042947	6.249854

* p<.05; ** p<.01; *** p<.001

Instruments for first differences equation

Standard

D.(L2.sta_tasset L2.current L2.stpay L2.stasset_to L2.equ_to L2.EBIT_sales L2.sales_growth L2.EPS L2.equ_growth L2.cash_growth L2.size)

GMM-type (missing=0, separate instruments for each period unless collapsed)

L(1/3).(dbt_ta roe stockp_growth)

Instruments for levels equation

Standard

L2.sta_tasset L2.current L2.stpay L2.stasset_to L2.equ_to L2.EBIT_sales L2.sales_growth L2.EPS L2.equ_growth L2.cash_growth L2.size _cons

GMM-type (missing=0, separate instruments for each period unless collapsed)

D.(dbt_ta roe stockp_growth)

```
Arellano-Bond test for AR(1) in first differences: z =      .  Pr > z =      .
Arellano-Bond test for AR(2) in first differences: z =      .  Pr > z =      .
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(11)   =  26.56  Prob > chi2 =  0.056
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(5)    =   3.14  Prob > chi2 =  0.679
    Difference (null H = exogenous): chi2(6)    =  23.42  Prob > chi2 =  0.01
  iv(L2.sta_tasset L2.current L2.stpay L2.stasset_to L2.equ_to L2.EBIT_sales L2.sales_growth L2.EPS
L2.equ_growth L2.cash_growth L2.size)
    Sargan test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(11)   =  26.56  Prob > chi2 =  0.05
```

All the tests show very similar results as the previous model with ROA, and all the instruments seems to be valid.

From the coefficient column, we can see that the results are also very similar to the results of the financial ratios, including ROA for almost all financial ratios. The sign of coefficients in table 6.13 is the same as in table 6.9 except for the EBIT/sales ratios. In the GMM-IV model presented in table 6.13, EBIT/sales ratio has a positive relationship with firm's credit ratings confirming the hypothesis that firms which have good profitability are more credit-worthy. The capital structure of the firms, current assets ratio and the short term assets turnover ratios are important ratios to be considered.

As can be seen from both two tables 6.9 and 6.13, the capital structure of the corporations is confirmed to be worth considering. Hence, we will have a more in-depth look inside this aspect in the following part of 6.4.

6.2 Earning management influence on credit ratings

To answer the question of whether earning management biases credit rating prediction, we apply the same procedure as mentioned above to the unadjusted and adjusted financial explanatory variables. To make it simple, we simplify the financial ratios and use only four financial ratios that are mostly used in the literature concerning earnings management, including liquidity ratio, profitability ratio, productivity ratio and capital structure (leverage) of the corporations. The univariate tests of the key financial ratios chosen present an evaluation of the expected relationships and indicators of economic significance for each variable under consideration. The results are shown in the table below.

Table 6.14 Univariate Ordered-Probit Model Estimates of Financial Explanatory Variables (alternatives)

The ordered-probit model is estimated separately for each of the alternative financial ratios. The model is estimated for the whole sample of 2,000 observations over the same period of 2011 to 2014.

	α1	**α2**	**α3**	**α4**	**α5**	**α6**	**α7**	**α8**	**β**	**Standard error**	**P> |z|**	**95% Conf. Interval**	
Liquidity	-2.08	-1.88	-1.46	-0.77	-0.24	0.31	0.86	1.86	**1.19**	0.09	**0.00**	1.02	1.36
Profitability	-2.20	-1.99	-1.56	-0.82	-0.24	0.36	0.98	2.09	**6.98**	0.30	**0.00**	6.38	7.57
Productivity	-2.20	-1.99	-1.56	-0.82	-0.24	0.36	0.98	2.09	**6.98**	0.30	**0.00**	6.38	7.57
Leverage	-2.80	-2.59	-2.15	-1.42	-0.86	-0.29	0.28	1.27	**-0.21**	0.01	**0.00**	-0.23	-0.19

As can be seen from the table, all four variables are statistically significant with a very small p-value (nearly 0). It corresponds to previous studies in the literature (Thai and Abdollahi, 2011; Korol, 2013). The coefficients of all the variables are also in the right direction hypothesized. The results from the table indicate that liquidity ratio (working capital to total assets) is positively related to credit ratings. This is similar to previous researches where it is suggested that high liquid corporations are not prone to financial distress hence achieves higher credit ratings (Moyer and Chatfield (1983)). The positive coefficient of profitability corresponds to the expectation that firms with higher profit

have a lower probability of distress so that they are likely ranked higher. A similar pattern is observed for productivity ratio. Higher productivity ratio indicates good status for corporations and hence good credit ratings. The leverage ratio, in contrast, experiences a negative coefficient since enterprises with a high level of debt are riskier and likely to achieve lower credit ratings.

In the next step, the ordered probit model is expanded for the whole set of financial ratios under consideration. The expansion begins by reporting the correlation among explanatory variables. Since the conditional number of the variables is checked to be smaller than 30 as mentioned in the previous section, there is no multicollinearity among them. The table below presents the correlation among variables.

Table 6.15 Correlation matrix of Financial Independent Variables (Alternatives)

This table shows the correlation between pairs of variables (alternatives) used in the ordered probit regression models. The sample period is from 2011 to 2014 with the panel of 2,000 observations.

	Liquidity	Profitability	Productivity
Liquidity			
Profitability	0.30		
Productivity	0.22	0.95	
Leverage	-0.34	-0.28	-0.21

All variables are not highly correlated, indicative of the different financial aspect of the corporations that each measure. There is one exception of profitability and productivity. In the next table, the ordered-probit model for all four financial ratios is presented.

Table 6.16 The Full Ordered-Probit Model (Alternatives)

This table presents the results of the full ordered-probit model incorporating alternative financial ratios. The model is estimated for the whole sample of 2,000 observations over the sample period of 2011 to 2014. The table shows the parameter estimates from the ordered-probit model with the standard error, robust form and cluster-robust form.

	Coef.	Std. Err.	P>z
Liquidity	0.4498	0.0966	0
Profitability	7.0719	0.9774	0
Productivity	-1.0178	0.8233	0.216
Leverage	-0.1426	0.0131	0
/cut1	-2.5523	0.0980	
/cut2	-2.3357	0.0859	
/cut3	-1.8774	0.0700	
/cut4	-1.0947	0.0575	
/cut5	-0.4810	0.0537	
/cut6	0.1610	0.0529	
/cut7	0.8160	0.0550	
/cut8	1.9622	0.0690	
	Log-likelihood		-3393.69
	LR chi2(4)		735.71
	Prob > chi2		0
	Pseudo R2		0.0978

As can be seen, the p-value of the whole model is very small (nearly 0) so that it is statistically significant. The p-value for individual financial ratios is statistically significant apart from the productivity ratio. The coefficient sign of financial ratios considered is similar to the univariate model for each ratio individually except for the productivity ratio. The negative coefficient of productivity ratio is opposite to expectation. As can be seen from the coefficient column, profitability ratio has a large impact on the credit ratings of the firms.

In the table below, we have the comparison of our model forecasts with actual credit ratings:

Table 6.17 Successful Prediction Matrix (Alternatives)

The table compares the predictions of the full ordered probit model using standard error with actual credit ratings of CIC (using alternative independent variables)

		Actual								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
Forcast	AAA	8	17	1	1	0	0	0	0	0
	AA	107	310	149	64	31	14	1	0	1
	A	2	47	99	80	21	9	4	3	1
	BBB	13	56	136	219	195	145	28	10	7
	BB	1	5	3	13	29	27	13	0	10
	B	1	5	8	23	24	23	11	2	2
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	1	2	7	6	1	0	3
Total		132	440	397	402	307	224	58	15	24
Percentage correct		6.06%	70.45%	24.94%	54.48%	9.45%	10.27%	0.00%	0.00%	12.50%
Overall percentage correct		34.55%								

As can be seen from the table, the ordered probit model for all the financial ratios under consideration successfully assigns credit ratings to approximately 34.55% of our sample firms. The model is specifically accurate for the firms in the middle ranks such as AA, A, BBB, B. Most of the firms rated AAA is forecasted to be AA due to the fact that the financial variables are quite similar for firms in these two categories and there are almost four times as many firms in the AA category than in the AAA one. A similar situation happens with firms in A, BBB, BB, and B categories. Specifically, the model shows a remarkably effective forecast for the A categories. However, the effectiveness of the model is distorted for the low categories including CCC, CC, C as it shows the high possibility of serious type I error (misclassifying risky firms as good firms).

The full procedure is repeated for adjusted financial ratios. The table below shows the descriptive data for financial ratios adjusted for earnings management.

Table 6.18 Descriptive Statistics of financial ratios (adjusted alternatives)

This table presents summary statistic information for the 4 adjusted alternatives financial ratios used in the research according to the rating categories. The sample period used is from 2011 to 2014 using a panel of 2,000 observations.

	Observation	Mean	Standard deviation	Min	Max
AAA					
adLiquidity	132	0.01	3.30	-23.06	7.73
adProfitability	132	-0.17	4.44	-32.28	15.62
adProductivity	132	-0.10	4.26	-30.94	14.76
adLeverage	132	0.62	5.22	-27.39	37.01
AA					
adLiquidity	440	-0.38	9.51	-139.78	19.95
adProfitability	440	-0.81	12.05	-183.58	29.94
adProductivity	440	-0.75	11.58	-174.07	29.94
adLeverage	440	7.08	131.08	-160.62	2731.68
A					
adLiquidity	397	0.15	8.79	-148.97	51.06
adProfitability	397	-0.01	9.73	-151.85	74.09
adProductivity	397	0.03	9.07	-139.15	69.93
adLeverage	397	1.25	15.73	-123.61	169.30
BBB					
adLiquidity	402	1.10	13.33	-40.24	194.99
adProfitability	402	1.34	17.12	-41.11	236.57
adProductivity	402	1.34	16.57	-39.70	222.82
adLeverage	402	1.18	12.31	-123.66	137.23
BB					
adLiquidity	307	-0.82	71.81	-1082.16	624.20
adProfitability	307	-1.81	90.35	-1432.45	647.57
adProductivity	307	-1.65	85.55	-1356.46	611.33
adLeverage	307	23.18	386.54	-92.09	6755.77
B					
adLiquidity	225	-0.06	3.05	-32.22	23.17
adProfitability	225	-0.24	3.67	-37.91	30.26
adProductivity	225	-0.20	3.57	-36.94	29.08
adLeverage	224	0.97	18.32	-77.78	173.08

CCC					
adLiquidity	58	0.07	6.38	-13.11	44.39
adProfitability	58	-0.09	7.27	-15.46	49.85
adProductivity	58	-0.03	7.24	-15.15	49.85
adLeverage	58	3.85	27.59	-53.64	184.76
CC					
adLiquidity	15	-2.24	6.35	-24.85	0.28
adProfitability	15	-2.43	5.89	-23.34	0.21
adProductivity	15	-2.30	5.69	-22.53	0.23
adLeverage	15	2.05	7.46	-8.09	25.94
C					
adLiquidity	24	-0.06	1.02	-1.92	2.55
adProfitability	24	-0.25	1.30	-3.93	2.59
adProductivity	24	-0.20	1.27	-3.90	2.59
adLeverage	24	-16.51	73.64	-359.71	13.28

The value of adjusted ratios is slightly lower than the unadjusted ratios. Accordingly, subsequent to the adjustment, the risk of distress increases. Lower ratios reflect a higher probability of being classified in lower credit rating categories (since we expect better credit ratings for better ratios). The higher standard deviation for the adjusted value may also indicate the higher proportion of misclassification as using the adjusted data for the model.

The univariate tests of the key financial ratios chosen present an evaluation of the expected relationships and indicators of economic significance for each variable under consideration. The results are shown in the table below.

Table 6.19 Univariate Ordered-Probit Model Estimates of Financial Explanatory Variables (adjusted alternatives)

The ordered probit model is estimated separately for each of the adjusted alternative financial ratios. The model is estimated for the whole sample of 2,000 observations over the same period of 2011 to 2014.

	α1	**α2**	**α3**	**α4**	**α5**	**α6**	**α7**	**α8**	**β**	**Standard error**	**P>|z|**	**95% Conf. Interval**	
adLiquidity	-2.26	-2.06	-1.66	-0.99	-0.48	0.04	0.57	1.51	**0.00**	0.00	**0.98**	0.00	0.00
adProfitability	-2.26	-2.06	-1.66	-0.99	-0.48	0.04	0.57	1.51	**0.00**	0.00	**0.97**	0.00	0.00
adProductivity	-2.26	-2.06	-1.66	-0.99	-0.48	0.04	0.57	1.51	**0.00**	0.00	**0.97**	0.00	0.00
adLeverage	-2.26	-2.06	-1.66	-0.99	-0.48	0.04	0.56	1.51	**0.00**	0.00	**0.82**	0.00	0.00

As can be seen from the table, the earning management totally distorts the effects of financial ratios on credit ratings. The p-value indicates that the entire models are statistically insignificant. The coefficient is nearly zero which shows no relationship to the credit ratings of individual adjusted financial ratios.

In the next step, the ordered-probit model is run for all the adjusted financial ratios together.

Table 6.20 The Full Ordered-Probit Model (Adjusted Alternatives)

This table presents the results of the full ordered-probit model incorporating adjusted alternative financial ratios. The model is estimated for the whole sample of 2,000 observations over the sample period of 2011 to 2014. The table shows the parameter estimates from the ordered probit model with the standard error, robust form and cluster-robust form.

	Coef.	Std. Err.	P>z
adLiquidity	-0.0020	0.0072	0.7810
adProfitability	0.0317	0.0622	0.6100
adProductivity	-0.0318	0.0641	0.6200
adLeverage	0.0000	0.0001	0.8180
/cut1	-2.2590	0.0780	
/cut2	-2.0661	0.0653	
/cut3	-1.6617	0.0479	
/cut4	-0.9927	0.0339	
/cut5	-0.4854	0.0295	
/cut6	0.0367	0.0283	
/cut7	0.5631	0.0299	
/cut8	1.5043	0.0434	
	Log-likelihood		-3763.568
	LR chi2(4)		0.33
	Prob > chi2		0.9878
	Pseudo R2		0

According to the table above, neither the entire model nor individual indicators have statistically significant p-value. Adjusted liquidity has a negative coefficient. The result contradicts expectation since it reflects that firms with higher liquidity are prone to financial distress and acquire low ranking. A similar pattern applies to the adjusted productivity ratio as it is negatively related to credit ratings. Profitability ratio, however, is in the right direction of expectation as it has a positive coefficient under the adjusted model. The adjusted capital structure of the corporation, different from all other financial ratios, shows no relationship to credit ratings. The accuracy rate of the adjusted model is examined in the table below:

Table 6.21 Successful Prediction Matrix (Adjusted Alternatives)

The table compares the predictions of the full ordered probit model using standard error with actual credit ratings of CIC (using adjusted alternative independent variables)

		Actual								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
Forcast	AAA	0	0	0	0	0	0	0	0	0
	AA	132	439	396	400	303	225	57	15	24
	A	0	0	0	0	0	0	0	0	0
	BBB	0	1	1	2	4	0	1	0	0
	BB	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0
Total		132	440	397	402	307	225	58	15	24
Percentage correct		0.00%	99.77%	0.00%	0.50%	0.00%	0.00%	0.00%	0.00%	0.00%
Overall percentage correct		22.05%								

The result depicts that the adjusted model cannot provide correct classification except for the category AA. However, the deviation is really small for credit rating AAA, A, BBB, BB and B as the forecasted ranks are only one level higher or lower than the actual ranks. For categories CCC, CC and C, the forecasted results are totally deteriorated with serious type I error (misclassifying distressed corporations as healthy ones). Koh (1991) suggested that Type I error was much more costly compared to type II error since misclassified corporations may cause crucial losses in business volume and enterprises' reputation. Investors and lenders might lose full of their investment while Type II error might cost in term of opportunity cast only (Wahlen, Stickney and Baginski, 2011).

It can be clearly seen that the model with unadjusted financial ratios is better and more appropriate in determining credit ratings of Vietnamese corporations. This result contradicts the research of Cho et al. (2012) as they find that the financial distress prediction power of the model using adjusted financial ratios is improved. The reason might be due to the specific characteristic of the Vietnamese corporations operating in an

emerging market whereas most of the studies conducted in literature are based on the developed market sample.

6.3 Rating transition

The Cox hazard model is run to capture the influence of macroeconomic factors in addition to other rating-specific factors. The table below presents the correlations among macro covariates.

Table 6.22 Correlation among macroeconomic factors

The table presents the correlations among macroeconomic factors chosen in the model.

	econ_growth	consumption	investment	industrial_product	unemployment	fiscal_balance	public_debt	money	inflation	interest	current_account	export	import
Economic Growth (GDP, annual variation in %) econ_growth													
Consumption (annual variation in %) consumption	-0.1102												
Investment (annual variation in %) investment	-0.3498	0.9647											
Industrial Production (annual variation in %) industrial_product	0.8719	-0.58	-0.754										

Unemployment Rate unemployment	0.5119	-0.285	-0.313	0.5992									
Fiscal Balance (% of GDP) fiscal_balance	0.5628	-0.846	-0.955	0.8625	0.264								
Public Debt (% of GDP) public_debt	0.0053	0.9626	0.9249	-0.4552	-0.015	-0.822							
Money (annual variation in %) money	-0.4005	0.0245	0.0337	-0.3851	-0.959	0.0175	-0.247						
Inflation (PPI, annual variation in %) inflation	0.4129	-0.935	-0.995	0.7876	0.277	0.9799	-0.907	0.007					
Policy Interest Rate (%) interest	0.5113	-0.896	-0.981	0.8493	0.323	0.9932	-0.855	-0.04	0.994				
Current Account (% of GDP) current_account	-0.7456	0.7121	0.8316	-0.969	-0.698	-0.868	0.559	0.475	-0.84	-0.88			
Exports (annual variation in %) export	0.4234	-0.943	-0.997	0.8044	0.354	0.9703	-0.893	-0.07	0.996	0.992	-0.87		
Imports (annual variation in %) import	0.6325	-0.579	-0.643	0.8299	0.922	0.6157	-0.35	-0.78	0.621	0.663	-0.916	0.681	
External Debt (% of GDP) external_debt	0.7933	-0.691	-0.84	0.9896	0.579	0.9153	-0.574	-0.34	0.864	0.912	-0.985	0.88	0.837

Most of the correlations among macroeconomic factors are quite moderate as expected. Even though some may be highly correlated, all the chosen macro factors are retained in the model specification since they are all connected, and their significance to the model is unclear. Due to the short time span of the dataset, the macroeconomic variables are not included simultaneously together with the rating history factors to avoid the potential multicollinearity problem. This is a weakness that must be raised in the outset of the research, hence the research findings in this study can only be indicative of the potential significance of the macroeconomic variables for ratings shift determination in this regard. The estimation results for the Cox hazard model with the macroeconomic variables being added to the rating history factors one by one are reported below.

Table 6.23 Analysis of individual macroeconomic factors using Cox hazard model

The table presents the marginal contributions of firms' specific factors of individual macroeconomic factors in transition into default.

Panel A

	Individual macro factors											
	Hazard ratio	β	p-value	Hazard ratio	β	p-value	Hazard ratio	β	p-value	Hazard ratio	β	p-value
Initial rating good (AAA-BB)	0.113	-2.178	0.930	0.114	-2.173	0.000	0.111	-2.194	0.867	0.113	-2.182	0.000
Initial rating bad(B- C)	1.000	0.000	0.000	1.000	0.000	0.000	1.000	0.001	0.000	0.000	0.000	0.000
Upgrade	0.692	-0.368	0.000	0.694	-0.366	0.000	0.690	-0.371	0.283	0.692	-0.369	0.000
Downgrade	1.720	0.542	0.000	1.707	0.535	0.000	1.717	0.541	0.881	1.722	0.543	0.000
log year	0.960	-0.040	0.712	0.523	0.340	0.361	0.058	-2.848	0.274	0.784	-0.243	0.094
Economic Growth (GDP, annual variation in %)	0.000	-14.702	0.011									
Consumption (annual variation in %)				0.000	-9.843	0.464						
Investment (annual variation in %)							31,500.860	10.358	0.008			

Industrial Production (annual variation in %)									0.068	-2.692	0.005
Log likelihood	-13,427.687			-13,430.579			-13,427.486			-13,427.029	
LR chi2	717.340			711.560			717.750			718.660	
Prob> Chi2	0.000			0.000			0.000			0.000	

Panel B

	Individual macro factors											
	Hazard ratio	β	p-value	Hazard ratio	β	p-value	Hazard ratio	β	p-value	Hazard ratio	β	p-value
Initial rating good (AAA-BB)	0.111	-2.194	0.000	0.114	-2.173	0.000	0.113	-2.183	0.000	0.111	-2.194	0.000
Initial rating bad(B- C)	1.000	0.001	0.000	1.011	0.007	0.000	1.001	0.000	0.000	1.123	0.394	0.000
Upgrade	-0.403	-0.371	0.000	0.693	-0.366	0.000	0.692	-0.369	0.000	0.690	-0.371	0.000
Downgrade	0.044	0.540	0.000	0.574	0.539	0.000	1.722	0.544	0.000	1.715	0.539	0.000
log year	-2.133	-0.022	0.838	0.978	-0.556	0.090	2.441	0.892	0.005	1.052	0.051	0.626
Unemployment Rate	-40.315	-35.477	0.012									
Fiscal Balance (% of GDP)				0.000	-8.522	0.050						
Public Debt (% of GDP)							-6.390	-5.927	0.005			
Money (annual variation in %)										1.645	0.497	0.015
Log likelihood	-13,427.804			-13,429.092			-13,427.005			-13,427.981		
LR chi2	717.110			714.530			718.710			716.760		
Prob> Chi2	0.000			0.000			0.000			0.000		

Panel C

	Individual macro factors											
	Hazard ratio	β	p-value	Hazard ratio	β	p-value	Hazard ratio	β	p-value	Hazard ratio	β	p-value
Initial rating good (AAA-BB)	0.113	-2.178	0.000	0.113	-2.178	0.000	0.120	-2.190	0.000	0.112	-2.190	0.000
Initial rating bad(B- C)	1.112	0.001	0.000	1.115	0.005	0.000	1.112	0.000	0.000	1.111	0.000	0.000

Upgrade	0.692	-0.368	0.000	0.692	-0.368	0.000	0.961	-0.370	0.000	0.691	-0.370	0.000
Downgrade	1.719	0.542	0.000	1.720	0.542	0.000	1.723	0.544	0.000	1.723	0.544	0.000
log year	0.123	-2.099	0.014	0.350	-1.051	0.017	0.717	-0.332	0.040	0.156	-1.856	0.004
Inflation (PPI, annual variation in %)	0.000	-8.399	0.012									
Policy Interest Rate (%)				0.001	-7.499	0.011						
Current Account (% of GDP)							124.730	4.826	0.003			
Exports (annual variation in %)										0.004	-5.636	0.003
Log likelihood	-13,427.700			-13,427.719			-13,426.579			-13,426.587		
LR chi2	717.220			717.280			719.560			719.540		
Prob> Chi2	0.000			0.000			0.000			0.000		

Panel D

	Individual macro factors					
	Hazard ratio	β	p-value	Hazard ratio	β	p-value
Initial rating good (AAA-BB)	0.111	-2.194	0.000	0.113	-2.184	0.000
Initial rating bad(B- C)	1.235	0.000	0.000	1.329	0.000	0.000
Upgrade	0.690	-0.371	0.000	0.691	-0.369	0.000
Downgrade	1.718	0.541	0.000	1.722	0.544	0.000
log year	0.861	-0.150	0.120	0.710	-0.343	0.043
Imports (annual variation in %)	0.300	-1.203	0.007			
External Debt (% of GDP)				0.011	-4.501	0.004
Log likelihood	-13,427.326			-13,426.884		
LR chi2	718.070			718.950		
Prob> Chi2	0.000			0.000		

The result of the table gives some ideas of each macroeconomic factor's potential importance and the direction of its effect in combination with rating specific covariates. The hazard ratio may be thought of as the relative "death rate" (Armirtage and Berry, 1994). In this case, it represents the transition to a situation of financial distress. The coefficients in a Cox regression relate to hazard; a positive coefficient indicates a worse prognosis and a negative coefficient indicates a protective effect of the variable with which it is associated.

One of the first things to notice is that the estimated coefficients and the p-value for the rating specific covariates change very little as the macro variables are added. Therefore, it can be seen that the information in the macroeconomic factor is incremental to that captured by rating specific explanatory variables. Nevertheless, most of the macroeconomic factors are statistically significant as being included in the specification factors. Economic growth rate, and consumption have negative coefficients which are consistent with expectations. A strong economy is expected to create opportunities and a healthy operating environment for the corporations and hence reduce the financial distress possibility. The investment has a positive coefficient which is opposite to expectation since more investment is expected to boost the development of corporations and hence reduce the default risk. The industrial production, on the other hand, has a negative coefficient which is in the right direction of expectation since a higher industrial output is expected to reduce the financial distress possibility of corporations.

The unemployment rate is negatively correlated to the distressing possibility of the corporations and has a large influence. This result is unexpected and seems to contradict the result for economic growth. The contradiction may disappear if we have more time periods in the dataset. Fiscal balance has a negative coefficient which follows the economic hypothesis. Lower fiscal balance means budget deficit that may lead to inflation and higher debt interest rate. Corporations will confront obstacles in approaching financial resources and have a higher risk of distress. Public debt's negative coefficient, however, is opposite to expectation since government borrowing increases

the total credit in the economy and hence drives up the cost of borrowing for corporations making it difficult to approach financial resources. Positive coefficient of money supply corresponds to expectation since higher levels of the money supply may lead to high inflation, higher cost and a hence higher risk of distress.

In contrast, the negative coefficient of inflation rate is complicated since high inflation can be both good and bad to the corporations. Although a high inflation rate increases corporate profits and implies higher demand for products and services at higher prices, it also increases cost and wages, leading to a tight employment market. A higher interest rate makes the borrowing cost of the corporations higher, hence the negative coefficient of the policy interest rate is contrary to expectation. Similarly, the positive coefficient of the current account is counter-intuitive. A current account surplus boosts employment in the export sector, and lower import spending means more spending on domestic goods and services. Consequently, the higher current account is expected to prevent financial distress of domestic corporations. Export and import level, in contrast, is complicated to hypothesize since the financial distress possibility of corporations based on its business' dependence on export and/import level. External debt can boost the country's economy in a specific term. However, in the long term, excessively high external debt can lead to a country's insolvency. In this research, since the study period is short, so external debt is expected to have a negative coefficient with the corporate financial distress possibility.

As can be seen from the p-value, most of the macroeconomic variables is statistically significant for determining the transition. Hence, macroeconomic variables have additional explanatory power to the determinants of Vietnamese corporate credit ratings.

Due to the excessively short time dimension and thus the limited variations in the macroeconomic variables, the model cannot accommodate multiple variables (to avoid the multicollinearity problem). The research findings in this context are only indicative. In future research with more observations across time, more robust results can be obtained by including multiple macroeconomic variables in the model.

6.4 Leverage Structure and financial distress

Following the procedure applied for corporate financial ratios in section 6.1, we test the suitable model for the first relationship between leverage structure and financial distress including ROE as an indicator of financial performance/distress.

In order to choose the appropriate estimation method for the panel model, we follow the same procedure to conduct a series of tests for individual effects, RE versus FE models, serial correlation, and endogeneity as before. The test results are reported below.

Random-effects GLS regression	Number of obs	=	2,000
Group variable: firm	Number of groups	=	500
R-sq:	Obs per group:		
within = 0.7266	min	=	4
between = 0.7387	avg	=	4
overall = 0.7236	max	=	4
	Wald chi2(3)	=	5134.96
corr(u_i, X) = 0 (assumed)	Prob > chi2	=	0

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
roe						
leverage	-0.0004	0.0011	-0.3500	0.7270	-0.0032	0.0024
roa	1.7836	0.0254	70.3500	0.0000	1.7183	1.8489
rd_at	0.0387	0.0191	2.0300	0.0420	-0.0104	0.0877
_cons	0.0044	0.0038	1.1600	0.2460	-0.0053	0.0141
sigma_u	0.0515					
sigma_e	0.0605					
rho	0.4203	(fraction of variance due to u_i)				

We next do the Breusch and Pagan Lagrangian multiplier test for random effect to choose between pooled OLS and panel model with random effects using the command “xttset0”. The null hypothesis in the Breusch and Pagan Lagrangian multiplier test is that variances across entities are zero.

roe[firm,t] = Xb + u[firm] + e[firm,t]
Estimated results:

	Var		sd=sqrt(Var)
rankcoded		0.0253	0.1589
e		0.0037	0.0605
u		0.0027	0.0515
Test:	Var(u)=0		0
	chibar2(01)=		441.71
	Prob > chibar2=		0

As can be seen from the test result (Prob> $\overline{X}^2$ =0), the null hypothesis is strongly rejected. We, therefore, must consider the individual firm's effects which happen when the four observations from each firm are collected in 4 years.

In order to choose between random effects model and fixed effects model, we test the null hypothesis H_0: the random effects model is adequate. We run the fixed effects model with the "xtreg" command.

