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Determinants of Priority Interest Rates for Securities Based on Non-Performing Loans in Chinese Commercial Banks

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Abstract

In this thesis, asset-backed securitization (ABS) refers to the securities that are introduced based on an asset pool which a group of non-performing loans (NPLs), which lack of liquidity, but own expected cash flows that generated by NPLs. The securities are transformed to be for-sale and run in the financial market through structural restructuring. As we all know, the pricing of ABS for NPLs is complicated and difficult. And Chinese four largest state-owned commercial banks have more and more serious problems in NPLs. Therefore, disposing of NPLs is an urgent issue in China. But Chinese economic development is so rapid it remained many threats in the NPLs due to a policy problem, economic structure, and Chinese special status. What's more, the history of securitization in China is short. There is no enough experience and technology to price the securities based on NPLs reasonably. In order to research the pricing problem for ABS of NPLs, this thesis would like to explore the determinants of affecting priority interest rate for senior tranche because of realizing these problems. It aims to provide the direction and method of pricing in the further securitization process. In this thesis, the multivariate regression analysis model is to qualitatively analyze the relevant factors affecting the priority interest rate of the securities which is based on NPLs. The thesis concludes that the determinants of affecting the priority interest rate for senior tranche based on NPLs are: whether it is the first issuance, whether it is state-owned enterprise, the ratio of the issued amount to the pooled amount and the ratio of the number of loans to the number of borrowers. There are negative correlations between the priority interest rate and each determinant except for the ratio of the issued amount to the pooled amount. In addition, this thesis described a linear equation between the priority interest rate and these four determinants. The article also comes up with one question that there are still some other determinants of affecting the priority interest rate. What's more, these determinants are also important role in affecting the priority interest rate.

Executive Summary

Since mortgage-backed securities were first issued in the US toward the latter part of the 1970s, credit asset securitization has developed rapidly in many countries around the world and become one of the most important financial tools at the end of Twentieth Century. From international environment since the 1980s, western countries, which represented by the US and the UK, and eastern countries, which represented by South Korean and Japan, deregulated in the financial market. asset-backed securitization (ABS) refers to the securities that are introduced based on an asset pool which a group of non-performing loans (NPLs), which lack of liquidity, but own expected cash flows that generated by NPLs. The securities are transformed to be for-sale and run in the financial market through structural restructuring. And then financial innovation has become an inevitable trend. The rapid growth in credit asset securitization may be attributable to the fact, which is able to increase business management measures and diversify credit risk. ABS also plays an active role in multiple functions such as connecting the credit and capital markets, advancing healthy growth in the capital markets, and other aspects.

Chinese four largest state-owned commercial banks have more and more serious problem in NPLs. Therefore, disposing of NPLs is an urgent issue in China. But Chinese economic development is so rapid it remained many threats in the NPLs due to a policy problem, economic structure, and Chinese special status. What's more, the history of securitization in China is short. There is no enough experience and technology to price the securities based on NPLs reasonably. Therefore, China started the credit asset securitization pilot in 2005 but subsequently halted due to the subprime crisis. And since 2012, the regulators restart securitization of credit assets, China's securities market grew rapidly, by the end of November 2015, the total amount of all types of credit asset securitization products issued was more than 50 billion RMB according to WIND database. With the rapid development of Chinese credit asset securitization market, investors are also deepening the awareness of the risks and benefits of securitization products. But on the contrary, China's pricing methods for the securitization products are still primary, and there is a gap between the risk assessment system of developed countries and China. This research is based on the background of the rapid development of the securitization of credit assets. It analyzes the determinants of

affecting the priority interest rate of the securities of NPLs. What's more, all the securities have been issued in the Chinese financial market.

This thesis mainly introduced the background, the significance, the definition of ABS and its operating process and so on. The core part is about the determinants of affecting the priority interest rate of the senior tranche for NPLs through multivariate linear regression model. And then the thesis would derive the linear relationship between the priority interest rate and the determinants. For the entire financial market, it will improve the role of financial products of ABS in optimizing the allocation of capital resources of the whole society, which has certain application value. In addition, based on the empirical results, the corresponding policy recommendations for the development of ABS in China are proposed to facilitate the healthy development of ABS.

After regression analysis, the thesis concludes that the determinants of affecting the priority interest rate for senior tranche based on NPLs are: whether it is the first issuance, whether it is state-owned enterprise, the ratio of the issued amount to the pooled amount and the ratio of the number of loans to the number of borrowers. There are negative correlations between the priority interest rate and each determinant except for the ratio of the issued amount to the pooled amount. In other words, the issuance of the securities for NPLs is more than one time, its corresponding priority interest rate is lower; the securities with state-owned enterprise have more guarantee and higher credibility because the government-owned enterprise has enough funds to support its operations and the probability of bankruptcies is lower. The risks are relatively lower. The securities are more secure, and the priority interest rate is lower; the smaller the number of borrowers and the more loans, the more the number of loans per capita, which means that the greater the span, the smaller the concentration and the higher the degree of dispersion. So, the risk is small, and then the interest is low, that is, the priority interest rate is low. There is a positive correlation between the priority interest rate and the ratio of the issued amount to the pooled amount. The lower the issued amount or the higher the amount of the asset pool, the higher the probability to get a benefit for the investors who own the securities, that is, a higher probability of redemption. In other words, the higher the ratio of the issued amount to the pooled amount, the higher the risk of

investment. And then the investors will receive more interest, so the priority interest rate will be higher.

As for constant, its value is large and much larger than the coefficients of other determinants. Here the article comes up with one question that there are still some other determinants of affecting the priority interest rate. What's more, these determinants are also important role in affecting the priority interest rate. However, Due to the lack of data, this study cannot completely analyze the regression analysis of each factor. Therefore, at this point, this thesis suggests further research should consider or focus on other determinants. Other determinants can be guarantee method of loans, location of enterprise, industries of enterprise and the purpose of the loan, etc. These are just referencing. The thesis hopes later scholar and researcher do more work on those.

There are still some regrets on this research. This research cannot do too much work on other determinants due to lack of data. This thesis would like to research other determinants: guarantee method, location of enterprise, industries of enterprise and the purpose of the loan and so on. But this thesis has to give up for these determinants as a result of a lack of data. Another regret is that this thesis also wants to research the specific pricing process of ABS for NPLs through capital asset pricing model (CAPM). And then the thesis proposes a specific and feasible method to price ABS for NPLs. But lack of data also breaks my thoughts. So here the thesis just provides some suggestions to research ABS for NPLs. If China wants to obtain breakthrough progress in disposing of NPLs, it still needs to do a large number of works on it. China still has a long path to go in ABS for NPLs in order to dispose of NPLs efficiently.

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I. Introduction

In this thesis, asset-backed securitization (ABS) refers to the securities that are introduced based on an asset pool which a group of non-performing loans (NPLs), which lack of liquidity, but own future cash flows that generated by NPLs. The securities are transformed to be for-sale and run in the financial market through structural restructuring. For banks, ABS is one of the most important financial instruments for banks to raise funds outside the balance sheet. However, there is no better way to define the issuance rate (or the coupon rate) of ABS products. Therefore, the thesis would like to research the determinants of affecting the senior rate for a senior tranche of securities. For the financial practitioner, if it is impossible to judge the coupon rate of the securities, it means that the ABS cannot be a financing tool with a predictable financing interest rate; for institutional investors, it is impossible to judge the fair value of a securitized product. it is also impossible to judge whether its value is overvalued or undervalued, which affects investment decisions in turn. This thesis intends to analyze the factors affecting the issuance rate (or senior rate) of ABS products (refer to NPLs) and uses the multivariant regression model to explore determinants of the priority interest rate for senior tranche and derive the linear relationship between the priority interest rate and the determinants. For the entire financial market, it will improve the role of financial products of ABS in optimizing the allocation of capital resources of the whole society, which has certain application value. In addition, based on the empirical results, the corresponding policy recommendations for the development of ABS in China are proposed to facilitate the healthy development of ABS.

1.1. Background

With the quick growth of the economy, the scale of Chinese commercial banks (CCBs) is also expanding rapidly. Commercial banks (CBs) play a vital role in economic development. But the problem of non-performing loans (NPLs) always influences the operation and the fast growth of the Chinese banking industry. CCBs used to lower NPL ratios and the Chinese government tried to reduce the balance of NPLs by establishing four state-owned asset management companies (AMCs). However, in recent years, both the balance and ratio of NPLs started to rise again. Since 2012, Chinese macroeconomic growth slowed down; the profits in some industries declined. The five-level classification of loans exacerbated the rise of non-

performing loans; the pace of interest rate liberalization accelerated. these reasons result in the growth of NPL ratio and the balance. Financial supervision is becoming stricter. As a result of the changes in these political and economic environments, the balance of loans of commercial banks has grown substantially more than doubled between 2012 and 2017. The continuous expansion of commercial banks and the grows of total loans cause growth in the balance of NPLs. Moreover, the huge growth in five years (2012-2017) still catch the attention of regulatory authority.

Figure 1 plots the magnitude of NPLs of state-owned commercial banks in China. Thanks to the global financial crisis in 2008, the balance of the four largest state-owned commercial banks is 406 billion RMB, accounting for 11.95% of the total balance of loans. In 2017, the balance is up to 762 billion RMB, accounting for 6.65% of total loans. NPL ratio increases from 4.3% in 2012 to 6.65% in 2017, as the balance of NPLs, it has grown annually. It shows that the rapid growth of NPLs cannot be just explained by economic development and rapid growth of total loans, the issue of NPLs in CCBs is really getting worse and worse.

NPLs OF COMMERCIAL BANKS IN CHINA

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Amount of NPL	405,736	352,657	298,866	292,210	297,797	326,453	431,788	633,191	762,783	761,519
Proportion of NPL	11.95	7.67	5.52	4.75	4.30	4.31	5.13	6.85	7.32	6.65
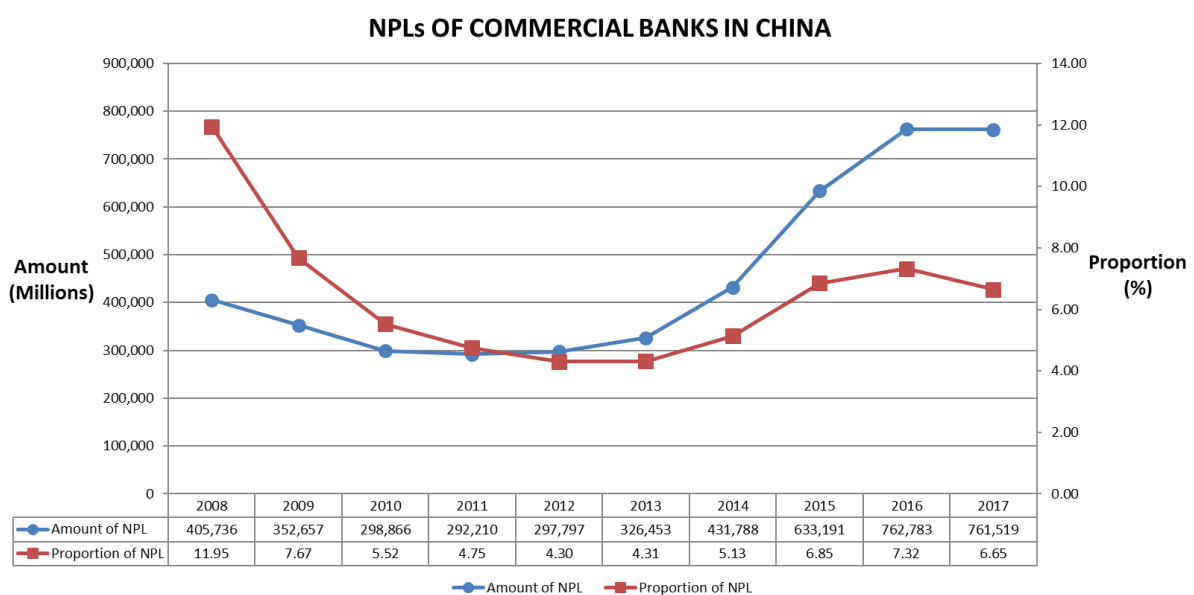
Figure 1. Changes in the Balance and Proportion of NPLs

Note: This figure plots the balance(millions) and proportion (%) of NPL of commercial banks in China from 2008 to 2017. Source: the original data is from annual financial report[1] of four-largest SOCBs[2] in China.

