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The Impact of COVID-19 on Chinese Consumer Finance ABS Market -- An Empirical Analysis Based on OAS Pricing Model

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The Impact of COVID-19
on Chinese Consumer Finance ABS Market
—— An Empirical Analysis Based on OAS Pricing Model

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by

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The object of this paper is COVID-19's impact on China's consumer finance ABS. Now the epidemic still continues. I wish my professors, friends, family members the happiness and health, hoping that the epidemic will end soon.

I am looking forward to visit professor Tony in Geneva as soon as possible.

Abstract

At the end of 2019, a novel coronavirus (named the COVID-19 pandemic or called COVID-19 for short) has spread worldwide rapidly. The negative impact of the epidemic on China's economy is mainly reflected in the first half of 2020, especially in the first quarter. This paper intends to take the epidemic situation as an emergency to the financial market, combining with the underlying assets of ABS and the market changes in the corresponding industry in China, then observe the performance of securitization products and examine the effectiveness of macroeconomic policies.

This paper selects consumer finance, which is greatly affected by the epidemic situation. We make an empirical analysis on the performance of China's asset securitization market from June 2018 to June 2020 (three years), based on the default rate and prepayment rate of underlying assets, and finds that new epidemic situation has increased the default risk of ABS securities of China's consumer finance. However, with the rapid control of the epidemic situation, the resumption of work and production is taking place effectively. Macroeconomic policies and a series of economic stimulus measures have a positive impact on the recovery of various indicators. From the perspective of different types of issuers, the OAS value of ABS securities issued by Internet companies is significantly lower than that of General consumer lending companies, but higher than that of general consumer loans of banks. We also find that during the epidemic period, the application of financial technology has affected the performance of ABS products. Our results show that it is beneficial to strengthen the application of technology in the financial market, and the advantages of using technology for risk control are becoming increasingly clear. It is the right time to promote the development of fintech in China.

Keywords: Consumer finance asset-backed securities (ABS), default rate, option adjusted spread (OAS), fintech

The Impact of COVID-19 on Chinese Consumer ABS Market
—— An Empirical Analysis Based on OAS Pricing Model

1 Introduction

The object of this paper is consumer finance. The common consumer finance includes automobile loan, personal consumption loan and so on (excluding mortgage loans). They are also the underlying assets of consumer financial ABS products which are most directly affected by the epidemic. Generally speaking, consumer finance refers to a modern financial service mode by which financial institutions provide consumption loans to individuals or families through multi-level and multi-channel credit forms to help consumers realize intertemporal consumption planning, stimulate current consumption demand, and promote the expansion of the current consumption market scale. Consumer finance is essentially inclusive finance, which helps the general public to everyone enjoy financial services equally.

In recent years, the percentage of consumption expenditure in China's GDP has been increasing year by year, and the final consumption rate (that is, the proportion of final consumption in GDP) has been above 50% since 2015 (of course, compared to 80% - 90% consumption rate in developed countries such as Europe and the United States, there is still a lot of room for improvement in China's consumption rate. With the continuous growth of China's total consumption and the upgrading of consumption structure, the scale of consumer finance has increased significantly. The increase in the proportion of national consumption in China's national economy and the improvement of national consumption ability leads to the fact that consumer finance has entered the golden era. With the continuous improvement of Chinese residents' income, the consumption structure, consumption content, and consumption mode of residents are constantly upgrading, various consumer financial products have emerged one after another and become an important force to stimulate national consumption growth under the background of national economic transformation and implementation of inclusive finance. Moreover, with the rise of China's e-commerce

platforms, consumer finance offered by Internet companies gradually shows far more vitality than traditional finance. Corresponding to the vigorous consumer demand, Internet giants are facing huge financing demands, which is also reflected in the development of consumer finance ABS issued by these Internet companies.

Asset-backed securities (ABS) are a kind of security whose principal and interest are paid back from the cash flow generated by the underlying assets in the collateral pool. Consumer finance asset-backed securities (hereinafter referred to as "consumer finance ABS") are asset securitization products based on consumer finance loans lent out by the issuers. ABS Securities is somehow preferred over traditional bonds because ABS securities separating the risk of the underlying assets from the credit of the originator due to "true sale" arrangement, and also play an important role in solving the accumulation of financial risks and fund maturity mismatch. More than 2 trillion-yuan consumer finance ABS has been issued in the interbank bond market, the Shanghai Stock Exchange and the Shenzhen Stock Exchange, which accounts for nearly one third of total China's asset securitization issuance.