Fixed-effects (within) regression	Number of obs	=	2,000
Group variable: firm	Number of groups	=	500
R-sq:	Obs per group:		
within = 0.7358	min	=	4
between = 0.6944	avg	=	4
overall = 0.6963	max	=	4
	F(3,1497)	=	1390.08
corr(u_i, Xb) = -0.4025	Prob > F	=	0

	Coef.	**Std. Err.**	**t**	**P>t**	**[99% Conf.**	**Interval]**
roe						
leverage	-0.0106	0.0014	-7.5400	0.0000	-0.0142	-0.0070
roa	1.9160	0.0306	62.5700	0.0000	1.8371	1.9950
rd_at	0.0187	0.0194	0.9600	0.3360	-0.0314	0.0687
_cons	0.0149	0.0034	4.3800	0.0000	0.0061	0.0236
sigma_u	0.076781					
sigma_e	0.060457					
rho	0.617288	(fraction of variance due to u_i)				

F test that all u_i=0: F(499, 1497) = 4.48 Prob > F = 0.0000

To choose between two models: FEM and REM, we use the Hausman test. Hausman test perform the Hausman's specification test (1978) with the null hypothesis H_0: difference in coefficients not systematic which means random effects model is appropriate.

---- Coefficients ----

	(b) fixed	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
leverage	-0.0106	-0.0004	-0.0102	0.0009
roa	1.9160	1.7836	0.1324	0.0172
rd_at	0.0187	0.0387	-0.0200	0.0037

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic
chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 204.78
Prob>chi2 = 0.0000

As can be seen from the test result, the Prob> $\overline{X}^2$ =0.000 strongly rejects H_0. Hence, there are fixed effects in the panel dataset that must be considered.

Assuming that leverage ratio is endogenous with ROE, then we will run the fixed effects model with instrument variables:

Fixed-effects (within) IV	regression	Number of obs	=	1,000
Group variable: firm		Number of groups	=	500
R-sq:		Obs per group:		
within = 0.7237		min	=	2
between = 0.6582		avg	=	2
overall = 0.6577		max	=	2
		Wald chi2(3)	=	2816.5
corr(u_i, Xb) = -0.5211		Prob > chi2	=	0

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
roe						
leverage	-0.0234	0.0033	-7.0700	0.0000	-0.0319	-0.0149
roa	2.1922	0.0649	33.8000	0.0000	2.0252	2.3593
rd_at	0.1069	0.0322	3.3200	0.0010	0.0239	0.1899
_cons	0.0179	0.0071	2.5100	0.0120	-0.0005	0.0362
sigma_u	0.1004					
sigma_e	0.0683					
rho	0.6836	(fraction of variance due to u_i)				

F test that all u_i=0: F(499,497) = 2.55 Prob > F = 0.0000

The Hausman test against the fixed effects models as follow:

---- Coefficients ----

	(b) fixed	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
leverage	-0.0234	-0.0106	-0.0128	0.0030
roa	2.1922	1.9160	0.2762	0.0572
rd_at	0.1069	0.0187	0.0882	0.0257

b = consistent under Ho and Ha; obtained from xtivreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 55.28

Prob>chi2 = 0.0000

The Hausman test's result above (Prob> $\bar{X}^2$ =0.000) rejects the null hypothesis H_0: difference in coefficients not systematic, hence there is endogeneity issue.

Following all the tests, the GMM-IV model is again chosen to the impact of capital structure on financial distress using ROE as an indicator of financial distress. The same procedure is applied to alternative models with the current ratio and interest coverage ratio as indicators of financial distress.

The GMM-IV model results for leverage structure's effects are presented in the table below:

Table 6.24 Relationship between financial distress and capital structure

The GMM-IV model for panel data toward corporations' capital structure.

Panel A: ROE as an indicator of financial distress

Group variable: firm	Number of obs	=	1000
Time variable : year	Number of groups	=	500
Number of instruments = 8	Obs per group: min	=	2
Wald chi2(4) = 1048.91	avg	=	2
Prob > chi2 = 0.000	max	=	2

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
roe						
roe L1.	-0.4142	0.0520	-7.9700	0.0000	-0.5481	-0.2802
leverage	-0.0239***	0.0026	-9.2300	0.0000	-0.0306	-0.0172
roa	2.0401***	0.1194	17.0900	0.0000	1.7326	2.3476
rd_at	0.2225***	0.0588	3.7800	0.0000	0.0710	0.3739
_cons	0.0580***	0.0084	6.8700	0.0000	0.0362	0.0797

* p<.05; ** p<.01; *** p<.001

Instruments for first differences equation

Standard

D.(L2.roa L2.rd_at)

GMM-type (missing=0, separate instruments for each period unless collapsed)

L(1/3).leverage

Instruments for levels equation

Standard

L2.roa L2.rd_at

_cons

GMM-type (missing=0, separate instruments for each period unless collapsed)

D.leverage

Arellano-Bond test for AR(1) in first differences: z = . Pr > z = .

Arellano-Bond test for AR(2) in first differences: z = . Pr > z = .

Sargan test of overid. restrictions: chi2(3) = 5.35 Prob > chi2 = 0.148

(Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:

GMM instruments for levels

Sargan test excluding group: chi2(1) = 0.54 Prob > chi2 = 0.462

Difference (null H = exogenous): chi2(2) = 4.81 Prob > chi2 = 0.090
iv(L2.roa L2.rd_at)
Sargan test excluding group: chi2(1) = 0.00 Prob > chi2 = 0.996
Difference (null H = exogenous): chi2(2) = 5.35 Prob > chi2 = 0.069

Panel B: current ratio as an indicator of financial distress

Group variable: firm	Number of obs	=	1000
Time variable : year	Number of groups	=	500
	Obs per group:		
Number of instruments = 7	min	=	2
Wald chi2(3) = 4.11	avg	=	2
Prob > chi2 = 0.249	max	=	2

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
current						
Current L1.	0.2637	2.3026	0.1100	0.9090	-5.6674	6.1948
leverage	-0.0964	0.2828	-0.3400	0.7330	-0.8250	0.6321
logca	-0.7840	0.4994	-1.5700	0.1160	-2.0705	0.5024
_cons	6.5070	6.3661	1.0200	0.3070	-9.8911	22.9051

Instruments for first differences equation
Standard
D.L2.logca
GMM-type (missing=0, separate instruments for each period unless collapsed)
L(1/3).leverage
Instruments for levels equation
Standard
L2.logca
_cons
GMM-type (missing=0, separate instruments for each period unless collapsed)
D.leverage

Arellano-Bond test for AR(1) in first differences: z = . Pr > z = .
Arellano-Bond test for AR(2) in first differences: z = . Pr > z = .

Sargan test of overid. restrictions: chi2(3) = 0.06 Prob > chi2 = 0.996
(Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
GMM instruments for levels

Sargan test excluding group: chi2(1) = 0.01 Prob > chi2 = 0.937
Difference (null H = exogenous): chi2(2) = 0.05 Prob > chi2 = 0.974
iv(L2.logca)
Sargan test excluding group: chi2(2) = 0.05 Prob > chi2 = 0.978
Difference (null H = exogenous): chi2(1) = 0.01 Prob > chi2 = 0.909

Panel C: Interest coverage ratio as an indicator of financial distress

Group variable: firm	Number of obs	=	1000
Time variable : year	Number of groups	=	500
Number of instruments = 8	Obs per group: min	=	2
Wald chi2(4) = 47.11	avg	=	2
Prob > chi2 = 0.000	max	=	2

	Coef.	Std. Err.	z	P>z	[99% Conf.	Interval]
icr						
icr L1.	0.6293	0.2000	3.1500	0.0020	0.1142	1.1445
leverage	-51.6425***	15.3357	-3.3700	0.0010	-91.1448	-12.1403
roic	-66.2209	58.1145	-1.1400	0.2540	-215.9139	83.4721
rd_bt	-77.8581	270.4631	-0.2900	0.7730	-774.5248	618.8086
_cons	429.5395*	174.7777	2.4600	0.0140	-20.6581	879.7371

* p<.05; ** p<.01; *** p<.001

Instruments for first differences equation
Standard
D.(L2.roic L2.rd_bt)
GMM-type (missing=0, separate instruments for each period unless collapsed)
L(1/3).leverage
Instruments for levels equation
Standard
L2.roic L2.rd_bt
_cons
GMM-type (missing=0, separate instruments for each period unless collapsed)
D.leverage

Arellano-Bond test for AR(1) in first differences: z = . Pr > z = .
Arellano-Bond test for AR(2) in first differences: z = . Pr > z = .

Sargan test of overid. restrictions: chi2(3) = 3.70 Prob > chi2 = 0.295
(Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
GMM instruments for levels
Sargan test excluding group: chi2(1) = 0.00 Prob > chi2 = 0.953
Difference (null H = exogenous): chi2(2) = 3.70 Prob > chi2 = 0.157
iv(L2.roic L2.rd_bt)
Sargan test excluding group: chi2(1) = 0.02 Prob > chi2 = 0.887
Difference (null H = exogenous): chi2(2) = 3.68 Prob > chi2 = 0.159

It can be seen from panel A that the leverage structure has a negative coefficient on ROE indicating the harmful influence of using a high level of debt on the return on shareholders' investment in the corporations. It rejects the null hypothesis that corporations with a high debt level would generate more benefit due to the tax advantages. However, it confirms the research result of Javad and Hamed (2011); Rasa (2012); Albert et al. (2013) and Lucy et al. (2014). The reason is that the advantages of using debt are only granted if the corporations can generate higher profit compared to the cost of debt.

The return on assets has a positive effect on return on equity. Higher profit-generating ability reduces the risk of the firm in general. This result supports the Dupont analysis of the relationship between ROE and ROA (Brealey et al., 2008).

Similar to ROA, the return on debt after tax also has positive effects on the corporations' ability to generate profit for the shareholders. This result rejects the null hypothesis. As the return on debt after tax increases, the effectiveness of using debt will be reduced, leading to a distortion of ROE. This result is in contrast to the findings in the research conducted by Suman (2010), Javad and Hamed (2011), and Tharmila and Arulvel (2013), which suggest a negative relationship between ROE and debt after tax.

According to panel B, the leverage structure has a negative coefficient, indicating that higher use of debt has harmful effects on the corporations' ability to meet short-term and long-term obligations. The higher debt level used by the corporations can make the firm more susceptible to risks and hence face a high financial distress possibility (Brealey et al., 2008). This inverse relationship confirms the research results of previous empirical studies (Rasa, 2012; Mohammad et al., 2013).

The current assets value, similarly, has a negative coefficient though higher level of short-term assets is expected to bring more liquidity for the corporation. The result challenges the studies conducted by Amalendu and Somnath (2012) and Mohammad et al., (2013).

According to panel C, leverage structure has a negative coefficient, indicating that higher use of debt has harmful effects on the corporations' ability to pay their interest obligations as higher borrowing quantity may lead to bigger burden to the firms.

The return on investment has a negative coefficient although corporations with better ability to generate profit from their financial resources are more likely to be able to cover their interest expenses. This result opposes the empirical studies of Mahammad et al., (2013) and Sorana (2013).

Similarly, the return on debt before tax has a negative coefficient. It is in the appropriate direction of expectation since the higher return on debt required by the lender puts a higher burden on the corporations and makes them more difficult to meet the obligations (Javad and Hamed, 2011).

The Sargan tests of over identification restriction cannot reject the null hypothesis that the instruments are valid instruments. In other words, the instruments selected are all valid and reasonable. There is no problem of over identification in the model.

6.5 Summary

This chapter documents the empirical procedures for measuring and estimating the key factors and mechanisms that determine the corporate financial distress conditions in the Vietnamese economy, paying special attention to the determination of corporate credit ratings. The current research is based on an extensive review of several related strands of literature and takes a triangulated approach to the examination of corporate financial distress determination in Vietnam. The examination focuses on four different but related aspects: i) the determination of corporate credit ratings; ii) the impact of earnings management on credit ratings; iii) the relationship between the corporate capital structure and financial distress possibility; iv) the shift in corporate credit ratings towards financial distress. A panel dataset consisting of 500 Vietnamese firms, together with key macroeconomic variables, for a four-year period, is constructed. A series of tests and various estimation methods are employed to estimate the empirical models. A summary of the main findings and implications are discussed in a subsequent chapter.

CHAPTER 7: Conclusion

7.1 General conclusions and findings

The Vietnamese economy is increasingly integrated into the global economy. Apart from the potential benefits of globalization, Vietnamese firms also face a wider range of risks. Therefore, understanding and managing corporate risks and more broadly their financial health is critically important for the key stakeholders of the corporate firms. Nevertheless, the current system and practice concerning corporate credit ratings and determination in Vietnam still have many deficiencies, and there is so far little systematic examination of the relevant issues in Vietnam. This research represents an attempt to fill in the gap in the academic literature concerning the Vietnamese corporations.

Since the literature on credit rating and determination is wide-ranging and there are many deficiencies in the Vietnamese rating system, the current study has taken a triangulated approach by adopting different but related perspectives of corporate financial health and employing a range of different analytical techniques. Through the specification and estimation of models of corporate credit rating determination, we have examined the impact of various financial and macroeconomic variables on credit ratings issued by Vietnam State Bank: Credit Information Centre. Specifically, the estimation is achieved by a series of GMM-IV models for credit rating determination and for the examination of the relationship between capital structure and various indicators of financial distress, the Cox hazard model for determining credit rating shifts, and ordered-probit models for examining the impact of earnings management on credit rating. The empirical results confirm the relevance of most of the conventional variables that are used for discriminating among categorical credit rankings. Not every relationship between independent variables and credit ratings are in the right hypothesized direction although most of the chosen explanatory variables are proved to be statistically significant. Specifically, the key firm-level variables for determining corporate credit ratings include capital structure, current ratio, short- term assets turnover, ROA, ROE, and the size of the

corporations. We have considered the potential problems of serial correlation and endogeneity and thus adopt the GMM-IV estimation method for financial ratio groups containing ROA or ROE; there is a minimal material change in the results concerning the statistical significance of the key variables in models with either ROA or ROE as one of the key explanatory variables.

Since in the accounting and credit rating literature, a noticeable issue concerns the possible manipulation of key financial ratios for the purpose of influencing the credit ratings of firms, we also investigate the empirical significance of this concern in Vietnam. The empirical results suggest that earnings management can potentially break the link between the key financial ratios and credit rating and thus discredit the entire credit rating system. Not only all the key financial ratios for rating become insignificant when they are adjusted, but also the accuracy of the predicted categories falls drastically for all categories apart from the AA category. The model with adjusted data suffers from serious Type I error. It might be caused by the use of the accrual method to calculate the earning management numbers. Therefore, Vietnamese credit issuers should use the unadjusted financial ratios whilst also keep in mind the effect of earning management practices.

A limitation of the ordered probit model or other regression models is that the use of the conventional financial ratios may have difficulty to identify those firms that are financially distressed. One possible explanation could be that the financially distressed firms may be particularly vulnerable to macroeconomic fluctuations and their ratings could deteriorate in situations of poor macroeconomic conditions. Therefore, the Cox hazard model is employed to examine how the credit ratings of corporate firms shift to categories of financial distress and how the shifts are related to macroeconomic factors in addition to the usual firm-specific factors like rating history. The analytical results confirm that incorporating macroeconomic factors along with rating specific variables lead to a highly statistically significant explanatory power for determining shifts in corporate credit ratings. A wide range of macroeconomic variables, including, economic

growth, the level of consumption, investment, fiscal balance, public debt, inflation, public interest rate, and exports, do significantly contribute to the shifts in corporate credit rating to financial distress status. The coefficients of rating related factors and their statistical significance level, however, are slightly influenced by the addition of macroeconomic factors. Therefore, the information obtained from macroeconomic covariates is incremental to that contained in the credit rating history of corporations. As is stated before, a limitation of the current study is the short time dimension of the panel dataset and thus the limited variations in the macroeconomic variables over time. Therefore, the research results in this study should be treated with caution and can only be indicative of the connection between ratings shift and macroeconomic conditions in Vietnam. With more observations over time, future studies can employ the method to generate more robust results.

In terms of capital structure, it is a complicated issue since it is influenced by several factors depending on the corporation's specific business filed. The involvement of debts increases financial risks so that enterprise managers are required to evaluate carefully strengths and weaknesses of their current leverage structure. The empirical results suggest that the corporate capital structure significantly influences various indicators of corporate financial health, hence ultimately has an impact on corporate credit rating.

7.2 Research contribution

Through the development and application of the dynamic panel models, Cox hazard model, and ordered-probit model, this thesis fills a gap in the literature on credit rating determinants that cover four different aspects: firm-specific financial ratios, macroeconomic factors, earning management practice, and capital structure. The research designs a plausible and logical approach to the determinants of credit ratings concerning almost all factors that credit issuers should pay attention to. The research approaches corporate credit ratings in different aspects to construct a detailed view of its determinants. The corporate ratings are shown to be affected by not only the firm-specific

factors but also other external factors including macroeconomic ones. Models are chosen carefully to fit the particular purposes of each step in the analysis. This covers the serious gap in the literature since most of the existing studies focus on single or a group of factors that share the same characteristics.

The current study systematizes the literature of theoretical and empirical researches concerning risk, financial risk, measurement methods, credit ratings, macroeconomic effects, earnings management impact and influence of capital structure. The huge body of literature relating to every aspect of the research is analyzed in detail and integrated into a logically coherent framework which is used for guiding and organizing the research examination. Specifically, the research includes several literatures conducted in emerging economies in numerous aspects. Since researches conducted in developing countries are a small proportion of the literature, the research endeavors to cover most of the related areas of research.

Third, the thesis analyzed the key aspects of the Vietnamese firms, markets and the macroeconomy with detailed descriptive data covering historical and current reality. The Vietnamese corporations are analyzed in the context of the general economic environment, legal basis, credit market, commercial banks systems, and credit measurement systems. The research shows an urgent requirement for an accurate credit rating system to be developed in Vietnam. The comparison and drawbacks of the current existing credit rating systems in Vietnam are fully discussed which lead to the need to improve the current thinking and practice. The research data are extracted from annual reports of the Vietnamese Government's departments, international organizations' assessments for Vietnam, Vietnamese State Banks documents, Vietnamese Law documents, and Vietnamese commercial banks' internal documents. The construction of the panel dataset for 500 Vietnamese firms with a wide range of financial ratios in itself is a useful resource for future studies in the relevant fields.

Fourth, the thesis empirically examines and quantifies the impacts of a wide range of firm-specific, market, and macroeconomic factors on the corporate credit ratings in the emerging economy of Vietnam. The key determinant variables include firm-specific financial ratios, rating history-based variables, macroeconomic factors, earning management practices, and capital structure influences. The sample size is also significant as the study identifies 500 Vietnamese corporations in several industries in a period of four years from 2011 to 2014. The data is collected carefully from the annual audited financial reports of the corporations. The financial ratios are calculated from those reports with the additional information from firms' prospectus. The market and macroeconomic data are collected from the Vietnamese Government Annual reports. The credit ratings are provided by the Vietnamese State Bank – Credit Information Centre. As can be seen, the research is rich in data considering Vietnam is an emerging economy and lack of transparency.

By incorporating various determinants of credit ratings, the current research provides valuable information in determining the credit quality of Vietnamese corporations. Credit issuers including commercial banks, lenders, and bondholders are able to use the information to assess the corporations. They could also use the information to improve or construct their own internal credit rating system for financial risk management purposes. Vietnamese corporations could also benefit from the research findings. Corporations could understand the borrowers' expectation and figure out which factors, firm-level and macroeconomic, significantly affect their own credit ratings. Therefore, they are able to improve the targeted factors to achieve better credit ratings and hence to help them to enhance their access to external funding.

7.3 Limitation of the research

In developing an appropriate framework to identify and quantify the determination of credit ratings, there are a number of difficulties to overcome.

First, in term of variables selection, very few existing studies directly concern the credit rating determination. Furthermore, almost all the existing studies are conducted for the developed economy with full data availability and different financial reporting systems compared to an emerging country like Vietnam. Therefore, it is impossible to select the variables by purely looking into the literature. The variables are selected due to the real situation of data availability in Vietnam. Hence, whether or not there are other Vietnamese specific variables and mechanisms for credit rating determination perhaps requires further consideration in the future. For example, the special relationship between banks and firms that have different ownership structures, the internal and external corporate governance structure, etc, may become the focus of future studies.

In addition, in terms of data collection, there are several limitations in data availability in Vietnam even in the legal aspect. Most of the data required for the research are limited to legal entity approach. Individual researchers are prevented from accessing the data sources without special agreements and approval from the State Bank of Vietnam. The limitation of data may result in imprecise reflection of the credit rating determinants. For example, Vietnamese bank-related information is still confidential for non-legal entity access, and it is illegal for an individual researcher to access the data and conduct investigation into the impacts of the bank-firm relationship on credit rating. The researcher is also prevented from publishing any detailed debts information of corporations by the Confidential Information Protection Agreement with the State Bank of Vietnam Credit Information Centre; the research, therefore, cannot conduct the test in detail for the credit rating immigration. There is no existing completed rating historical database so that the research cannot expand over a longer period of time for the panel data analysis. In term of research methodologies selection, the research has to confront with difficulty in accessing a large amount of information. Since the research aims to analyze the determinants of credit ratings in several aspects, it is impossible to choose only one method for every single factor as each group of factors to have their own

specific characteristics. Hence, the combined framework is constructed to make a valid application.

7.4 The suggested credit assessment process and rating procedure

In the process of conducting empirical research, the current study made frequent contacts with numerous experts in charge of the data sources and rating procedures in Vietnamese banks and rating agencies. Through extensive discussions with the experts and in conjunction with the literature review and the empirical findings in this study, the current research has identified various enhancements to the existing credit rating system in Vietnam. The credit rating model is suggested on the basis of the current availability of the database for corporations operating in Vietnam and the experience of pros and cons of Vietnamese commercial banks' credit assessment systems as well as CIC.

The current study has identified a key set of financial ratios that play a significant role in identifying corporate credit ratings. Although some other financial ratios are statistically insignificant, their role in credit rating should not be completely ignored, especially given their significance in other studies and the limitations of the current study (e.g. data quality). Other factors including macroeconomic factors, earning management and capital structure are also suggested to be seriously considered. In particular, a wide range of macroeconomic factors is significant for identifying firms that experience deterioration in their credit ratings to financial distress status.

The proposed changes to the ratings and meaning

As can be seen, from the CIC ranking system mentioned in Chapter 4, there is no rank for the default corporations and there is also no defaulted corporations recorded in Vietnam during the time of four years from 2011to 2014 which may cause bias in research relating to credit ratings in the Vietnamese economy. Based on the credit rating of the leading Credit Rating Agencies in the world and the ranking system used by CIC (as shown in Chapter 4), the ranking systems for Vietnamese corporations can be adjusted with two additional ranks as follow:

Table 7.1

Suggested ranking system

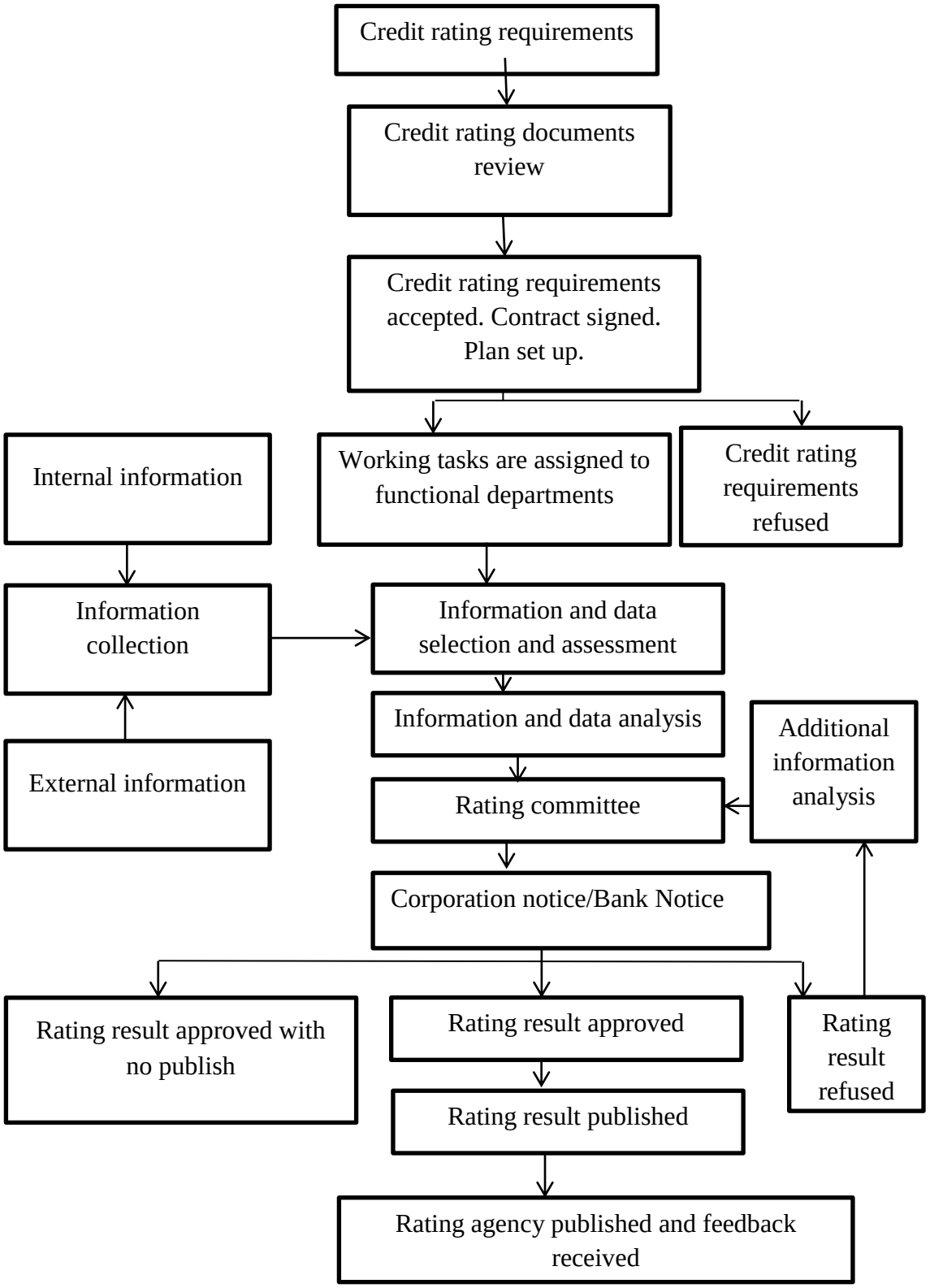
Rank	Meaning
AAA	Best corporations. Low risk and have really strong liquidity. Best repayment capacity.
AA	Lower credit quality than AAA but still remain really strong repayment capacity.
A	Sensitive to the business operating environment but remain relatively strong repayment capacity.
BBB	being able to ensure the safe repayment capacity but can be easily affected by the unfavorable business environment leading to repayment capacity reduction.
BB	The provision shows some drawbacks; can be easily affected by the unfavorable business environment leading to repayment capacity reduction.
B	Still showing acceptable repayment capacity but the unfavorable business environment can easily weaken repayment capacity and lead to default.
CCC	Currently, experience low repayment capacity. The full repayment can be only expected in a favorable business environment.
CC	Nearly lose the repayment capacity.
C	On the bankruptcy applying or similar process.
D	Default or bankruptcy status applied or being liquidated.
R	This warning sign can be added in a blanket next to the ranks beside the symbol (+/-) in order to accurately present the status of corporations. The letter R expresses the risk related to the debt itself or other risks related to the expected income not being stated in the credit rating main reports such as the floating interest rate policy.

The credit rating process (references from the credit rating process of Vietcombank, Vietinbank, MB bank and CIC with the thesis author's own adjustments)

The credit rating process can be summarized in the following chart of the process:

Figure 7.1

Suggested credit rating procedure



The data related to the corporation under consideration can be collected from the external and internal sources as well as the database of the credit rating agency itself.

The external sources of information can include:

- Reports and analysis from the professional industry research organizations and industry administration office about the industries that corporation is operating.
- Government's report and statistical data from Statistic Office, State Bank or related Ministry.
- Other non-official sources such as a specific journal, conferences, experts' advice…

The internal sources of information can include:

- Audited annual financial reports.
- Prospectus, contracts or stock deals.
- Reports of management, quality, employees, corporation's history, etc.
- Information provided by the corporation itself and the interview record if any.