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[1] http://www.icbc-ltd.com/ICBCLtd/Investor%20Relations/Financial%20Information/Financial%20Reports/
http://www.abchina.com/en/investor-relations/performance-reports/annual-reports/
[2] http://www.boc.cn/en/investor/ir3/
http://www.ccb.com/cn/investor/report/annual_report_1.html

Securitization has opened a new way to dispose of NPLs in China's banking industry. Asset-backed securitization (ABS) is the process of issuing securities on the capital market based on the expected cash flows generated by an asset pool, which is credit enhancement or rating. Then the cash flow is allocated to a different tranche, namely, senior, mezzanine and equity tranche. Each tranche has a different proportion of total assets and a different rate of return. Generally speaking, the senior tranche accounts for most of the total asset, almost above 80% of the total asset amount (Hull, 2015). Therefore, senior tranche is the most important part among securitization products and affects the whole value of the securities. The aim of this thesis is on the research of determinants of affecting senior interest rate (priority interest rate) for the senior tranche.

ABSs refer to assets that lack liquidity but are with predictable cash flows in the future. A pool of assets is formed through centralized packaging according to common characteristics. Securitization for NPLs is an advanced marketization method to dispose of NPLs in developed countries, from which China's financial institutions and regulators have been learning. China started ABS pilot in 2005 but subsequently halted it due to the subprime crisis. Gradually, as to address the problem of NPLs in commercial banks, China restarted the pilot project for asset-backed securitization (ABS) of commercial banks in 2012 (Yin, Zhang and Zhang, 2018). But the pricing of ABS for NPLs has always been a core issue because it is directly related to costs and benefits of the issuer and the investors. Its pricing process and calculations are also much more complicated than the pricing of normal ABS. The pricing of ABS for NPLs is related to too many complex factors, such as the structure and design of asset pools, risk factors and so on. Asset-backed securities for NPLs in China generally are divided into three tiers: senior tranche, a mezzanine tranche, and equity tranche. What's more, senior tranche is the most important one and plays a leading role in the pricing process of securities based on NPLs. Knowing factors determining priority interest rate is the first step for the pricing in order to get the value of priority interest rate. This study will emphasize on determinants affecting the priority interest rate.

1.2. The significance of the research

Many developed countries such as the United States, South Korean and Japan, all carried out

ABS projects. What's more, developed countries have controlled their problem of NPLs to a large degree through ABS and reduced many financial risks. The facts prove that securitization for NPLs is one of the effective methods for the marketization disposal of NPLs (Ren, 2003). Since the start of the pilot project for securitization for NPLs, CCBs have developed their securitization business. By the end of 2017, China has had the largest number of securitization issuance and the largest funding amount via securitization among joint-stock banks (Yin, Zhang and Zhang, 2018). But there are still many problems and obstacles in affecting the progress of asset-backed securitization of CBs. the most important point is the pricing of securitization for NPLs as the above part mentioned. The most important points of pricing are determining the determinants of expected return rate of the senior tranche because it is the main entity of issued securities. Therefore, the research of asset-backed securitization has a great significance in exploring marketization disposal methods of NPL and speeding the development of securitization.

1.3. Financial innovation becoming an inevitable trend

From international environment since the 1980s, western countries, which represented by the US and the UK, and eastern countries, which represented by South Korean and Japan, deregulated in the financial market. The environment for financial innovation is more liberal and the motivation is stronger. However recently financial innovation for NPLs occurred in respective countries with a development trend. ABS for NPLs promoted financial system transform and triggered a financial service revolution. The entire financial market, financial structure and operation mechanism took place to a varying degree. It has caused huge influence on economic development among the entire environment. What's more, the problem of NPLs became worse and worse and now Chinese banking industries are in important development and transition period. Therefore, financial innovation is crucial for Chinese banking industries.

1.4. Research content and its structure

This thesis aims to research the determinants of the priority interest rate for a senior tranche of the securities based on NPLs in Chinese commercial banks. This thesis would like to research the purpose of loans, guarantee method for the loan, location as well as industries as

determinants of the priority interest rate. But this study will focus on pooled amount, issued amount, the number of loans, the number of borrowers, whether the first issuance, whether state-owned enterprise and percentage of senior tranche as research entities. This study will apply a multivariate linear regression model to explore the relationship between selected research entities and priority interest rate. Regarding the content structure, the thesis will be written by the following structure:

Section 1 will precisely introduce the background, the significance, and research content and its structure. Section 2 will review domestic and abroad literature, and describe the definition securities for NPLs, causes, and categories of loans in China, and huge harm of the study. Section 3 mainly studies the ABS overview. Section 4 will focus on methodology. It is about problem statement, the objective of the study, the introduction of model and hypotheses. Section 5 is about results and regression equation according to SPSS. Section 6 and section 7 are discussion and conclusion respectively.

II. Literature review

2.1. The history[3]

To clarify the implemented reason of NPLs of Chinese state-owned banks, this research first has to study them by putting it to the background of total economic system reform. NPLs of state-owned commercial banks (SOCBs) occurred as the transition process from a planned economy to a market economy. A full understanding of the historical reasons, which resulted in NPLs from SOCBs, is good to analyze the causes of NPLs. NPLs from SOCBs in China approximately has gone through four stages:

The first stage was before 1983[4]. In this period the reform just has begun. Basically, China is still a planned economy. SOCBs operate exclusively by Chinese government totally formulated a national economic plan. They do not have market competition and the concept of commercial banks. At that time the function of banks was small and no loan autonomy. Moreover, the bank is not responsible for the recovery of loans, so basically, no NPLs was reformed.

The second stage was between 1984 and 1990, Market economy has begun to develop gradually in this period. Various professional banks and several joint-stock banks were established. The credit relationship between banks and enterprises formulate, what's more, it introduced a business concept. The transition from Grant to loan as an important reform measure played a huge role in the process of Chinese transition from a planned economy to a market economy. Meanwhile, it also caused many NPLs of SOCBs.

The third stage was between 1991 and 1999. This period is the peak for the huge growth of NPLs of SOCBs. On the one hand, many credit loan funds flowed into real estate and the stock market because of China's economy happened bubble in 1992. The governance was implemented in 1993 and then the bubble burst. A small part of losses was borne by the investors, the other and quite more part of losses was reflected in the balance of banks and the financial institution, therefore, many NPLs was formed. On the other hand, a part of state-

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[3] https://en.wikipedia.org/wiki/1990s_Chinese_bank_restructurings
[4] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2505450

owned enterprise cannot adapt to market competition and be in the status of shutting down and turning in the process of transition from planned economic system to market economic system. What's more, there has been lots of bankruptcy within the country with the acceleration of pilot reform of China's state-owned enterprises in 1997. In addition, many local governments have protected the local enterprises from maliciously evading the debts to maintain their own benefit, it also caused worse the increase of NPLs.

The fourth stage was between 1999 and the present. The Chinese government started to pay more attention to the problem of NPLs in SOCBs and adopt many policies and measures after learning from the Asian financial crisis. It aimed at solving the new NPL and the historic NPLs. In this period China's NPLs has been improved significantly due to a series of policy support and bank reform. Both the number and the proportion of NPLs have been decreased continuously over 5 years since 2002(Wu, 2012).

2.2. The definition of securities for non-performing loans (NPLs) and the scope of the thesis

Before the thesis defines the securitization of NPLs, this thesis will introduce what a non-performing asset is. All in short, the bank's NPA refer to assets that banks cannot achieve expected returns under realistic conditions. The credit assets of commercial banks in China generally adopt two classification methods. One is to classify according to the repayment period and it focuses on the time value of loans. The other is to classify according to the borrower's solvency ability and its focus on the economic value of the loan. Countries with developed banking industry generally adopt the second classification method. According to annual financial reports of Chinese commercial banks, this method divides loans into five categories (see figure 2):

1. Normal, the borrower can perform the contract and can repay the principal and interest 100%.

2. Concerns, although the borrower can perform the contract, in the case of unfavorable financial situation and the unfavorable situation continues, the repayment ability may be reduced. As a result, it will become the bank's non-performing assets.

3. Substandard, the borrower's repayment ability and mortgage guarantee are not enough to

repay 100% of the loan, and the bank assets have obvious loss probability.

4. Doubtful, it is impossible for the borrower to repay the entire loan, and the bank cannot avoid a certain loss of principal and interest.

5. Loss, the bank's principal and interest are basically unable to recover. The latter three types of loans are called non-performing loans, i.e. non-performing assets of banks. The non-performing assets of state-owned commercial banks in China mainly refer to non-performing loans.
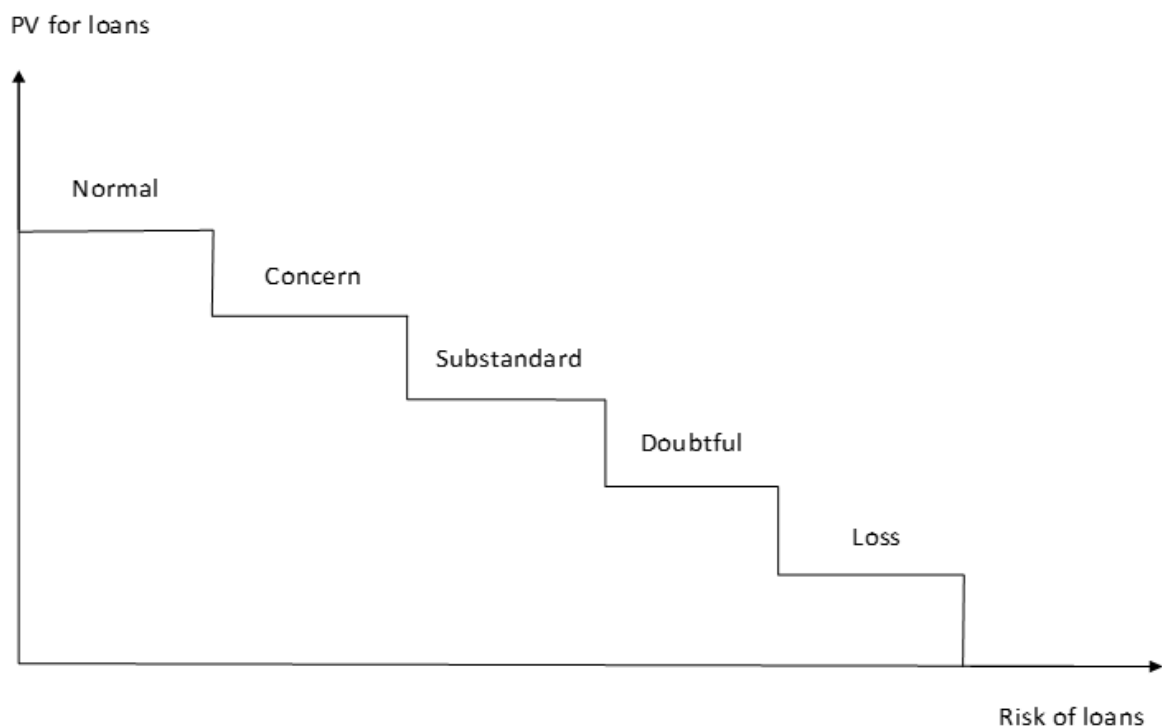
Figure 2. PV of loans under five-level loans and its risk
Note: this figure is self-made according to classification concept of Chinese loans.

Because most NPAs in China is generated by the four major state-owned commercial banks, this thesis will mainly research their NPAs. NPAs is relatively difficult to handle, especially those NPAs which accepted by AMCs. In addition, this thesis initiates that other shadow banking channels should be restricted, and commercial banks should be encouraged to conduct the asset securitization business to activate credit assets and improve the efficiency of capital financing (Yin, Zhang and Zhang, 2018).