In this paper, ABS product data will be selected to analyze the impact of the epidemic on consumer financial institutions, mainly based on the considerations that companies' financial indicators are related to asset balance on the accounting reporting day, and these financial indicators usually have lags, so it is difficult to reflect the real impact of the epidemic in a timely and effective manner. The underlying assets of ABS can reflect the overall loan performance of the company to a certain extent. Through the monthly public trustee report, the amount of new overdue loans and non-performing loans as well as the overall non-performing level at each time point can be visually observed, and this can help describe the impact of the epidemic on ABS products and the company's assets dynamically.

In order to better understand the impact of the epidemic on the spread of consumer finance ABS, this paper finally analyzes the OAS spread using option adjusted model. By calculating the value of OAS, namely the net interest spread after removing the impact of embedded prepayment options, we find that, due to the sharp drop in China's economic growth and consumer income level after the outbreak of the epidemic, defaults rise and recovery rate drops significantly, thus increasing the positive excess spreads of the abs

products. We mainly find that (1) The OAS value of consumer finance ABS in 2020 is significantly higher than that of other years, indicating that the COVID-19 epidemic increases the spread of consumer finance ABS in China. (2) With the rapid control of the epidemic situation and the effective resumption of work and production, macroeconomic policies and government stimulus measures have a certain positive impact on the recovery of various indicators; (3) The OAS value of consumer finance ABS of Internet enterprise is significantly lower than that of General consumer lending companies, but higher than that of general consumer loans of banks; (4) During the epidemic period, the application of fintech has a certain impact on the performance of ABS products. In some cases, the OAS value of Internet giants (especially Ali series) is lower than that of general consumer loan abs.

The drawback of this paper is as follows. First, this paper doesn't include spread analysis for subordinated tranches. Subordinated tranche products are mostly traded using agreements between two private parties, the trading yield and spread of which are hard to be observed. In practice, the back envelope approach is used to calculate the spread of the subordinated tranches, but in order to ensure the preciseness of the empirical analysis, we don't make analysis on the spread of the subordinated tranches. Second, this paper lacks the analysis of the cash flow of consumer finance ABS products. The stability of cash flow is the monitoring indicator that investors pay most attention to. However, due to the confidentiality of data, it is not available in this paper. However, the analysis in this respect has little impact on the main theme of the spread of consumer finance ABS affected by the epidemic, and we pay more attention to the influencing factors of the spread. Third, the investigation time of this paper is not long enough, the epidemic is still continuing, and its impact has not really ended, which needs to be observed in the longer term.

The structure of this paper is as follows. The first part is the introduction, the second part is the literature review, the third part is the empirical model construction, the fourth part is the data introduction and regression results, and the fifth part is the calculation and analysis of the OAS option value in China's consumer finance ABS market. The sixth part is the summary of the main conclusions.

2 Literature Review

For a long time, the research on interest rate and pricing of asset securitization products has been a hot issue. With the continuous development and improvement of the market, the research results on the influencing factors of interest rate of asset-backed securities are increasingly abundant. Compared with Treasury bonds with no credit risk, there is a spread between the interest rate of asset-backed securities and the market risk-free rate due to the underlying prepayment risk, default risk, market liquidity risk and tax treatment. Collin-Dufresne et al. (2001), Huang J et al. (2003), and Chikashi et al. (2005) studied the data of American corporate bonds and found that risk-free interest rate, slope of spot Treasury yield curve, yield of stock market and other factors could significantly influence the credit spread of bonds. Dennis V. and Frank J. (2009) analyzed the spread of asset-backed securities from the perspectives of credit rating, time, and liquidity. With the development of asset securitization market in China, the study of China's ABS products pricing has also accumulated to some extent. Xu (2017) studied the pricing rule of personal housing mortgage loans, consumer loans and business loans and found that the coupon rate is negatively correlated with the security rating and is positively correlated with the weighted average maturity and bond maturity, and the reference rate is the core factor affecting the coupon rate of the four models.