Credit assessment process matrix

Table 7.2

Credit rating process matrix

Objects	Information Collection	Decision making	Credit result publish
New Corporation	▪Industrial information and data ▪Published information of the corporation ▪Corporation's internal data: financial reports, meeting reports, prospectus, other documents ▪Information and data about corporations operating in the same industry	▪Analysts ▪Engagement Managers ▪Experts' support	▪Credit quality assessment reports and related documents ▪Updated information ▪Credit status summary of industry ▪Industry research ▪Special reports and notes if any
A corporation that has been assessed previously	▪Industrial information and data ▪Published information of the corporation ▪Corporation's internal data: financial reports, meeting reports, prospectus, other documents ▪Information and data about corporations operating in the same industry	▪Analysts ▪Engagement Managers ▪Experts' support	▪Credit quality assessment reports and related documents ▪Updated information ▪Credit status summary of industry ▪Industry research ▪Special reports and notes if any ▪Stockholders' notice ▪Stock Exchange reports submit

A corporation with re-assessment requirement	▪Industrial information and data ▪Published information of the corporation ▪Corporation's internal data: financial reports, meeting reports, prospectus, other documents ▪Information and data about corporations operating in the same industry	▪Analysts ▪Engagement Managers ▪Experts' support	▪Credit quality assessment reports and related documents ▪Updated information ▪Credit status summary of industry ▪Industry research Special reports and notes if any
	▪Industrial information and data ▪Published information of the corporation ▪Corporation's internal data: financial reports, meeting reports, prospectus, other documents ▪Information and data about corporations operating in the same industry	▪Analysts ▪Engagement Managers ▪Experts' support ▪Analysts from the previous assessment team ▪Voting committee	▪Credit quality assessment reports and related documents ▪Updated information ▪Credit status summary of industry ▪Industry research Special reports and notes if any ▪Stockholders' notice ▪Stock Exchange reports submit
Corporations with changes in credit quality assessment result	▪Industrial information and data ▪Published information of the corporation ▪Corporation's internal data: financial reports, meeting reports, prospectus, other documents ▪Information and data about corporations operating in the same industry ▪Update information and adjustment ▪Information and data's accuracy assessment	▪Analysts ▪Engagement ▪Managers ▪Experts' support ▪Analysts from the previous assessment team ▪Voting committee	▪Credit quality assessment reports and related documents ▪Updated information ▪Credit status summary of industry ▪Industry research ▪Special reports and notes if any ▪Stockholders' notice ▪Stock Exchange reports submit

REFERENCES

Abarbanell, J.S. and Lehavy, R., 2007. Letting the "tail wag the dog": The debate over GAAP versus street earnings revisited. Contemporary Accounting Research, 24(3), pp.675-723.

Abdullah, N.A.H., Halim, A., Ahmad, H. and Rus, R.M., 2008. Predicting corporate failure of Malaysia's listed companies: comparing multiple discriminant analysis, logistic regression and the hazard model. International Research Journal of Finance and Economics, 15, pp.201-217.

ACCA (2006), Financial information for management, Paper 1.2, FTMS Global

Adams, M., Burton, B. and Hardwick, P., 2003. The determinants of credit ratings in the United Kingdom insurance industry. Journal of Business Finance & Accounting, 30(3-4), pp.539-572.

Addae, A.A., Nyarko-Baasi, M. and Hughes, D., 2013. The effects of capital structure on profitability of listed firms in Ghana. European Journal of Business and Management, 5(31), pp.215-230.

Afrasiabi, J. and Ahmadinia, H., 2011. HOW FINANCING EFFECT ON CAPITAL STRUCTURE, EVIDENCE FROM TEHRAN STOCK EXCHANGE (TSE). International journal of academic research, 3(1).

Agarwal, V. and Taffler, R.J., 2006. Twenty-five years of z-scores in the UK: do they really work. Cranfield School of Management Working paper.

Agénor, P.R. and Aizenman, J., 1999. Financial Sector Inefficiencies and Coordinate Failures: Implications for Crisis Management (No. w7446). National bureau of economic research.

Alba, P., Bhattacharya, A., Claessens, S., Ghosh, S. and Hernandez, L., 1999. The role of macroeconomic and financial sector linkages in East Asia's financial crisis. The Asian financial crisis: Causes, contagion and consequences, pp.9-64.

Alba, P., Claessens, S. and Djankov, S., 1998. Thailand's corporate financing and governance structures (No. 2003). World Bank Publications.

Albareto, G., Benvenuti, M., Mocetti, S., Pagnini, M. and Rossi, P., 2008. L'organizzazione dell'attività creditizia e l'utilizzo di tecniche di scoring nel sistema bancario italiano: risultati di un'indagine campionaria. Questioni di economia e finanza, 12.

Alifani, G.A. and Nugroho, A.B., 2013. Proving Modigliani and Miller Theories of Capital structure: The Research on Indonesia's cigarette companies. International journal of economic sciences, 2013(3).

Allayannis, G., Brown, G.W. and Klapper, L.F., 2003. Capital structure and financial risk: Evidence from foreign debt use in East Asia. The Journal of Finance, 58(6), pp.2667-2710.

Allen, F. and Gale, D., 2000. Comparing financial systems. MIT press.

Allen, L. and Saunders, A., 2002. A survey of cyclical effects in credit risk measurement models.

Altman, E., HADELMANN, R. and Narayanan, P., 1977. ZETA analysis: a new model to identify bankruptcy risk of corporations: in Journal of Banking and Finance. June, pp470-492.

Altman, E.I. and Brady, B., 2002. Explaining aggregate recovery rates on corporate bond defaults. New York University-Salomon Center-Leonard N. Stern School of Business.

Altman, E.I. and Eisenbeis, R.A., 1978. Financial applications of discriminant analysis: a clarification. Journal of Financial and Quantitative Analysis, 13(1), pp.185-195.

Altman, E.I. and Hotchkiss, E., 2010. Corporate financial distress and bankruptcy: Predict and avoid bankruptcy, analyze and invest in distressed debt (Vol. 289). John Wiley & Sons.

Altman, E.I. and Kao, D.L., 1992. Rating drift in high-yield bonds. The Journal of Fixed Income, 1(4), pp.15-20.

Altman, E.I. and Narayanan, P., 1997. An international survey of business failure classification models. Financial Markets, Institutions & Instruments, 6(2), pp.1-57.

Altman, E.I. and Saunders, A., 2001. An analysis and critique of the BIS proposal on capital adequacy and ratings. Journal of banking & finance, 25(1), pp.25-46.

Altman, E.I., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. The journal of finance, 23(4), pp.589-609.

Altman, E.I., 2006. Default recovery rates and LGD in credit risk modeling and practice: an updated review of the literature and empirical evidence. New York University, Stern School of Business.

Altman, E.I., Eom, Y.H. and Kim, D.W., 1995. Failure prediction: evidence from Korea. Journal of International Financial Management & Accounting, 6(3), pp.230-249.

Altman, E.I., Haldeman, R.G. and Narayanan, P., 1977. ZETATM analysis A new model to identify bankruptcy risk of corporations. Journal of banking & finance, 1(1), pp.29-54.

Amato, J.D. and Furfine, C.H., 2004. Are credit ratings procyclical?. Journal of Banking & Finance, 28(11), pp.2641-2677.

Amihud, Y., Christensen, B.J. and Mendelson, H., 1992. Further evidence on the risk-return relationship (Vol. 11). Graduate School of Business, Stanford University.

Aretz, K. and Pope, P.F., 2013. Common factors in default risk across countries and industries. European Financial Management, 19(1), pp.108-152.

Ashbaugh-Skaife, H., Collins, D.W. and LaFond, R., 2006. The effects of corporate governance on firms' credit ratings. Journal of accounting and economics, 42(1), pp.203-243.
Ashbaugh-Skaife, H., Collins, D.W. and LaFond, R., 2006. The effects of corporate governance on firms' credit ratings. Journal of accounting and economics, 42(1), pp.203-243.
Baber, W.R., Fairfield, P.M. and Haggard, J.A., 1991. The effect of concern about reported income on discretionary spending decisions: The case of research and development. Accounting Review, pp.818-829.

Back, B., Laitinen, T., Hekanaho, J. and Sere, K., 1997. The effect of sample size on different failure prediction methods. Turku Centre for Computer Science Technical Report, 155, pp.1-23.

Baimwera, B. and Muriuki, A.M., 2014. Analysis of corporate financial distress determinants: A survey of non-financial firms listed in the NSE. International Journal of Current Business and Social Sciences, 1(2), pp.58-80.

Baker, M. and Wurgler, J., 2002. Market timing and capital structure. The journal of finance, 57(1), pp.1-32.

Bakshi, G., Madan, D.B. and Zhang, F.X., 2001. Investigating the sources of default risk: Lessons from empirically evaluating credit risk models.

Baldwin, C.Y. and Mason, S.P., 1983. The resolution of claims in financial distress the case of Massey Ferguson. The Journal of Finance, 38(2), pp.505-516.

Bangia, A., Diebold, F.X., Kronimus, A., Schagen, C. and Schuermann, T., 2002. Ratings migration and the business cycle, with application to credit portfolio stress testing. Journal of banking & finance, 26(2), pp.445-474.

Bangia, A., Diebold, F.X., Kronimus, A., Schagen, C. and Schuermann, T., 2002. Ratings migration and the business cycle, with application to credit portfolio stress testing. Journal of banking & finance, 26(2), pp.445-474.

Bangia, A., Diebold, F.X., Kronimus, A., Schagen, C. and Schuermann, T., 2002. Ratings migration and the business cycle, with application to credit portfolio stress testing. Journal of banking & finance, 26(2), pp.445-474.

Bangia, A., Diebold, F.X., Kronimus, A., Schagen, C. and Schuermann, T., 2002. Ratings migration and the business cycle, with application to credit portfolio stress testing. Journal of banking & finance, 26(2), pp.445-474.

Bannier, C.E., 2007. Heterogeneous multiple bank financing: does it reduce inefficient credit-renegotiation incidences?. Financial Markets and Portfolio Management, 21(4), pp.445-470.

Barnes, P., 1987. The analysis and use of financial ratios: a review article. Journal of Business Finance & Accounting, 14(4), pp.449-461.

Barnhill Jr, T.M. and Maxwell, W.F., 2002. Modeling correlated market and credit risk in fixed income portfolios. Journal of Banking & finance, 26(2), pp.347-374.

Bartov, E., 1993. The timing of asset sales and earnings manipulation. Accounting Review, pp.840-855.

Basel Committee on Banking Supervision and Bank for International Settlements, 1999. Credit risk modelling: Current practices and applications. The Committee.

Basel Committee on Banking Supervision, 1988. International convergence of capital measurement and capital standards. Basel Committee on Banking Supervision.

Basel Committee on Banking Supervision, 2000. Principles for the Management of Credit Risk.

Basel Committee on Banking Supervision, 2003. Consultative document, The New Basel Capital Accord.

Basel Committee on Banking Supervision, 2005. International Convergence of Capital Measurement and Capital Standards (A Revised Framework).

Bauer, J. and Agarwal, V., 2014. Are hazard models superior to traditional bankruptcy prediction approaches? A comprehensive test. Journal of Banking & Finance, 40, pp.432-442.

Bauer, L. and Bushe, D., 1994. Measuring Degrees of Risk. Faculty of Extension, University of Alberta.

BCBS_ Basel Committee on Banking Supervision, 1999. Credit risk modeling: Current practice and applications, April.

Beaver, W.H., 1966. Financial ratios as predictors of failure. Journal of accounting research, pp.71-111.

Becker, B. and Milbourn, T., 2011. How did increased competition affect credit ratings?. Journal of Financial Economics, 101(3), pp.493-514.

Bellotti, T., Matousek, R. and Stewart, C., 2011a. A note comparing support vector machines and ordered choice models' predictions of international banks' ratings. Decision Support Systems, 51(3), pp.682-687.

Bellotti, T., Matousek, R. and Stewart, C., 2011b. Are rating agencies' assignments opaque? Evidence from international banks. Expert Systems with Applications, 38(4), pp.4206-4214.

Bellovary, J.L., Giacomino, D.E. and Akers, M.D., 2007. A review of bankruptcy prediction studies: 1930 to present. Journal of Financial education, pp.1-42.

Bens, D.A., Nagar, V. and Wong, M.H., 2002. Real investment implications of employee stock option exercises. Journal of Accounting Research, 40(2), pp.359-393.

Bens, D.A., Nagar, V., Skinner, D.J. and Wong, M.F., 2003. Employee stock options, EPS dilution, and stock repurchases. Journal of Accounting and Economics, 36(1), pp.51-90.

Berchtold, R., 2007. Jonathan Berk, Peter DeMarzo. Corporate Finance.

Berger, A.N. and Udell, G.F., 1995. Relationship lending and lines of credit in small firm finance. Journal of business, pp.351-381.

Berger, A.N. and Udell, G.F., 1998. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. Journal of banking & finance, 22(6), pp.613-673.

Berger, A.N., Miller, N.H., Petersen, M.A., Rajan, R.G. and Stein, J.C., 2005. Does function follow organizational form? Evidence from the lending practices of large and small banks. Journal of Financial economics, 76(2), pp.237-269.

Bergman, Y.Z. and Callen, J.L., 1991. Opportunistic underinvestment in debt renegotiation and capital structure. Journal of Financial Economics, 29(1), pp.137-171.

Bernanke, B. and Gertler, M., 1989. Agency costs, net worth, and business fluctuations. The American Economic Review, pp.14-31.

Bessis, J., 2011. Risk management in banking. John Wiley & Sons.

Bhattacharya, C.B., Korschun, D. and Sen, S., 2009. Strengthening stakeholder–company relationships through mutually beneficial corporate social responsibility initiatives. Journal of Business ethics, 85, pp.257-272.

Bhojraj, S. and Sengupta, P., 2003. Effect of corporate governance on bond ratings and yields: The role of institutional investors and outside directors. The Journal of Business, 76(3), pp.455-475.

Bhunia, A. and Mukhuti, S., 2012. Financial risk measurement of small and medium–sized companies listed in Bombay stock exchange. International Journal of Advances in Management and Economics, 1(3), pp.27-34.

Bhunia, A. and Mukhuti, S., 2012. Financial risk measurement of small and medium–sized companies listed in Bombay stock exchange. International Journal of Advances in Management and Economics, 1(3), pp.27-34.

Bissoondoyal-Bheenick, E. and Treepongkaruna, S., 2011. An analysis of the determinants of bank ratings: comparison across ratings agencies. Australian Journal of Management, 36(3), pp.405-424.

Blum, M., 1974. Failing company discriminant analysis. Journal of accounting research, pp.1-25.

Blume, M.E., Lim, F. and MacKinlay, A.C., 1998. The declining credit quality of US corporate debt: Myth or reality?. The journal of finance, 53(4), pp.1389-1413.

Bolton, P. and Scharfstein, D.S., 1996. Optimal debt structure and the number of creditors. Journal of Political Economy, 104(1), pp.1-25.

Bone, R.B., 2007. Determinantes de Ratings Corporativos no Setor de Petróleo: o Caso da Petrobrás. RAC-Eletrônica, 1(3).

Bone, R.B., 2010. Determinantes dos ratings corporativos na indústria petrolífera: o caso da Repsol-YPF. Revista Eletrônica de Administração, 16(1), pp.70-90.

Boot, A.W., Milbourn, T.T. and Schmeits, A., 2005. Credit ratings as coordination mechanisms. The Review of Financial Studies, 19(1), pp.81-118.

Bose, I., 2006. Deciding the financial health of dot-coms using rough sets. Information & Management, 43(7), pp.835-846.

Bouzouita, R. and Young, A.J., 1998. A probit analysis of best ratings. Journal of Insurance Issues, pp.23-34.

Bouzouita, R. and Young, A.J., 1998. A probit analysis of best ratings. Journal of Insurance Issues, pp.23-34.

Boyazny, M., 2005. Taming the Asian Tiger: Revival of Non-Performing Assets on the Asian Continent. The Journal of Private Equity, 8(2), pp.104-109.

Boyd, J.H. and De Nicolo, G., 2005. The theory of bank risk taking and competition revisited. The Journal of finance, 60(3), pp.1329-1343.

Boyd, J.H., De Nicolò, G. and Jalal, A.M., 2006. Bank risk-taking and competition revisited: New theory and new evidence.

Brealey, R., 2008. Myers s. Printsipy korporativnykh finansov.

Breuer, W. and Gürtler, M. eds., 2008. 50 Years After MM: Recent Developments in Corporate Finance (Vol. 6). Springer DE.

Breusch, T.S. and Pagan, A.R., 1979. A simple test for heteroscedasticity and random coefficient variation. Econometrica: Journal of the Econometric Society, pp.1287-1294.

Brunner, A. and Krahnen,J. P., 2006. Multiple lenders and corporate distress: Evidence on debt restructuring. CFS Working Paper No. 2001/04 revised, Frankfurt.

Brunner, A. and Krahnen, J.P., 2008. Multiple lenders and corporate distress: Evidence on debt restructuring. The Review of Economic Studies, 75(2), pp.415-442.

Buehler, S., Kaiser, C. and Jaeger, F., 2006. Merge or fail? The determinants of mergers and bankruptcies in Switzerland, 1995–2000. Economics Letters, 90(1), pp.88-95.

Burgstahler, D. and Dichev, I., 1997. Earnings management to avoid earnings decreases and losses. Journal of accounting and economics, 24(1), pp.99-126.

Bushee, B.J., 1998. The influence of institutional investors on myopic R&D investment behavior. Accounting review, pp.305-333.

Campbell, J.Y., Hilscher, J. and Szilagyi, J., 2008. In search of distress risk. The Journal of Finance, 63(6), pp.2899-2939.

Campbell, J.Y., Lo, A.W.C. and MacKinlay, A.C., 1997. The econometrics of financial markets. princeton University press.

Canbas, S., Cabuk, A. and Kilic, S.B., 2005. Prediction of commercial bank failure via multivariate statistical analysis of financial structures: The Turkish case. European Journal of Operational Research, 166(2), pp.528-546.

Canh, N.T. and Cuong, N.T., 2011. The determinants of capital structure for Vietnam's seafood processing enterprises. Science & Technology, 14(Q1-2011).

Cantor, R. and Packer, F., 1997. Differences of opinion and selection bias in the credit rating industry. Journal of Banking & Finance, 21(10), pp.1395-1417.

Cantor, R., Hamilton, D.T., Ou, S. and Varma, P., 2005. Default and Recovery Rates of Corporate Bond Issuers, 1920-2004. Moody's Investor Service, Special Comment, Global Credit Research.

Carey, M., 1998. Credit risk in private debt portfolios. The Journal of Finance, 53(4), pp.1363-1387.

Carey, M., 1998. Credit risk in private debt portfolios. The Journal of Finance, 53(4), pp.1363-1387.

Carey, M., Post, M. and Sharpe, S.A., 1998. Does corporate lending by banks and finance companies differ? Evidence on specialization in private debt contracting. The Journal of Finance, 53(3), pp.845-878.

Carling, K., Jacobson, T., Lindé, J. and Roszbach, K., 2007. Corporate credit risk modeling and the macroeconomy. Journal of Banking & Finance, 31(3), pp.845-868.

Carmichael, D.R., 1972. The auditor's reporting obligation: the meaning and implementation of the fourth standard of reporting (Vol. 1). American Institute of Certified Public Accountants.

Carmichael, R., 1972. The auditor's reporting obligation. Published American Institute.

Carty, L.V. and Fons, J.S., 1994. Measuring changes in corporate credit quality. The Journal of Fixed Income, 4(1), pp.27-41.

CFA Institute, 2008. Financial Statement Analysis, CFA Program Curriculum ,Volume 3, Pearson Custom Publishing.

Chan, L.K. and Lakonishok, J., 1993. Institutional trades and intraday stock price behavior. Journal of Financial Economics, 33(2), pp.173-199.

Chandrasekharan, C.V., 2012. Determinants of capital structure in the Nigerian listed firms. International Journal of Advanced Research in Management and Social Sciences, 1(2), pp.108-133.

Chapman, C., 2006. Key points of contention in framing assumptions for risk and uncertainty management. International Journal of Project Management, 24(4), pp.303-313.

Charitou, A. and Lambertides, N., 2003. Earnings management prior to bankruptcy. working paper, University of Cyprus.

Chaudhuri, A. and De, K., 2011. Fuzzy support vector machine for bankruptcy prediction. Applied Soft Computing, 11(2), pp.2472-2486.

Chen Jin, 1999. "The Empirical Analysis on the Financial Distress Prediction of the Listed Corporate," Accounting Research. 4, pp. 31-38,.

Chen Lianghua, Sun Jian, 2005. "Corporate Governance and Financial Distress: Evidence from Shanghai Security Market," Journal of Southeast University Philosophy and Social Science Edition, 7, 28-3.

Chen, N.F., Roll, R. and Ross, S.A., 1986. Economic forces and the stock market. Journal of business, pp.383-403.

Chen, W.S. and Du, Y.K., 2009. Using neural networks and data mining techniques for the financial distress prediction model. Expert Systems with Applications, 36(2), pp.4075-4086.

Chen, Z. and Chan-Lau, M.J.A., 1998. Financial Crisis and Credit Crunch As a Result of Inefficient Financial Intermediation: With Reference to the Asian Financial Crisis (No. 98-127). International Monetary Fund.

Chirinko, R.S. and Guill, G.D., 2000. A framework for assessing credit risk in depository institutions: Toward regulatory reform. Journal of Banking & Finance, 15(4-5), pp.785-804.

Cho, S., Fu, L. and Yu, Y., 2012. New risk analysis tools with accounting changes: Adjusted z-score. The Journal of Credit Risk, 8(1), p.89.

Chowdhury, A. and Chowdhury, S.P., 2010. Impact of capital structure on firm's value: Evidence from Bangladesh. Business & Economic Horizons, 3(3).

Choy, E., Gray, S. and Ragunathan, V., 2006. Effect of credit rating changes on Australian stock returns. Accounting & Finance, 46(5), pp.755-769.

Christensen, J.H., Hansen, E. and Lando, D., 2004. Confidence sets for continuous-time rating transition probabilities. Journal of Banking & Finance, 28(11), pp.2575-2602.

Claessens, S. and Glaessner, T.C., 1997. Are financial sector weaknesses undermining the East Asian miracle?. World Bank Publications.

Claessens, S., Djankov, S. and Ferri, G., 1999. Corporate distress in East Asia: The effect of currency and interest rate shocks.

Claessens, S., Djankov, S. and Klapper, L., 2003. Resolution of corporate distress in East Asia. Journal of Empirical Finance, 10(1), pp.199-216.

Claessens, S., Djankov, S. and Lang, L.H., 2000. The separation of ownership and control in East Asian corporations. Journal of financial Economics, 58(1), pp.81-112.

Coe, D.T. and Kim, S.J. eds., 2002. Korean crisis and recovery. International Monetary Fund.

Cole, R.A. and Gunther, J., 1995. A CAMEL rating's shelf life.

Cole, R.A., 1998. The importance of relationships to the availability of credit. Journal of Banking & Finance, 22(6), pp.959-977.

Concina, L., 2014. Risk attitude & economics. FonCSI.

Conigliani, C., Ferri, G. and Generale, A., 1997a. La relazione banca-impresa e la trasmissione degli impulsi della politica monetaria. Moneta e credito, 50(198).

Conigliani, C., Ferri, G. and GENERALE, A., 1997b. The impact of the bank-firm relations on the propagation of monetary policy squeezes: an empirical assessment for Italy. PSL Quarterly Review, 50(202).

Corsetti, G., Pesenti, P. and Roubini, N., 1999. What caused the Asian currency and financial crisis?. Japan and the world economy, 11(3), pp.305-373.

Cossin, D. and Pirotte, H., 2001. Advanced credit risk analysis. Financial Approaches and.

Couderc, F. and Renault, O., 2004. Times-to-default: Life cycle, global and industry cycle impacts. Unpublished manuscript, University of Geneva and Warwick Business School.

Cox, D.R., 1992. Regression models and life-tables. In Breakthroughs in statistics (pp. 527-541). Springer, New York, NY.

Creighton, A., Gower, L. and Richards, A.J., 2007. The impact of rating changes in Australian financial markets. Pacific-Basin Finance Journal, 15(1), pp.1-17.

Crook, J.N., Edelman, D.B. and Thomas, L.C., 2007. Recent developments in consumer credit risk assessment. European Journal of Operational Research, 183(3), pp.1447-1465.

Crosbie, P. and Bohn, J., 2003. Modeling default risk.

D'Auria, C., Foglia, A. and Reedtz, P.M., 1999. Bank interest rates and credit relationships in Italy. Journal of Banking & Finance, 23(7), pp.1067-1093.

Das, S.R., Freed, L., Geng, G. and Kapadia, N., 2006. Correlated default risk. The Journal of Fixed Income, 16(2), pp.7-32.

De Laurentis, G. and Maino, R., 2009. I rating a base statistica: sviluppo, validazione, funzioni d'uso per la gestione del credito. Bancaria.

De Nicolò, G. and Loukoianova, E., 2007. Bank ownership, market structure and risk.

Deakin, E.B., 1972. A discriminant analysis of predictors of business failure. Journal of accounting research, pp.167-179.

Deakin, E.B., 1977. Business failure prediction: an empirical analysis. Chapter, 4, pp.72-88.

Dechow, P.M. and Skinner, D.J., 2000. Earnings management: Reconciling the views of accounting academics, practitioners, and regulators. Accounting horizons, 14(2), pp.235-250.

Dechow, P.M. and Sloan, R.G., 1991. Executive incentives and the horizon problem: An empirical investigation. Journal of accounting and Economics, 14(1), pp.51-89.

Dechow, P.M., Kothari, S.P. and Watts, R.L., 1998. The relation between earnings and cash flows. Journal of accounting and Economics, 25(2), pp.133-168.

Defang, C. and Haoqin, X., 2005. The Model of Financial Distress Prediction Based on Ownership Structure [J]. Nankai Business Review, 6, p.015.

Degeorge, F., Patel, J. and Zeckhauser, R., 1999. Earnings management to exceed thresholds. The Journal of Business, 72(1), pp.1-33.

Degryse, H. and Van Cayseele, P., 2000. Relationship lending within a bank-based system: Evidence from European small business data. Journal of financial Intermediation, 9(1), pp.90-109.

Delloye, M., Fermanian, J.D. and Sbai, M., 2005. Estimation of a reduced-form credit portfolio model and extensions to dynamic frailties. Preliminary Version, BNP-Paribas.

Denis, D.J. and Mihov, V.T., 2003. The choice among bank debt, non-bank private debt, and public debt: evidence from new corporate borrowings. Journal of financial Economics, 70(1), pp.3-28.

Detragiache, E., Garella, P. and Guiso, L., 2000. Multiple versus single banking relationships: Theory and evidence. The Journal of Finance, 55(3), pp.1133-1161.

Detragiache, E., Garella, P. and Guiso, L., 2000. Multiple versus single banking relationships: Theory and evidence. The Journal of Finance, 55(3), pp.1133-1161.

Dewatripont, M. and Maskin, E., 1995. Credit and efficiency in centralized and decentralized economies. The Review of Economic Studies, 62(4), pp.541-555.

Diamond, D.W. and Dybvig, P.H., 1983. Bank runs, deposit insurance, and liquidity. Journal of political economy, 91(3), pp.401-419.

Diamond, D.W., 1984. Financial intermediation and delegated monitoring. The review of economic studies, 51(3), pp.393-414.

Diamond, D.W., 1991. Debt maturity structure and liquidity risk. The Quarterly Journal of Economics, 106(3), pp.709-737.

Dimitras, A.I., Slowinski, R., Susmaga, R. and Zopounidis, C., 1999. Business failure prediction using rough sets. European Journal of Operational Research, 114(2), pp.263-280.

Dimitras, A.I., Zanakis, S.H. and Zopounidis, C., 1996. A survey of business failures with an emphasis on prediction methods and industrial applications. European Journal of Operational Research, 90(3), pp.487-513.

Ding, Y., Song, X. and Zen, Y., 2008. Forecasting financial condition of Chinese listed companies based on support vector machine. Expert Systems with Applications, 34(4), pp.3081-3089.

Ding, Y., Song, X. and Zen, Y., 2008. Forecasting financial condition of Chinese listed companies based on support vector machine. Expert Systems with Applications, 34(4), pp.3081-3089.

Dinh, K. and Kleimeier-Ros, S., 2006. Credit scoring for Vietnam's retail banking market: implementation and implications for transactional versus relationship lending.

Đỗ Hoàng Toàn, Phan Kim Chiến, 2008. Quản lý rủi ro trong doanh nghiệp, NXB Khoa học kỹ thuật, Hà Nội.

Đoàn Văn Trường, 2005. Các phương pháp xác định giá trị tài sản vô hình, NXB Khoa học kỹ thuật, Hà Nội.

Domac, I. and Ferri, G., 1999. Did the East Asian crisis disproportionately hit small businesses in Korea?. Economic Notes, 28(3), pp.403-429.

Doumpos, M. and Zopounidis, C., 1999. A multicriteria discrimination method for the prediction of financial distress: The case of Greece. Multinational Finance Journal, 3(2), p.71.

Drukker, D.M., 2003. Testing for serial correlation in linear panel-data models. The stata journal, 3(2), pp.168-177.

Duan, J.C., 1994. Maximum likelihood estimation using price data of the derivative contract. Mathematical Finance, 4(2), pp.155-167.

Duffie, D. and Singleton, K.J., 2012. Credit risk: pricing, measurement, and management. Princeton University Press.

Duffie, D., Saita, L. and Wang, K., 2007. Multi-period corporate default prediction with stochastic covariates. Journal of Financial Economics, 83(3), pp.635-665.

Dwor-Frecaut, D., Colaço, F.X. and Hallward-Driemeier, M. eds., 2000. Asian corporate recovery: findings from firm-level surveys in five countries. World Bank Publications.