2.3. The special status and characteristics of asset-backed securitization in China

2.3.1. The characteristic of ABS in China

Chinese asset-backed securitization started relatively late. In addition, there are many problems in China's securities market. There are also special characteristics of asset-backed securitization in China (Wu, 2012)：

1. The quality of service of financial intermediaries is bad, and the operation of credit rating agencies is not standardized.

2. The operation process of Chinese securities issuer lacks regulatory and norm.

3. China's current relevant laws are not complete

4. The external environment of non-performing asset securitization of commercial banks in China needs further development

These factors have seriously hindered the pace of Chinese securitization of NPAs. The progress of securitization of NPAs not only require the continuous researches from scholars but also need the stability and regulation in the securities market. with the vigorous promotion of the regulatory authorities and active participation of financial institutions in the securitization, recently China's ABS has experienced rapid development and continuous breakthrough. But some difficulties still exist in the pricing of the securities. This thesis will specifically research the determinants of the priority interest rate.

2.4. Foreign and domestic research status

In this thesis, the research on the priority interest rate is emphasized on its determinants when asset securitization products are issued. Its determinants are whether the first issuance, whether the state-owned enterprises, the number of borrowers, the number of loans, the proportion of priority products, the issued amount and the pooled amount, etc. These factors are theoretically inferred to have an impact on the pricing of securitized products. This section will summarize the research result of various Chinese and foreign researchers on securitization products from its definition and pricing or priority interest rate. It will be helpful for studying the determinants of the issuance interest rate.

Traditional banking operating mode is absorbing deposits and issuing loans. In the 1960s, with

the increasing demand for housing mortgage loans, American banks found that the traditional model could not keep pace with the problems. The situation leads to the development of the mortgage-backed securities (MBS) market. Various types of mortgage loan portfolios are generated, and their cash flows (interest and principal) are packaged into bonds for sale to investors. The US government established the Government National Mortgage Association (GNMA, also known as Ginnie Mae) in 1968. Ginnie Mae guaranteed repayment of the interest and principal of the eligible housing loan on time and issued the mortgaged securities to the investor. In the 1980s, securitization developed by the mortgage market was applied to other assets, such as US auto loans and credit card receivables. Securitization has become more and more popular in other countries of the world. With the continuous development of the securitization market, investors are slowly beginning to accept securities without default guarantees.

2.4.1 The source and definition of ABS

US investment banker Lewis S. Rannieri is the first person in using the term "asset-backed securitization" in 1977. Since then, "asset-backed securitization" has spread rapidly in the world. With the continuous expansion of its scale, more and more related products have appeared, and its connotation and definition have been continuously enriched and improved. The meaning of ABS has the distinction between narrow concept and broad concept. James A. Rosenthal and Juan M. Ocampo (1988) argue that broad ABS refers to "all asset portfolio phenomena with securities as a medium". Gardener (1991) holds a similar view with them, and he believes that ABS is a process and tool that enables savers and borrowers to partially or completely match through financial markets. what's more, ABS break the closed market reputation provided by banks or other lending institutions and open it in the financial market. The narrowly defined ABS is more specific and more directional. David A. Walker (1988) argues that ABS is a tool for transforming illiquid assets into financial products, which are tradable in capital markets. Christine A. Pavel (1989) defines asset-backed securitization as: "Dividing a collection of loans into securities for sale to investors, compared to the sale of a whole or a portion of loans, the same thing is that the original holder of the loan can be provided with a source of funds, and the original holder of the loan can remove the asset from the balance sheet; the difference is that the securitization has greatly increased its Liquidity and flexibility

for small scale credit assets that are difficult to sell directly. Frank J. Fabozzi (1996), which is "father of securitization" of the US and professor from Yale University, gives the definition: "the process of creating security secured by assets." The definition of "the father of securitization" by Yale University professor Frank J. Fabozzi (1996) is: "The process of creating security backed by assets". Definition of Shanker & Collettad: ABS refers to a voucher of equity or claims that represent a certain interest or its guarantee, which is derived from property or property collection that has independent and predictable cash flows. The transaction structure is designed to reduce or diversify the risks of owners of these basic assets during the holding period or the sale period and to make these assets more market-oriented and improve their liquidity.

In the related research in China, Li (2001) refers to the direct financing methods of issuing stocks, bonds, commercial papers, etc. in the financial market as "traditional securitization" or "primary securitization"; Collecting assets and other assets are grouped together to form an asset pool, and technical treatment is carried out to issue securitized products to the financial market to achieve market transactions, The form of financing is called "asset-backed securitization"; also known as "secondary securitization". There are also scholars who define ABS from a legal perspective. For example, Huang (2002) believes that ABS is a system that converts the property rights, which lack liquidity, into the ownership of capital securities by creating and constructing legal relationships between the participating entities. For the definition of asset securitization, From the financial perspective, it emphasized the principle of capital flow and the way of financing, while the legal perspective emphasizes the real sale and risk isolation. At present, the Chinese mainstream view is that an asset securitization is a form of financing for issuing tradable securities with the support of specific asset portfolios or specific cash flows. It includes the identification, transfer and integration of the underlying assets into an asset pool, and then splits and reorganizes the cash flow of the asset pool and releases it on the market through public or non-public means. Regarding the definition of asset securitization, James A. Rosenthal & Juan M. Ocampo (1988) argued that asset securitization is a process of restructuring and transformation that allows loans and receivables to be sold in the form of securities. Ge (2005) believes that asset securitization refers to the bank as a promoter let credit assets, which lacks liquidity but is able to generate predictable and stable cash flow, restructure to form asset pools, and then separate and

redistribute risk and benefit in the pool, and then dividing them into securities that can be circulated in the market, this is the process of re-financing.

2.4.2. Foreign research status

Credit spread can be understood as the difference between the yield to maturity corresponding to fixed return securities and the yield to maturity corresponding to risk-free bonds of the same term. The following is a breakdown of the common credit spread pricing model into two main genres. The first genre is a structural model. The structured model is based on the option pricing theory which priced the bonds, the structured model links the default probability of the bonds with the fair value of the company's assets, and gradually relaxes the assumptions that are inconsistent or simplified with reality. The purpose is to find out a pricing formula that fits well with actual data.

Merton (1974) based on the option pricing model of Black and Scholes (1973), applied the idea of no-arbitrage pricing to bond pricing and regarded corporate bonds as derivatives of corporate assets. The corresponding credit spread pricing model is derived under risk-neutral conditions.

Collin-Dufresne, Goldstein and Martin (2001) used linear regression models to study the changes in credit risk factors for credit spreads. Campbell and Taksler (2003) studied how credit risk factors determine the level of credit spreads. Cremers, Driessen, Maenhout and Weinbaum (2008) studied the impact of stock option volatility on corporate bond credit spreads. Ericsson, Jacobs and Oviedo (2009), Zhang, Zhou and Zhu (2009) measure credit spreads based on credit default swaps.

The liquidity of fixed-income securities refers to the marketability of fixed-income securities with a low transaction cost, a short trading time and no change in the asset price of fixed-income securities. Conversely, the liquidity risk of fixed income securities refers to the risk that the fixed income securities will not be completed and sold at the required time.

When Amihud and Mendelson (1986) studied transaction costs, they explored the liquidity premium at equilibrium prices of asset pricing. Studies have shown that liquidity risk leads to

investors' expected return differences. Chen, Lesmond and Jason (2007) have confirmed that liquidity risk can partly explain the level and change of credit spreads and is a significant component of credit spreads. Christian and Andre (2015) pointed out that loan securitization in Europe is a composite decision based on bank-specific as well as market- and country-specific determinants. What's more, these determinants change when separately investigating securitization transactions during the pre-crisis and crisis period. Moreover, other results show that determinants of loan securitizations in Europe depend on the transaction type, the underlying asset portfolio and regulatory and institutional environment under which banks operate. Nahid also researched determinants of NPLs in commercial banks in 2015. His research suggested that interest rate, GDP, bank's loan supervision capacity and economic condition influence the level of NPLs.

Yin, Zhang and Zhang (2018) examine the determinants of commercial banks' loan securitization in China. The paper finds the real determinants of Chinese banks' securitization include cost advantage exploitation, performance promotion and capital regulatory arbitrage. What's more, it concludes that China's loan securitization market welcomes large state-owned commercial banks with higher ratings rather than small- and medium-sized banks with poor asset quality. Therefore, this thesis would like to focus on State-Owned Commercial Banks in China for the study of non-performing loans securitization. In the meantime, it points out that banks' securitization businesses increase with the high profitability factor and low cost/low-risk factor and that securitization businesses decrease with high capital adequacy factor and high loan risk factor. The overall findings from this study indicate that other shadow banking channels should be restricted, and commercial banks should be encouraged to conduct the asset securitization business to activating stock credit assets and improve the efficiency of capital financing.

2.4.3. Domestic Research Status

In China, the situation of China's securitization market has just started, various pricing methods have not yet matured. The focus of this domestic scholar-related research is on the pricing of the underlying assets transferred from the issuer to the SPV and the pricing of the final issuance and circulation of the securitized products in the securitization process. For the

composition of the asset pool, the price at which the loan promoter transfers or sells the asset to the SPV is determined. This thesis will introduce the progress of securitization since starting securitization and research result in China. And it is about the determinants of pricing for ABS and senior interest rate for senior tranche, and the impact of liquidity risk or credit spread on the priority interest rate.

Jiang (2004) focuses on the transaction costs, and the price determination should be negotiated to avoid a higher transaction fee when the assets are transferred. Feng (2005) believes that the price of the asset transfer should be determined by considering the term structure of the interest rate. First, the loan holder needs to know the time limit for the sale of the loan. On this basis, they should choose a benchmark interest rate and the term structure of the interest rate and combine other risks to compensate the interest rate. From the perspective of the development of asset securitization, in developing countries where the capital market is not yet mature, the credit asset transfer pricing of banks often adopts a government-led approach and applies negotiated pricing methods. If there are differences between the two parties on the pricing results, it is also possible to introduce profit sharing mechanisms and other methods of distributing income; in the capital markets of developed countries, the secondary market for credit asset transfer is more developed, Therefore, the pricing method is mainly dominated by the market, and often adopts the discounted cash flow discount method and the risk classification algorithm.

Fang, Liang, Wang and Zhang (2010) studied the factors affecting the liquidity risk of China's inter-bank bond market. The research shows that the liquidity of China's bond market is affected by many factors at domestic and abroad; among them, domestic money supply, International major exchange rate fluctuations and international capital costs are the main influencing variables of the bond market liquidity,

Peng, Xu, Yang and Zhou (2011) studied the impact of macroeconomic uncertainty on the valuation of corporate bond credit risk has an important effect. Wu (2012) believes that bond pricing can be transferred to the recently issued bonds of the market for reference, and then adjusted according to market demand for changes in yield when it is difficult to find a direct and explicit quantitative relationship. He and Shao (2012) established a time series analysis

for the changes in the credit spread of corporate bonds in China during the subprime mortgage crisis and analyzed the relationship between bond spreads and liquidity indicators. The research shows that liquidity risk has been integrated into China's corporate bond credit spreads.

Zhang (2013) studied the pricing factors of corporate bonds issued by city investment companies, which mainly engaged in municipal construction, and established a regression model. It pointed out CPI, money supply M2, stock market index, GDP per capita, Shibor (Shanghai Interbank Offered Rate) and various micro factors such as bonds Credit rating, issuance size, issuance maturity, special terms, credit enhancement measures, and lead underwriters are the main pricing factors, and it is pointed out that there is a big difference between the distribution spread model of general corporate bonds.