Many studies have concluded that the option characteristics of asset securitization mainly consider prepayment and default risk factors, and different ABS products have different characteristics, requiring different pricing methods. Dennis Vink (2008) believed that the types of underlying assets of asset securitization products were quite different, so the factors influencing the prices of these securities should also be different. He concluded that ABS, MBS and CDO were three completely different asset securitization products, and pointed out that they needed different pricing methods respectively in practice.

Both domestic and foreign researchers believe that ABS have different risk characteristics from credit bonds, the main risks of credit debt are credit risk and liquidity risk, while ABS are usually regarded as bonds with embedded options and have different

risk characteristics. Pang Yang (2016) pointed out that ABS products have option characteristics, in which the senior security is equivalent to shorting a put option plus longing a treasury bond, and the subordinated security is equivalent to longing a long call option. Mezzanine tranche is the most complex, equivalent to longing a put option to senior tranches and shorting a call option to subordinated tranches. Therefore, the option characteristics must be taken into account in the risk analysis and pricing of securities. Correspondingly, there are a large number of research literature related to the application of option adjusted spread (OAS) pricing model in asset securitization. K. Dunn, J. McConnell (1981) divided the pricing methods of ABS into static cash flow yield method (SCFY), static spread pricing (SS), interest rate model pricing, option adjusted spread pricing (OAS) and refinancing threshold pricing method (RTP), etc. The OAS method takes into account all cash flow changes in the case of different interest rates, and takes into account term structure, interest rate fluctuations and other factors, thus can more accurately reflect the value of interest-sensitive bonds. Therefore, it is regarded as the best pricing method for MBS and ABS products at present by Brent W. Ambrose and Richard J. Buttimer (2000). It is generally believed that the pricing process of ABS using OAS model includes two parts: one is the modeling of the dynamic behavior of the term structure of interest rate; the other is the modeling of the prepayment behavior. To be specific, CIR model, Ho-Lee model, Hull & White model, Vasicek model and HJM model are commonly used to determine the term structure of interest rates. Among them, the CIR interest rate model proposed by Cox, Ingersoll & Ross (1978) is relatively mature and has been confirmed in the Chinese market. Compared with other models, such as Ho-Lee, Vasicek, etc., its solutions of CIR model are always non-negative (if the Feller condition is satisfied, the probability of 1 is positive), and it also satisfies the mean reversion property. In terms of forecasting prepayment, Fabozzi (1995) elaborated a model to predict prepayment by establishing a multiplicative form function of mortgage interest rate change. Dunn & McConnell (1981) regarded prepayment as a call option and reflected this option in the marginal conditions of the pricing equation of mortgage-backed securities. Schwartz and Torous (1989) put forward that we should analyze the problem of prepayment by using the survival model.

Many researchers have fully discussed the default risk and prepayment risk of asset-backed securities, and I hereby further summarize relevant research findings according to these two risks.

In terms of default risk, domestic and foreign scholars believe that the factors affecting the default risk of asset securitization can be divided into three categories: macro-economy, characteristics of underlying assets and characteristics of loans. Taking RMBS as an example, housing is the underlying asset, and corresponding characteristic indicators include the types of mortgage properties and the characteristics of homeowners. Jung (1962) believed that there was a positive correlation between loan-to-value ratio, personal housing mortgage interest rate and default risk. Herzog and Earley (1970) found that borrower characteristics were an important factor leading to default. Among them, a more unstable career and greater changes in household income are more likely to lead to high default risk. As for loan characteristics, loan terms, ways of paying interest and LTV are important indicators affecting default rate. According to Moody's statistics, a nearly 20-year study of California mortgages from 1970 to 1988 shows that the default rate for borrowers with a 10-year term began to increase at a rapid rate from year 3 to year 6, and peaked at year 4. Mathias Schmit (2004) collected transaction data of major European financial institutions from 1990 to 2000, estimated probability density function and risk measurement via resampling method, and studied the credit risk of investment portfolios based on this.

In terms of prepayment risk, McConnell (1981) assumed that the influencing factor of prepayment behavior was only "refinancing cost". Curley and Guttentag (1977) pointed out that the maturity of mortgage loan, contract interest rate and market interest rate had the greatest influence on the prepayment rate of loan portfolio. Richard Stanton (1995) proposed a new prepayment model using generalized method of moments based on the debtor's rational decision, and the results showed that the transaction cost faced by the mortgage holder seemed to far exceed the explicit cost usually incurred. Sherman Davis (2004) took the data from 1997 to 2001 as the research object and made an empirical analysis on the prepayment behavior. The study constructed a prepayment model, using public data to monitor the prepayment rate of variable rate mortgage asset-backed securities, and found

that refinancing incentives of variable interest rate to variable interest rate and variable interest rate to fixed interest rate seemed to be the main drivers of prepayment.