Edmister, R.O., 1972. An empirical test of financial ratio analysis for small business failure prediction. Journal of Financial and Quantitative analysis, 7(2), pp.1477-1493.

Eidleman, G.J., 1995. Z scores-A Guide to failure prediction. The CPA Journal, 65(2), p.52.

Eighteenth Meeting of the IMF Committee on Balance of Payments Statistics Washington, D.C., (June 27–July 1 (2005)), The Treatment of Nonperforming Loans.

Eisenbeis, R.A., 1977. Pitfalls in the application of discriminant analysis in business, finance, and economics. The Journal of Finance, 32(3), pp.875-900.

Elendner, H., 2012. Rating-induced default risk and downgrade hesitation. Mimeo.

Elsas, R. and Krahnen, J.P., 1998. Is relationship lending special? Evidence from credit-file data in Germany. Journal of Banking & Finance, 22(10), pp.1283-1316.

Elsas, R., Heinemann, F. and Tyrell, M., 2004. Multiple but asymmetric bank financing: The case of relationship lending (No. 1251). CESifo working paper.

Erickson, M. and Wang, S.W., 1999. Earnings management by acquiring firms in stock for stock mergers. Journal of Accounting and Economics, 27(2), pp.149-176.

Ericsson, J., Reneby, J. and Wang, H., 2005. Can structural models price default risk? Evidence from bond and credit derivative markets.

Fama, E.F. and French, K.R., 1992. The cross-section of expected stock returns. the Journal of Finance, 47(2), pp.427-465.

Fama, E.F., 1985. What's different about banks?. Journal of monetary economics, 15(1), pp.29-39.

Fama, E.F., 1986. Term premiums and default premiums in money markets. Journal of Financial Economics, 17(1), pp.175-196.

Fama, E.F., French, K.R., Booth, D.G. and Sinquefield, R., 1993. Differences in the risks and returns of NYSE and NASD stocks. Financial Analysts Journal, 49(1), pp.37-41.

Farinha, L.A. and Santos, J.A., 2002. Switching from single to multiple bank lending relationships: Determinants and implications. Journal of Financial Intermediation, 11(2), pp.124-151.

Fensterstock, A.L.B.E.R.T., 2005. Credit scoring and the next step. Business credit, 107(3), pp.46-49.

Ferri, G. and Messori, M., 2000. Bank–firm relationships and allocative efficiency in Northeastern and Central Italy and in the South. Journal of Banking & Finance, 24(6), pp.1067-1095.

Figlewski, S., Frydman, H. and Liang, W., 2012. Modeling the effect of macroeconomic factors on corporate default and credit rating transitions. International Review of Economics & Finance, 21(1), pp.87-105.

Finlay, S., 2009. Are we modelling the right thing? The impact of incorrect problem specification in credit scoring. Expert Systems with Applications, 36(5), pp.9065-9071.

Finlay, S.M., 2006. Using genetic algorithms to develop scoring models for alternative measures of performance. Lancaster (UK).

Fischer, K., 1990. Hausbankbeziehungen als Instrument der Bindung zwischen Banken und Unternehmen: Eine theoretische und empirische Analyse. na.

FitzPatrick, P.J., 1932. A comparison of the ratios of successful industrial enterprises with those of failed companies.

Fledelius, P., Lando, D. and Nielsen, J.P., 2004. Non-parametric analysis of rating transition and default data (pp. 77-100). John Wiley & Sons, Inc..

Foglia, A., Laviola, S. and Reedtz, P.M., 1998. Multiple banking relationships and the fragility of corporate borrowers. Journal of Banking & Finance, 22(10), pp.1441-1456.

Foster, G., 1986. Financial Statement Analysis, 2/e. Pearson Education India.

Foulke, R.A., 1961. Practical financial statement analysis.

Frank, M.Z. and Goyal, V.K., 2007. Trade-off and pecking order theories of debt.

Fridson, M.S., Garman, M.C. and Wu, S., 1997. Real interest rates and the default rate on high-yield bonds. The Journal of Fixed Income, 7(2), pp.29-34.

Fritz, S. and Hosemann, D., 2000. Restructuring the credit process: Behaviour scoring for German corporates. International Journal of Intelligent Systems in Accounting, Finance & Management, 9(1), pp.9-21.

Fu, G., Fu, W. and Liu, D., 2012. Empirical study on financial risk factors: Capital structure, operation ability, profitability, and solvency-evidence from listed companies in China. E3 Journal of Business Management and Economics, 3(5), pp.173-178.

Fudenberg, D. and Tirole, J., 1995. A theory of income and dividend smoothing based on incumbency rents. Journal of Political economy, 103(1), pp.75-93.

Furman, J., Stiglitz, J.E., Bosworth, B.P. and Radelet, S., 1998. Economic crises: evidence and insights from East Asia. Brookings papers on economic activity, 1998(2), pp.1-135.

Gajurel, D.P., 2005. Capital Structure Management in Nepalese Enterprises.

Galveo, R.K.H., Becerra, V.M. and Abou-Seada, M., 2002. Variable selection for financial distress classification using a genetic algorithm. In Evolutionary Computation, 2002. CEC'02. Proceedings of the 2002 Congress on (Vol. 2, pp. 2000-2005). IEEE.

Gapen, M.T., Gray, D.F., Lim, C.H. and Xiao, Y., 2004. Compilation Guide on Financial Soundness Indicators (Washington DC: International Monetary Fund).

García Herrero, A. and Santabárbara, D., 2004. Where is the Chinese Banking system going with the ongoing reform?. EconWPA.

Gentry, J.A., Newbold, P. and Whitford, D.T., 1985. Classifying bankrupt firms with funds flow components. Journal of Accounting research, pp.146-160.

Gentry, J.A., Newbold, P. and Whitford, D.T., 1987. Funds flow components, financial ratios, and bankruptcy. Journal of business finance & accounting, 14(4), pp.595-606.

Geroski, P.A. and Gregg, P., 1996. What makes firms vulnerable to recessionary pressures?. European Economic Review, 40(3), pp.551-557.

Gersbach, H. and Wehrspohn, U., 2001. Lean IRB approaches and transition design: The Basel II proposal.

Gerstenberg, C.W., 1959. Financial organization and management of business. Prentice-Hall.

Gertner, R. and Scharfstein, D., 1991. A theory of workouts and the effects of reorganization law. The Journal of Finance, 46(4), pp.1189-1222.

Ghosh, M.A.R. and Ghosh, S.R., 1999. East Asia in the aftermath: was there a crunch?. International Monetary Fund.

Giesecke, K., 2003, March. Successive correlated defaults: Pricing trends and simulation. In Computing in Economics and Finance (Vol. 247, p. 2003).

Gombola, M.J. and Ketz, J.E., 1983. A note on cash flow and classification patterns of financial ratios. Accounting Review, pp.105-114.

Goudie, A.W. and Meeks, G., 1991. The exchange rate and company failure in a macro-micro model of the UK company sector. The Economic Journal, 101(406), pp.444-457.

Graham, J.R. and Harvey, C.R., 2001. The theory and practice of corporate finance: Evidence from the field. Journal of financial economics, 60(2), pp.187-243.

Graham, J.R., Harvey, C.R. and Rajgopal, S., 2005. The economic implications of corporate financial reporting. Journal of accounting and economics, 40(1), pp.3-73.

Gray, S., Mirkovic, A. and Ragunathan, V., 2006. The determinants of credit ratings: Australian evidence. Australian Journal of Management, 31(2), pp.333-354.

Greene, W.H., 1993. Econometric Analysis (Macmillan Publishing Company, New York).

Greenspan, A., 1999. Lessons from the Global Crisis, Remarks Made before the World Bank Group and the International Monetary Fund on September 27, 1999.

Greenwald, B.C., Kohn, M. and Stiglitz, J.E., 1990. Financial market imperfections and productivity growth. Journal of Economic Behavior & Organization, 13(3), pp.321-345.

Grossman, S.J. and Hart, O.D., 1980. Takeover bids, the free-rider problem, and the theory of the corporation. The Bell Journal of Economics, pp.42-64.

Guiso, L. and Minetti, R., 2004. Multiple creditors and information rights: theory and evidence from us firms.

Gunny, K.A., 2010. The relation between earnings management using real activities manipulation and future performance: Evidence from meeting earnings benchmarks. Contemporary Accounting Research, 27(3), pp.855-888.

Güttler, A. and Wahrenburg, M., 2007. The adjustment of credit ratings in advance of defaults. Journal of Banking & Finance, 31(3), pp.751-767.

Hackbarth, D., Miao, J. and Morellec, E., 2006. Capital structure, credit risk, and macroeconomic conditions. Journal of Financial Economics, 82(3), pp.519-550.

Hamilton, D.T., 2004. Rating transitions and defaults conditional on watchlist, outlook and rating history.

Hand, D.J., 2004, May. Marginal classifier improvement and reality. In Symposium on Data Mining, Ghent University (Belgium), May.

Hardwick, P., Adams, M. and Burton, B., 2000. The determinants of credit ratings in the United Kingdom insurance industry.

Harhoff, D. and Körting, T., 1998. Lending relationships in Germany–Empirical evidence from survey data. Journal of Banking & Finance, 22(10), pp.1317-1353.

Harris, M. and Raviv, A., 1979. Optimal incentive contracts with imperfect information. Journal of economic theory, 20(2), pp.231-259.

Hart, O. and Moore, J., 1998. Default and renegotiation: A dynamic model of debt. The Quarterly Journal of Economics, 113(1), pp.1-41.

Harvey, C.R. and Roper, A.H., 1999. The Asian Bet. Financial markets and development: the crisis in emerging markets, pp.29-116.

He, D., 2006. The role of KAMCO in resolving nonperforming loans in the Republic of Korea. In Bank Restructuring and Resolution (pp. 348-368). Palgrave Macmillan, London.

Healy, P.M. and Wahlen, J.M., 1999. A review of the earnings management literature and its implications for standard setting. Accounting horizons, 13(4), pp.365-383.

Healy, P.M. and Wahlen, J.M., 1999. A review of the earnings management literature and its implications for standard setting. Accounting horizons, 13(4), pp.365-383.

Hellmann, T.F., Murdock, K.C. and Stiglitz, J.E., 2000. Liberalization, moral hazard in banking, and prudential regulation: Are capital requirements enough?. American economic review, pp.147-165.

Henebry, K.L., 1997. A test of the temporal stability of proportional hazards models for predicting bank failure. Journal of Financial and Strategic Decisions, 10(3), pp.1-11.

Hermawan, M.S., Tirok, J. and Dawis, D.S., 2010. The Degree of Company Vulnerability Using Altman Model: A Survey of Public Listed Companies in Indonesia. Journal of Applied Finance and Accounting, 2(2), pp.88-99.

Hickman, W.B., 1958. Corporate bond quality and investor experience. NBER Books.

Higson, C., Holly, S., Kattuman, P. and Platis, S., 2004. The Business Cycle, Macroeconomic Shocks and the Cross-Section: The Growth of UK Quoted Companies. Economica, 71(282), pp.299-318.

Hoàng Đình Tuấn, 2003. Lý thuyết mô hình toán kinh tế, NXB Khoa học và kỹ thuật, Hà Nội.

Hoàng Kim, 1998. Tiền tệ và ngân hàng, NXB Chính trị quốc gia, Hà Nội.

Holmstrom, B. and Tirole, J., 1997. Financial intermediation, loanable funds, and the real sector. the Quarterly Journal of economics, 112(3), pp.663-691.

Holmstrom, B., 1982. Moral hazard in teams. The Bell Journal of Economics, pp.324-340.

Houston, J. and Brigham, E.F., 2009. Fundamentals of Financial Management.[Cincinnati, Ohio]: South-Western College Pub (p. 90). ISBN 0-324-59771-1.

Houston, J.F. and James, C.M., 2001. Do relationships have limits? Banking relationships, financial constraints, and investment. The Journal of Business, 74(3), pp.347-374.

Hsieh, S.J., 1993. A note on the optimal cutoff point in bankruptcy prediction models. Journal of Business Finance & Accounting, 20(3), pp.457-464.

Iannotta, G., 2006. Testing for opaqueness in the European banking industry: evidence from bond credit ratings. Journal of Financial Services Research, 30(3), pp.287-309.

Imanzadeh, P., Maran-Jouri, M. and Sepehri, P., 2011. A study of the application of Springate and Zmijewski bankruptcy prediction models in firms accepted in Tehran Stock Exchange. Australian Journal of Basic and Applied Sciences, 5(11), pp.1546-1550.

Iskandar-Datta, M.E. and Emery, D.R., 1994. An empirical investigation of the role of indenture provisions in determining bond ratings. Journal of banking & finance, 18(1), pp.93-111.

Jacksonh, S.B. and Pitman, M.K., 2001. Auditors and earnings management. The CPA journal, 71(7), p.38.

James, C., 1987. Some evidence on the uniqueness of bank loans. Journal of financial economics, 19(2), pp.217-235.

Jarrow, R.A. and Turnbull, S.M., 1995. Pricing derivatives on financial securities subject to credit risk. The journal of finance, 50(1), pp.53-85.

Jarrow, R.A., Lando, D. and Turnbull, S.M., 1997. A Markov model for the term structure of credit risk spreads. The review of financial studies, 10(2), pp.481-523.

Jensen, M.C. and Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of financial economics, 3(4), pp.305-360.

Jiménez, G. and Saurina, J., 2004. Collateral, type of lender and relationship banking as determinants of credit risk. Journal of banking & Finance, 28(9), pp.2191-2212.

Jones, F.L., 1987. Current techniques in bankruptcy prediction. Journal of accounting Literature, 6(1), pp.131-164.

Jones, S. and Hensher, D.A., 2004. Predicting firm financial distress: A mixed logit model. The Accounting Review, 79(4), pp.1011-1038.

Jorion, P., Liu, Z. and Shi, C., 2005. Informational effects of regulation FD: evidence from rating agencies. Journal of financial economics, 76(2), pp.309-330.

Joy, O.M. and Tollefson, J.O., 1975. On the financial applications of discriminant analysis. Journal of Financial and Quantitative Analysis, 10(5), pp.723-739.

Joy, O.M. and Tollefson, J.O., 1978. Some clarifying comments on discriminant analysis. Journal of Financial and Quantitative Analysis, 13(1), pp.197-200.

Kaminsky, G.L. and Reinhart, C.M., 1999. The twin crises: the causes of banking and balance-of-payments problems. American economic review, pp.473-500.

Kang, C., 2006. From the front lines at Seoul Bank: restructuring and reprivatization. In Bank Restructuring and Resolution (pp. 229-267). Palgrave Macmillan UK.

Kang, Q. and Liu, Q., 2007. Credit rating changes and CEO incentives.

Kaplan, R.S. and Urwitz, G., 1979. Statistical models of bond ratings: A methodological inquiry. Journal of business, pp.231-261.

Karels, G.V. and Prakash, A.J., 1987. Multivariate normality and forecasting of business bankruptcy. Journal of Business Finance & Accounting, 14(4), pp.573-593.

Kasznik, R. and Lev, B., 1995. To warn or not to warn: Management disclosures in the face of an earnings surprise. Accounting review, pp.113-134.

Kasznik, R., 1999. On the association between voluntary disclosure and earnings management. Journal of accounting research, 37(1), pp.57-81.

Kaufmann, D., Kraay, A. and Zoido-Lobatón, P., 1999. Aggregating governance indicators (Vol. 2195). world Bank publications.

Kavvathas, D., 2001. Estimating credit rating transition probabilities for corporate bonds.

Keasey, K. and Watson, R., 1987. Non-Financial Symptoms and the Prediction of Small Company Failure: A Test of Argenti's Hypotheses. Journal of Business Finance & Accounting, 14(3), pp.335-354.

Keeley, M.C., 1990. Deposit insurance, risk, and market power in banking. The American Economic Review, pp.1183-1200.

Keenan, S.C. and Sobehart, J.R., 1999. 1Performance Measures for Credit Risk Models.

Ketokivi, M. and McIntosh, C.N., 2017. Addressing the endogeneity dilemma in operations management research: Theoretical, empirical, and pragmatic considerations. Journal of Operations Management, 52, pp.1-14.

Kevin, S., 2015. Security analysis and portfolio management. PHI Learning Pvt. Ltd..

Kho, B.C. and Stulz, R.M., 2000. Banks, the IMF, and the Asian crisis. Pacific-Basin Finance Journal, 8(2), pp.177-216.

Kim, H. and Gu, Z., 2004. Financial determinants of corporate bond ratings: an examination of hotel and casino firms. Journal of Hospitality & Tourism Research, 28(1), pp.95-108.

Kim, H.E., 1999. Was the credit channel a key monetary transmission mechanism following the recent financial crisis in the Republic of Korea? (Vol. 2103). World Bank Publications.

Kim, M.J. and Han, I., 2003. The discovery of experts' decision rules from qualitative bankruptcy data using genetic algorithms. Expert Systems with Applications, 25(4), pp.637-646.

Kiyotaki, N. and Moore, J., 1997. Credit cycles. Journal of political economy, 105(2), pp.211-248.

Knight, F.H., 2012. Risk, uncertainty and profit. Courier Corporation.

Ko, C.J., 1982. A delineation of corporate appraisal models and classification of bankruptcy firms in Japan. New York University, New York.

Koh, H.C., 1992. THE SENSITIVITY OF OPTIMAL CUTOFF POINTS TO MISCLASSIFICATION COSTS OF TYPE I AND TYPE II ERRORS IN THE GOING-CONCERN PREDICTION CONTEXT. Journal of Business Finance & Accounting, 19(2), pp.187-197.

Koh, H.C., 1992. THE SENSITIVITY OF OPTIMAL CUTOFF POINTS TO MISCLASSIFICATION COSTS OF TYPE I AND TYPE II ERRORS IN THE GOING-CONCERN PREDICTION CONTEXT. Journal of Business Finance & Accounting, 19(2), pp.187-197.

Kolari, J., Glennon, D., Shin, H. and Caputo, M., 2002. Predicting large US commercial bank failures. Journal of Economics and Business, 54(4), pp.361-387.

Koopman, S.J. and Lucas, A., 2005. Business and default cycles for credit risk. Journal of Applied Econometrics, 20(2), pp.311-323.

Koopman, S.J. and Lucas, A., 2005. Business and default cycles for credit risk. Journal of Applied Econometrics, 20(2), pp.311-323.

Koopman, S.J., Kräussl, R., Lucas, A. and Monteiro, A.B., 2009. Credit cycles and macro fundamentals. Journal of Empirical Finance, 16(1), pp.42-54.

Koopman, S.J., Lucas, A. and Monteiro, A., 2008. The multi-state latent factor intensity model for credit rating transitions. Journal of Econometrics, 142(1), pp.399-424.

Koralun-Bereźnicka, J., 2013. How Does Asset Structure Correlate with Capital Structure?–Cross-Industry and Cross-Size Analysis of the EU Countries. Universal Journal of Accounting and Finance, 1(1), pp.19-28.

Koskela, E. and Stenbacka, R., 2000. Is there a tradeoff between bank competition and financial fragility?. Journal of Banking & Finance, 24(12), pp.1853-1873.

Kothari, S.P., Shanken, J. and Sloan, R.G., 1995. Another look at the cross-section of expected stock returns. The Journal of Finance, 50(1), pp.185-224.

Kraus, A. and Litzenberger, R.H., 1973. A state-preference model of optimal financial leverage. The journal of finance, 28(4), pp.911-922.

Kumar, S., Anjum, B. and Nayyar, S., 2012. Financing Decisions: Studi of Pharmaceutical Companies of India. international journal of marketing, financial services & management research, 1(1), pp.14-28.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R., 2000. Investor protection and corporate governance. Journal of financial economics, 58(1), pp.3-27.

Laeven, L., 1999. Risk and efficiency in East Asian banks.

Laitinen, E.K. and Laitinen, T., 2001. Bankruptcy prediction: Application of the Taylor's expansion in logistic regression. International review of financial analysis, 9(4), pp.327-349.

Lam, J., 2003. Overview of enterprise risk management. Handbook of Finance.

Lando, D. and Skødeberg, T.M., 2002. Analyzing rating transitions and rating drift with continuous observations. journal of banking & finance, 26(2), pp.423-444.

Lane, W.R., Looney, S.W. and Wansley, J.W., 1986. An application of the Cox proportional hazards model to bank failure. Journal of Banking & Finance, 10(4), pp.511-531.

Langemeier, M., 2016. Leverage and Interest Rate Risk. farmdoc daily.

Leland, H.E., 1994. Corporate debt value, bond covenants, and optimal capital structure. The journal of finance, 49(4), pp.1213-1252.

Leshno, M. and Spector, Y., 1996. Neural network prediction analysis: The bankruptcy case. Neurocomputing, 10(2), pp.125-147.

Leuz, C., Nanda, D. and Wysocki, P.D., 2003. Earnings management and investor protection: an international comparison. Journal of financial economics, 69(3), pp.505-527.

Li, M.Y.L. and Miu, P., 2010. A hybrid bankruptcy prediction model with dynamic loadings on accounting-ratio-based and market-based information: A binary quantile regression approach. Journal of Empirical Finance, 17(4), pp.818-833.

Liang, L. and Wu, D., 2005. An application of pattern recognition on scoring Chinese corporations financial conditions based on backpropagation neural network. Computers & Operations Research, 32(5), pp.1115-1129.

Liao, H.H. and Chen, T.K., 2005. A multi-period corporate credit model---an intrinsic valuation approach. Working Paper. www. ssrn. com.

Lin, T.H., 2009. A cross model study of corporate financial distress prediction in Taiwan: Multiple discriminant analysis, logit, probit and neural networks models. Neurocomputing, 72(16), pp.3507-3516.

Lin, T.H., 2009. A cross model study of corporate financial distress prediction in Taiwan: Multiple discriminant analysis, logit, probit and neural networks models. Neurocomputing, 72(16), pp.3507-3516.

Ling, Z., 2000. Financial Distress Discriminant Analysis Model and Its Application. Rorecasting, 6, p.007.

Lintner, J., 1965. The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. The review of economics and statistics, pp.13-37.

Liviu, T.A., 2005. ASSETS'STRUCTURE AT CREDIT UNIONS.

Longin, F. and Solnik, B., 2001. Extreme correlation of international equity markets. The journal of finance, 56(2), pp.649-676.

Lubben, S.J., 2003. Railroad receiverships and modern bankruptcy theory. Cornell L. Rev., 89, p.1420.

Lummer, S.L. and McConnell, J.J., 1989. Further evidence on the bank lending process and the capital-market response to bank loan agreements. Journal of Financial Economics, 25(1), pp.99-122.

Machauer, A. and Weber, M., 2000. Number of bank relationships: An indicator of competition, borrower quality, or just size? (No. 2000/06). CFS Working Paper.

Machauer, A. and Weber, M., 2000. Number of bank relationships: An indicator of competition, borrower quality, or just size? (No. 2000/06). CFS Working Paper.

Machin, S. and Van Reenen, J., 1993. Profit margins and the business cycle: evidence from UK manufacturing firms. The journal of industrial economics, pp.29-50.

Mai Siêu, Đào Minh Phúc, Nguyễn Quang Tuấn, 2002. Cẩm nang quản lý tín dụng ngân hàng, NXB Thống kê, Hà Nội

Manab, N.A., Theng, N.Y. and Md-Rus, R., 2015. The Determinants of Credit Risk in Malaysia. Procedia-Social and Behavioral Sciences, 172, pp.301-308.

Mann, C., Hamilton, D., Varma, P. and Cantor, R., 2003. What happens to fallen angels? A Statistical review 1982-2003. Moody's Investor Service Special comment, July.

Manso, G., 2013. Feedback effects of credit ratings. Journal of Financial Economics, 109(2), pp.535-548.

Mare, D.S., 2015. Contribution of macroeconomic factors to the prediction of small bank failures. Journal of International Financial Markets, Institutions and Money, 39, pp.25-39.

Martens, D., Van Gestel, T., De Backer, M., Haesen, R., Vanthienen, J. and Baesens, B., 2010. Credit rating prediction using ant colony optimization. Journal of the Operational Research Society, 61(4), pp.561-573.

Martínez-Miera, D. and Repullo, R., 2007. Does competition reduce the risk of bank failure?, unpublished manuscript, CEMFI.

Matousek, R. and Stewart, C., 2009. A note on ratings of international banks. Journal of Financial Regulation and Compliance, 17(2), pp.146-155.

Mayer, C., 1994. The assessment: money and banking: theory and evidence. Oxford Review of Economic Policy, 10(4), pp.1-13.

Mays, F.E., 2004. Credit scoring for risk managers: The handbook for lenders. Thomson/South-Western.

McDonald, C.G. and Van de Gucht, L.M., 1999. High-yield bond default and call risks. The Review of Economics and Statistics, 81(3), pp.409-419.

Mckee, T.E., 2000. Developing a bankruptcy prediction model via rough sets theory. International Journal of Intelligent Systems in Accounting, Finance & Management, 9(3), pp.159-173.

Mckee, T.E., 2000. Developing a bankruptcy prediction model via rough sets theory. International Journal of Intelligent Systems in Accounting, Finance & Management, 9(3), pp.159-173.

Mcleay, S. and Omar, A., 2000. The sensitivity of prediction models to the non-normality of bounded and unbounded financial ratios. The British Accounting Review, 32(2), pp.213-230.

Merwin, C.L., 1942. Financing small corporations in five manufacturing industries, 1926-36. NBER Books.

Michelsen, M., 2011. Corporate financing choices: new ideas and revisited common themes.

Miera, D.M. and Repullo, R., 2010. Does competition reduce the risk of bank failure. The Review of Financial Studies, 23(10), pp.3639-3661.

Miller, M.H. and Modigliani, F., 1961. Dividend policy, growth, and the valuation of shares. the Journal of Business, 34(4), pp.411-433.

Miller, M.H. and Modigliani, F., 1961. Dividend policy, growth, and the valuation of shares. the Journal of Business, 34(4), pp.411-433.

Min, J.H. and Lee, Y.C., 2005. Bankruptcy prediction using support vector machine with optimal choice of kernel function parameters. Expert systems with applications, 28(4), pp.603-614.

Modigliani, F. and Miller, M.H., 1958. The cost of capital, corporation finance and the theory of investment. The American economic review, 48(3), pp.261-297.

Modigliani, F. and Miller, M.H., 1963. Corporate income taxes and the cost of capital: a correction. The American economic review, pp.433-443.

Molinero, C.M., Gomez, P.A. and Cinca, C.S., 1996. A multivariate study of Spanish bond ratings. Omega, 24(4), pp.451-462.

Moody, J., 1914. Moody's Analyses of Investments, Part II. Public Utilities and Industrials. New York: Moody's Investor Services.

Moro, A., Lucas, M., Grimm, U. and Grassi, E., 2010. Financing SMEs: a model for optimising the capital structure.

Morris, S. and Shin, H.S., 2004. Coordination risk and the price of debt. European Economic Review, 48(1), pp.133-153.

Morris, S. and Shin, H.S., 2004. Coordination risk and the price of debt. European Economic Review, 48(1), pp.133-153.

Moses, D.O.U.G.L.A.S. and Liao, S.S., 1987. On developing models for failure prediction. Journal of commercial bank Lending, 69(7), pp.27-38.

Moyer, R.C. and Chatfield, R., 1983. Market power and systematic risk. Journal of Economics and Business, 35(1), pp.123-130.

Muathe, S.M.A., Mwangi, L.W. and Kosimbei, G.K., 2014. Relationship between Capital Structure and Performance of Non-Financial Companies Listed In the Nairobi Securities Exchange, Kenya.

Nakamura, L. ,1993. Commercial bank information: Implications for the structure of banking, in (M. Klausner and L. White, eds.) Structural Change in Banking, pp. 131-60. Homewood, IL: Irwin.

Nam, C.W., Kim, T.S., Park, N.J. and Lee, H.K., 2008. Bankruptcy prediction using a discrete-time duration model incorporating temporal and macroeconomic dependencies. Journal of Forecasting, 27(6), pp.493-506.

Ngô Văn Thứ, 2005. Thống kê thực hành, NXB Khoa học kỹ thuật, Hà Nội.

Nguyễn Cao Văn, Trần Thái Ninh, 1999. Lý thuyết xác suất và thống kê toán, NXB Khoa học và kỹ thuật, Hà Nội.

Nguyễn Hải Sản ,1999. Đánh giá doanh nghiệp, NXB Tài chính, TP.HCM.

Nguyễn Minh Kiều (2007), Tài chính doanh nghiệp, NXB Thống kê, TP.HCM.

Nguyễn Thế Khải, 2003. Phân tích hoạt động kinh tế doanh nghiệp, NXB Tài chính, Hà Nội.

Nickell, P., Perraudin, W. and Varotto, S., 2000. Stability of rating transitions. Journal of Banking & Finance, 24(1), pp.203-227.

Nirajini, A. and Priya, K.B., 2013. Impact of capital structure on financial performance of the listed trading companies in Sri Lanka. International Journal of Scientific and Research Publications, 3(5), pp.1-9.

Norvaisiene, R., 2012. The impact of capital structure on the performance efficiency of Baltic listed companies. Engineering Economics, 23(5), pp.505-516.

Odom, M.D. and Sharda, R., 1990, June. A neural network model for bankruptcy prediction. In Neural Networks, 1990., 1990 IJCNN International Joint Conference on (pp. 163-168). IEEE.