Li and Han (2014) established a linear regression model and found that only risk-free interest rate has a limited impact on the interest rate of RMB bond issuance in Hong Kong, the default risk and Liquidity risk has not been significantly affected among the three major factors of risk-free interest rate, default risk and liquidity risk. Huang, Huang, Huang and Wang (2015) analyzed the impact of liquidity risk on corporate bond spreads through studying proxy variables of liquidity risk, such as income volatility, bond issuance, bond trading and bond age. This is made by establishing a regression model.

Jiang (2016) studied this research that is different from traditional quantitative methods. Firstly, he determined the determinants of the ABS coupon rate based on the determinants of the coupon rate of fixed income securities; Secondly, assuming some correlations between an ABS coupon rate and the DCM pricing curve from NAFMII (National Association of Financial Market Institutional Investors) or the province where the insurer is from, and then construct a linear regression model. The research results show that the linear regression model has good fit and prediction, therefore, will be of meanings in the application.

Xu (2016) extracted the current priority and sub-priority credit asset-backed securities issued in China and made OLS regression analysis of the premium portion of its coupon rate relative to the risk-free rate (one-year bond yield). The analysis shows the factors affecting the coupon

rate of China's credit asset securitization products within the framework of the hypothesis of the research, which is mainly risk-free interest rates, the rating of securities, the maturity and the asset size of the sponsoring institution.

2.5. Asset-backed securitization is a "double-edged sword"-advantage and disadvantage

There are five advantages in the securitization for NPAs:

1. Securitization of non-performing assets not only effectively reduce the liquidity risk of commercial banks, but also enable the commercial bank to obtain and timely stable cash flow, and develop new business, and improve the efficiency of commercial bank funds.

2. Securitization of non-performing assets can disperse and transfer default risk, interest rate risk, inflation risk, policy risk, all these risks exist in supply and demand.

3. For some long-term and high-risk credit businesses of commercial banks, asset-backed securitization can release the related-funds. What's more, the obtained funds can be invested in securities with high liquidity, such as finance and national debt. Moreover, it is able to efficiently decrease the ratio of the high-risk asset in asset structure and increase the leverage effect of assets. Furthermore, it obtains larger profits in less capital.

4. After the securitization of non-performing assets, the difference between original deposit and loan, and the continued service fee will be converted into intermediate income to optimize the income structure of commercial banks after deducting the income of the paying investor and related fees intermediary.

5. It increases the flexibility of non-performing assets to transfer loans from the balance sheet through sales. If commercial banks reduce the debt, the ratio of assets to liabilities can be improved; if investing in other assets, the asset-liability management requirements can be realized by optimizing the asset structure.

Disadvantages:

It is difficult for banks with high-risk exposure to conduct asset securitization businesses for managing credit risk. However, information on fundamental assets is not transparent to investors. Therefore, for the investors, judging the risk of asset-backed securities can only rely on the originating bank's reputation (Yin, Zhang and Zhang 2018)

2.6. Why studying securitization for NPLs again?

Why this thesis continues studying securitization of NPLs, the reasons can be explained in the following three points.

Firstly, judging from the effectiveness of the disposal of NPAs by four major AMCs in China, the efficiency is not good, and the pricing is in a status of random and simple, and the recovery rate of asset is low. Securitization for NPLs is a new way of disposing of NPLs, which can greatly improve the efficiency and benefits of AMCs disposal, and at the same time, it is helpful to solve the problem with the high proportion and amount of NPLs of SOCBs in China.

Secondly, the thesis investigated various types of literature, it is easy to know that the researches from other scholars have not deeply involved the determination of asset value and the problem for securities pricing. Therefore, this paper conducts in-depth research and discussion on the core issues of China's securitization of NPLs: asset pricing, the establishment of SPV and operation, credit enhancement, etc. The quick implementation of Chinese securitization for NPLs has played a certain role in promoting.

Thirdly, asset-backed securitization is a systematic project; what's more, it requires the simultaneous improvement and matching of various factors, such as policy system, legal environment and market conditions. Policies aimed at strengthening information disclosure in asset securitization businesses and increasing information transparency will reduce possible adverse selection problems in the asset securitization market and allow high-risk banks to participate in asset securitization businesses (Yin, Zhang and Zhang, 2018). The thesis aims at letting securitization can achieve satisfactory results in China. At the same time, since China's securities market has not developed for a long time, it is still not standardized. How to effectively deal with NPLs by securitization should be further deepened, revised, improved and developed. As Yin, Zhang and Zhang (2018) said, In China, a key problem related to asymmetric information is that the rating agencies have low public credibility. Thus, it is necessary to improve rating efficiency and the credibility of rating agencies.

III. Asset-backed securitization overview

3.1. ABS overview

3.1.1. the definition of ABS

The definition given by the US Securities and Exchange Commission is that: Asset-backed securitization is mainly supported by cash flow, which is provided by a pool of receivables or other financial assets, what's more, cash flows are guaranteed by terms for converting into cash and having the necessary rights in a limited period. the security may also be securities backed by assets that can provide income to the securities holder through the terms of service or with appropriate distribution procedures.

At present, normally definitions used by domestic scholars are: Asset-backed securitization refers to the securities that lack liquidity, but own future cash flows that integrated by assets like receivables. The securities are transformed to be for-sale and run in the financial market through structural restructuring. It is also the process of financing.

3.1.2. Basic conditions for ABS

Almost any existing asset can be securitized, but from the experience of asset-backed securitization for more than 20 years, the assets that are used for securitization operations, which generally have the following characteristics:

1. Own predictable, stable future cash flows

2. There are very few defaults or loss events in history.

3. The future cash flows are more evenly distributed over the duration of the asset.

4. The corresponding debtor has a wide geographical and demographic distribution

5. The original holders have had the assets for a period. the income of the assets was relatively stable, and no credit problems occurred during this period.

6. The corresponding collateral is easy to liquidate, and the collateral has a very high utility for the debtor, thereby forcing the debtor to pay the principal and interest of the asset on time.

7. Own standardized, high-quality contracts, etc.

3.1.3. Major players in ABS

ABS is a meticulous and complex technology with a large division of labor involving more

participants. The main players include initiator, service providers, issuers, investment banks, credit rating agencies, credit enhancement agencies, trustees and investors. They all form a perfect organism.

1. The initiator of ABS: which refers to financial institutions created for sales and collateral for ABS, also known as the original equity (seller). It is the original owner of the securitized financial assets; whose function is to choose the underlying assets of securitization and bundled.

2. The service provider: usually the initiator of ABS or its subsidiary, which is responsible for collecting the principal and interest due and for recovering those overdue loans receivables.

3. The issuer: refers to the institution that purchases the underlying assets of the initiator, designs and issues the asset-backed securities.

4. Investment banks: which are responsible for publicly selling its underwriting or consignment for ABS in the process of ABS.

5. The credit enhancement institutions: which are institutions that provide derivative credit in the process of credit enhancement.

6. Credit rating institutions: which refer to institutions that provide credit rating services for asset-backed securities.

7. The trustee: the organizations which are responsible for managing the cash flows generated by the loan portfolio, for conducting securities levels and for issuing securities principal and interest to investors.

8. Investors: market traders who buy asset-backed securities.

3.1.4. Operational process

The initiator put the underlying assets (NPLs) into an asset pool, and then sell the pool of assets to a special purpose carrier (SPV). The asset pool will be guaranteed by the SPV with predictable cash income, and then the securities will be issued to the investor through credit enhancement institution and rating institution. Therefore, SPV can raise funds and repay the cash received in the future to investors, achieve the purpose of raising funds for initiator and getting returns for investors. The specific ABS process is shown in figure 3.
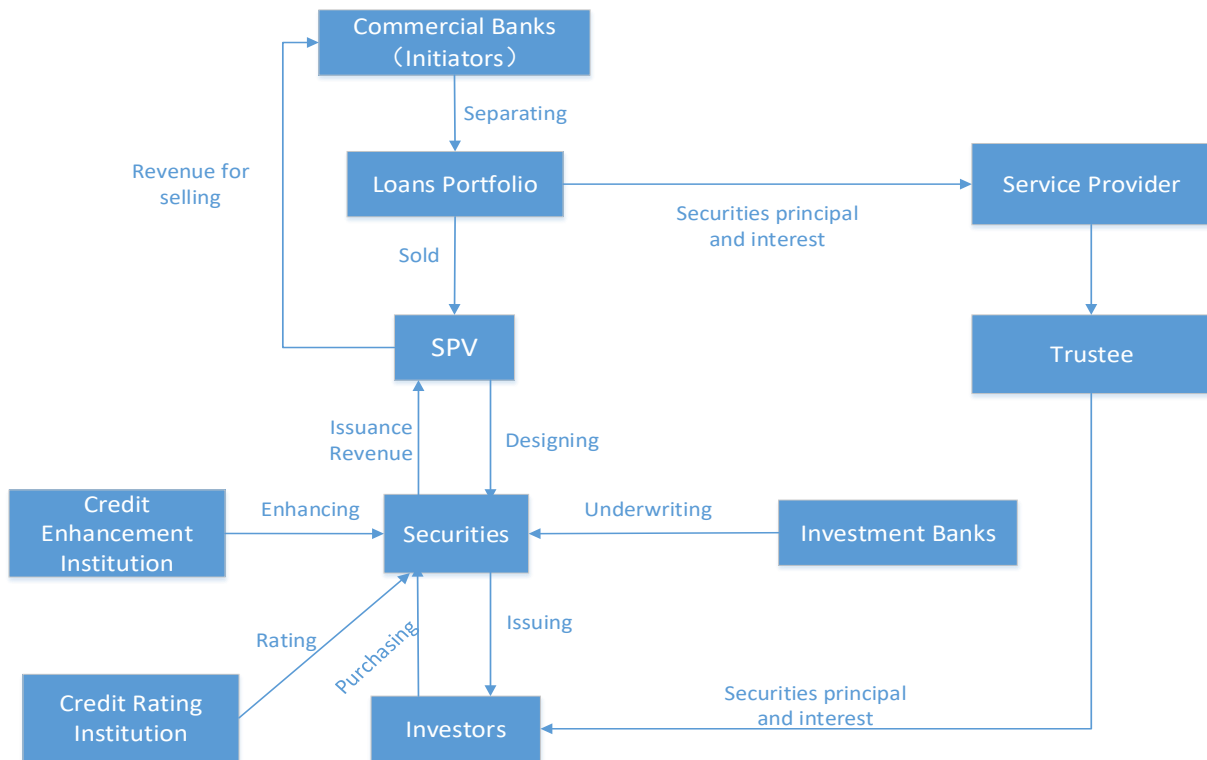
Figure 3. ABS process

Note: this figure is about the whole process for ABS implementation, and this figure is made by the author according to the ABS concept and several works of literature.

3.1.5. The basic principle of ABS

1. Principle of asset restructuring.

Based on the analysis of their own financing needs, the original beneficiaries of the assets determine the goal of ABS according to their needs and then combine the credit assets that generate future cash flows according to the principle of the asset portfolio. finally, an asset pool can be formed.

2. The principle of risk isolation:

Achieving risk isolation depends on two main factors: the actual sale of securitized assets and the establishment of SPVs in the transaction structure. To achieve true risk isolation between initiator and SPVs, the principles should be followed when setting up SPV: limiting the operation scope of SPVs; limiting debts; setting up independent directors; not making mergers and acquisitions; maintaining separation of account and accounting.

3. The principle of credit enhancement.

The purpose of credit enhancement is to reduce the cost of issuance, increase the credit rating of the issued securities, and attract more investors. Credit enhancement methods are divided into internal and external enhancement. Internal enhancement includes reserve accounts, the excess of the mortgage, and Priority / secondary hierarchy. External enhancement includes insurance, bank letters of credit, corporate guarantees, and cash-backed accounts.

3.2. The significance of tiering technology in asset securitization

3.2.1. Better meet the needs of investors with different risk preferences

After the tiering technique is adopted, if there was a problem in reimbursement, the loss is first borne by the investors of subordinated securities. The investors with the priority bonds are therefore highly secure. Of course, the rate of return is smaller. Investors with subordinated bonds can achieve high returns because they take on high risks. This allows investors of different preferences to get what they want. It achieved the precise equivalence of "high risk, high return" and "low risk and low return".