3 Empirical Model and Variable Selection

The data in this paper mainly comes from two aspects: one is WIND data terminal, the other is China Asset Securitization Analysis website (https://www.cn-abs.com/). Other sources of data include the Chinese bond information network (https://www.chinabond.com.cn/), the Chinese bureau of statistics website (http://www.stats.gov.cn/), public reports on the central Treasury securities registration and settlement companies (reference reports are mainly annual and semi-annual), the official website of the Securities Industry and Financial Markets Association (SIFMA) and the Financial Industry Regulatory Authority (FINRA).

We selected 756 consumer finance ABS products, totally 2,642 securities, issued from 2016 to June 2020 in China. The annual number of issuance is shown in the figure below:
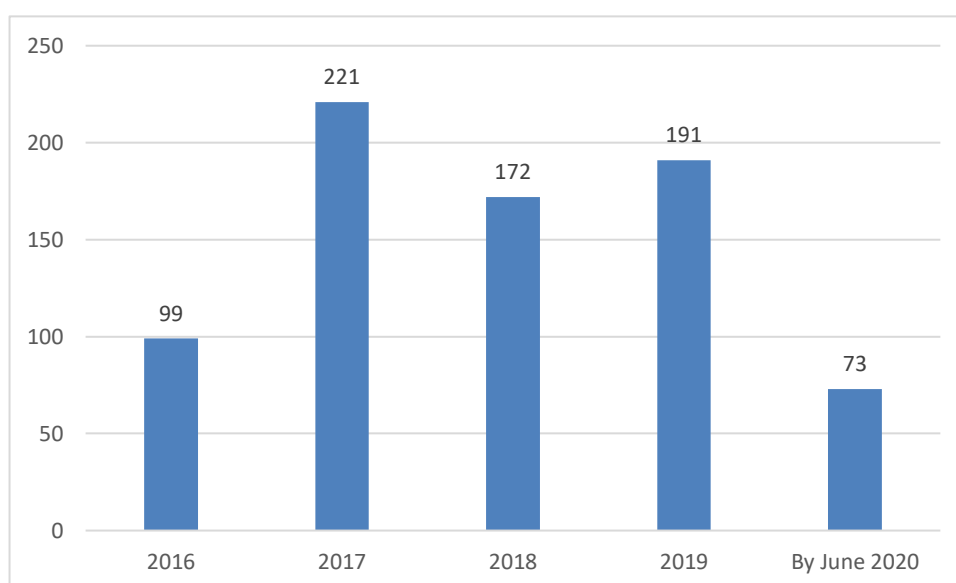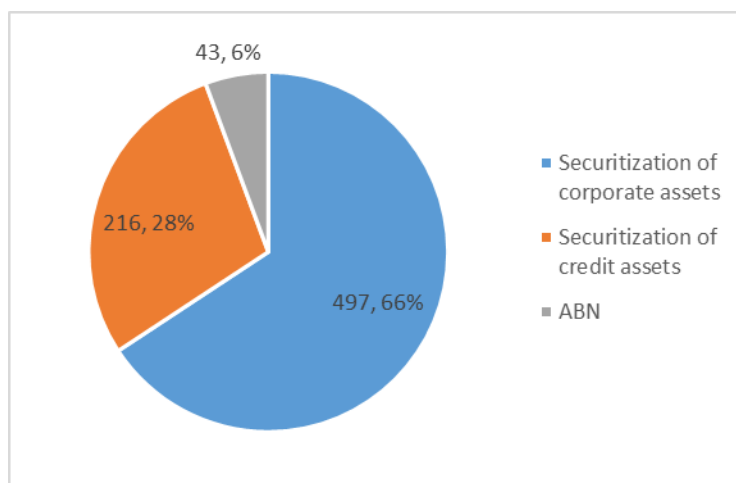

u: Circulation Statistics of Consumer Finance ABS Products

We counted the types of these 756 consumer finance ABS products, and the results are shown in the figure below:

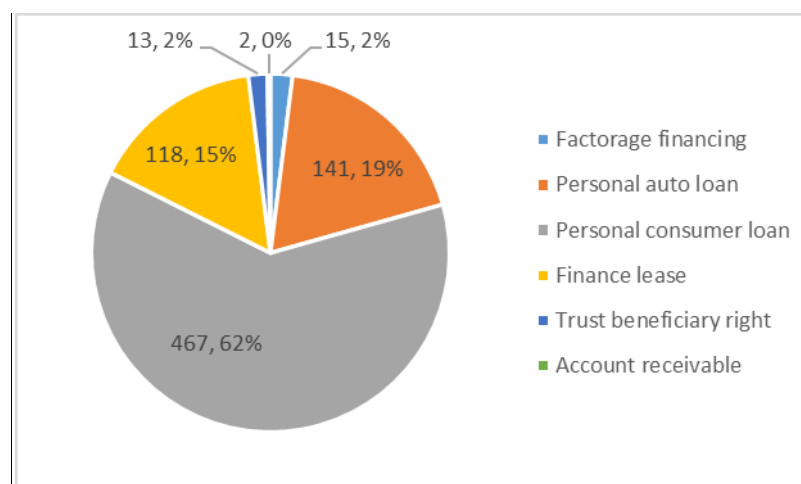u: Type of Consumer Finance ABS Product -- CNABS Primary Classification

Figure 3: Type of Consumer Finance ABS Product -- CNABS Secondary Classification

It can be seen that, from the perspective of primary classification, consumer finance ABS are dominated by corporate asset securitization products, accounting for 66%, credit asset securitization products account for 28%, and asset-backed notes only account for 6%. From the perspective of secondary categories, more than half of the products were personal consumer loans (accounting for 62%), followed by personal auto loans (accounting for 19%).

Among the 756 consumer finance ABS products, there are a total of 2,642 securities, including 1,099 senior securities, 775 mezzanine securities and 768 subordinated securities. Since most of the subordinated securities in China are held by the issuer, and yield of

subordinated securities cannot be obtained, the subordinated securities are removed from the sample. Finally, a total of 730 consumer finance ABS products, including 1,819 securities, can be analyzed after excluding some securities whose data are missing. At the same time, considering that the issuance quantity and scale of consumer finance ABS products have increased significantly since 2017 and have entered a stable period since then, the research object of this paper is mainly 634 consumer finance ABS products from the beginning of 2017 to the end of June 2020, totaling 1,449 securities. The interest rates of the 1,449 securities are shown below:
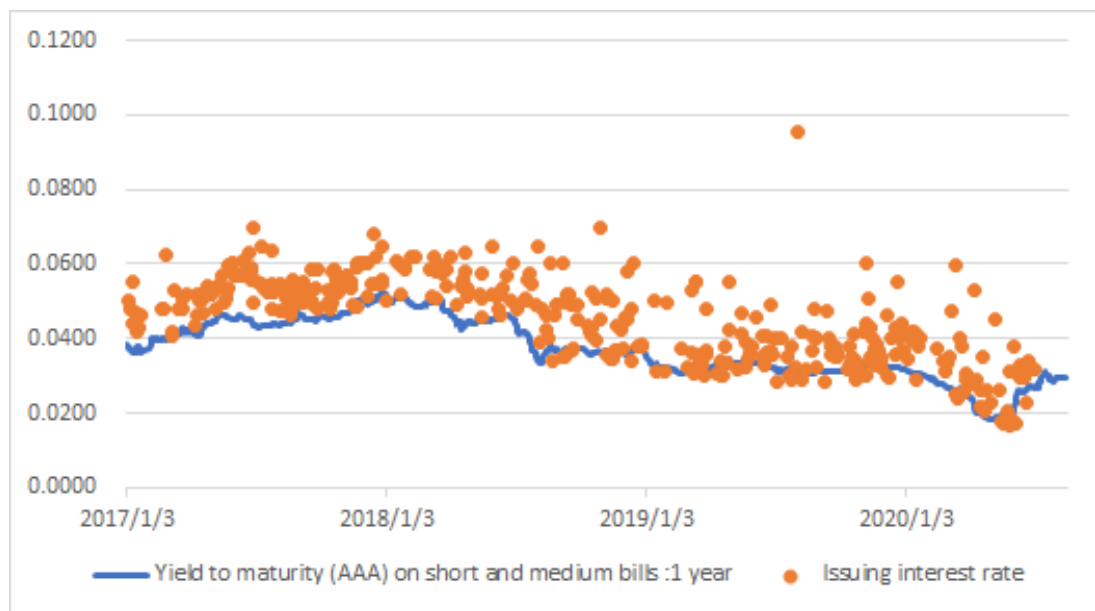