Öğüt, H., Doğanay, M.M., Ceylan, N.B. and Aktaş, R., 2012. Prediction of bank financial strength ratings: The case of Turkey. Economic Modelling, 29(3), pp.632-640.

Ohlson, J.A., 1980. Financial ratios and the probabilistic prediction of bankruptcy. Journal of accounting research, pp.109-131.

Olokoyo, F.O., 2013. Capital structure and corporate performance of Nigerian quoted firms: A panel data approach. African Development Review, 25(3), pp.358-369.

Ong, C.S., Huang, J.J. and Tzeng, G.H., 2005. Building credit scoring models using genetic programming. Expert Systems with Applications, 29(1), pp.41-47.

Ongena, S. and Smith, D.C., 2000. What determines the number of bank relationships? Cross-country evidence. Journal of Financial intermediation, 9(1), pp.26-56.

Ongena, S. and Smith, D.C., 2001. The duration of bank relationships. Journal of Financial Economics, 61(3), pp.449-475.

Ooghe, H. and Verbaere, E., 1985. Predicting business failure on the basis of accounting data: The Belgian experience. The International Journal of Accounting, 9(2), pp.19-44.

Ooghe, H., Joos, P. and De Vos, D., 1993. Risico-indicator voor een onderneming aan de hand van falingspredictie-modellen. Accountancy & Bedrijfskunde, 18(3), pp.3-26.

Ooghe, H., Joos, P., De Vos, D. and De Bourdeaudhuij, C., 1994. Towards an improved method of evaluation of financial distress models and presentation of their results (pp. 1-22). Working Paper, Department of Corporate Finance, Ghent University (Belgium), January.

Pan, J., 2013. Evaluating theories of capital structure in different financial systems: an empirical analysis (Bachelor's thesis, Università Ca'Foscari Venezia).

Panigrahi, A.K., 2010. Capital Structure of Indian Corporate: Changing Trends.

Papaikonomou, V.L., 2010. Credit rating agencies and global financial crisis: Need for a paradigm shift in financial market regulation. Studies in Economics and Finance, 27(2), pp.161-174.

Park, A., Yang, D., Shi, X. and Jiang, Y., 2010. Exporting and firm performance: Chinese exporters and the Asian financial crisis. The Review of Economics and Statistics, 92(4), pp.822-842.

Partnoy, F., 1999. The Siskel and Ebert of financial markets: Two thumbs down for the credit rating agencies. Wash. ulq, 77, p.619.

Pei, G. and Shirai, S., 2004. The Main Problems of China's Financial Industry and Asset Management Companies. Keio University Center of Excellence Program Policy and Governance Working Paper Series, 29.

Pesaran, M.H., Schuermann, T. and Treutler, B.J., 2007. Global business cycles and credit risk. In The risks of financial institutions (pp. 419-474). University of Chicago Press.

Pesaran, M.H., Schuermann, T., Treutler, B.J. and Weiner, S.M., 2006. Macroeconomic dynamics and credit risk: a global perspective. Journal of Money, Credit, and Banking, 38(5), pp.1211-1261.

Petersen, M.A. and Rajan, R.G., 1994. The benefits of lending relationships: Evidence from small business data. The journal of finance, 49(1), pp.3-37.

Petersen, M.A. and Rajan, R.G., 1995. The effect of credit market competition on lending relationships. The Quarterly Journal of Economics, 110(2), pp.407-443.

Pinches, G.E. and Mingo, K.A., 1973. A multivariate analysis of industrial bond ratings. The journal of Finance, 28(1), pp.1-18.

Pinches, G.E. and Singleton, J.C., 1978. The adjustment of stock prices to bond rating changes. The Journal of Finance, 33(1), pp.29-44.

Pogue, T.F. and Soldofsky, R.M., 1969. What's in a Bond Rating. Journal of financial and quantitative analysis, 4(2), pp.201-228.

Pongsatat, S., Ramage, J. and Lawrence, H., 2004. Bankruptcy prediction for large and small firms in Asia: a comparison of Ohlson and Altman. Journal of Accounting and Corporate Governance, 1(2), pp.1-13.

Poon, W.P. and Chan, K.C., 2008. An empirical examination of the informational content of credit ratings in China. Journal of Business Research, 61(7), pp.790-797.

Poon, W.P., Firth, M. and Fung, H.G., 1999. A multivariate analysis of the determinants of Moody's bank financial strength ratings. Journal of International Financial Markets, Institutions and Money, 9(3), pp.267-283.

Poor, H.V., 1868. Poor's manual of the railroads of the United States

Popescu, L., & Sorin, V. (2011, April 20). Retrieved from http://steconomice.uoradea.ro/.

Pourali, M.R., Samadi, M. and Karkani, E., 2013. The study of relationship between capital intensity and financial leverage with degree of financial distress in companies listed in Tehran Stock Exchange. International Research Journal of Applied and Basic Sciences, 4(12), pp.3830-3839.

Pratheepkanth, P., 2011. Capital structure and financial performance: evidence from selected business companies in Colombo stock exchange Sri Lanka. Researchers World, 2(2), p.171.

Puagwatana, S. and Gunawardana, K.D., 2005, September. Business failure prediction model: a case study of technology industry in Thailand. In Engineering Management Conference, 2005. Proceedings. 2005 IEEE International (Vol. 1, pp. 246-249). IEEE.

Qu, Y., 2008. Macroeconomic factors and probability of default. European Journal of Economics, Finance and Administrative Sciences, 13, pp.192-215.

Rafiei, F.M., Manzari, S.M. and Bostanian, S., 2011. Financial health prediction models using artificial neural networks, genetic algorithm and multivariate discriminant analysis: Iranian evidence. Expert Systems with Applications, 38(8), pp.10210-10217.

Rafiei, F.M., Manzari, S.M. and Bostanian, S., 2011. Financial health prediction models using artificial neural networks, genetic algorithm and multivariate discriminant analysis: Iranian evidence. Expert Systems with Applications, 38(8), pp.10210-10217.

Rajan, R.G., 1992. Insiders and outsiders: The choice between informed and arm's-length debt. The Journal of Finance, 47(4), pp.1367-1400.

Rajendran, K. and Achchuthan, S., 2013. Liquidity and Capital Structure: Special reference to Sri Lanka Telecom Plc.

Rasiah, D. and Kim, P.K., 2011. A theoretical review on the use of the static trade off theory, the pecking order theory and the agency cost theory of capital structure. International Research Journal of Finance and Economics, 63, pp.150-159.

Rehman, S.S.F.U., 2013. Relationship between financial leverage and financial performance: Empirical evidence of listed sugar companies of Pakistan. Global Journal of Management and Business Research.

Repullo, R., 2004. Capital requirements, market power, and risk-taking in banking. Journal of financial Intermediation, 13(2), pp.156-182.

Reynolds, P.D., Bygrave, W.D., Autio, E., Cox, L.W. and Hay, M., 2002. Global entrepreneurship monitor: executive report, GEM, Babson College and Ewing Marion Kaufmann Foundation, Wellesley, MA and Kansas City, MO.

Reynolds, S., Fowles, R., Gander, J., Kunaporntham, W. and Ratanakomut, S., 2002. Forecasting the probability of failure of Thailand's financial companies in the Asian financial crisis. Economic Development and Cultural Change, 51(1), pp.237-246.

Richardson, F.M. and Davidson, L.F., 1983. An exploration into bankruptcy discriminant model sensitivity. Journal of Business Finance & Accounting, 10(2), pp.195-207.

Richardson, F.M. and Davidson, L.F., 1984. On linear discrimination with accounting ratios. Journal of Business Finance & Accounting, 11(4), pp.511-525.

Richardson, F.M., Kane, G.D. and Lobingier, P., 1998. The impact of recession on the prediction of corporate failure. Journal of Business Finance & Accounting, 25(1-2), pp.167-186.

Ritchie, B. and Marshall, D.V., 1993. Business risk management. Chapman & Hall.

Roberts, M.R. and Whited, T.M., 2012. Endogeneity in corporate finance, forthcoming in George Constantinides, Milton Harris, and René Stulz, eds. Handbook of the Economics of Finance.

Roje, G., 2005, January. The role of accounting determinants in predicting long term credit ratings. In 28th European accounting association Congress.

Roll, R., 1977. A critique of the asset pricing theory's tests Part I: On past and potential testability of the theory. Journal of financial economics, 4(2), pp.129-176.

Ronn, E.I. and Verma, A.K., 1986. Pricing risk-adjusted deposit insurance: An option-based model. The Journal of Finance, 41(4), pp.871-895.

Roodman, D., 2009. How to do xtabond2: An introduction to difference and system GMM in Stata. The stata journal, 9(1), pp.86-136.

Rosner, R.L., 2003. Earnings manipulation in failing firms. Contemporary Accounting Research, 20(2), pp.361-408.

Ross, S.A., 1976. The arbitrage theory of capital asset pricing. Journal of Economic Theory, pp.341-360.

Ross, S.A.W., Jaffe, R.W., Ross, J.F.S.A., Westerfield, R.W. and Jaffe, J.F., 2009. Finanzas corporativas/Corporate finance (No. 658.15/. 16). McGraw-Hill,.

Roychowdhury, S., 2006. Earnings management through real activities manipulation. Journal of accounting and economics, 42(3), pp.335-370.

Roychowdhury, S., 2006. Earnings management through real activities manipulation. Journal of accounting and economics, 42(3), pp.335-370.

Sales, B.F., 2006. Desenvolvimento de metodologia de rating baseada no modelo ordered probit (Doctoral dissertation).

Sapienza, P., 1997. Le scelte di finanziamento delle imprese italiane. Le banche e il finanziamento delle imprese, Bologna, Il Mulino.

Sasso, L., 2012. Capital structure and corporate governance: the role of hybrid financial instruments (Doctoral dissertation, The London School of Economics and Political Science).

Saurina Salas, J., Jimenez, G. and Lopez, J.A., 2007. How Does Competition Impact Bank Risk Taking?.

Sayari, N. and Mugan, F.C.S., 2013. Cash flow statement as an evidence for financial distress. Universal Journal of Accounting and Finance, 1(3), pp.95-102.

Schultz-Nielsen, M., 2014. Optimal Corporate Investments and Capital Structure (Doctoral dissertation, DEPARTMENT OF ECONOMICS AND BUSINESS AARHUS UNIVERSITY. DENMARK OPTIMAL CORPORATE INVESTMENTS AND CAPITAL STRUCTURE Martin Schultz-Nielsen A dissertation submitted to the School of Business and Social Sciences, Aarhus University).

Schumpeter, E.A., 1939. Business Cycles New York.

Scott, J.A. and Dunkelberg, W.C., 1999. Bank consolidation and small business lending: A small firm perspective. In Federal Reserve Bank of Chicago Proceedings (No. 760).

Serrano-Cinca, C. and GutiéRrez-Nieto, B., 2013. Partial least square discriminant analysis for bankruptcy prediction. Decision Support Systems, 54(3), pp.1245-1255.

Setiono, R., Baesens, B. and Mues, C., 2011. Rule extraction from minimal neural networks for credit card screening. International journal of neural systems, 21(04), pp.265-276.

Sharma, D.S. and Iselin, E.R., 2003. The Relative Relevance of Cash Flow and Accrual Information for Solvency Assessments: A Multi-Method Approach. Journal of Business Finance & Accounting, 30(7-8), pp.1115-1140.

Sharpe, S.A., 1990. Asymmetric information, bank lending, and implicit contracts: A stylized model of customer relationships. The journal of finance, 45(4), pp.1069-1087.

Sharpe, W.F., 1964. Capital asset prices: A theory of market equilibrium under conditions of risk. The journal of finance, 19(3), pp.425-442.

Shavell, S., 1979. Risk sharing and incentives in the principal and agent relationship. The Bell Journal of Economics, pp.55-73.

Shen, C.H., Huang, Y.L. and Hasan, I., 2012. Asymmetric benchmarking in bank credit rating. Journal of International Financial Markets, Institutions and Money, 22(1), pp.171-193.
Shen, C.H., Huang, Y.L. and Hasan, I., 2012. Asymmetric benchmarking in bank credit rating. Journal of International Financial Markets, Institutions and Money, 22(1), pp.171-193.
Shinong, W. and Xianyi, L., 2001. A Study of Models for Predicting Financial Distress in China's Listed Companies [J]. Economic Research Journal, 6, pp.46-55.

Shiu, Y. and Chiang, C., 2008. Determinants of financial strength ratings: evidence from the Lloyd’s Market.

Shubita, M.F. and Alsawalhah, J.M., 2012. The relationship between capital structure and profitability. International Journal of Business and Social Science, 3(16).

Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. Journal of Business, 74, 101–124.

Shumway, T., 2001. Forecasting bankruptcy more accurately: A simple hazard model. The Journal of Business, 74(1), pp.101-124.

Sih, A., 2006. Predição do grau de ratings corporativos. Programa de Pós-Graduação do Departamento de Engenharia Elétrica, Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro, RJ, Brazil. Mas-ter's Thesis.

Skinns, L., Scott, M. and Cox, T., 2011. Risk. The Darwin College Lectures; 24.

Smith, R.F., 1935. Changes in the Financial Structure of Unsuccessful Industrial Corporations, by Raymond F. Smith... and Arthur H. Winakor... University of Illinois.

Sobehart, J.R., Keenan, S.C. and Stein, R., 2000. Benchmarking quantitative default risk models: a validation methodology. Moody's Investors Service.

Sori, M., Hamid, M., Nassir, A. and Mohamad, Z., 2001. Forecasting corporate failure in Malaysian industrial sector firms. Asian Academy of Management Journal, 6(1), pp.15-30.

Sori, M.Z. and Hasbullah, J., 2009. Financial ratios, discriminant analysis and the prediction of corporate distress.

Sori, Z.M., Hamid, M.A., Nassir, A.M. and Mohamad, S., 2006. Some basic properties of financial ratios: Evidence from an emerging capital market. International Research Journal of Finance and Economics, 2, pp.71-87.

Spiceland, J. D., Sepe, J. F., & Tomassini, L. A., 2007. Intermediate Accounting (4th ed.). United State: McGraw-Hill Professional Publishing.

Stanley G. Eakins, 2002. Finance investment, instiutions, and management, Addison wesley, New York.

Steele A., 1995. Going concern qalificatioins and bankruptcy prediction. Paper presented at the 18th Annual Congress of the Euqopean Accounting Association, Birmingham (UK), 10-12 May, pp.1-28

Stern, J.M. and Chew Jr Jr, D. eds., 2003. The revolution in corporate finance. Wiley-Blackwell.

Stiglitz, J.E. and Weiss, A., 1981. Credit rationing in markets with imperfect information. The American economic review, 71(3), pp.393-410.

Stiglitz, J.E., 1969. A re-examination of the Modigliani-Miller theorem. The American Economic Review, pp.784-793.

Sun, J. and Hui, X.F., 2006, August. Financial distress prediction based on similarity weighted voting CBR. In International Conference on Advanced Data Mining and Applications (pp. 947-958). Springer, Berlin, Heidelberg.

Sun, J., He, K.Y. and Li, H., 2011. SFFS-PC-NN optimized by genetic algorithm for dynamic prediction of financial distress with longitudinal data streams. Knowledge-Based Systems, 24(7), pp.1013-1023.

Sun, J., Jia, M.Y. and Li, H., 2011. AdaBoost ensemble for financial distress prediction: An empirical comparison with data from Chinese listed companies. Expert Systems with Applications, 38(8), pp.9305-9312.

Swanson, E. and Tybout, J., 1988. Industrial bankruptcy determinants in Argentina. Studies in Banking and Finance, 7, pp.1-25.

Sylla, R., 2002. An historical primer on the business of credit rating. Ratings, rating agencies and the global financial system, 19.

Tạ Quang Khánh, Nguyễn Hữu Đương, 2002. Đề tài nghiên cứu khoa học. Giải pháp hoàn thiện một bước việc phân tích, xếp loại doanh nghiệp đối với trung tâm thông tin tín dụng, VNH 98.07

Taffler, R.J. and Tisshaw, H., 1977. Going, going, gone–four factors which predict. Accountancy, 88(1003), pp.50-54.

Taffler, R.J., 1982. Forecasting company failure in the UK using discriminant analysis and financial ratio data. Journal of the Royal Statistical Society. Series A (General), pp.342-358.

Taffler, R.J., 1983. The assessment of company solvency and performance using a statistical model. Accounting and Business Research, 13(52), pp.295-308.

Taffler, R.J., 1983. The z-score approach to measuring company solvency. The Accountant's Magazine, 87(921), pp.91-96.

Tam, K.Y. and Kiang, M.Y., 1992. Managerial applications of neural networks: the case of bank failure predictions. Management science, 38(7), pp.926-947.

Tam, K.Y., 1991. Neural network models and the prediction of bank bankruptcy. Omega, 19(5), pp.429-445.

Tamari, M., 1966. Financial ratios as a means of forecasting bankruptcy. Management International Review, pp.15-21.

Teoh, S., Wong, T. and Rao, G., 1998. Are earnings during initial public offerings opportunistic. Review of accounting studies March, pp.175-208.

Teoh, S.H. and Wong, T.J., 1997. Analysts' credulity about reported earnings and overoptimism in new equity issues.

Terence C. Mills, 1996. The econometrics of Financial time series, Cambridge university, Melbourne.

Terry S. Maness, John T. Zietlow, 1998. Short-term financial management, The Dryden Press, Harcourt Brace College Publishers.

Tharmila K., Arulvel K. K., 2013. The impact of the capital structure and financial performance: A study of the listed companies traded in Colombo stock exchange, Merit Research Journal of Accounting, Auditing, Economics and Finance Vol. 1(5) pp. 106-117.

Theodossiou, P., Kahya, E., Saidi, R. and Philippatos, G., 1996. Financial distress and corporate acquisitions: Further empirical evidence. Journal of Business Finance & Accounting, 23(5-6), pp.699-719.

Thomas, J.K. and Zhang, H., 2002. Inventory changes and future returns. Review of Accounting Studies, 7(2), pp.163-187.

Tirapat, S. and Nittayagasetwat, A., 1999. An investigation of Thai listed firms' financial distress using macro and micro variables. Multinational Finance Journal, 3(2), p.103.

Treacy, W.F. and Carey, M., 2000. Credit risk rating systems at large US banks. Journal of Banking & Finance, 24(1), pp.167-201.

Trujillo-Ponce, A., Samaniego-Medina, R. and Cardone-Riportella, C., 2014. Examining what best explains corporate credit risk: accounting-based versus market-based models. Journal of Business Economics and Management, 15(2), pp.253-276.

Tseng, F.M. and Lin, L., 2005. A quadratic interval logit model for forecasting bankruptcy. Omega, 33(1), pp.85-91.

Tú, T.C., 2003. Phân tích số liệu nhiều chiều, NXB Khoa học và Kỹ thuật. Hà Nội.

Tucker, J. and Tucker, D.J., 1996, August. Neural networks versus logistic regression in financial modelling: a methodological comparison. In in Proceedings of the 1996 World First Online Workshop on Soft Computing (WSC1.

Urapeepatanapong, K., Sethsathira, S. and Okanurak, C., 1998. New bankruptcy act to boost Thai economy. International Financial Law Review, 17(4), p.33.

Van Gestel, T., Baesens, B. and Martens, D., 2010. From linear to non-linear kernel based classifiers for bankruptcy prediction. Neurocomputing, 73(16), pp.2955-2970.

Van Wymeersch, C., Declerc, M. and Heins, B., 1991. Flux financiers et prévision de faillite: une analyse comportementale de l'entreprise. In Research Workshop on Accounting and Finance, Mars.

Varetto, F., 1998. Genetic algorithms applications in the analysis of insolvency risk. Journal of Banking & Finance, 22(10), pp.1421-1439.

Vassalou, M. and Xing, Y., 2004. Default risk in equity returns. The Journal of Finance, 59(2), pp.831-868.

Vatavu, S., 2013. Current challenges in capital structure decisions: Evidence from Romanian companies operating in different sectors. Managerial Challenges of the Contemporary Society. Proceedings, 5, p.181.

Vintila, G. and Floriniþa, D.U.C.A., 2012. The Impact of Financial Leverage to Profitability Study of Companies Listed in Bucharest Stock Exchange. Ovidius University Annals, Economic Sciences Series, 12(1), pp.1741-1744.

Von Thadden, E.L., 1992. The commitment of finance, duplicated monitoring and the investment horizon (No. 0027). European Science Foundation Network in Financial Markets, c/o CEPR, 77 Bastwick Street, London EC1V 3PZ..

Wadhwani, S.B., 1986. Inflation, bankruptcy, default premia and the stock market. The Economic Journal, 96(381), pp.120-138.

Wang, K. and Duffie, D., 2004, August. Multi-Period corporate failure prediction with stochastic covariates. In Econometric Society 2004 Far Eastern Meetings (No. 747). Econometric Society.

Wang, Y., Wang, S. and Lai, K.K., 2005. A new fuzzy support vector machine to evaluate credit risk. IEEE Transactions on Fuzzy Systems, 13(6), pp.820-831.

Warner, J.B., 1978. Financial Crises: Institutions and Markets In a Fragile Environment. The Journal of Finance, 33(1), pp.366-368.

Welch, I., Teoh, S.H. and Wong, T.J., 1995. Earnings Management and The Post-Issue Underperformance in Seasoned Equity Offerings (No. 9-95.). University of California at Los Angeles.

Westerfield, R. W., Jaffe, J. F., & Jordan, B. D., 2009. Corporate finance: Core principles & applications. McGraw-Hill Irwin.

Whitaker, R.B., 1999. The early stages of financial distress. Journal of Economics and Finance, 23(2), pp.123-132.

Wilcox, J.W., 1973. A prediction of business failure using accounting data. Journal of Accounting Research, pp.163-179.

Wilson, T., 1997. Portfolio credit risk (II): The second part of an article explaining how macroeconomic variables can be used to assess credit risk. RISK-LONDON-RISK MAGAZINE LIMITED-, 10, pp.56-62.

Wilson, T.C., 1997. Portfolio credit risk.

Wintoki, M.B., Linck, J.S. and Netter, J.M., 2012. Endogeneity and the dynamics of internal corporate governance. Journal of Financial Economics, 105(3), pp.581-606.

Wood, D. and Piesse, J., 1988. The information value of failure predictions in credit assessment. Journal of Banking & Finance, 12(2), pp.275-292.

Wooldridge, J.M., 2003. Further results on instrumental variables estimation of average treatment effects in the correlated random coefficient model. Economics letters, 79(2), pp.185-191.

Wruck, K.H., 1990. Financial distress, reorganization, and organizational efficiency. Journal of financial economics, 27(2), pp.419-444.

Wu, D.D., Liang, L. and Yang, Z., 2008. Analyzing the financial distress of Chinese public companies using probabilistic neural networks and multivariate discriminate analysis. Socio-Economic Planning Sciences, 42(3), pp.206-220.

Wu, Y., Gaunt, C. and Gray, S., 2010. A comparison of alternative bankruptcy prediction models. Journal of Contemporary Accounting & Economics, 6(1), pp.34-45.

Xu, M. and Zhang, C., 2009. Bankruptcy prediction: the case of Japanese listed companies. Review of Accounting Studies, 14(4), pp.534-558.

Yang, J.W., 2013. Management Earnings Forecast And Earnings Management: Does Prior-Period Forecast Accuracy Play A Role?. Journal of Business & Economics Research (Online), 11(3), p.147.

Yang, Z.R., Platt, M.B. and Platt, H.D., 1999. Probabilistic neural networks in bankruptcy prediction. Journal of Business Research, 44(2), pp.67-74.

Yap, B.C.F., Munuswamy, S. and Mohamed, Z., 2012. Evaluating company failure in Malaysia using financial ratios and logistic regression. Asian Journal of Finance & Accounting, 4(1), pp.330-344.

Yin Yuxuan, Gu Wenlin, 2014., An empirical study on factors influencing capital structure of pharmaceutical listed corporations, ISSN : 0975-7384.

Yobas, M.B., Crook, J.N. and Ross, P., 2000. Credit scoring using neural and evolutionary techniques. IMA Journal of Management Mathematics, 11(2), pp.111-125.

Yoon, E. and Jang, S., 2005. The effect of financial leverage on profitability and risk of restaurant firms. The Journal of Hospitality Financial Management, 13(1), pp.35-47.

Young, G., 1995. Company liquidations, interest rates and debt. The Manchester School, 63(S1), pp.57-69.

Zavgren, C., 1983. The prediction of corporate failure: the state of the art. Journal of Accounting Literature, 2(1), pp.1-38.

Zavgren, C., 1983. The prediction of corporate failure: the state of the art. Journal of Accounting Literature, 2(1), pp.1-38.

Zavgren, C.V., 1985. Assessing the vulnerability to failure of American industrial firms: a logistic analysis. Journal of Business Finance & Accounting, 12(1), pp.19-45.

Zhang Houqi, 2002. Financial Distress Prediction System of Listed Corporate: Theory Study and Evidence Analysis. Shanghai Securities Unit Research.

Zhang Jian, 2004. Research on the Internal Governance Structure, Ownership Structure and Financial Distress of Listed Corporate in China. Master Thesis of Jilin University, Jilin University

Zhang, G., Hu, M.Y., Patuwo, B.E. and Indro, D.C., 1999. Artificial neural networks in bankruptcy prediction: General framework and cross-validation analysis. European journal of operational research, 116(1), pp.16-32.

Zhou, C., 2001. An analysis of default correlations and multiple defaults. The Review of Financial Studies, 14(2), pp.555-576.

Zmijewski, M.E., 1984. Methodological issues related to the estimation of financial distress prediction models. Journal of Accounting research, pp.59-82.

Zopounidis, C., 1999. Multicriteria decision aid in financial management. European Journal of Operational Research, 119(2), pp.404-415.

APPENDICES

Appendix A: Implication and suggestion for the credit assessment process and rating procedure for Vietnamese corporations

1. The determinant factors for credit rating under consideration

The considered factors will be divided into two main classes: financial and non-financial factors.

Financial factors

The financial factors will be acquired through the calculation based on audited financial reports of corporations. There are 11 financial factors selected classified into four groups: liquidity, operation, profitability, and growth.

A Liquidity ratios

Liquidity ratios are selected since analyzing these ratios provide banks with the ideas about the capacity to repay the short-term credit hold by corporations in the near future. Short-term credits are usually used to finance short-term assets so that the liquidate level of current assets essentially affects the repayment capacity of corporations. Consequently, the current ratio and the quick ratio will be selected.

Current ratio= Current assets/current liabilities

In order to ensure the purposes of credit that mainly focus on financing short term assets of the corporations, banks can deduct transferred current assets, prepaid accounts, and intangible assets.

Currently, most of the main commercial banks in Vietnam and the Financial Ministry consider 1 to be the acceptable current ratio. However, this level of 1 is quite dangerous since minor issues such as reduction in product consumption, overdue account receivable, etc. can put pressure on the financial status of the corporation. Consequently, the current

ratio should probably larger than 1. Simultaneously, the corporation should remain reasonable inventory and receivable level as well as no overdue short-term debt. Ideally, the current ratio of the corporation should be larger than the industrial average.

The specific characteristic of the industry is a noticeable issue since different industries present a different level of current assets as well as current liabilities and hence current ratio. For example, corporations with long production turnover such as shipbuilder corporations should have a higher current ratio since inventory, account receivable are usually at a high level, and cash inflow is unstable compared to other industries. In contrast, corporations with short product turnover period can receive cash in the short term and acquire longer account payable due period so that they can present a lower current ratio. Therefore, corporations under consideration should be divided into different industries and from each industry; healthy corporations with best credit history will be selected in order to calculate the reasonable current ratio for the industries. The result is used as a benchmark for the assessment process.

The inventory should be noticed in the calculation since in Vietnamese accounting system; the inventory is recorded due to the real price, not the selling price so that the differences should be considered in a different situation.

Suggested mark for the current ratio is as follow:

Curent Ratio	Production cycle	≤1	>1 - 1.5	>1.5 - 2	>2 - 2.5
This period ratio≥ Previous period ratio (or industry average)	Long (ex: construction, shipbuilder…)	0			
	Medium (ex: ciment, paper products…)	0			
	Short (ex: services)	0			
This period ratio<Previous	Long (ex: construction, shipbuilder…)	0			

period ratio (or industry average)	Medium (ex: cement, paper products…)	0			
	Short (ex: services)	0			

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

Quick ratio= (Cash+ Cash equivalent+ Account receivable)/ Current liability

The quick ratio reflects the safety of the debts due to the value of available assets with high liquidity. Compared to the current ratio, the inventory is deleted from the equation for the quick ratio since the liquidity of inventory is the lowest in the list. The liquidity of inventory depends on the quality of the product itself, the demand and supply equilibrium in the market and the fluctuation in the consumption amount. The inventory also suffers from depreciation through time. If trouble comes (typically because the firm cannot sell its finished product inventory for more than production cost), inventories may not be sold at anything above fire-sale prices.

Besides inventory, the deduction of prepaid expenses and account receivables from the numerator is reasonable especially for agricultural corporations since these corporations usually have to present large prepayment to the suppliers.