3.2.2. Promoting the issuance of asset-backed securities, especially non-performing asset-backed securities

Since tiered securities can better meet the different needs of different investors, they can attract investors from all levels, including pension funds, insurance funds and other cautious investors relative to risk investors such as hedge funds. In this way, in the case of no tiering, securities with difficult of issuance may be issued smoothly through tiering.

1. Especially for non-performing asset-backed securities, only a few risk investors will buy them without tiering, so it is often difficult to issue. With the tiered technology, each priority bond receives a high level of security and a high-security rating. It attracts a large number of cautious investors while subordinated securities attract risky investors. This promoted the issuance greatly.

2. Those asset-backed securities with general risk may not meet the high-security needs of cautious investors, nor the high-return needs of risk-orientated investors in the case of no tiering. Therefore, if tiering is adopted, it can better meet the needs of investors from all kinds of levels, thus promoting its issuance.

3.2.3. Improving the financial security of the entire society

In general, risk investors such as hedge funds are more able to bear risks than prudential investors such as pension funds and insurance funds. After suffering the same losses, they are relatively not easy to cause social shocks due to loss and fail. Therefore, through stratification, they can bear the main risks and improve the financial security of society.

3.2.4. Promoting venture capital through strict supervision.

In countries with strict supervision, such as China, bonds with higher risk are not allowed to be issued. The issuance of tiered asset-backed bonds opened a breakthrough here, and even non-performing asset-backed securities can be approved for regulation. This has promoted venture capital to a certain extent.

3.3. Tranche introduction of ABS

Figure 4 shows a simple securitization approach, which is called asset-backed securities. The bank, which issues the loan, sells the cash flow-generating loan portfolio to a special institution, and then the cash flow is allocated to a different tranche. There are 3 shares in Figure 4, which are senior tranche, mezzanine tranche and equity tranche. This thesis makes an example of describing the tranche introduction of ABS (see figure 4). The total assets have a denomination of X million dollars, with a senior tranche of 80%, a mezzanine tranche of 15%, and equity tranche of 5%. The return rate on the senior tranche is LIBOR plus 60 basis points, for mezzanine tranche, it is LIBOR plus 250 basis points, and for equity tranche, it is LIBOR plus 2000 basis points. This is just an example of this thesis. But, the situation is much more complex than the example. Although it seems that equity tranche is the most cost-effective, it is not. There is no guarantee for the payment of interest and principal. Compared with other tranches, the equity tranche is more likely to lose a portion of the principal, and the possibility of receiving interest is less likely. The cash flow of securitization is distributed in the form of a so-called waterfall. In general, the cash flow distribution of the waterfall is shown in Figure 4. The cash flow of payments of the principal and interest is distributed in different waterfall forms. The principal payment is first allocated to the senior tranche until the principal of the tranche is fully repaid, and then the mezzanine tranche is allocated until the principal of the tranche is fully repaid, and only after that, the equity tranche is paid to principal.
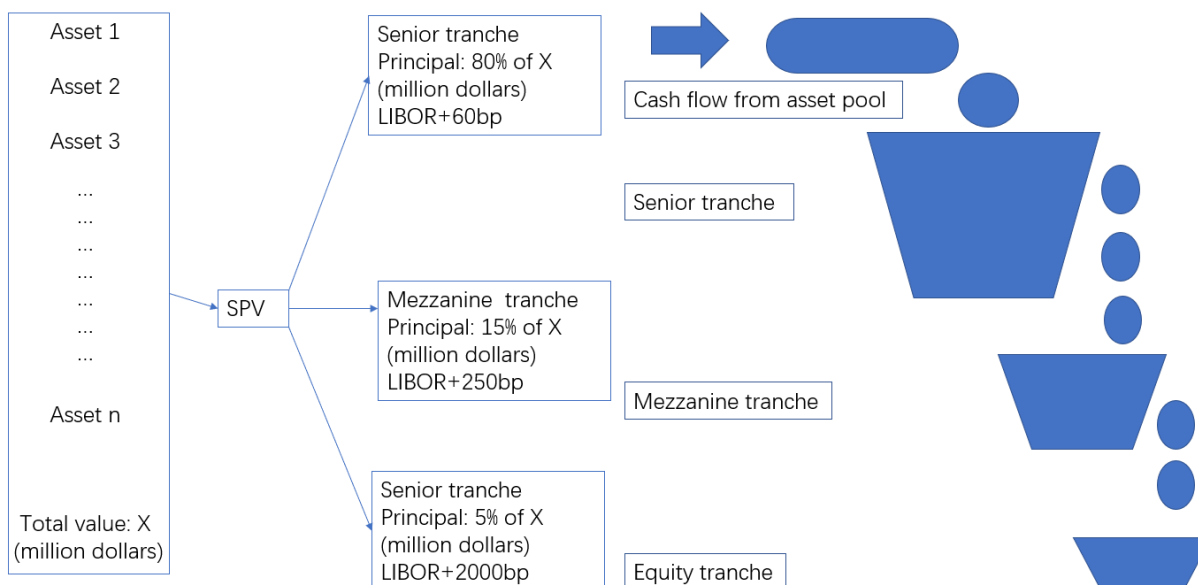
Figure 4. An asset-backed security (simplified); bp ¼ basis points (1bp ¼ 0.01%) and the waterfall in asset-backed security.

Note: the left one is asset-backed security (simplified); bp ¼ basis points (1bp ¼ 0.01%), it shows that composition and the total value of asset pool, SPV, percentage and return rate of each tranche. the right one is the waterfall in asset-backed security for senior tranche, mezzanine tranche and equity tranche. This figure is from financial risk management textbook-Options, Futures, and Other Derivatives (tenth edition) of John C. Hull.

The payment of interest is also first allocated to the senior tranche until the senior tranche receives interest on all commitments above the outstanding principal. It is assumed that the promised interest can be repaid before the interest payment is distributed to the mezzanine tranche. When the return promised by the mezzanine tranche is also satisfied, and the cash flow remains, then the equity tranche is allocated.

The extent of the principal received by each tranche depends on the extent of the loss of the underlying asset. The impact of waterfall cash flow is basically as follows: The initial 5% of the asset loss is borne by the equity tranche. If the loss exceeds 5%, the equity tranche will lose the entire principal, and the mezzanine tranche will bear the remaining loss. If the loss exceeds 20%, The mezzanine tranche will lose the entire principal and the senior share will bear the remaining losses.

ABSs

ABS CDO

```
┌─────────┐        ┌──────────────────────┐
│ ASSETS  │───────▶│ Senior tranche (80%) │
└─────────┘        │ AAA                  │
                   └──────────────────────┘

                   ┌──────────────────────┐        ┌──────────────────────┐
                   │ Mezzanine tranche(15%)│──────▶│ Senior tranche (65%0 │
                   │ BBB                  │        │ AAA                  │
                   └──────────────────────┘        └──────────────────────┘

                                                   ┌──────────────────────┐
                                                   │ Mezzanine tranche    │
                                                   │ (25%)                │
                                                   │ BBB                  │
                                                   └──────────────────────┘

                   ┌──────────────────────┐        ┌──────────────────────┐
                   │ Equity tranche (5%)  │        │ Equity tranche (15%) │
                   │ Not rated            │        │ BBB                  │
                   └──────────────────────┘        └──────────────────────┘
```
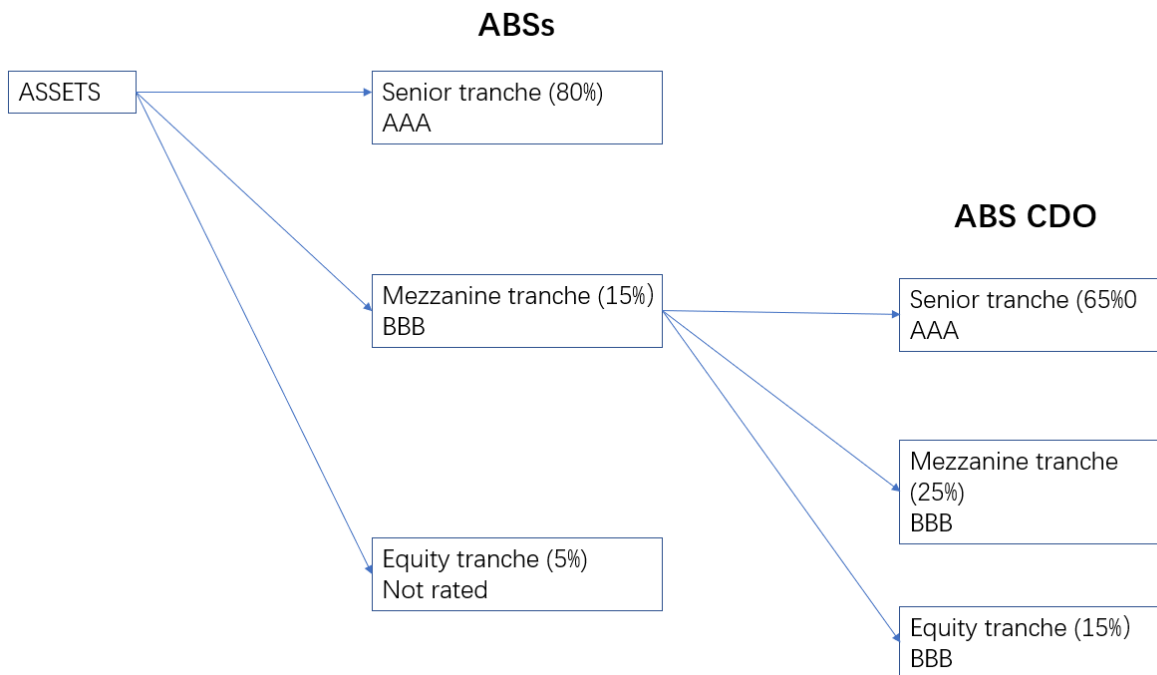
Figure 5. Creation of ABSs and an ABS CDO from portfolios of assets (simplified).

Note: this figure is simplified creation of ABSs and an ABS CDO from portfolios of assets, it shows that percentage and rating of each tranche in ABSs and percentage and rating of each tranche in ABS CDO from the portfolio of assets. This figure is from financial risk management textbook-Options, Futures, and Other Derivatives (tenth edition) of John C. Hull.

We can look at the structure of asset-backed securities in two ways. One is the form of the waterfall in Figure 5. The cash flow is first allocated to the senior tranche, then the mezzanine tranche, and finally the equity tranche. The other is the way of taking losses, the equity tranche first bears the loss, then the mezzanine tranche, and finally the senior share. Rating agencies such as Moody's, Standard & Poor's, and Fitch have played an important role in the securitization process. The asset-backed securities shown in Figure 5 are designed to ensure that the credit rating of the senior tranche is AAA, while the credit rating of the mezzanine tranche is usually BBB (although lower than AAA, but still investment grade), and the equity tranche is usually not credited rating.

IV. Data and Methodology

4.1. Problem statement

Since mortgage-backed securities were first issued in the US toward the latter part of the 1970s, credit asset securitization has developed rapidly in many countries around the world and become one of the most important financial tools at the end of Twentieth Century. The rapid growth in credit asset securitization may be attributable to the fact, which is able to increase business management measures and diversify credit risk. It also plays an active role in multiple functions such as connecting the credit and capital markets, advancing healthy growth in the capital markets, and other aspects. China started the credit asset securitization pilot in 2005 but subsequently halted due to the subprime crisis. And since 2012, the regulators restart securitization of credit assets, China's securities market grew rapidly, by the end of November 2015, the total amount of all types of credit asset securitization products issued was more than 50 billion RMB according to WIND database. With the rapid development of Chinese credit asset securitization market, investors are also deepening the awareness of the risks and benefits of securitization products. But on the contrary, China's pricing methods for the securitization products are still primary, and there is a gap between the risk assessment system of developed countries and China. This research is based on the background of the rapid development of the securitization of credit assets. It analyzes the determinants of affecting the priority interest rate of the securities of NPLs. What's more, all the securities have been issued in the Chinese financial market.