Figure 4: Issuing Interest Rate of Consumer Finance ABS Products

From the beginning of 2017 to the end of June 2020, the average interest rate of issued consumer finance ABS is 5.02%, the maximum is 13.5%, and the minimum is 1.65%, with a large gap. In terms of interest rate spread, since 2017, the average spread between consumer finance ABS and one-year AAA medium notes is 126 basis points, the maximum is 1023 basis points, and the minimum is -63 basis points. Further, we calculated the interest rate and interest spread of consumer finance ABS from 2017 to June 2020, and the results are as follows:

Table 1: Comparison of Interest Rates of Consumer Finance ABS from 2017 to 2020

	Minimum	Quartile	Median	Mean	Third quartile	Maximum
2017	0.04080	0.05255	0.05560	0.05632	0.05900	0.099000
2018	0.03390	0.04780	0.05250	0.05433	0.06000	0.13500
2019	0.02820	0.03580	0.03965	0.04391	0.04813	0.13500
2020	0.01650	0.02900	0.03550	0.03925	0.04730	0.09000

Table 2: Comparison of Interest Spread of Consumer Finance ABS from 2017 to 2020

	Minimum	Quartile	Median	Mean	Third quartile	Maximum
2017	-0.00140	0.00794	0.01035	0.01129	0.01300	0.04580
2018	-0.003311	0.007485	0.012154	0.014236	0.017685	0.099017
2019	-0.003854	0.003642	0.007205	0.011752	0.016346	0.102362
2020	-0.006366	0.004782	0.009408	0.014667	0.021437	0.064659

From the perspective of issuing interest rate, the issuing interest rate of consumer finance ABS is decreasing year by year. Taking into account the possible impact of downward interest rates, the benchmark interest rate selected here is the issuing rate of triple-A rated medium notes with the same term. It can be seen that the average spread of consumer finance ABS in 2020 is significantly higher than that in each year from 2017 to 2019. This indicates that excluding the impact of macro interest rate, the interest rate of real issuance of consumer finance ABS in 2020 is higher than that in previous years. To some extent, this explains the impact of the epidemic on consumer finance ABS. And just to be clear, in terms of the benchmark interest rate, we select medium notes issued in the interbank bond market. The main reasons are as follows. First, AAA medium-term notes have the characteristics of good issuer qualification and low credit risk. More importantly, the turnover rate of medium notes is higher than that of government bonds and Chinese bond market as a whole, which means their liquidity is pretty good.

Given the impact of COVID-19 on China's consumer finance ABS, the following hypotheses are proposed:

1. China's consumer finance ABS is extremely likely to face the risk of a sharp rise in delinquent rate and deterioration of overall asset quality due to the decrease in residents' income, decrease in collection efficiency and increase in residents' cash reserves.

2. Macroeconomic policies and government stimulus measures for the resumption of work and production will play a certain mitigating role. The impact of these policies on China's economy and market will be reflected through some indicators of consumer finance ABS (default rate, early repayment rate, OAS value, etc.).

3. During the epidemic, consumer finance ABS products issued by Internet giants and banks may have different performances due to different extents of fintech application.

Factors related to prepayment. Based on the single monthly mortality (SMM) from 2018 to the first half of 2020, personal auto loans were relatively stable. As can be seen from the figure below, personal auto loans were most seriously affected by the epidemic in January and February 2020, and gradually returned to the normal level after March.