Similar to current assets, small quick ratio presents limited credit quality of the Corporation for the short term debts. However, the excessively large quick ratio can be the signal of ineffective capital use. Marking system for the quick ratio is suggested as follow:

Quick Ratio	Production cycle	≤1	>1 - 1.2	>1.2 - 1.4	>1.4 - 1.6
This period ratio≥ Previous period ratio (or industry average)	Long (ex: construction, shipbuilder…)	0			
	Medium (ex: cement, paper products…)	0			
	Short (ex: services)	0			
This period ratio<Previous period ratio (or industry average)	Long (ex: construction, ship builder…)	0			
	Medium (ex: cement, paper products…)	0			
	Short (ex: services)	0			

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

The analyst should pay attention to some long-term liabilities that will due in the short term but have not been moved to short-term liabilities since the Vietnamese accounting system does not require this process.

B, Operating Ratios

The operating ratios will be assessed through inventory occupancy (inventory turnover days) and receivable collection period.

Inventory Occupancy= Average Inventory/ COGS x Days per period

Inventory turnover= COGS/ Average Inventory

The reasonable inventory turnover cannot be defined for all industries since different corporations with different development strategies have different inventory level. The inventory turnover can be compared to the previous period's one or with the average level of the industry. Normally, COGS/inventories can be considered acceptable at the result of 7 or 8. However, the lower the inventories turnover are preferred since it reflects good quality of inventories, high capital turnover and high liquidity of the inventories that ensure cash inflow and hence debt payment.

Inventories occupancy depends on capital turnover, management capacity and inventories management strategies of the corporations (storing inventories to the warehouse with the high amount at one time or separating the inventories into a smaller amount in several times, for example). In addition, inventories occupancy can depend on the specific characteristic of the production process, the distance between material supply and factories, consumer demand, the product nature, and supply chain management strategy, etc.

Marking system for inventories turnover period is suggested as follow:

Inventories turnover days	Inventories level	≤45	>45 - ≤60	>60 - ≤75	>75 - ≤90	>90
This period ratio< Previous period ratio (or industry average)	Long (ex: construction, ship builder…)					
	Medium (ex: cement, paper products, sugar. beverage…)					
	Short (ex: services)					0
This period ratio≥Previous period ratio (or	Long (ex: construction, ship builder…)					

industry average)	Medium (ex: cement, paper products, sugar. beverage…)					0
	Short (ex: services)					0

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

Average collection period= Average receivable/ average daily sales

The average collection period is believed to be an efficient indicator presenting the efficiency of collection department. It, however, sometimes results from an unduly restrictive credit policy. In order to assess the repayment capacity of the corporation, the account receivables should be only the ones related to the sales.

The shorter the average collection period is, the better the corporation's credit quality is and vice versa. Nevertheless, business strategies, competitive strategies, and relationship to the consumers are also an essential factor to be considered. Furthermore, the time of collection period depends on the selling policy of the corporations, discount rate, financial status of buyers and the management capacity on the due receivables. Consequently, comparing the average collection period of the corporation to the average industrial level is suggested. In most of the cases currently, Vietnamese commercial banks accept the result of 30 to 45 days. In the special case that most of the receivables of corporations burden on a single customer or a group of main customers, the credit quality of those customers should be considered in addition.

The marking system for the average collection period is suggested as follow:

Average collection	Financial status level	30	>30 - ≤45	>45 - ≤60	>60 - ≤90	>90

period						
This period ratio< Previous period ratio (or industry average)	Strong					
	Medium					
	Weak					0
This period ratio≥Previous period ratio (or industry average)	Strong					
	Medium					0
	Weak				0	0

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

C, Profitability and Capital use efficiency

The repayment capacity of corporations mainly comes from its business results. If sales are too low, there is even the possibility that corporation cannot cover the periodical interest payment. Furthermore, debt issuers also want to control the capital use efficiency of the corporation to ensure a stable management capacity and sales growth. The efficiency will be analyzed through the comparison between the input amount and business results.

Return on Assets= EBIT/ Average total assets

ROA reflects the ability to generate earning per unit of assets. The higher ROA is, the better assets are used. Since ROA is independent of the corporation's leverage and tax policy of the government, it can present the management capacity of the corporation. The assets in a company's book are valued on the basis of their original cost less any depreciation. A higher return on assets does not mean that you could buy the same assets today and get a high return in the future. Nor does a low return on assets imply that the

assets could be better employed elsewhere. Thus return on assets does not tell you whether the firm's assets being used efficiently.

ROA= EBIT/Average total assets= Sales/ Average total assets x EBIT/ Sales= Assets turnover x (1- Expenses/ Sales)

It can be seen that ROA depends on assets turns over and the relationship between earnings and total sales. Therefore, in order to increase ROA, the corporation must either increase assets turnover or limit the total expenses. The assets turnover depends on management capacity and assets structure of corporation so that it is necessary to decrease unreasonable storage reduce production time as well as receivable period, etc. in order to improve assets turnover.

Normally, commercial banks appreciate corporations with ROA that is higher than banks' interest rate since higher ROA ensures the possibility that the loans can create high returns hence high chance of full repayment. The low ROA shows the alarming signal of unfavorable business conditions and the high possibility of default.

In order to have an accurate assessment, ROA is suggested to be analyzed in the relative connection to leverage level of a corporation which is calculated by the ratio of Debt over Total Assets. In the case of good business conditions, increasing leverage ratio, the return on equity is much higher without issuing more stocks and vice versa. In the point of view of the debt issuer, the lower leverage level seems to ensure higher security for the debt. It, however, prevents the corporation from expanding their business. Consequently, it is necessary to identify a reasonable leverage level for corporations. Currently, the leverage ratio is considered in different ways in a different business environment of the country. While the French commercial banks accept the proportion of equity from 20%, Korean commercial banks usually accept an only higher level of 30% to 50%. In Vietnam, the Decree 59/CP of the government dated 3rd October 1996 regulates that the debt of corporation cannot exceed the amount of equity published in the newest public notice.

From the data collected from the Vietnamese corporations, the average equity proportion is approximately 32% therefore; the debt level can be about 50% to 60%.

The marking system for ROA in a relationship with leverage is suggested as follow:

ROA	ROA compared to the interest rate	Leverage				
		≤30	>30-≤40	>40-≤60	>60-≤70	>70
This period ratio≥Previous period ratio (or industry average)	> interest rate					
	= interest rate					
	<interest rate					
This period ratio<Previous period ratio (or industry average)	> interest rate					
	= interest rate					
	<interest rate					

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

Interest Charges= EBIT/ Interest expenses

The interest charges ratio shows the corporation's ability of interest payment. This ratio depends on the capital use efficiency being reflected by the difference between ROA and the bank's interest rate; and the leverage of the corporation. Currently, the debt of corporations operating in Vietnam mainly comes from bank borrowing. Therefore, most commercial banks expect high-interest coverage ratio in order to ensure the low possibility of default. However, since the interest rate coverage is mainly based on the changes in EBIT, the profit trend should be considered in the assessment process. EBIT is expected to grow by time.

The marking system for interest coverage ratio in the relationship with profit trend is suggested as follow:

Profit trend	Interest Coverage			
	<1	=1	>1- ≤2	>2
Grow continuously in 3 years				
Grow continuously in 2 years				
Grow continuously monthly in 1 years				
Others				

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

Net Profit margin= EBIT/ Sales

High net profit margin proves the small difference between earnings and sales hence the small possibility that corporation suffers from negative effects of selling price decrease or higher expenses, etc. Therefore, the higher net profit margin is, the better the corporation is. In developed countries, net profit margin must higher than 6%. In Vietnam, however, it has not been analysed probably yet. Since it can be different in various industries, a comparison between net profit margin of the corporation under consideration and the average industrial level is essential.

The marking system for net profit margin is suggested as follow:

Net profit margin	Mark
This period> the previous one (or industrial average); show stable trend	5
This period> the previous one (or industrial average); show unstable trend	3
This period= the previous one (or industrial average)	1
This period><the previous one (or industrial average)	0

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

D, Business scale, and growth

Sales growth rate= (Sales of this terms-Sales of the previous term)/ Sales of the previous term

Sales generation is the base for the next growing period of the corporations so that it is crucial for the debt issuers to identify the sales growth status of the corporations in order to ensure that the corporation can generate enough earning to cover the interest and debt payments. The higher sale growth rate is, the better the corporation is. However, in different stage of the business cycle in addition to product cycle, competition in the industry and management strategy, the sales growth rates may be unable to show a stable, increasing trend. In this case, a stable sales growth rate can be acceptable.

Another issue in assessing repayment capacity of corporations is that the growing in sales is not a firm guarantee for healthy status since it depends on the growth in profit as well.

Change in current profit= (Current profit of this term-Profit of the previous term)/ Profit of the previous term

The marking system for change in sales growth rates in a relationship to change in current profit is suggested as follow:

Sales growth rates		Change in current profit				
		>0			=0	<0
		0-<25	25-≤50	>50		
>0	1-<25					
	25-≤50					
	>50					
=0						
<0						

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

Business scale

The business scale of the corporation shows its financial strength and confirms the trustiness of the debt issuer to the corporation. There are various ways of assessing the business scale of the corporation. However, Vietnamese commercial banks usually assess their sales and equity. Sales and equity level of the corporation not only present the guarantee for debt repayment but also show the re-investment capacity of the corporation. The big business scale can also present the market shares and market power of the corporation. In order to identify the classification of business scale, it is necessary to create a system of grouping corporations based on their structure and industries. An example is the classification system of Vietcombank, one of the four biggest commercial banks in Vietnam and is supported by the State Bank of Vietnam in order to create its system.

Industry	Equity classification (billion VND)				
	Very big	Big	Medium	Small	Micro
Heavy industry, printing	>20	10-20	5-10	2-5	<2
Gas, Electricity	>200	100-200	20-100	20-50	<20
Beverage, Cigarette	>80	50-80	20-50	5-20	<5
Paper, wood	>40	20-40	10-20	5-10	<5
…					

Industry	Sales classification (billion VND)				
	Very big	Big	Medium	Small	Micro
Heavy industry, printing	>30	20-30	10-20	3-10	<3
Gas, Electricity	>300	200-300	100-200	20-100	<20
Beverage, Cigarette	>250	160-250	90-160	20-90	<20
Paper, wood	>50	35-50	20-35	5-20	<5
…					

The marking system for business scale is suggested as following

Sales		Equity scale				
		Very big	Big	Medium	Small	Micro
This period sales≥ The previous one (or industry average)	Very big					
	Big					
	Medium					
	Small					
	Micro					
This period sales< The previous one (or industry average)	Very big					
	Big					
	Medium					
	Small					
	Micro					

In the table above, the marks for current ratio are ranged from 0 to 5 (worst to best) with the middle cutting point is 2. (The middle cutting point is just the suggested reasonable mark. The real one must be calculated for each industry based on real data).

In overall, there are nine financial aspects mentioned with the suggested marking system. However, based on the real data, it is necessary to use the MDA method to identify which financial aspects are significant to put into the system of assessment. All the mark should also be re-calculated in order to fit the ranking system from AAA to D as suggested above.

Financial aspects	**Ranking system**									
	AAA	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**	**CC**	**C**	**D**
1	a1	a2	a3	a4	a5	a6	a7	a8	a9	a10
2	b1	b2	b3	b4	b5	b6	b7	b8	b9	b10
3	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10
4	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10
5	e1	e2	e3	e4	e5	e6	e7	e8	e9	e10
6	f1	f2	f3	f4	f5	f6	f7	f8	f9	f10
7	g1	g2	g3	g4	g5	g6	g7	g8	g9	g10
8	h1	h2	h3	h4	h5	h6	h7	h8	h9	h10
9	i1	i2	i3	i4	i5	i6	i7	i8	i9	i10
10	j1	j2	j3	j4	j5	j6	j7	j8	j9	j10
…										

In the table above, a1, a2,…b1, b2… is the mark of each rank for every single financial aspect under consideration.

Financial aspect	Weight	Ranking system									
		AAA	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**	**CC**	**C**	**D**
1	y1	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
2	y2	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
3	y3	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
4	y4	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
5	y5	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
6	y6	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
7	y7	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
8	y8	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
9	y9	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
10	y10	a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
…		a+3x	a+2x	a+x	a	a-x	a-2x	a-3x	a-4x	a-5x	a-6x
Total	y	(a+3x)y	(a+2x)y	(a+x)y	ay	(a-x)y	(a-2x)y	(a-3x)y	(a-4x)y	(a-5x)y	(a-6x)y

The table above is the suggested ranking system for the total mark for corporations in the same industry.

Assume that BBB is the average of the industry.

Y= y1+y2+…yn

The total mark of a rank equals the weight y multiplied by the mark of each rank.

a is the average mark of the industry.

x is the difference between two continuous ranks in each financial aspect= (mark for AAA- mark for D)/ Total number of ranks= 9xy/10

Non-financial factors

A Business environment

(1) Business cycle

The business cycle depends on the GNP of the countries and other specific characteristics of the industry itself. For example, the banking industry is sensitive to the changes in interest rate. In general, business cycle matches to the economic cycle, and the

assessment is usually based on the changes in a specific economic stage at the time of consideration.

(2) The potential development of industry

The potential development of the industry relates strictly to the changes in the economic cycle. A developed industry with various further development opportunity provides corporations numerous advantages in business operation. The corporation can expand its market and improve its market power. The assessment should be based on the expected level of development.

(3) Competition in the industry

In industry, the competition mainly focuses on price and product quality. The competition status in an industry depends on the market structure, the number of corporations operating in the industry and the price setting strategy. The competition in an industry also depends on the entry requirements. The corporations that are already operating in the industry usually have to identify their price based on the market equilibrium level except for the monopoly or monopolistic markets.

(4) Suppliers

The debt issuers should also consider the corporation as a customer to their suppliers in order to identify and analyze the effects of the suppliers on the business of the corporations.

(5) Regulations and policies

Regulations and legal policies can also be the crucial factors that define the business future of corporations.

A ranking system for the business environment is suggested as follow:

Rank	Mark	Business cycle	Potential development	Competition	Suppliers	Specific regulations
AAA	b+3j	Very developed	Really good	Non	Stable	None
AA	b+2j	Good developed	Quite good	Very low	Stable	Low
A	b+j	Quite developed	Good	Low	Acceptably stable	Low
BBB	b	Quite developed	Good	Low	Good	Low
BB	b-j	Medium	Normal	Somehow low	Normal	Low
B	b-2j	Expansion	Sub-normal	Normal	Normal	Normal
CCC	b-3j	stable	Little potential	A little high	Difficult	Appeared
CC	b-4j	Contraction	Little potential	Quite high	Difficult	High
C	b-5j	Contraction	Bad	High	Rare	Quite high
D	b-6j	Trough	Really bad	Very high	Really bad	Really high
Sum (m)		m1	m2	m3	m4	m5

m is the total weight = m1+m2+m3+m4+m5

b is the average for the industry

The difference between two continuous rank =(mark of AAA-mark of D)/ total number of ranks= ((b+3j)m – (b-6j)m)/10= 9mj/10

B, Business operation

(1) Business activities diversification and adjustment due to the product cycle

Any changes in product cycles can affect sales so that it is necessary to pay attention to the adjustments of corporations for the product cycle, especially the industry with high elasticity of sales to the product cycle. The diversification in business activities is crucial

to prevent the sales reduction due to the product cycle in addition to the management capacity, supply chain, and sales policies.

(2) Product quality

In Vietnam, the product quality is assessed through the ISO 9000/9002. The corporations' products can be classified into three groups: no ISO 9000/9002; with ISO 9000/9002; Just received ISO 9000/9002 check currently.

(3) Market scale

The market scale can be identified by the aggregate demand for the product at a point of time or the total sales of all the corporations in the industry. Depends on the products, the corporations' market scale can be classified to be Very big, big, medium, small, niche.

(4) Market share

The market share of a corporation can be identified by the ratio between the expected sales of the corporation to total sales of the industry. Due to the assumptions made, the accuracy of the corporation's market share should be considered carefully.

(5) Research and development (R&D)

The market power of the corporations and the demand for the products can be affected significantly by the changes in technology applied. Therefore, the investment in R&D should be put on the list of considered factors. However, corporations sometimes still can expand the number of products produced by reaching the economies of scale without changing any technology.

The marking system for business operation factors is suggested as follow:

Rank	Mark	Product cycle	Product quality	Market scale	Market share	R&D	Sum mark
AAA	c+3k	Very developed	Really good	Very big	Leader	Good	(c+3k)n
AA	c+2k	Good developed	Quite good	Big	Follower	Good	(c+2k)n
A	c+k	Quite developed	Good	Big	Follower	Reasonable	(c+k)n
BBB	c	Quite developed	Good	Big	Quite big	Reasonable	cn
BB	c-k	Medium	Normal	Normal	Big	Reasonable	(c-k)n
B	c-2k	Expansion	Sub-normal	Normal	Normal	Normal	(c-2k)n
CCC	c-3k	stable	Little potential	Small	Normal	Unreasonable	(c-3k)n
CC	c-4k	Contraction	Little potential	Small	Small	Unreasonable	(c-4k)n
C	c-5k	Contraction	Bad	Small	Small	No potential	(c-5k)n
D	c-6k	Trough	Really bad	Micro	Really small	none	(c-6k)n
Sum (n)		n1	n2	n3	n4	n5	

n is the sum of weight= n1+n2+n3+n4+n5

c is the industrial average

k is the difference between two continuous ranks in the system= (mark of AAA-mark of D)/ total number of ranks

C, Management quality

(1) Corporation structure

The corporate structure can be assessed through the efficiency of the structure in business operation and earning generation capacity. Based on the business strategy that the corporation is pursuing, the debt issuer can decide whether the structure is suitable for

applying the strategy chosen or not. The information processing efficiency, decision making and earning generation capacity can be used as guidelines for the assessment.

(2) Manager board

The management board can be assessed on reputation, experience, achievement records, capacity, and knowledge, etc.

(3) Human resources management policy

Human resources management policy can be assessed on the hiring and employment policies, promotion and commission, etc. The human resources management policy ensures the stable labor level and encourages the productivities of the employees hence improve the business quality. The ranking system can range from the favorable working environment to the strike of the employees.

(4) Strategic development

Since the remarkable development of technology, globalization trend and fluctuation in customers' demand put pressure on corporations to change, strategic development of corporation should be considered as an important factor. The developing strategies must match the business environment and corporations' available resources.

(5) Corporation's culture

Corporation's culture is the common value and customs of the employees. It helps to identify the specific image and brand name of corporations. Hence, it affects the customers' view and demand for the corporation's products and services.

A ranking system for management quality is suggested as follow:

Rank	Mark	Corporation structure	Manager board	Strategic development	Human resources policy	Corporation's culture	Sum mark
AAA	d+3t	Best	Really good	Best	Best	Good	(d+3t)p
AA	d+2t	Highly efficient	Quite good	Highly efficient	Highly efficient	Good	(d+2t)p
A	d+t	Quite efficient	Good	Quite efficient	Quite efficient	Reasonable	(d+t)p
BBB	d	Quite developed	Good	Quite developed	Quite developed	Reasonable	dp
BB	d-t	Medium	Normal	Medium	Medium	Reasonable	(d-t)p
B	d-2t	Good	Sub-normal	Good	Good	Normal	(d-2t)p
CCC	d-3t	Normal	Little potential	Normal	Normal	Unreasonable	(d-3t)p
CC	d-4t	Contraction	Little potential	Contraction	Contraction	Unreasonable	(d-4t)p
C	d-5t	Bad	Bad	Bad	Bad	No potential	(d-5t)p
D	d-6t	Really bad	Really bad	Really bad	Really bad	none	(d-6t)p
Sum (p)		p1	p2	p3	p4	p5	

p is the sum of weight= p1+p2+p3+p4+p5

d is the industrial average

t is the difference between two continuous ranks in the system= (mark of AAA-mark of D)/ total number of ranks=9tp/10

Therefore in total, we have the ranking system suggested as follow:

Rank	Factors				Total mark
	Financial	Industry	Business operation	Management	
AAA	(a+3x)y	(b+3j)m	(c+3k)n	(d+3t)p	Z1(a+3x)y+Z2(b+3j)m+Z3(c+3k)n+Z4(d+3t)p
AA	(a+2x)y	(b+2j)m	(c+2k)n	(d+2t)p	Z1(a+2x)y+Z2(b+2j)m+Z3(c+2k)n+Z4(d+2t)p
A	(a+x)y	(b+j)m	(c+k)n	(d+t)p	Z1(a+x)y+Z2(b+j)m+Z3(c+k)n+Z4(d+t)p
BBB	ay	bm	cn	dp	Z1ay+Z2bm+Z3cn+Z4dp
BB	(a-x)y	(b-j)m	(c-k)n	(d-t)p	Z1(a-x)y+Z2(b-j)m+Z3(c-k)n+Z4(d-t)p
B	(a-2x)y	(b-2j)m	(c-2k)n	(d-2t)p	Z1(a-2x)y+Z2(b-2j)m+Z3(c-2k)n+Z4(d-2t)p
CCC	(a-3x)y	(b-3j)m	(c-3k)n	(d-3t)p	Z1(a-3x)y+Z2(b-3j)m+Z3(c-3k)n+Z4(d-3t)p
CC	(a-4x)y	(b-4j)m	(c-4k)n	(d-4t)p	Z1(a-4x)y+Z2(b-4j)m+Z3(c-4k)n+Z4(d-4t)p
C	(a-5x)y	(b-5j)m	(c-5k)n	(d-5t)p	Z1(a-5x)y+Z2(b-5j)m+Z3(c-5k)n+Z4(d-5t)p
D	(a-6x)y	(b-6j)m	(c-6k)n	(d-6t)p	Z1(a-6x)y+Z2(b-6j)m+Z3(c-6k)n+Z4(d-6t)p
Weight	Z1	Z2	Z3	Z4	

2. Other factors to be considered

2.1 Macroeconomic factors

The macroeconomic factors can be considered separately for each factor using or the groups of factors using the ordered probit model in chapter 6. The ordered probit regression result can be used to identify the credit ratings of corporations based on financial ratios extracted from annual financial reports and macroeconomic data from the National Statistic Department.

2.2 Credit rating immigration matrix

Credit immigration can be done using Credit metrics methods.

Assumptions

_All the borrowers (corporations) can be ranked in different creditworthiness classifications and all the corporations in the same classification experience similar credit migration possibility (all the corporations are credit homogeneous within the same rating class).

_The Corporation's risk includes the specific risk and systematic risk.

_The equity value can be used to assess the value of the corporation's assets.

_To make the model simple, the Credit Metrics model assumes that individual corporation involves in only one credit relationship (one loan contract) with a bank over a period of time.

_The time period to assess the credit migration is one year.

The input of the model

_There is a ranking system for the creditworthiness of the corporations.

_The characteristics of the loans including value, due date, interest rate, etc. must be transparent and accessible.

_All the financial information of the corporations.

_The industry's ratios.

The basic idea of the model

Assume that bank issue a loan with the stated value M, annual interest amount N, dues in T years to the corporation with credit ranking g with g∈ G (G is the set of the credit ranks). If the annual interest rate from year 1 to year t to the corporations with ranking g is f_t^g, the value of the loan at the end of year 1 is:

$V_t^g = N + \sum_{t=2}^{T-1} \frac{N}{(1+f_t^g)^{t-1}} + \frac{M+N}{(1+f_t^g)^{t-1}}$

If the credit migration possibility is $\pi(g)$, the expected value of the loan at the due date is:

E(V1)= $\sum_g V_1^g * \pi(g)$

The standard deviation of the loan value is:

$$\sigma_o^2[V1] = \sum_g (V_1^g - E(V1))^2 * \pi(g)$$

In view of the bank, there is a portfolio of loans. The standard deviation of this portfolio is: $\sigma_P^2 = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \sigma_{ij}^2 - (n-2) \sum_{i=1}^{n} \sigma_i^2$

In which σ_P^2 is the standard deviation of the loan portfolio, σ_i^2 is the standard deviation of individual loan and σ_{ij}^2 is the coefficient correlation between two loans. The calculation of the σ_P^2 is essentially important since it helps the bank estimate the possible loss and have reasonable provision.

The coefficient correlation between the two loans is dependent on the credit migration possibility relationship among loans.

Assume the distribution of the loan value V is a continuous stochastic distribution. Based on the Merton model mentioned above, the value of the loan can be denoted as:

$$\frac{dV}{V} = \mu.dt + \sigma.dW$$

In which μ is the average growth rate of the corporation's assets, σ is the standard deviation of the growth rate of the corporation's assets, W is the continuous time stochastic Wiener process. μ and σ are assumed to follow geometric Brownian motion. Then, the value of the loan at time t is:

$$V_t = V_0.exp\left\{\left(\mu - \frac{\sigma^2}{2}\right)t + \sigma\sqrt{t}W_t\right\}$$

Credit Metrics model assume $R = \frac{\ln\left(\frac{V_t}{V_0}\right) - \left(\mu - \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}} \sim$ N (0; 1)

R=$\sum_i w_i x_i + w\varepsilon$ in which $\{x_i\}$ is the set of the industrial ratios, w_i is the weight of the corporation's involvement in the industry, ε is the individual characteristic estimation and follow the standard normal distribution, w is identified to ensure the standard deviation of R equal 1.

If two corporations have loans with the value R and R' respectively, then:

$$\rho(R; R') = \sum_i \sum_j w_i\, w_j corr(x_i; x_j)$$

Based on the Merton's option valuation theory (see Appendix about Black-Scholes_ Merton model for default probability), Credit Metric model has the credit migration possibilities of two corporations from rank (g; m) to (h; n) is:

P(h; n)= $P\left(Z_g^{h-1} < R < Z_g^h, Z_m^{n-1} < R' < Z_m^n\right) = \int_{Z_g^{h-1}}^{Z_g^h} \int_{Z_m^{n-1}}^{Z_m^n} f(u, u', \rho) du du'$

In which, f(u,u', ρ) is the distribution function of (R; R'):

$$f(u,u',\rho) = \frac{1}{2\pi\sqrt{1-\rho^2}} exp\left\{\frac{-1}{2(1-\rho^2)}(u^2 - 2\rho.u.u' + u'^2)\right\}$$

Then: $\sigma_{ij}{}^2 = \sum_h \sum_n \left(V_i^h + V_j^n\right)^2 . P(h;n) - \left(\sum_h \sum_n \left(V_i^h + V_j^n\right)^2 . P(h;n)\right)^2$

Since the researcher is prevented from publishing any detailed debts information of corporations by the Confidential Information Protection Agreement with the State Bank of Vietnam_ Credit Information Centre, the research cannot conduct the test in detail. However, it is highly recommended for the commercial banks and the State Bank-Credit Information Centre with full data access in order to capture full credit rating migrations of corporations.

The credit migration possibility for Vietnamese firms in four years from 2011 to 2014 for each industry is calculated with the results presented in **Appendix E**.

2.3 Thresholds of financial distress

The threshold of financial distress is the cutting point that corporations overcome the point will lead to the threats of insolvency.

The revenue from sales is a value that is easy to be acquired and analyzed. Therefore, we will identify the level of sales that can be considered the threshold for firms. Firms with sales below that point may have a high possibility of facing financial distress.

The model developed by Takashi Shibata-Tetsuya Yamada will be applied.

Call the sales revenue of the corporation at time t X_t and this variable based on the geometric Brownian motion, be neutral to the risk.

$$dX_t = \mu X_t dt + \sigma X_t dz_t$$

$$Xo = x \quad (1)$$

In which:

- μ is the average value of the geometric Brownian
- σ is the standard deviation

➔ μ and σ are constant numbers

- i_t is a geometric Brownian motion

We denote w as the operating cost of the corporation, M as the value of the bank loans, C as the liquidation value of the corporation, c equal C/M, r as the risk-free rate and b is the interest rate on the bank loans.

There are two basic assumptions about these variables: u<r<b and c<1 (means C<M as assuming the liquidate value can never cover all the bank loans because of the assets value reduction, bureaucratic cost, opportunity costs, etc.)

Denoting the time that the legal document handed into the court τ_b and the time for the corporation to be liquidated τ_c.

There is an assumption that the stockholders who vote to decide the liquidation time for the corporations will try to maximize the equity value of the corporations before "ran" out of the corporations. This assumption is equivalent to the idea that the stockholders will choose the time that the sales revenue of the corporation is maxed before the liquidation time ($t< \tau_b$) because after the liquidation time ($\tau_b \leq t$) the stockholders will have no right from the corporations and acquire no more revenue from the corporation's sales. Assume that the best time to liquidate is τ_{b*}.

The maximum equity value of the corporation is:

$$E(X_t)= \text{Max } E_t \left(\int_t^{\tau b} e^{-r(s-t)} \, (Xs - w - bM) ds \right) \quad (2)$$

$$X\, \tau_{b*} = x_b = \frac{y}{y-1} . \left(\frac{w+bM}{r} \right) . (r - \mu) \text{ and } y = \frac{1}{2} - \frac{\mu}{\sigma^2} - \sqrt{\left(\frac{\mu}{\sigma^2} - \frac{1}{2} \right)^2 + \frac{2r}{\sigma^2}} < 0$$

➔ $\left(\frac{x}{\text{xb}}\right)^{y}$ is the probability of bankruptcy (or being liquidated) of the corporation.