4.2. Objectives of this study

The objective of the study is to determine the factors affecting interest rate for senior bond for NPLs securities to price its securities. And then it will propose some recommendations for pricing problem of ABS in the financial market. Therefore, the research question in this thesis is to investigate the determinants of affecting priory interest rate in ABS for NPLs by using multivariance linear regression model. What's more, this thesis would like to drive the linear relationship (or linear equation) between the determinants and priority interest rate for senior tranche.

4.3. The multivariate linear regression model

In this thesis, the multivariate regression analysis model is to qualitatively analyze the relevant factors affecting the priority interest rate of the securities which is based on NPLs. The econometric model is used to do regression test for the relevant factors affecting the priority interest rate of the securities for NPLs., and then regression equation for the priority interest rate established by the coefficient of a significance test. Finally, the thesis can drive a linear relationship between the priority interest rate for senior tranche and the determinants. It will help the financial market to price the securities for NPLs as a reference.

The regression equation of the multivariate regression analysis model is as follows:

$$r_i = \beta_0 + \beta_1 D_{f,i} + \beta_2 D_{s,i} + \beta_3 P_i + \beta_4 Log\ d_{1,i} + \beta_5 Log\ d_{2,i} + \varepsilon_i$$

where r_i is the priority interest rate of security i, β_0 is constant, $D_{f,i}$ is the dummy variable to indicate whether it is a first issuance ($D_{f,i} = 1$ for the first issuance, and 0 otherwise), $D_{s,i}$ is the dummy variable to indicate whether it is a state-owned enterprise ($D_{s,i}=1$ for state-owned enterprise, and 0 otherwise), P_i is the percentage of senior tranche in asset pool, $d_{1,i}$ is the ratio of issued amount to pooled amount, $d_{2,i}$ is the ratio of number of loans to number of borrowers, β_1, β_2, β_3, β_4, β_5 are respectively the coefficients of $D_{f,i}$, $D_{s,i}$, P_i, $Log\ d_{1,i}$ and $Log\ d_{2,i}$. and ε_i is error term.

In the regression model, the constant β_0 also refers to an explanatory variable that needs to be mentioned. In the research of this study, it is regarded as the influence of other variables on the priority interest rate. Due to the lack of data, this study cannot completely analyze the regression analysis of each factor. However, this study can determine the influence degree of other variables on the priority interest rate according to the value of the constant. If the value of the constant is large, it indicates that other variables have a greater influence on the priority interest rate, that means that this article did not research other important variables. future authors will need to look for more data or more possible factors to perform regression analysis on priority interest rates. If the constant value is small, it means that the impact factor involved in this article is more comprehensive. then It can conclude what factors determine the priority interest rate.

To perform a regression analysis on the data, this article will standardize the sample data. For

textual data such as subject nature and whether it is the first issuance. This thesis will introduce dummy variables for processing. For example, for the number of issuance periods, if the issued bond is the first issuance, it is 0. If the issued bond is not the first period, it is 1; for the subject nature, if the NPL enterprise is a state-owned enterprise, it is 1, if the NPL enterprise is a private enterprise, it is 0. Because these two variables are processed as dummy variables, they are called as $D_{f,i}$ and $D_{s,i}$ respectively in the regression equation. In addition, due to the issued amount, the total amount of the pooled loans, the number of borrowers and the number of loans is large, and the dependent variable is the interest rate, its value is small, so this article will use the ratio of the issued amount to the pooled amount and the ratio of the number of borrowers to the number of loans as independent variables. In the equation, they are shown as $d_{1,i}$ and $d_{2,i}$ respectively. And then these two ratios will be processed logarithmically as $Log\ d_{1,i}$ and $Log\ d_{2,i}$. Please refer to the annex section for the processed data.

In this article, priority issuance rate (priority interest rate) from the primary market is used as the dependent variable. The reason why choosing priority issuance rate from the primary market is mainly due to the following three reasons: First, the current asset securitization market in China has insufficient liquidity in the secondary market. It presents the phenomenon that institutional investors have been holding after investment, the secondary market trading activity is not enough. What's more, the lack of liquidity resulted in a lack of research data. Second, at present, traders of the primary market in China's asset securitization are limited to institutional investors and qualified Investors. compared with the general investors' strong economic strength and investment experience, it ensures the reasonableness of the issuance rate to a certain extent. the issuance rate of the primary market is the transaction rate at the time of its initial issuance, which also reflects pricing expectation of actual risk-return when investors purchase the securities for the first time. third, at present, China's asset securitization products are issued at parity, usually 100 for each, so the coupon rate directly reflects its issuance rate, and data collection is easy. Therefore, in this article, we select the priority products which have been determined at the time of issuance as the research object and reject the samples corresponding to the secondary products.

The issuance interest rate of the research object in this article has two types: fixed interest

rate and floating interest rate. The issuance interest rate reflects the combination of the risk-free interest rate and risk-return ratio. The interest rate of priority securities, that is, the "coupon rate", generally adopts fixed interest rate.

4.4. Samples

A total of 66 securities products were selected from WIND database. These securities are issued between 2016 and 2018. All securities products we can get are 74 securities, but we have to delete 8 securities due to loss of one of the data. What's more, some of them are state-owned enterprise, some of them are not the first issuance among these 66 securities. The samples included the nature of the subject, the number of borrowers, the number of loans, the proportion of priority products, the priority interest rate, the issued amount, and the number of issued times (See the appendices section for original data). In this article, the priority interest rate for senior tranche is used as the explained variable (dependent variable), the nature of the subject, the number of borrowers, the number of loans, the proportion of priority products, the issued amount, and first issuance are used as explanatory variables (independent variables). This article intends to use more factors as the explanatory variables, but the determinants can only be selected based on the existing data.

4.5. Descriptive statistics

Table 1 shows the descriptive statistics for 66 securities that were issued in China between 2016 and 2018 according to WIND database. Column (2) reports the mean of each variable. Column (3) shows the median of each variable. Maximum and minimum are shown in Column (4) and column (5) respectively, followed by the standard deviation in column (6) of each variable. From the table, the number of borrowers is represented by $N_{B,i}$; the number of loans is represented by $N_{L,i}$; the issued amount is represented by $N_{IA,i}$; the pooled amount is represented by $N_{PA,i}$. As for row ($D_{f,i}$) and row (($D_{s,i}$), their value is 0 or 1 due to the dummy variables. So maximum and minimum are 0 or 1. As for the number of loans and the number of borrowers, their minimums are 8.709 and 24 respectively in column (5) and maximums are 138691 and 277368 respectively in column (4). It means the number of loans is only 8.709 and the number of borrowers is just 24 in some of the securities. But their maximums are

large and is more than 100 thousand of the number of loans and borrowers. The difference between securities is large.

Table 1. Descriptive statistics for the determinants and priority interest rate for the senior tranche

	Mean (2)	Median (3)	Maximum (4)	Minimum (5)	S.D. (6)
r_i	0.048	0.051	0.065	0.030	0.008
P_i	0.756	0.767	0.911	0.595	0.059
$D_{f,i}$	0.530	1	1	0	0.499
$D_{s,i}$	0.288	0	1	0	0.453
$N_{B,i}$	7056.514	14526.500	277368.000	24.000	62395.404
$N_{L,i}$	3486.849	7271.374	138691.101	8.709	31199.434
$N_{IA,i}$	3.861	3.830	30.640	1.330	5.254
$N_{PA,i}$	15.979	15.700	101.541	2.199	14.395
$d_{1,i}$	0.242	0.213	0.691	0.078	0.174
$d_{2,i}$	1.332	1.045	9.054	1.000	1.287

Note: This table shows the descriptive statistics for 66 securities that were issued in China between 2016 and 2018 according to WIND database. $D_{f,i}$ is the dummy variable to indicate whether it is the first issuance for securities i ($D_{f,i}$ =1 for the first issuance, and 0 otherwise), $D_{s,i}$ is the dummy variable to indicate whether it is a state-owned enterprise ($D_{s,i}$=1 for state-owned enterprise, and 0 otherwise), P_i is the percentage of senior products in an asset pool for securities i, $N_{B,i}$ is the amount of the borrowers for securities i, $N_{L,i}$ is the amount of loans for securities i, $N_{IA,i}$ is the issued amount for securities i, $N_{PA,i}$ is the pooled amount for securities i, $d_{1,i}$ is the ratio of issued amount to pooled amount for securities i and $d_{2,i}$ is the ratio of the number of loans to number of borrowers for securities i. S.D. is the standard deviation.

4.6. Hypotheses

4.6.1. First issuance

On the one hand, if the first issuance of an ABS is a success, the issuer may have the incentive to lower the priority interest rate in further issuances. As a result, further issuances will have a negative impact on priority interest rates. On the other hand, form an investor's perspective, the more times an asset pool has been securitized, the higher the chance that there will be a default. Thus, the impact of the first issuance on priority interest rates is not clear. So, we propose the following hypothesis on the relationship between the priority interest rate and whether it is the first issuance.

H_0: whether the first issuance has an impact on the priority interest rate.

H_1: whether the first issuance has no impact on the priority interest rate

4.6.2. Percentage of senior products in an asset pool

In asset-backed securities based on non-performing assets, three-tier securities are generally issued simultaneously: priority bond bonds, sub-priority bonds and sub-bonds. Bonds at each level are based on the quality of the underlying assets, Credit, industry, subject nature and other factors to assess, it is obvious that priority bonds are the lowest risk of default, the highest probability of redemption, so the higher the proportion of priority bonds in the entire asset pool, indicating The higher the credit rating in the asset pool, the lower the risk, the lower the interest rate, and the lower the priority interest rate. Therefore, we can make the following hypothesis:

The relationship between the priority interest rate and percentage of senior products.

H_0: there is no significant effect between the priority interest rate and percentage of senior products.

H_1: there is significant effect between the priority interest rate and percentage of senior products, what's more, the relationship is a negative correlation.

4.6.3. State-owned enterprise?

The nature of the underlying assets of securities generally includes state-owned enterprises and private enterprises. State-owned enterprises do not need to introduce too much. It is a government-owned enterprise with sufficient funds to support operations. The probability of bankruptcies is low, and the risks are relatively low. However, if it is a private enterprise, it can only rely on profit and loss to maintain the normal operation of the enterprise. Once there is a problem in the capital chain or other links, the enterprise may close at any time, and the risk is relatively high. Therefore, if the loaned enterprise is a government enterprise or a state-owned enterprise, then securities issued are more secure, the risk will be lower, the interest will be lower, and the interest rate of the priority securities will be lower. Therefore, we can make the following hypothesis:

The relationship between the priority interest rate and the nature of the subject.

H_0: there is no significant effect between the priority interest rate and the nature of the subject.

H_1: there is significant effect between the priority interest rate and the nature of the subject.

4.6.4. The issued amount and pooled amount

In the issuance of securities for NPLs, the issued amount is usually lower than the total amount of the asset pool. It is because the lower the issued amount or the higher the amount of the asset pool, the higher probability to get a benefit for the investors who own the securities, that is, a higher probability of redemption. Therefore, it can be easily analyzed that the higher the ratio of the issued amount to the pooled amount, the higher the risk of investment, and the investor will receive more interest, so the priority interest rate will be higher. In this article, we will choose the ratio of the issued amount to pooled amount as the independent variable. Therefore, we can make the following hypothesis:

The relationship between the priority interest rate and the ratio of the issued amount to the pooled amount.

H_0: there is no significant effect between the priority interest rate and the ratio of the issued amount to the pooled amount.

H_1: there is significant effect between the priority interest rate and the ratio of the issued amount to the pooled amount.