The month over month prepayment rate of personal credit card installment decreased, and its year-over-year rate is far below its historical average. General personal consumer loans show high prepayment fluctuations due to inclusion of quarterly payment products with high prepayment rate. After removing some samples, the prepayment of personal consumer loans increased steadily.
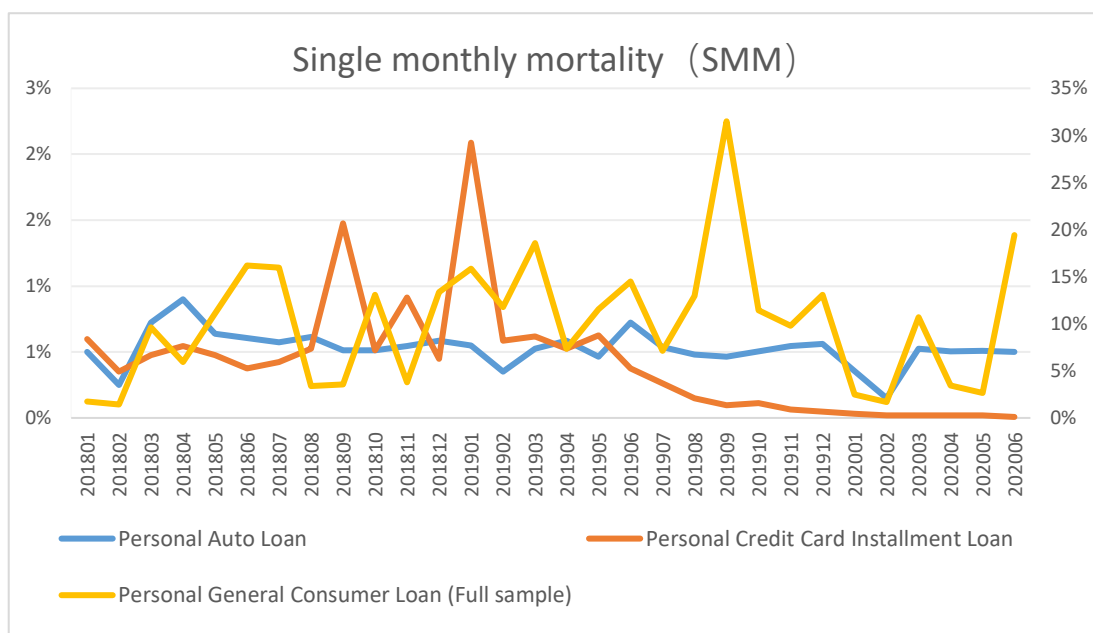
Figure 5: Single Monthly Mortality of Consumer Finance ABS

Factors related to default. We first examine the delinquency rate of asset pools of consumer finance ABS in personal auto loans and personal consumer loans (divided into credit card installments and general consumer loans) during the epidemic:

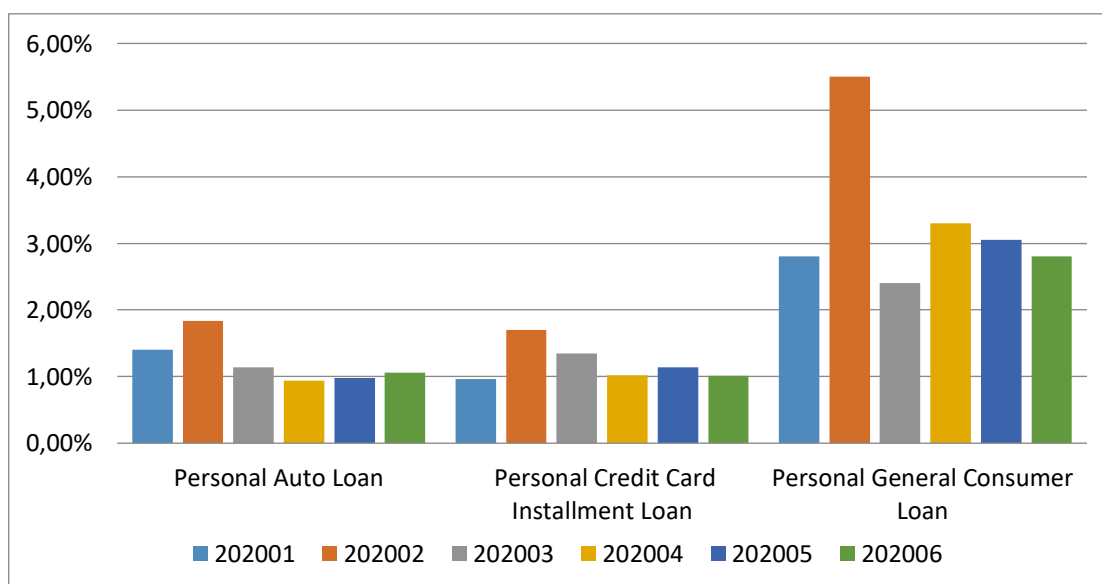Figure 6: Delinquent Rate of Consumer Finance ABS (1-30 days)