Then we have $\lim_{x\to\infty}\left(\frac{x}{\text{xb}}\right)^{y}$=0 since y<0; and $\left(\frac{x}{\text{xb}}\right)^{y}$=1 when x= x_b.

From (2) we have:

$$E(x)=\left(\frac{x}{r-\mu}-\frac{w+bM}{r}\right)+\left(-\frac{xb}{r-\mu}+\frac{w+bM}{r}\right)\left(\frac{x}{xb}\right)^{y} \quad (3)$$

➔ When x $\to\infty$ (the corporation normally operates and generate positive value), the value of equity $E(x)=\left(\frac{x}{r-\mu}-\frac{w+bM}{r}\right)$is the present value of the revenue.

We have $\lim_{x\to\infty} E(x)=\left(\frac{x}{r-\mu}-\frac{w+bM}{r}\right)$ and $\lim_{x\to xb} E(x)=0$

When $x>x_b$, E(x)>0 since E(x) is the equity value of the corporation.

As stated above, the stockholders will try to choose the point of time that te equity value is max to hand in the bankruptcy order to the court. Denote debt value at time t $D(X_t)$ as:

$$D(X_t)=\max E_t\left(\int_t^{\tau b*} e^{-r(s-t)}bM\ ds+\int_{\tau b*}^{\tau c} e^{-r(s-t)}\ (X_s-w)ds+e^{-r(s-T)}C\right) \quad (4)$$

In which:

- $\int_t^{\tau b*} e^{-r(s-t)}bM\ ds$ is the present value of the bM before the liquidation time ($t<\tau_{b*}$).
- $\int_{\tau b*}^{\tau c} e^{-r(s-t)}\ (X_s-w)ds$ is the present value of the bank's income from the corporation from the time of legal document hand in to the real liquidation time ($\tau_{b*}<t<\tau_c$).
- $e^{-r(s-T)}C$ is the present value of the liquidation value.

$$D(x)=\frac{bM}{r}+\left(D|_{x<x_b}(x_b)-\frac{bM}{r}\right)\left(\frac{x}{x_b}\right)^{y} \text{ With } x_b<x \quad (5)$$

In which $\frac{bM}{r}$ is the present value of the interest,

$D|x < x_b(x) = \frac{x}{r-\mu} - \frac{w}{r} + \left(cM - \frac{x_c}{r-\mu} + \frac{w}{r}\right)\left(\frac{x}{x_c}\right)^y$ (6)

$x_c = \frac{y}{y-1}\left(cM + \frac{w}{r}\right)(r-\mu)$ (7)

➔ $\lim_{x\to\infty} D(x) = \frac{bM}{r}$ $\lim_{x\to x_b} D(x) = D|x < x_b(x_b)$

It can be seen that when the sales revenues go far from the liquidation level, the debt value will be the present value of the total interest. When the sales revenue reaches the liquidation level, the debt value will be the value of the debt after the liquidation: $D|x < x_b(x_b)$.

In equation (6), $\frac{x}{r-\mu} - \frac{w}{r}$ is the value that the bank receives after the liquidation (which equals the present value of the sales revenue minus the present value of the operation cost.) One of the most remarkable point here is that as $x=x_c$ then cM=C which means as the revenue reach the liquidation level of x_c, all the value that the bank can acquire is only liquidation value of the corporation.

As a consequent, the bank should pay attention to two value points of the sales revenue including x_b and x_c:

$x_b = \frac{y}{y-1}.\left(\frac{w+bM}{r}\right).(r-\mu)$

$x_c = \frac{y}{y-1}\left(cM + \frac{w}{r}\right)(r-\mu)$

and $y = \frac{1}{2} - \frac{\mu}{\sigma^2} - \sqrt{\left(\frac{\mu}{\sigma^2} - \frac{1}{2}\right)^2 + \frac{2r}{\sigma^2}} < 0$

with μ and σ are the mean and standard deviation of the revenue.

It is highly recommended for the commercial banks and the State Bank-Credit Information Centre with full data access in order to capture insolvency level of the corporations and after that, capture the time for liquidating the corporations based on the expected liquidation value. As the sales reach x_c, the bank can liquidate the distress corporations to acquire desirable liquidated value.

For the value of sales that play the role as a threshold under which the corporations may face the possibility of financial distress, we conducted the calculation for 500 corporations in the sample.

	Smallest	Largest	Mean	Standard Deviation	Skewness	Kurtosis
Actual Sales	218.00	73,393,403	1,279,053	3,996,982	11	166
Financial Distress Sales level	-30,548,784	2,531,415	60,745.98	752,090.50	-35	1,398

Appendix B: Artificial Intelligence in Financial Distress Prediction

The neural network model is a specific computer-based model consisting of an interconnected group of artificial neurons and processes information using a connectionist approach for computation. The pioneering applications of NN in financial distress prediction appeared in the early1990s (Tam, (1991 and 1992). Afterward, there were a wealth of researches on NN methods and the most popular used is the three-layer feed forward back propagation neural network (BPNN). The three layers include the input layer, hidden layer and the output layer The hidden layer determines the relationships between input and output layers and store them as weighs of the connection links. (Odom and Sharda, (1990); Chen and Du, (2009); Lin, (2009)). The probabilistic neural network which employs Bayesian decision-making theory based on an estimation of the probability density in data space is also widely used (Yang et al., (1999); Wu, Liang, and Yang, (2008)). Due to its ability to draw a strong mapping relationship between input and outputs based on the network structure, the neural network is usually considered to outperform statistical models such as MDA and Logit models with many research evidences (Valvo, Becerra, Abou-Seada, (2002); Liang and Wu, (2005); Zhang, Hu and Patuwo, (1999); Lesho, (1996)). It is obvious that NN can achieve higher accuracy than statistical models in the case where data does not satisfy the statistical assumptions since the statistical relations among variables are unnecessary to be considered. However, there is a requirement of far more data needed to be trained which easily leads to excessive duplication of training and overfitting, consequently contaminating the accuracy and stability of cross samples prediction. Furthermore, it seems to be a crucial drawback of neural network that the methods used in hidden layers are difficult to understand and communicate to the analysts without expert computation knowledge. In order to solve the problem, in 2011, Setiono et al. provided a novel approach to NN to easily generate concisely and suggested comprehensible classification rules for the users.

The evolution algorithms (EAs) are the "generic population-based meta-heuristic optimization algorithms. The EAs actually are rooted in the biological evolution including mutation reproduction, recombination, etc. In the research conducted in 1998 about the application of the EAs, in specific genetic algorithm in assessing insolvency risk, Varetto (1998) tried to produce the linear functions without any assumptions or restriction of the statistical methods. However, the result of the MDA still outperformed the computation methods. Later in research published in 2003, Kim and Han (2003) also used a genetic algorithm to mine the experts' qualitative insolvency prediction rules and realized that the coverage rate of that rules-based methods is relatively low. Recently, in new research conducted in 2011 widely cover neural network, genetic algorithm and MDA (2011), Rafiei et al proved that genetic algorithm performed lower accuracy than neural network. Besides the most popular one of a genetic algorithm, other EAs methods are also developed such as AntMiner + based on Ant Colony Optimization (Martens et al, (2010)), Particle Swarm Optimization, etc. However, most of the researches agree that EAs methods are more suitable to be combined with other classification algorithms methods for better prediction accuracy.

The rough set is another artificial intelligence technique to which the researchers pay attention to in predicting financial difficulties of the corporation. Their advantages of easily understandable rules, no statistical restrictions of the probability and fuzzy member and providing a combination of qualitative and quantitative variables are proved through the researches on specific cases; such as the research on the detailed sample of 80 Greek firms provided by Dimistras et al. (1999) or the study of Mckee on American data (2000). However, the rough set involves shortcoming unfixed structure and poor universality.

One of the most recent artificial intelligence methods is support vector machines (SVM). SVM is based on the structural risk minimization principle. According to Wang et al. (2005)), this computational method is really promising in financial distress prediction owing to its power of classification and function estimation. The implementation of SVM in predicting the distress events for South Korean corporations (Min and Lee, (2005)) and

Chinese listed firms (Ding et al., (2008)) suggested that SVM may outperform MDA, Logit and neural network methods. Compared to other methods such as Fisher MDA and quadratic MDA, SVM is also considered to be superior in predictive power (Gesel et al., (2010)). Similar to EAs, SVM is also usually used in hybrid or ensemble methods.

In general, despite the advantages of artificial intelligence methods, their predictive power compared to statistical methods is still questioned. According to the studies of Yobas et al (2000) in which the accuracy of the financial distress prediction of traditional statistical methods such as linear discriminant analysis was compared to computational intelligence techniques such as neural network, decision tree, and genetic algorithm, linear discriminant analysis is still superior to genetic algorithms and neural networks. The study of Fritz and Hosemann (2000) in which linear discriminant analysis was compared with genetic algorithms, artificial neural networks, M6 decision tree, and k-nearest neighbors decision rule also reached a similar conclusion. However, since the mentioned studies do not use the same training and test sets for experimenting with the different techniques discussed in the research, their conclusions are criticized. In 2005, Ong et al. observed that the standard genetic programming outperformed artificial networks, CART and C4.5 decision trees, rough sets and even logistic regression. Supporting for the artificial intelligence methods, in his researches conducting in 2006 and 2009 with the data supplied by Experian UK, Finlay suggested an evolutionary approach to the implementation of credit scoring models and concluded that genetic algorithms can perform as well as or marginally better than neural networks, OLS regression, and logistic regression. Similarly, as developing a combination model based on back propagation neural networks and genetic programming, Zhang et al. (2007) concluded that it could outperform any single classifier over the Australian and German databases.

Appendix C: Exposure at default and Loss Given Default

The risk premium is assigned to a particular customer in the same mechanism of the insurance fee as the borrowers are assigned a default probability and the value of risk premium is decided base on this source of information.

In the calculation related to the expected loss, the loss fraction which is also called the loss given default (LGD) and the fraction of loans' exposure which is also called exposure at default (EAD) is developed since the default risk contain both the uncertainty about the default and the exposure after the default as mentioned above. Along with the probability of default, the LGD and EAD are the important parameters to assess the credit portfolio. According to the New Basel Capital Accord (Basel II), each bank can develop its own estimates of these three parameters for their customers to reflect the nature of their portfolio. Generally, the loss of any obligatory is defined by the loss variable:

Ł= EAD x LGD x L (1.1) with the L= 1_D with the 1_D is Bernoulli random variable.

(We have to recall the Bernoulli trials. Bernoulli trials are a diagram of the probability theory based on independent tests, each test that can identify either a successful outcome or failure. The probability of an event will be determined by the permit distribution binomial. Mathematically, a test is described by a Bernoulli sample space/consists of two values, s is the "success" and f is the "failure". Therefore it is space form $\Omega = \{s, f\}$. A random variable X is defined in this sample space is a function $X : \Omega \mapsto \mathbf{R}$. In this case, simple random variable, defined by:

$$X(\omega) = \begin{cases} 1 & \text{if } \omega = s \\ 0 & \text{if } \omega = f. \end{cases}$$

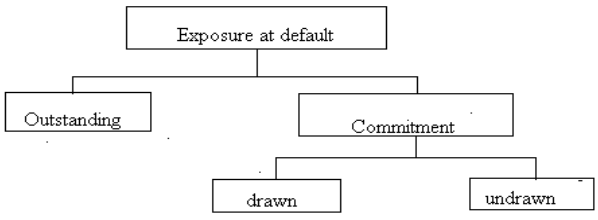
Therefore, in the formula above, we should underline the probability space (Ω, F, P) with the sample space Ω, a ∂-Algebra F and a probability measure P.) Since the expectation of any Bernoulli random variable is its event probability, the formula 1.1 can be developed to find the expected loss if the expected loss is defined as the expectation of its corresponding loss variable Ł. If the EAD and LGD is assumed to be constants, then:

Expected Loss= EL= Expected value of Ł= E (Ł) = EAD x LGD x P (D) = EAD x LGD x DP (1.2)

(With DP stands for Default probability). This is the normally used formula for calculating the expected loss of the borrowers with three parameters: Default probability, Exposure ate default and Loss given default

- **The Exposure at default**

The EAD specify the exposure that the creditor does have to the borrowers in the case of the borrower's default. In general, EAD includes the outstanding which refers to the portion of the exposure already drawn by the borrowers and the commitments which refer to the exposure the creditors (normally banks) has promised to lend the borrowers at their request. EAD is equal to the current amount outstanding in case of fixed exposures like term loans. According to the Basel Guidelines, EAD for commitments measures the amount of the facility that is likely to be drawn further if a default occurs. For revolving exposures like lines of credit, EAD can be divided into drawn and undrawn commitments; typically the drawn commitment is known whereas the undrawn commitment needs to be estimated to arrive at a value of EAD. Two popular terms used to express the percentage of the undrawn commitment that will be drawn and outstanding at default (in case of a default) are Conversion Factor (CF) [3] and Loan Equivalent (LEQ). Only the drawn commitments (prior to default) will actually contribute to the loss on the loan.



The EAD component

Calculation of EAD is different under the foundation and advanced approach. The natural form of the EAD is: **EAD= Outstanding + γ x Commitments (1.3)**

With the γ denotes the expected portion of the commitments likely to drawn prior to default. Therefore, γ can be considered to be the random variable capturing the uncertain components of the EAD. In the book of "Credit risk modeling"_ Chapman& Hall/CRC Press_2003, it is called the "utilization of the undrawn part of the commitments.

There are two ways of EAD calculation including the foundation approach and the advanced approach. The advanced approach is more flexible than the foundation approach since in the former approach, the Basel Committee on Banking Supervision permits the banks to use their own internal estimates of EAD while in the latter approach; the principle is guided by the committee.

Under the foundation approach, EAD is calculated taking account of the underlying asset, forward valuation, and facility type and commitment details. The value guarantees, collateral or security are not taken into account. In this approach, the committee proposes to define the EAD on commitments and revolving credits as 75% of off-balance sheet amount of exposure. On-balance sheet netting of loans and deposits of a bank to a corporate counterparty is permitted to reduce the estimate of EAD under certain conditions.

Under the advanced approach, although the banks are allowed to calculate their own EAD for their borrowers, a bank wishing to use its own estimates of EAD will need to demonstrate to its supervisor that it can meet additional minimum requirements pertaining to the integrity and reliability of these estimates. All estimates of EAD should be calculated net of any specific provisions a bank may have raised against an exposure. (*Basel II: Revised international capital framework*)

(Notice: Owing to the fact that the newest Basel_ the Basel III's implementation process is set to be 8 years since 2010 by the Union of Basel, in this thesis written in 2012, the issue used as a reference is Basel 2 which is widely accepted in Vietnam).

- **The Loss given default**

Generally, Loss given default (LGD) specifies the portion of loss the bank will really suffer in the case of default. This is an attribute of any exposure on bank's client. Exposure is the amount that one may lose in an investment. LGD is the credit loss incurred if an obligor defaults. Loss Given Default is facility-specific because such losses are generally understood to be influenced by key transaction characteristics such as the presence of collateral and the degree of subordination.

The LGD can also be defined as the (1 – recovery rate). Therefore, it can be obviously seen that the LGD is difficult to calculate because the recovery rate cannot be estimated straightforward. The recovery rate depends on many factors for example the quality of the collateral, the seniority of the banks' claim on the borrowers' assets as mentioned above.

Theoretically, the LGD is calculated in various ways but the most popular one is derived from the formula (1.2) above with the result comes from the expected loss and the EAD.

In Basel II, similar to the EAD, there are also two ways of LGD calculation including the foundation approach and the advanced approach. For the former approach, according to Basel II_ Basel II: Revised international capital framework (BCBS), we consider two important formulas:

Exposure without Collateral

Under the foundation approach, BIS prescribes fixed LGD ratios for certain classes of unsecured exposures:

- Senior claims on corporate, sovereigns and banks not secured by recognized collateral attract a 45% LGD.
- All subordinated claims on corporate, sovereigns and banks attract a 75% LGD.

Exposure with Collateral

The effective loss given default (LGD*) applicable to a collateralized transaction can be expressed as

LGD* = LGD x (E* / E) (1.4)

Where:

- LGD is that of the senior unsecured exposure before recognition of collateral (45%);
- E is the current value of the exposure (i.e. cash lent or securities lent or posted);
- E* should be calculated based on the following formula:

$E^* = \max\{0, [E \times (1 + He) - C \times (1 - Hc - H_{fx})]\}$ Where:

- E* = the exposure value after risk mitigation
- E = current value of the exposure
- He = haircut appropriate to the exposure
- C = the current value of the collateral received
- Hc = haircut appropriate to the collateral
- H_{fx} = haircut appropriate for currency mismatch between the collateral and exposure (The standard supervisory haircut for currency risk where exposure and collateral are denominated in different currencies is 8%)

Under the advanced approach, although the banks are allowed to calculate their own LGD for their borrowers, a bank wishing to use its own estimates of LGD will need to demonstrate to its supervisor that it can meet additional minimum requirements pertinent to the integrity and reliability of these estimates. All estimates of LGD should be calculated net of any specific provisions a bank may have raised against an exposure.

One problem is the comparison of LGD estimates (usually averages) arising from different time periods where differing default definitions have been in place. The following formula is used to compare LGD estimates from one time period x with another (y):

$LGD_y = LGD_x * (1\text{-Cure Rate}_y) / (1\text{-Cure Rate}_x)$ (1.6)

Therefore, it can be seen that the LGD refers to the expectation of the severity of default.

Appendix D: Brownian Motion

Call the assets A. The value of A given by a stochastic process is: A= $(A_t)t \geq 0$. Assume that A involves the geometric Brownian motion. Therefore, the process of asset values is the solution of the stochastic differential equation:

$$\mathbf{A_t - A_o = \mu_A \int_0^t A s ds + \sigma_A \int_0^t A s dB s}$$

With the $\boldsymbol{\mu_A}$ denotes the drift of A; $\boldsymbol{\sigma_A}>0$ denotes the standard deviation fo A and $(B_s)s \geq 0$ denotes the geometric Brownian motion. Applying the Itô's formula, we have the solution of the equation (1.13) is $\mathbf{A_t = A_0\ exp((\mu_A - 0.5\ \sigma_A^2)t + \sigma_A B_t)\ (t \geq 0)}$

According to the elementary calculus, the expotentional function $f(t)=f_0e^{ct}$ is the unique solution of the differential equation; $df(t)=cf(t)dt$; $f(0)=f_o$. From the equation 1.13:

$$\mathbf{dA_t = \mu_A A_t dt + \sigma_A A_t dB_t \text{ then: } \frac{A(t+dt)-At}{At} = \mu_A dt + \sigma_A dB_t}$$

Obviously, the geometric Brownian motion add some random noise to the exponential growth. Consequently, the process will involve some random walk instead of smooth function. From the equation (1.16), we can see that the return of A has the "linear" trend with the slope μ_A and volatility of σ_A. Therefore, the expectation and volatility function of the Geometric Brownian motion can be expressed by:

$$\mathbf{E[A_t] = A_o exp(\mu_A t)} \qquad \mathbf{V[A_t] = A_0^2 exp(2\mu_A t)(exp(\sigma_A^2 t) - 1)}$$

Appendix E: Black-Scholes-Merton model for default probability

- **The original Black-Scholes model for the European oprion pricing**

Call option: $\mathbf{c= S_tN(d_1) –Ke^{-rt}N(d_2)}$ Put option: $\mathbf{p=Ke^{-rt}N(-d_2)- S_tN(-d_1)}$

With $\mathbf{d_1= \frac{\ln\left(\frac{St}{K}\right)+ \left(r+\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}}$ $\mathbf{d_2= \frac{\ln\left(\frac{St}{K}\right)+ \left(r-\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}} = d_1-\sigma\sqrt{t}}$

Denotation: c_call price p_ put price K_strike price S_t_ spot price at t

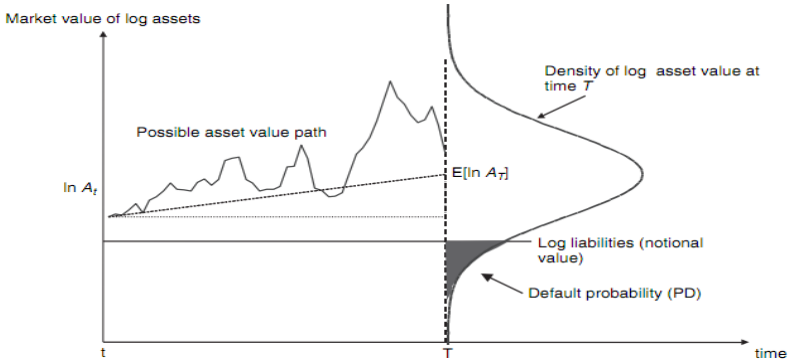
t_ time σ_ standard deviation r_ risk free rate N_ natural distribution

- **The original Black-Scholes-Merton model for default probability**

Recall the explanation in the above section, the equity of the corporation at the moment of time t is $\mathbf{E_t= e^{-rt}\ Exp[max(A-D;0)]}$ and the market value of the firm's asset follows the geometric Brownian motion **(Appendix 6)**: $\mathbf{dA_t= \mu_A A_t dt +\sigma_A A_t dB_t}$ in which μ_A is the expectation of the market value of the assets and σ is the standard deviation. As equity can be considered as the derivative in the assets with the strike price is the book value of total debt, apply the Black-Scholes equation for European call option:

$\mathbf{E_t= A_tN(d_1) –De^{-rt}N(d_2)}$ **(1.18) with** $\mathbf{d_1= \frac{\ln\left(\frac{At}{D}\right)+ \left(r+\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{(t)}}}$ $\mathbf{d_2= \frac{\ln\left(\frac{At}{D}\right)+ \left(r-\frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}} = d_1-\sigma\sqrt{t}}$

From the equation above, the d_2 can be derived if the A_t, σ_A, E_t and D. The $N(-d_2)$, as assume to be the normal distribution, can be calculated consequently and reflect the default probability of the corporation.



Default probability in Merton model

Since the debts of the company has different term to maturity, we have to simply D by assume that all the debts of the company are in total a debt with one term to maturity and constant interest by using the application from the Hsia model (1991): **$t = B_t/I$** with t is the term to maturity, **Bt** is the market value of the debt and I is the annual interest expense of the company. Since **B_t** is difficult to calculate due to the unsystematic information in Vietnam, the estimation for B_t is equal **(A_t-E_t)** with the assumption that the assets of the company involves only equity and debt. Therefore, **$D = B_t e = (A_t - E_t)e$ and $t = B_t/I = (A_t - E_t)e/I$.**

$$\Rightarrow E_t = A_t N(d_1) - (A_t - E_t)e^{1-r(\frac{Vt-Et}{I})} N(d_2)$$

with $d_1 = \frac{\ln\left(\frac{At}{(At-Et)e}\right) + (r + \frac{\sigma^2}{2})(\frac{At-Et}{I})}{\sigma\sqrt{\frac{At-Et}{I}}}$ $\quad$ $d_2 = \frac{\ln\left(\frac{At}{(At-Et)e}\right) + \left(r - \frac{\sigma^2}{2}\right)\left(\frac{At-Et}{I}\right)}{\sigma\sqrt{\frac{At-Et}{I}}} = d_1 - \sigma\sqrt{\frac{At-Et}{I}}$

Appendix F

Credit Immigration Possibility for Vietnamese Corporation 2011-2014

Basic materials (Code: 1000)

Table AF.1

Credit ratings immigration_ Basic materials industry

Number of corporations	2014	2013	2012	2011
AAA	6	3	3	6
AA	16	18	16	12
A	15	18	14	22
BBB	14	10	14	13
BB	8	8	9	7
B	3	5	5	2
CCC	0	1	1	1
CC	1	0	1	0
C	0	0	0	0

2011-2012

Number of changes

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	2	4	0	0	0	0	0	0	0
	AA	1	7	2	2	0	0	0	0	0
	A	0	5	9	6	1	1	0	0	0
	BBB	0	0	3	5	5	0	0	0	0
	BB	0	0	0	1	3	2	1	0	0
	B	0	0	0	0	0	2	0	0	0
	CCC	0	0	0	0	0	0	0	1	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	33.33%	66.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	8.33%	58.33%	16.67%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	22.73%	40.91%	27.27%	4.55%	4.55%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	23.08%	38.46%	38.46%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	14.29%	42.86%	28.57%	14.29%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2012-2013

Number of changes

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	1	2	0	0	0	0	0	0	0
	AA	2	10	1	2	1	0	0	0	0
	A	0	5	7	2	0	0	0	0	0
	BBB	0	1	8	4	1	0	0	0	0
	BB	0	0	1	1	3	4	0	0	0
	B	0	0	1	1	2	1	0	0	0
	CCC	0	0	0	0	1	0	0	0	0
	CC	0	0	0	0	0	0	1	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	33.33%	66.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	12.50%	62.50%	6.25%	12.50%	6.25%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	35.71%	50.00%	14.29%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	7.14%	57.14%	28.57%	7.14%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	11.11%	11.11%	33.33%	44.44%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	20.00%	20.00%	40.00%	20.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2013-2014

Number of changes

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	2	1	0	0	0	0	0	0	0
	AA	4	12	1	1	1	0	0	0	0
	A	0	3	6	8	1	0	0	0	0
	BBB	0	0	2	5	3	0	0	0	0
	BB	0	0	4	0	1	2	0	1	0
	B	0	0	2	0	2	1	0	0	0
	CCC	0	0	0	0	1	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	66.67%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	22.22%	66.67%	5.56%	5.56%	5.56%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	16.67%	33.33%	44.44%	5.56%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	20.00%	50.00%	30.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	50.00%	0.00%	12.50%	25.00%	0.00%	12.50%	0.00%
	B	0.00%	0.00%	40.00%	0.00%	40.00%	20.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Industrials (Code: 2000)

Table AF.2

Credit ratings immigration_ Industrials

Number of corporations	2014	2013	2012	2011
AAA	11	8	7	8
AA	40	25	27	31
A	21	29	22	23
BBB	34	31	27	45
BB	35	35	41	42
B	31	33	41	32
CCC	7	17	13	4
CC	2	3	4	0
C	5	5	4	1

2011-2012

Number of changes

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	4	4	0	0	0	0	0	0	0
	AA	3	19	4	4	1	0	0	0	0
	A	0	2	12	2	2	4	1	0	0
	BBB	0	2	6	14	13	10	0	0	0
	BB	0	0	0	7	17	12	4	2	0
	B	0	0	0	0	8	15	6	1	2
	CCC	0	0	0	0	0	0	2	0	2
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	1	0

Probability

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	9.68%	61.29%	12.90%	12.90%	3.23%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	8.70%	52.17%	8.70%	8.70%	17.39%	4.35%	0.00%	0.00%
	BBB	0.00%	4.44%	13.33%	31.11%	28.89%	22.22%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	16.67%	40.48%	28.57%	9.52%	4.76%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	25.00%	46.88%	18.75%	3.13%	6.25%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	0.00%	50.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%

2012-2013

Number of changes

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	1	0	0	0	0	0	0	0	0
	AA	1	7	4	0	0	0	0	0	0
	A	0	3	3	1	1	0	0	0	0
	BBB	0	0	5	3	2	2	0	0	0
	BB	0	0	0	6	5	0	2	0	0
	B	0	0	0	1	3	6	2	0	0
	CCC	0	0	0	1	1	1	0	0	0
	CC	0	0	0	0	0	0	0	1	0
	C	0	0	0	0	0	0	0	1	0

Probability

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	14.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	3.70%	25.93%	14.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	13.64%	13.64%	4.55%	4.55%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	18.52%	11.11%	7.41%	7.41%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	14.63%	12.20%	0.00%	4.88%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	2.44%	7.32%	14.63%	4.88%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	7.69%	7.69%	7.69%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	25.00%	0.00%

2013-2014

Number of changes

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	1	1	0	0	0	0	0	0	0
	AA	1	9	0	0	0	0	0	0	0
	A	0	5	6	0	1	0	0	0	0
	BBB	0	1	1	4	4	2	0	0	0
	BB	0	0	0	8	3	1	0	0	0
	B	0	0	0	0	6	3	0	0	0
	CCC	0	0	0	0	1	3	0	0	0
	CC	0	0	0	0	0	0	2	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	12.50%	12.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	4.00%	36.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	17.24%	20.69%	0.00%	3.45%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	3.23%	3.23%	12.90%	12.90%	6.45%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	22.86%	8.57%	2.86%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	18.18%	9.09%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	5.88%	17.65%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	66.67%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Consumer goods (Code: 3000)

Table AF.3

Credit ratings immigration_ Consumer goods

Number of corporations	2014	2013	2012	2011
AAA	10	10	7	8
AA	19	16	19	21
A	13	16	12	14
BBB	16	13	10	15
BB	4	6	12	9
B	5	7	9	4
CCC	2	1	1	0
CC	0	0	0	0
C	2	2	1	0