4.6.5. Number of loans and number of borrowers

1. Debtor (borrower) credit risk

The number of borrowers is large, and the percentage of the loan balance of customers with non-performing loan record is relatively small, and the potential loss risk is relatively small. The original debtor is highly concentrated, and the common debtor has greater pressure on future capital expenditures, high leverage, and a large number of external guarantees. If there is a large capital expenditure, an increase in the asset-liability ratio, and a large amount of compensation or debt concentration, it will likely have a significant impact on the full redemption of the special program. In products with a relatively high concentration of debtors, the solvency and credit level of important debtors determine the security and stability of priority securities payments. According to the regulations, the important debtor is "the principal balance of the pooled receivables for a single receivable debtor accounts for more than 15% of the asset pool, or the balance of the pooled receivables of the debtor and its related parties accounts for more than 20% the total amount of assets pool.

In terms of asset pool concentration, the number of underlying assets is large, the amount is small, and the degree of dispersion is high. The span between the number of borrowers and the number of pooled loans in different CLO products are larger. The larger the span, the smaller the concentration, the higher the degree of dispersion. The issuance institution use risk dispersion principle and the priority repayment mechanism to carry out the structured arrangement to achieve the improvement the credit rating of the priority securities of ABS, while reducing the impact of the single debtor default risk on the asset pool.

All in all, the smaller the number of borrowers and the more loans, the more the number of loans per capita, which means that the greater the span, the smaller the concentration and the higher the degree of dispersion. So, the risk is small, and then the interest is low, that is, the priority interest rate is low. This article will use the ratio of the number of loans to the number of borrowers as an independent variable to analyze the factors that determine the priority interest rate. So, we made the following hypothesis:

The relationship between the priority interest rate and the ratio of the number of loans to the number of borrowers

H_0: there is no significant effect between this ratio and the priority interest rate.

H_1: there is significant effect between this ratio and the priority interest rate.

V. Analysis

5.1. Results

We perform all calculations in SPSS. As we mentioned above, the independent variables include priority percentage (P_i), first issuance $(D_{f,i})$, state-owned $(D_{s,i})$, Log (issued amount/pooled amount) $(Log\ d_{1,i})$ and Log(the number of loans to the number of borrowers) $(Log\ d_{2,i})$. The dependent variable is the priority interest rate (r_i). The regression equation and each regression coefficient are analyzed by using SPSS. The statistical analysis results are as follows:

Table 2. Regression coefficient significance test

variables	β	SE	p-value
β_0	5.432	1.167	0.000
$D_{f,i}$	-0.423	0.173	0.017
$D_{s,i}$	-0.417	0.179	0.023
$Log\ d_{1,i}$	1.080	0.334	0.002
$Log\ d_{2,i}$	-0.341	0.070	0.000
P_i	0.013	0.015	0.392
R^2		0.377	
Adjusted R^2		0.326	
DF for regression		5	
DF for residual		60	

Note: This table summarizes the regression results. $D_{f,i}$ is the dummy variable to indicate whether it is a first issuance ($D_{f,i} = 1$ for the first issuance, and 0 otherwise), $D_{s,i}$ is the dummy variable to indicate whether it is a state-owned enterprise ($D_{s,i}$=1 for state-owned enterprise, and 0 otherwise), P_i is the percentage of senior products in asset pool, $d_{1,i}$ is the ratio of issued amount to pooled amount and $d_{2,i}$ is the ratio of the number of loans to the number of borrowers, β_0 is constant for this linear equation. β is the coefficients of each variable. SE is short for standard error. DF is the degree of freedom. This table is made according to the analysis result of SPSS. P-value is obtained based on statistical significance at the 5% level.

From Table 2, for priority percentage, its corresponding P-values are 0.392. it is greater than 0.05. so, at the significance level a = 0.05, priority percentage is not a significant factor for the priority interest rate. But for other independent variables, such as first issuance, State-owned, log $d_{1,i}$ (issued amount/pooled amount) and log $d_{2,i}$ (the number of loans to the number of borrowers), their respective P-value is 0.017, 0.023, 0.002 and 0.000. therefore, they are considered as significant variables. the coefficient of determination R^2 =0.377, and the

adjusted R^2=0.326, it shows that the regression equation has a fit. In other words, there is a fit between the original data and regression linear equation. The degree of freedom for regression is 5 and the degree of freedom for residual is 60.

5.2. Establishing a regression equation for corresponding factors

Based on the results of the regression analysis, this article establishes a linear relationship between first issuance $(D_{f,i})$, state-owned($D_{s,i}$), log (issued amount/pooled amount) ($log\ d_{1,i}$) and log(the number of loans to the number of borrowers) ($log\ d_{2,i}$) and the dependent variable priority interest rate (r_i) of securities for NPLs:

$$r_i = 5.432 - 0.423D_{f,i} - 0.417D_{s,i} + 1.08Log\ d_{1,i} - 0.341Log\ d_{2,i}$$

where r_i is the priority interest rate of security i, $D_{f,i}$ is the dummy variable to indicate whether it is a first issuance ($D_{f,i} = 1$ for the first issuance, and 0 otherwise), $D_{s,i}$ is the dummy variable to indicate whether it is a state-owned enterprise ($D_{s,i}$=1 for state-owned enterprise, and 0 otherwise), $d_{1,i}$ is the ratio of issued amount to pooled amount and $d_{2,i}$ is the ratio of the number of loans to the number of borrowers.

From the regression equation, we can see the constant is 5.432. it is larger than the coefficients of other determinants much more. As we discussed above, If the value of the constant is large, it indicates that other variables have a greater influence on the priority interest rate, that means that this article did not research other important variables. If the constant value is small, it means that the impact factor involved in this article is more comprehensive. then It can conclude what factors determine the priority interest rate. Obviously, other variables that are not mentioned in this thesis also have a greater influence on the priority interest rate for senior tranche. As for the factor-whether it is the first issuance, its coefficient is -0.423. it means the priority interest rate will decrease 0.423 when the factor changes from 0 to 1 because the factor is the dummy variable (only 0 or 1). It indicates that the priority interest rate will decrease 0.423 when the factor changes from the first issuance to more than one time of issuance. The more times the securities are issued, the lower the priority interest rate for senior tranche. Considering into the factor-whether it is state-owned enterprise, its coefficient is -0.417. the value of the factor is only 0 or 1 because of the dummy variable that the thesis set. It indicates that the priority interest rate will decrease 0.417 when

the value of the factor changes from 0 to 1. It means that the priority interest rate will decrease 0.417 when the enterprise changes from private enterprise to the state-owned enterprise. As we mentioned above, the securities have a smaller risk and more guarantee if it is a state-owned enterprise, so the priority interest rate is smaller.

As for the factor: the ratio of the issued amount to pooled amount, its coefficient is 1.08. its correlation is positive between the priority interest rate and the ratio of the issued amount to the pooled amount. The equation indicates that the priority interest rate will increase 1.08 when $\log d_{1,i}$ (log (the ratio of the issued amount to pooled amount)) increase by one unit or one point. It means that an increase in the ratio of the issued amount to pooled amount will result in the increase in the priority interest rate. As we discussed above, the higher the ratio of the issued amount to the pooled amount, the higher the risk of investment, and the investor will receive more interest, so the priority interest rate will be higher. Talking about the factor: the ratio of the number of loans to the number of borrowers, its coefficient is -0.341. its correlation is negative between the priority interest rate and the ratio of the number of loans to the number of borrowers. The coefficient indicates that the priority interest rate will decrease 0.341 when log (ratio of the number of loans to the number of borrowers) increases by one unit. It means that the priority interest rate increases as increase the ratio of the number of loans to the number of borrowers. the smaller the number of borrowers and the more loans, the more the number of loans per capita, which means that the greater the span, the smaller the concentration and the higher the degree of dispersion. So, the risk is small, and then the interest is low, that is, the priority interest rate is low.

VI. Discussion

Based on our results, it can be concluded that the factors, which affect the priority interest rate of ABS for NPLs, include: whether the first issuance, whether the state-owned enterprise, the ratio of the issue amount to the pooled amount, the ratio of the number of loans to the number of borrowers. The conclusions are consistent with the hypothesis presented in section 3 of this article. The reasons are analyzed as follows:

1.The more the period of issued securities, the lower the priority interest rate level. It indicates that the current securities in the Chinese market are favored by most investors; the market acceptance is higher; the return is stable, and the risk is low. The recognition was increasing, priority interest rates are getting lower and lower. Therefore, the results of the data analysis are consistent with the theoretical assumptions, as to whether it is the first issuance does affect the level of the priority interest rate.

2. Loan enterprises with assets supporting securities for NPLs are state-owned enterprises, and then the lower the priority interest rate. It explains that asset-backed securities for NPLs have the typical characteristics and structural characteristics of interest rates, like other market bonds. When the loan enterprise is a state-owned enterprise or a government enterprise, its potential credit risk is small.

3.In the case that the pooled amount remains the same, the higher the issued amount, the higher the priority interest rate. The data analysis results are consistent with the previous theoretical assumptions, and the ratio of the issued amount to the pooled amount does affect the issuance rate of the priority bond.

4. In the case where the number of borrowers remains the same, the more the number of loans, the lower the priority rate.

For constants, it is also necessary to discuss its significance. From the results of SPSS analysis, the constant is 5.432, which is greater than the absolute value of the coefficient of any one variable. It indicates the factors affecting the priority interest rate except for the first period, a state-owned enterprise, the ratio of issuance amount to the pooled amount and the ratio of the number of loans to the number of borrowers, there are other important factors. However, due to the lack of data, there is no way to continue studying additional determinants for the

priority interest rate in this thesis. It can only be concluded that there are other factors influence for priority interest rates, not limited to the ones mentioned in this article. And other impact factors are also a very important role for priority interest rates.

VII. Conclusion

As we all know, the pricing of ABS for NPLs is complicated and difficult. And Chinese four largest state-owned commercial banks have more and more serious problem in NPLs. Therefore, disposing of NPLs is an urgent issue in China. But Chinese economic development is so rapid it remained many threats in the NPLs due to a policy problem, economic structure, and Chinese special status. What's more, the history of securitization in China is short. There is no enough experience and technology to price the securities based on NPLs reasonably. This thesis would like to explore the determinants of affecting priority interest rate for senior tranche because of realizing these problems. It aims to provide the direction and method of pricing in the further securitization process.

The thesis concludes that the determinants of affecting the priority interest rate for senior tranche based on NPLs are: whether it is the first issuance, whether it is state-owned enterprise, the ratio of the issued amount to the pooled amount and the ratio of the number of loans to the number of borrowers. There are negative correlations between the priority interest rate and each determinant except for the ratio of the issued amount to the pooled amount. In other words, the issuance of the securities for NPLs is more than one time, its corresponding priority interest rate is lower; the securities with state-owned enterprise have more guarantee and higher credibility because the government-owned enterprise has enough funds to support its operations and the probability of bankruptcies is lower. The risks are relatively lower. The securities are more secure, and the priority interest rate is lower; the smaller the number of borrowers and the more loans, the more the number of loans per capita, which means that the greater the span, the smaller the concentration and the higher the degree of dispersion. So, the risk is small, and then the interest is low, that is, the priority interest rate is low. There is a positive correlation between the priority interest rate and the ratio of the issued amount to the pooled amount. The lower the issued amount or the higher the amount of the asset pool, the higher the probability to get a benefit for the investors who own the securities, that is, a higher probability of redemption. In other words, the higher the ratio of the issued amount to the pooled amount, the higher the risk of investment. And then the investors will receive more interest, so the priority interest rate will be higher.

As for constant, its value is large and much larger than the coefficients of other determinants. Here the article comes up with one question that there are still some other determinants of affecting the priority interest rate. What's more, these determinants are also important role in affecting the priority interest rate. However, Due to the lack of data, this study cannot completely analyze the regression analysis of each factor. Therefore, at this point, this thesis suggests further research should consider or focus on other determinants. Other determinants can be guarantee method of loans, location of enterprise, industries of enterprise and the purpose of the loan, etc. These are just referencing. The thesis hopes later scholar and researcher do more work on those.

There are still some regrets on this research. This research cannot do too much work on other determinants due to lack of data. This thesis would like to research other determinants: guarantee method, location of enterprise, industries of enterprise and the purpose of the loan and so on. But this thesis has to give up for these determinants as a result of a lack of data. Another regret is that this thesis also wants to research the specific pricing process of ABS for NPLs through capital asset pricing model (CAPM). And then the thesis proposes a specific and feasible method to price ABS for NPLs. But lack of data also breaks my thoughts. So here the thesis just provides some suggestions to research ABS for NPLs. If China wants to obtain breakthrough progress in disposing of NPLs, it still needs to do a large number of works on it. China still has a long path to go in ABS for NPLs in order to dispose of NPLs efficiently.

VIII. Bibliography

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IX. Appendices

Table 3. The original data of 66 securities

	r_i	P_i	$D_{f,i}$	subject nature	issued amount (100 millions)	pooled amount (100 millions)	the amount of borrowers	the amount of loans
1	0.0403	0.8158	1	1	3.8	20.542771	115165	57591.6212
2	0.0405	0.911	0	1	1.427	9.443347	22478	11242.75785
3	0.04	0.7551	0	0	2.45	31.260937	75693	37858.6984
4	0.044	0.8125	1	1	1.6	10.857332	10753	5380.43722
5	0.0529	0.7297	1	1	3.7	8.113208	1340	673.2108567
6	0.043	0.8232	1	0	3.79	24.686	210829	105423.8168
7	0.0428	0.7667	1	0	1.5	11.623173	64882	32444.28275
8	0.0428	0.7689	1	0	2.64	16.133075	60668	30339.13013
9	0.0488	0.5946	1	0	5.55	17.937318	2029	1020.925739
10	0.0488	0.6591	1	0	8.8	12.925337	5777	2893.633015
11	0.0488	0.7556	1	0	22.5	41.664424	16721	8380.584209
12	0.042	0.7931	1	1	3.3412	29.845017	48352	24185.89513
13	0.042	0.7813	1	1	5.76	22.281787	123106	61560.36537
14	0.0438	0.754	1	0	5	46.194144	127807	63919.61451
15	0.045	0.7742	1	0	3.1	18.728843	127350	63679.53082
16	0.0535	0.6471	0	1	4.25	8.87144	39	20.34731214
17	0.0536	0.75	1	1	17.6	33.527052	11667	5847.66547
18	0.054	0.8528	1	0	2.052	4.305712	506	250.8110726
19	0.0489	0.8187	1	0	3.86	27.268852	277368	138691.1008
20	0.054	0.8451	0	0	1.42	14.998594	35716	17859.26012
21	0.05	0.7899	1	0	1.38	9.310884	35785	17891.33821
22	0.052	0.8	0	0	1.65	14.442921	66429	33215.10943
23	0.054	0.7895	1	0	1.52	2.19904153	620	305.5837127
24	0.056	0.6883	1	0	4.78	11.72837146	704	352.0121352
25	0.054	0.7488	0	0	6.41	10.38600743	2797	1398.127189
26	0.0535	0.7	0	0	2	6.796389	24	8.708795679
27	0.0598	0.8398	1	0	4.406	6.937321	2721	1357.767126
28	0.0598	0.6476	1	0	5.25	17.814354	1456	729.5382534
29	0.0598	0.8065	1	0	12.4	22.335678	8338	4174.10167
30	0.05	0.7869	0	1	3.05	15.716639	118545	59272.18915
31	0.055	0.8085	0	0	4.7	31.615238	221075	110543.4764
32	0.0567	0.75	0	0	4	32.735188	60806	30408.96822
33	0.054	0.7143	0	0	2.8	15.225197	76775	38385.9981
34	0.054	0.7642	0	1	2.2769	14.326098	25592	12793.92222
35	0.0541	0.7909	0	1	1.6185	10.967121	12332	6162.163537
36	0.065	0.7826	0	0	2.3	4.901866	253	120.0456402
37	0.0564	0.7778	0	0	1.8	13.000357	127252	63622.33573
38	0.049	0.8	1	1	5	23.011204	123981	61991.68312
39	0.0565	0.7941	1	0	5.1	38.007567	148471	74242.17368
40	0.057	0.7905	1	0	2.1	11.38173	48309	24149.60645
41	0.057	0.7169	1	0	1.95	15.683484	27053	13523.00619
42	0.06	0.7143	0	0	1.33	2.531767	131	56.34054061
43	0.053	0.7754	0	0	5.7	11.284276	175	82.77641557
44	0.0528	0.7748	0	0	1.643	15.244047	30861	15425.92295
45	0.0535	0.7517	0	0	7.25	19.392972	84	40.40560686
46	0.053	0.7571	0	1	14	25.087545	8205	4104.999782
47	0.052	0.7463	0	0	6.7	18.359915	24	9.343027321
48	0.051	0.8428	0	0	1.59	12.164659	61370	30678.19587
49	0.0536	0.7619	1	0	2.1	4.81589	259	119.7785175
50	0.051	0.7537	0	0	4.06	24.878242	148969	74482.89939
51	0.052	0.7826	0	0	2.3	12.36374	48119	24052.22895
52	0.052	0.7805	0	0	2.05	18.317762	31931	15960.24667
53	0.05	0.7799	1	1	5.36	10.03563	2714	1349.439001
54	0.045	0.7656	0	1	1.8791	15.557738	11721	5853.793654
55	0.0428	0.7436	1	0	3.51	23.999519	146028	73010.72
56	0.0438	0.7609	1	0	4.6	10.833788	546	264.6084131
57	0.044	0.7679	1	1	4.74	22.253697	112076	56034.0631
58	0.045	0.68	1	1	6.154043	28.802457	119	58.29283468
59	0.0318	0.7278	0	0	15.8	48.930622	147	82.45649436
60	0.0329	0.6221	1	0	6.43	22.17236	119	55.09222357
61	0.0319	0.6163	0	0	10.77	35.879082	138	70.89592864
62	0.033	0.7692	1	1	15.6	28.038132	7980	3990.189938
63	0.033	0.661	0	1	7.02	23.332692	81	36.072379
64	0.0348	0.673	0	0	30.64	101.540737	204	134.6162824
65	0.0398	0.766	1	0	4.7	11.065568	529	253.9784303
66	0.03	0.8069	0	0	2.33	15.090598	60007	29993.56106

Note: This table summarizes the regression results. $D_{f,i}$ is the dummy variable to indicate whether it is a first issuance ($D_{f,i} = 1$ for the first issuance, and 0 otherwise), $D_{s,i}$ is the dummy variable to indicate whether it is a state-owned enterprise ($D_{s,i}$=1 for state-owned enterprise, and 0 otherwise), P_i is the percentage of senior products in asset pool, $d_{1,i}$ is the ratio of issued amount to pooled amount and $d_{2,i}$ is the ratio of the number of loans to the number of borrowers. These data are from WIND database and this table is made by the author according to original data of 74 securities from WIND database.

Table 4. Updated data from Table 3 after calculation

	r_i	P_i	$D_{f,i}$	$D_{s,i}$	$Log\ d_{1,i}$	$Log\ d_{2,i}$
1	0.0403	0.8158	1	1	0.184979913	1.144167065
2	0.0405	0.911	0	1	0.151111677	1.589287303
3	0.04	0.7551	0	0	0.078372571	1.011956191
4	0.044	0.8125	1	1	0.147365854	1.196875291
5	0.0529	0.7297	1	1	0.456046486	1.194029851
6	0.043	0.8232	1	0	0.153528316	1.053337065
7	0.0428	0.7667	1	0	0.12905254	1.006427052
8	0.0428	0.7689	1	0	0.163638984	1.018823762
9	0.0488	0.5946	1	0	0.309410805	1.09659931
10	0.0488	0.6591	1	0	0.680833312	1.014367319
11	0.0488	0.7556	1	0	0.540029067	1.003109862
12	0.042	0.7931	1	1	0.111951687	1.808922071
13	0.042	0.7813	1	1	0.258507094	1.099653957
14	0.0438	0.754	1	0	0.108238828	1.012464106
15	0.045	0.7742	1	0	0.165520102	1.005088339
16	0.0535	0.6471	0	1	0.479065405	3.179487179
17	0.0536	0.75	1	1	0.524949226	1.000857118
18	0.054	0.8528	1	0	0.476576232	1.007905138
19	0.0489	0.8187	1	0	0.141553447	1.038933835
20	0.054	0.8451	0	0	0.094675541	1.071928547
21	0.05	0.7899	1	0	0.148213639	1.010088026
22	0.052	0.8	0	0	0.114242818	1.006141896
23	0.054	0.7895	1	0	0.691210229	1
24	0.056	0.6883	1	0	0.407558715	1.025568182
25	0.054	0.7488	0	0	0.617176527	1.008223096
26	0.0535	0.7	0	0	0.294273915	1.5
27	0.0598	0.8398	1	0	0.635115486	1.009922822
28	0.0598	0.6476	1	0	0.294706168	1.125
29	0.0598	0.8065	1	0	0.555165596	1.003238187
30	0.05	0.7869	0	1	0.194061847	1.139314184
31	0.055	0.8085	0	0	0.14866249	1.04568133
32	0.0567	0.75	0	0	0.122192669	1.012778344
33	0.054	0.7143	0	0	0.183905666	1.031637903
34	0.054	0.7642	0	1	0.158933717	1.007306971
35	0.0541	0.7909	0	1	0.147577473	1.02675965
36	0.065	0.7826	0	0	0.469209073	1.075098814
37	0.0564	0.7778	0	0	0.138457736	1.012667777
38	0.049	0.8	1	1	0.217285458	1.094288641
39	0.0565	0.7941	1	0	0.134183806	1.0510268
40	0.057	0.7905	1	0	0.184506222	1.010039537
41	0.057	0.7169	1	0	0.124334619	1.027723358
42	0.06	0.7143	0	0	0.525324803	1.27480916
43	0.053	0.7754	0	0	0.505127666	2.902857143
44	0.0528	0.7748	0	0	0.107779778	1.011049545
45	0.0535	0.7517	0	0	0.373846773	2.476190476
46	0.053	0.7571	0	1	0.558045835	1
47	0.052	0.7463	0	0	0.364925437	3.583333333
48	0.051	0.8428	0	0	0.1307065	1.040068437
49	0.0536	0.7619	1	0	0.436056471	2.471042471
50	0.051	0.7537	0	0	0.163194811	1.04583504
51	0.052	0.7826	0	0	0.186027852	1
52	0.052	0.7805	0	0	0.111913235	1.092010898
53	0.05	0.7799	1	1	0.534097012	1.004053058
54	0.045	0.7656	0	1	0.12078234	1.024741916
55	0.0428	0.7436	1	0	0.146252931	1.044991372
56	0.0438	0.7609	1	0	0.424597565	2.637362637
57	0.044	0.7679	1	1	0.212998317	1.089947893
58	0.045	0.68	1	1	0.21366382	2.554621849
59	0.0318	0.7278	0	0	0.322906175	9.054421769
60	0.0329	0.6221	1	0	0.290000704	2.12605042
61	0.0319	0.6163	0	0	0.300174904	3.97826087
62	0.033	0.7692	1	1	0.55638514	1
63	0.033	0.661	0	1	0.300865412	3.024691358
64	0.0348	0.673	0	0	0.301750814	5.87745098
65	0.0398	0.766	1	0	0.424740962	2.255198488
66	0.03	0.8069	0	0	0.154400773	1

Note: This table summarizes the regression results. $D_{f,i}$ is the dummy variable to indicate whether it is a first issuance ($D_{f,i} = 1$ for the first issuance, and 0 otherwise), $D_{s,i}$ is the dummy variable to indicate whether it is a state-owned enterprise ($D_{s,i}$=1 for state-owned enterprise, and 0 otherwise), P_i is the percentage of senior products in asset pool, $d_{1,i}$ is the ratio of issued amount to pooled amount and $d_{2,i}$ is the ratio of the number of loans to the number of borrowers. These data are from WIND database and this table is made by the author according to original data of 74 securities from WIND database.