2011-2012

Number of changes

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	4	3	0	0	0	1	0	0	0
	AA	2	11	6	2	0	0	0	0	0
	A	1	3	3	4	3	0	0	0	0
	BBB	0	1	3	3	5	3	0	0	0
	BB	0	1	0	1	4	3	0	0	0
	B	0	0	0	0	0	2	1	0	1
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	50.00%	37.50%	0.00%	0.00%	0.00%	12.50%	0.00%	0.00%	0.00%
	AA	9.52%	52.38%	28.57%	9.52%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	7.14%	21.43%	21.43%	28.57%	21.43%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	6.67%	20.00%	20.00%	33.33%	20.00%	0.00%	0.00%	0.00%
	BB	0.00%	11.11%	0.00%	11.11%	44.44%	33.33%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%	25.00%	0.00%	25.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2012-2013

Number of changes

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	5	1	0	0	0	0	0	0	0
	AA	4	7	5	1	0	0	0	0	0
	A	0	3	8	0	0	0	0	0	0
	BBB	0	2	0	4	1	0	0	0	0
	BB	0	0	2	4	2	4	0	0	0
	B	1	0	0	1	2	3	1	0	0
	CCC	0	0	0	0	0	0	0	0	1
	CC	0	0	0	0	0	0	0	0	1
	C	0	0	0	0	0	0	0	0	1

Probability

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	71.43%	14.29%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	21.05%	36.84%	26.32%	5.26%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	25.00%	66.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	20.00%	0.00%	40.00%	10.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	16.67%	33.33%	16.67%	33.33%	0.00%	0.00%	0.00%
	B	11.11%	0.00%	0.00%	11.11%	22.22%	33.33%	11.11%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%

2013-2014

Number of changes

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	5	4	1	0	0	0	0	0	0
	AA	3	8	2	0	0	0	0	0	0
	A	2	4	6	2	1	0	0	0	0
	BBB	0	0	1	8	1	0	0	0	0
	BB	0	0	0	3	2	0	0	0	0
	B	0	0	0	1	0	5	1	0	0
	CCC	0	0	0	0	0	0	1	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	2

Probability

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	50.00%	40.00%	10.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	18.75%	50.00%	12.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	12.50%	25.00%	37.50%	12.50%	6.25%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	7.69%	61.54%	7.69%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	50.00%	33.33%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	14.29%	0.00%	71.43%	14.29%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%

Healthcare (Code: 4000)

Table AF.4

Credit ratings immigration_ Healthcare

Number of corporations	2014	2013	2012	2011
AAA	1	4	2	1
AA	10	4	5	4
A	1	2	3	7
BBB	2	4	5	0
BB	0	1	0	2
B	1	0	0	0
CCC	0	0	0	1
CC	0	0	0	0
C	0	0	0	0

2011-2012

Number of changes

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	1	0	0	0	0	0	0	0	0
	AA	1	3	0	0	0	0	0	0	0
	A	0	2	2	3	0	0	0	0	0
	BBB	0	0	0	0	0	0	0	0	0
	BB	0	0	1	1	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	1	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	25.00%	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	28.57%	28.57%	42.86%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2012-2013

Number of changes

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	2	0	0	0	0	0	0	0	0
	AA	1	3	1	0	0	0	0	0	0
	A	1	1	0	1	0	0	0	0	0
	BBB	0	0	1	3	1	0	0	0	0
	BB	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	20.00%	60.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	33.33%	33.33%	0.00%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	20.00%	60.00%	20.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2013-2014

Number of changes

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	1	3	0	0	0	0	0	0	0
	AA	0	4	0	0	0	0	0	0	0
	A	0	2	0	0	0	0	0	0	0
	BBB	0	0	1	2	0	1	0	0	0
	BB	0	1	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	25.00%	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	25.00%	50.00%	0.00%	25.00%	0.00%	0.00%	0.00%
	BB	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Customer services (Code: 5000)

Table AF.5

Credit ratings immigration_ Customer service

Number of corporations	2014	2013	2012	2011
AAA	7	4	6	4
AA	13	11	13	12
A	13	16	11	16
BBB	7	11	11	10
BB	4	1	4	2
B	1	3	2	3
CCC	2	1	0	0
CC	0	0	0	0
C	0	0	0	0

2011-2012

Number of changes

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	2	1	1	0	0	0	0	0	0
	AA	4	6	2	0	0	0	0	0	0
	A	0	4	5	7	0	0	0	0	0
	BBB	0	2	2	4	2	0	0	0	0
	BB	0	0	0	0	1	1	0	0	0
	B	0	0	1	0	1	1	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	50.00%	25.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	33.33%	50.00%	16.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	25.00%	31.25%	43.75%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	20.00%	20.00%	40.00%	20.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	0.00%	50.00%	50.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	33.33%	0.00%	33.33%	33.33%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2012-2013

Number of changes

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	3	3	0	0	0	0	0	0	0
	AA	1	6	4	2	0	0	0	0	0
	A	0	2	6	3	0	0	0	0	0
	BBB	0	0	6	4	1	0	0	0	0
	BB	0	0	0	1	0	3	0	0	0
	B	0	0	0	1	0	0	1	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	7.69%	46.15%	30.77%	15.38%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	18.18%	54.55%	27.27%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	54.55%	36.36%	9.09%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	25.00%	0.00%	75.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	50.00%	0.00%	0.00%	50.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2013-2014

Number of changes

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	2	2	0	0	0	0	0	0	0
	AA	4	6	1	0	0	0	0	0	0
	A	1	5	8	2	0	0	0	0	0
	BBB	0	0	4	4	2	0	1	0	0
	BB	0	0	0	1	0	0	0	0	0
	B	0	0	0	0	1	1	1	0	0
	CCC	0	0	0	0	1	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	36.36%	54.55%	9.09%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	6.25%	31.25%	50.00%	12.50%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	36.36%	36.36%	18.18%	0.00%	9.09%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Utilities (Code: 7000)

Table AF.6

Credit ratings immigration_ Utilities

Number of corporations	2014	2013	2012	2011
AAA	5	2	2	2
AA	9	10	8	9
A	5	7	8	7
BBB	4	3	6	5
BB	1	2	0	1
B	0	0	0	0
CCC	0	0	0	0
CC	0	0	0	0
C	0	0	0	0

2011-2012

Number of changes

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	0	2	0	0	0	0	0	0	0
	AA	2	5	1	1	0	0	0	0	0
	A	0	0	5	2	0	0	0	0	0
	BBB	0	1	2	2	0	0	0	0	0
	BB	0	0	0	1	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	22.22%	55.56%	11.11%	11.11%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	0.00%	71.43%	28.57%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	20.00%	40.00%	40.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2012-2013

Number of changes

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	0	2	0	0	0	0	0	0	0
	AA	2	6	0	0	0	0	0	0	0
	A	0	2	5	1	0	0	0	0	0
	BBB	0	0	2	2	2	0	0	0	0
	BB	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	25.00%	75.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	25.00%	62.50%	12.50%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2013-2014

Number of changes

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	1	1	0	0	0	0	0	0	0
	AA	4	6	0	0	0	0	0	0	0
	A	0	2	5	0	0	0	0	0	0
	BBB	0	0	0	3	0	0	0	0	0
	BB	0	0	0	1	1	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	40.00%	60.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	28.57%	71.43%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Financials (Code: 8000)

Table AF.7

Credit ratings immigration_ Financials

Number of corporations	2014	2013	2012	2011
AAA	0	0	0	0
AA	16	14	15	9
A	15	18	17	13
BBB	24	17	15	20
BB	14	12	15	22
B	6	10	10	12
CCC	1	1	3	1
CC	0	2	2	0
C	1	3	0	0

2011-2012

Number of changes

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	0	0	0	0	0	0	0	0	0
	AA	0	6	2	0	1	0	0	0	0
	A	0	6	5	1	1	0	0	0	0
	BBB	0	1	5	9	2	1	2	0	0
	BB	0	2	4	4	7	5	0	0	0
	B	0	0	1	1	4	4	0	2	0
	CCC	0	0	0	0	0	0	1	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	0.00%	66.67%	22.22%	0.00%	11.11%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	46.15%	38.46%	7.69%	7.69%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	5.00%	25.00%	45.00%	10.00%	5.00%	10.00%	0.00%	0.00%
	BB	0.00%	9.09%	18.18%	18.18%	31.82%	22.73%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	8.33%	8.33%	33.33%	33.33%	0.00%	16.67%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2012-2013

Number of changes

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	0	0	0	0	0	0	0	0	0
	AA	0	8	4	0	0	0	0	0	0
	A	0	4	6	4	0	0	0	0	0
	BBB	0	0	3	4	5	0	0	0	0
	BB	0	0	0	6	4	2	0	0	0
	B	0	0	1	1	1	5	0	1	1
	CCC	0	0	0	0	0	1	0	0	1
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	0.00%	53.33%	26.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	23.53%	35.29%	23.53%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	20.00%	26.67%	33.33%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	40.00%	26.67%	13.33%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	10.00%	10.00%	10.00%	50.00%	0.00%	10.00%	10.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	33.33%	0.00%	0.00%	33.33%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2013-2014

Number of changes

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	0	0	0	0	0	0	0	0	0
	AA	0	8	3	1	1	0	0	0	0
	A	0	4	5	5	0	0	0	0	0
	BBB	0	0	6	9	0	0	0	0	0
	BB	0	0	0	4	5	1	0	0	0
	B	0	0	0	0	6	2	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	1
	C	0	0	0	0	1	2	0	0	0

Probability

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	0.00%	57.14%	21.43%	7.14%	7.14%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	22.22%	27.78%	27.78%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	35.29%	52.94%	0.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	33.33%	41.67%	8.33%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	60.00%	20.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	50.00%
	C	0.00%	0.00%	0.00%	0.00%	33.33%	66.67%	0.00%	0.00%	0.00%

Technologies (Code: 9000)

Table AF.8

Credit ratings immigration_ Technologies

Number of corporations	2014	2013	2012	2011
AAA	0	0	0	1
AA	3	4	5	1
A	5	3	1	4
BBB	3	3	5	4
BB	2	3	2	3
B	0	0	0	0
CCC	0	0	0	0
CC	0	0	0	0
C	0	0	0	0

2011-2012

Number of changes

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	0	1	0	0	0	0	0	0	0
	AA	0	1	0	0	0	0	0	0	0
	A	0	2	1	1	0	0	0	0	0
	BBB	0	0	0	2	2	0	0	0	0
	BB	0	1	0	2	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2012								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2011	AAA	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	50.00%	25.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	0.00%	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	33.33%	0.00%	66.67%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2012-2013

Number of changes

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	0	0	0	0	0	0	0	0	0
	AA	0	4	1	0	0	0	0	0	0
	A	0	0	1	0	0	0	0	0	0
	BBB	0	0	0	2	3	0	0	0	0
	BB	0	0	1	1	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2013								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2012	AAA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	0.00%	80.00%	20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	0.00%	0.00%	40.00%	60.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

2013-2014

Number of changes

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	0	0	0	0	0	0	0	0	0
	AA	0	2	2	0	0	0	0	0	0
	A	0	0	2	1	0	0	0	0	0
	BBB	0	1	1	1	0	0	0	0	0
	BB	0	0	0	1	2	0	0	0	0
	B	0	0	0	0	0	0	0	0	0
	CCC	0	0	0	0	0	0	0	0	0
	CC	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0

Probability

		2014								
		AAA	AA	A	BBB	BB	B	CCC	CC	C
2013	AAA	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	AA	0.00%	50.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	A	0.00%	0.00%	66.67%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%
	BBB	0.00%	33.33%	33.33%	33.33%	0.00%	0.00%	0.00%	0.00%	0.00%
	BB	0.00%	0.00%	0.00%	33.33%	66.67%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CCC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CC	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Appendix G

Future research

Further studies should be conducted for each individual small industry and for different economic regions in Vietnam in order to analyse the difference among industries and economic regions. Therefore, the influence of industry-specific factors and region-specific factors can be incorporate in the model.

Future study should also consider indicators for credit ratings for the commercial banks besides non-bank corporations. Since the financial structures of the banks are different, and the information related to the commercial banks is limited, the research cannot conduct an analysis of the determinants of credit ratings issued for Vietnamese commercial banks.

Future studies should be conducted for the bank-firm analysis if the related data and information are available since the influence of credit market structure, the concentration of the bank-firm relationships and the effects of relationship lending might remarkably influence corporate credit ratings.

Future studies should expand the sample size in order to achieve higher accuracy level. In this research, the sample includes only 500 corporations in the period of four years. Further exploration of time line and number of corporations involve is needed to promote the propriety of the research results.

Suggestion for future research on relationship lending effects

It is obvious that lending is both the main source of income for commercial banks and an important source of finance for non-financial corporate firms. In the developing countries due to the nascent stage of the development of financial markets, bank lending is the dominant source of external funding for non-financial corporate firms. Due to this close relationship, it is possibly essential to examine the effects of the bank related issues on

the firms' financial distress besides the usual sources of financial distress on the corporate firms.

Despite the fact that firms can access the financial support from different kinds of sources and financial institutions, bank loans still play an important role in increasing the firm value. In his study published in 1985, Farma examined this issue in the context of the uniqueness of the banks in serving function of financial intermediation. The observations showed that the customers were more willing to pay the price to maintain a banking relationship. In spite of the fact that only certificates of deposits (CD) are subjected to reserve requirements, it still serves as a competitive instrument and pays similar returns to commercial paper (CP) and bankers acceptances (BA). Since CDs are in effect costlier than CP and BA, banks will charge their borrowers a higher rate than the borrower can access through the direct financing in the CP and BA market. As a result, Farma concluded that there must be something special about the banks that serve as the motivation for the borrowers to pay higher rates. He also expressed the idea that if the bank is not special and has no uniquely attractive characteristic, other non-bank financial institutions that are not subject to reserve requirement would charge a lower rate and attract all the customers from the bank. Explaining this uniqueness, Farma offered a reason that banks enjoyed the insider position, for example having the membership on the board of directors and supervision of the borrower in its decision process or getting access to the special sources of information about the borrowers. He also pointed out that since bank loans are close to being last in terms of priority of the claim on the borrowers' assets in case of bankruptcy, the approval of a bank loan may be able to send a signal of safety to the market which in turn creates a certification effect reducing the cost of information collection to other fund supplier and hence the cost of fund to the customers. The argument about information priority of the bank was also confirmed by the study produced before by Diamond in 1984 in which banks were considered to enjoy the advantage over outsider lender since they know more about the borrowers. In 1987, James provided a test on the issues raised by Farma using the event study methodology of

the proposition that if banks have some unique information about the borrowing firms, announcements of bank loans should add market value to the firms. Since the observations of bank loan announcements to non-financial firms in the Wall Street Journal from 1973 to 1984 do generate a positive and significant effect on the stock values of the borrowing firms while the announcements of private placements produce negative and insignificant effects and the announcements of public debt offer negative and significant effects, it can be indicated that there are differences among the effects of funds through bank loans, private placements, and public offerings with the bank loans containing more valuable information.

The arguments of James, however, was challenged by Lummer and Mc Connell (1989) in which they question the point of time the banks can acquire the advantage over the outsider lenders in term of borrowers' creditworthiness. The finding is that when a bank enters new credit agreements, they have no advantage over outsider lenders. Overtime, however, they gradually become the insiders for approaching many sources of information that the outsiders cannot. The similar issues were also raised by Carey, Post and Sharpe (CPS, 1998)) as they investigated whether the relationship lending is limited to banks. They found that banks and financial companies are only specified by risk, and two types of intermediaries are equally likely to finance info-problematic borrowers. The specialization along risk lines is also found and hold by Denis and Mihov (2003).

It can be seen from the literature that due to the specific approach of banks to firm's information; the bank can assess the credit worthiness as well as predict the financial distress to the corporations based on the information of the firms themselves. However, there is a gap in the banks' assessing procedure that is, the procedure ignores the effects of the issues related to the banks themselves to the financial distress possibility of the corporations. In this research, the influence of credit market structure, the concentration of the bank-firm relationships and the effects of relationship lending will be considered.

1. The influence of credit market structure on the firm's financial distress possibility

The credit market structure is a specific terminology with a wide scope. In this research, we concentrate on the market concentration, in other words, the competition in the loan markets. It is clear that higher competition in credit market can lead to the high possibility of unequivocally to the welfare benefits. The literature about the credit market structure and the competition among financial intermediaries is rich. However, it seems to be limited to the stability banking sectors. The link between the competition among banks to the financial distress possibility of the firms, in this case, the borrowers of the banks, is still vague, indirect and do not provide unequivocal theoretical guidance on the directions of the effects. The empirical studies on this relationship are rare in the literature.

One line of the argument is that as the increasing competition among banks can lead to the increasing rate of financial distress for the borrowers, even the default risk possibility. In the research on deposit insurance, risk and market power in 1990, Keeley stated that increased competition might have reduced the banks' incentives to act prudently with regard to risk taking. Therefore, the assessment and control process to the projects of the borrower may be less carefully produced which consequently leads to the higher possibility of financial distress. In support of this argument, in the research conducted in 1994 concerning the bank-firms relationship, Peterson and Rajan offered the idea that the competition not only draws riskier applicants due to the adverse selection effect but also influences borrowers to choose riskier applicants due to the incentive or moral hazard effect. In the later research also conducted by Petersen and Rajan in 1995, the monopolistic bank was found to experience the higher possibility of offering more credit and at lower rates to immature or distressed firms compared to other types of creditors. They also pointed one incentive of helping those types of firms at difficult moments is to build up and maintain the relationships in the future in order to prevent the customers from going to the competitor banks. However, the banks cannot expect the firms' surplus shortly and will be forced to charge a higher premium to cover the risks which may lead to the excessive burden to the firms and increase the possibility of financial distress. The

issue of banking competition was also concerned in the research conducted by Hellman et al. in 2000. He considered the increasing competition among banks as the consequence of financial market liberalization. The competition, according to Hellman, will erode profits; lower profits imply lower franchise values which lead to lower incentives for making good loans, increasing moral- hazard problems. The insufficient control and monitoring process from the banks will allow corporations to find it desirable to gamble. Similarly, in their book concerning comparison among different financial systems, Allen and Gale (2000), found that competition among financial intermediaries may be undesirable because it can undermine the intermediaries' ability to provide inter-temporal smoothing as well as increasing the possibility of financial distress of the borrowers. Repullo (2003), in his study about market power and risk-taking in banking, confirmed that bank competition eroded the present value of banks' future rents and reduced their incentives to behave prudently which led to the higher possibility of financial distress of the borrowers after receiving the fund from banks.

Despite the fact that a large body of evidence shows a positive relationship (though indirectly) between banking competition and the financial distress possibility of the firms, counter arguments are also abundant. One of the influential studies is the research featuring moral hazard on the part of entrepreneurs based on a model of bank risk taking designed by Boyd and De Nicolo (2005). In their research, the authors pointed out that the declining competition in the market created incentives for the banks earning more rents in loans market by charging higher loan rates using their market power. As a consequence, the borrowers will have to confront with higher interest costs which lead to lower profits and the possible result of adjusting the business in riskier investments. The issue of competition among banks can lead to socially undesirable outcomes in the forms of failures, runs and panics as a result of moral hazard (as stated in Stiglit and Weiss, (1981)). The prediction of the mentioned model was explored and supported by the later empirical research of Boyd et al. in 2006. A further study on the risk-shifting effect identified in the research of Boyd and De Nicolo (2005) besides the model was explored

by Repullo and Martinez- Miera (2007) by allowing imperfection correlation across individual firms' default probabilities. They proved that the risk-shifting effect tended to dominated in the monopolistic credit market whereas the competitive markets experienced more with the margin effect. Another research conducted by Koskela and Stenbacka in 2000 proved that greater competition among banks could lead the corporations to remain solvent and repay their loans. Lending support to this conclusion, De Nicolo and Loukoianova (2007), in a study related to the bank concentration in which the bank ownership was taken into account, suggested a positive and significant relationship between the credit market competition and the risk of failure. The negative link between the bank competition and financial distress possibility of the corporations is also drawn in the study of Jimenez et al. in 2007 in which the link between these variables was tested to find out whether it is U-shaped or linear.

Since there is a certain degree of confusion in the discussion of the relationship between banking market competition and corporate financial distress, it is hard to conclude whether the rising level of banking competition leads to higher or lower levels of corporate financial distress.

2. The influence of lending concentration relationships on the firm's financial distress possibility

In addition to the structure of the credit market that is mentioned above, the concentration in the lending relationship between bank and firm can also significantly affects the financial distress possibility of the corporations. While early empirical studies on the number of bank relationship reached the conclusion that firm normally obtain a large fraction of their debt from single intermediary (Peterson and Rajan, (1994), Harhoff and Korting, (1998) for example); the recent works on firms provide that corporations' findings can come from substantial number of banks (Ongena and Smith, (2000), Brunner and Krahmen, (2006), Machauer and Weber, (2001), Farinha and Santos, (2002)). Therefore, the heterogeneous multiple bank financing and its relationship to the financial

distress possibility of the firms has received scant attention in both theoretical and empirical literature.

In the literature, some researchers support the idea that the concentrated lending relationship can reduce the default possibility of the firms. The first argument raised is that the higher concentration lowers the monitoring costs of the bank and consequently encourages the monitoring and screen procedure of the banks that reduces the possibility of financial distress of the borrowers. Studying about the lenders-entrepreneur relationship, Harris-Raviv (1979), Holstrom (1979), and Shavell (1979) supported this idea and stated that continuously monitoring additional information about an agent will help resolve moral hazard problems. Similarly, in a study developing a theory of financial intermediation based on minimum cost production of information useful for resolving incentive problems, Diamond (1984) showed that lowering the cost enhance bank monitoring and screening which Schumpeter (1939) assigned such a "delegated monitoring" role to the bank. Furthermore, the concentrated bank-firm relationship also allows corporations to signal their willingness of refraining from the credit risk (Bannier, (2007)). In specific cases, relationship with just one bank helps to create a climate of trust and consolidate the relationship over time, thus giving the firm the benefit of reliable financing (Mayer, (1994)) as well as strengthening the monitoring ability of the bank to firms hence reducing the fragility in the firms' balance sheet and lower the default risk of the firms (Foglia et al., (1998)). A further relationship with a bank, it has been argued, is much less risk of an enormous increase in interest rates during tight credit period (Conigliani et al., (1997a, b). Therefore, it is believed that holding a concentrated banking relationship can help to reduce the possibility of potential coordination failure arising among creditors as the borrowers facing the financial distress (Gertner and Scharfstein, (1991); Morris and Shin, (2004)). It is a great benefit since such coordination failure can lead to takeover failures (Grossmann and Hart, (1980)), or bank runs (Diamond and Dybvig, (1983), Morris and Shin, (1999)).

On the other hand, a significant number of studies reject the benefit of concentrated lending to the reduction of financial distress to the borrowers. Various studies concur that a large number of lending relationship leads to lower average borrowing costs for the corporations than more concentrated ones (Sapienza, (1997); D' Auria et al., (1998)). The study of Bris and Welch in 1996 also showed that a large number of creditors reduced the possibility of default for the borrower and compromised creditors' collection abilities. "Given a fixed level of debt, a distressed firm with a million uncoordinated small creditors is less likely to be forced to pay its obligation than a firm with one creditor." Therefore, it can be predicted that firms can be more likely to face financial distress as they have a single creditor (Hart and Moore, (1998)). Additionally, in normal time, multiple banking may well be well beneficial since it alleviated the hold-up risk inherent in single-source bank loans (Rajan, (1992)). Multiple banking is also able to protect the debtors against the sudden liquidity deterioration of the bank (Detragiache, Garella and Guiso, (2000)) and solve the moral hazard problem underlying the basic borrower-lender relationship hence reduce the incentive for the borrower to default strategically (Bargman and Callen, (1991), Rajan, (1992), Bolton and Scharfstein, (1996)). Lending support to this idea, Brunner, and Krahner, (2008) found that the formation of bank pools increased the likelihood of success for the borrowers. Another explanation for the benefit of multiple fund resources is the reduction of liquidity risk, in the sense of Diamond (1991)), is considered to be the risk that a profitable project will have to be prematurely liquidated. If the firm experience the concentrated bank loan relationship, as the bank tightens the credit lines, the investment projects may be terminated. Consequently, it can be said that multiple lenders benefits the borrowers with the diversification and hence reduce liquidity shock (Detragiache et al., (2000)). The insurance against liquidity risk for the corporations is more effective if it can have heterogeneous bank loans relationships (Elsas et al., (2004)). This asymmetry across multiple creditors may also provide the signal to indicate that the corporations have more valuable and redeploy-able assets (Guiso and Minetti, (2004)). In some research, the dark side of the concentrated banking relationship is criticized for the rise of certain monopoly power and the potential

ability of the bank to extract rents as the borrowers are tied to the bank. If the hold-up problem is too severe, theory predicts the choice of a multitude of lenders hence reduces their bargaining power and avoids the renegotiation of debt contract (Dewatripont and Maskin, (1995), Von Thadden, (1992)).

3. The effects of the two sides relationship between bank and firm on the financial distress ability of the firm itself

In section 2, the relationship between the corporation and its multiple creditors is discussed. The question raised in the second section is to identify the optimal number of creditors involved in the lending relationship and the concentration level of the lending which minimize the financial distress possibility of the borrower. The main point of this section is that we are going to look at the single relationship lending between bank and firm. In other words, section 2 focuses on the lending relationships among corporations and its lenders, Section 3 focuses on the relationship lending.

Relationship lending is defined as a long-term implicit contract between a bank and its debtor. The obvious benefits of relationship lending include inter-temporal smoothing, credit availability, payoff enhancement and efficient decision making in distress situation (Fischer (1990), Sharpe, (1990), Rajan, (1992), Peterson and Rajan, (1995)). In many empirical works, the duration of the bank-borrower relationship is used as the proxy for relationship lending since it reflects the relationship intensity over time (Petersen and Rajan, (1994), Berger and Udell, (1995), Ongena and Smith, (2001)). The accumulation of duration can show the tie-up of the creditor-borrower relationship. Furthermore, the switching costs and the essential of hold-up problem are also reflected by duration. However, as concerned by Diamond (1991), the relationship between creditor and borrower is not monotonic since it takes the time to establish the accumulated duration and the value of the previously observed information as well as the marginal value of additional information may decrease after some time. Opposed to the idea that duration provided the degree of severity of the borrower lock-in, Ongena and Smith's result

(2001) showed that the higher probability of relationship termination associates with longer duration and the shortest relationships are observed from the small, young and highly levered firms. Similarly, Houston and James (2001) also considered firm's specific characteristics such as market to book ratio, firm size and business risk as the indicators for relationship banking assessment.

The relationship lending, obviously, is difficult to be assessed since the relationships that the corporation involves are private information except for the exclusive relationship. However, the fact that exclusive lending is neither a necessary nor a sufficient condition for relationship lending eases the value of this information. Holmstrom and Tirol (1997) proved that in order to prevent the moral hazard of the borrower to ensure the low possibility of financial distress, only a fraction of the fund need to come from a monitoring lender and the rest can be financed by other intermediaries in the credit market. Different form financial statement lending which places most emphasis on the information from the firm's financial statements or asset based lending in which the decisions principally based on the quality of the collaterals, in relationship lending, the decisions is substantially base on the proprietary information about the firm and its owners over time. The information is collected from the provisions of loans (Petersen and Rajan, (1994), Berger and Udell, (1995)) or through deposits and other financial products (Nakamura, (1993), Cole, (1998), Degryse and van Gayseele, (2000)). Remarkably, the total information gathered over time has enormous value compared to the firm's financial statements, collateral or credit score which help the relationship lender deal with the financial distress problem much better than other lenders. Apart from the duration, alternative measurement of relationship lending in empirical research also include the existence of the relationship (Cole, (1998)), the breadth of multiple services and accounts provided by Bank (Nakamura, (1993), Cole, (1998), Scott and Dunkelberg, (1999)), exclusive of the relationship (Ferri and Messori, (2000), Machauer and Weber, (2000), Berger,Klapper and Udell, (2001)), the involvement of main bank (Elsas and Krahnen, (1998)), the mutual trust in the relationship (Harhoff and Korting, (1998)).

Considering the single lending relationship between bank and firm, one noticeable research on monopoly lending with the basic of real option following Mella Brral and Perraudin (1997) conducted by Takashi Shibata and Tetsuya Yamada (2009).

Following the research of Agostino, M., Gagliardi, F. and Trivieri, F.(2012), the relationship between banks and corporations can be tested through regression model with the variables:

-Dependent variables: FDP of the corporation

_Key independent variables:

-The market structure presented by DHHI (Herfindahl-Hirschman Index for main banks) and BHHI (Herfindahl-Hirschman Index for banks' branches)

- ln of debts provided by the main banks that issue most credit to the corporations.

-Number of firm-bank relationships of the corporation.

_ Control variables may include:

-Duration of the firm's lending relationship with the bank.

-ln of the assets (to measure the size of the corporation)

-age of the corporation

-Short-term debts/ total assets

-Long-term debts/ total assets

-ln of total bank debts

-Tangible assets/ Total assets

-Cash Flow/Total assets

_Dummy variables may include:

-Pure manufacturing industry or not

-State-owned corporations or not

-specialized suppliers or not

The ln GDP can be included to reflect the economic condition.

Since the Vietnamese bank related information is still confidential for non-legal entity approach and it is illegal for an individual researcher to approach, the research cannot conduct the test in detail. However, it is highly recommended for the commercial banks and the State Bank-Credit Information Center with full data access in order to capture the full relationship between banks and firms and hence to be able to issue more accurate credit ratings.