It can be seen that in the six months (up to June 2020) during the epidemic period, the one-to-30-day delinquent rate of all kinds of assets decreased after reaching its peak in February, indicating that the delinquent rate tended to fall back to the normal level after the epidemic was effectively controlled. In terms of personal auto loans, it may be directly

related to the incentive policies that many auto finance companies have launched plans to postpone the repayment of loans. Credit card delinquencies have been generally stable since February. Compared with the peak in February, the delinquency for general consumer loans dropped significantly in March, but rebounded in April. On the one hand, with the control of the epidemic and the implementation of relevant policies, the repayment ability has been improved. On the other hand, the support policies cannot be effective for a long time, so attention should be paid to the recovery of the real economy.

Take a look at the annualized default rate of consumer finance ABS from January 2018 to June 2020 for personal auto loans, personal consumer loans (subdivided into credit card installments and general consumer loans):
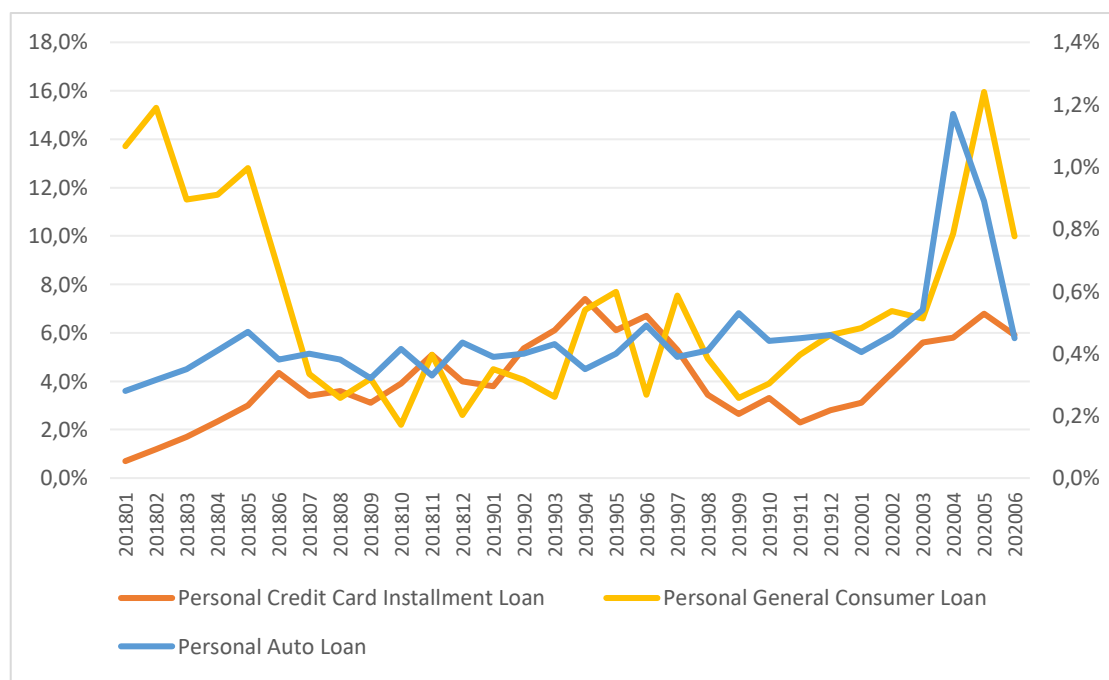
Figure 7: Annualized Default Rate of Consumer Finance ABS

It can be seen that in April 2020, the annualized default rate on personal auto loans peaked, while the peak of the annualized default rate of personal general consumer loan ABS products was delayed by one month. However, the default rate of all kinds of products finally fell in June. In May 2020, the default rate showed a significant increase, while in June, the default rate showed a significant decrease, basically returning to the average level before the epidemic. We believe this is because there is usually a three-month gap between overdue and default events.

4 Empirical Model and Statistical Results

4.1 Empirical Model

In this chapter, we will use the data (personal consumer finance ABS securities after 2017 mentioned above) and the model to explore the influencing factors of consumer finance ABS interest rate. Here, in order to eliminate the impact of macro interest rate on consumer finance ABS interest rate, the interest rate spread is selected as the dependent variable of the model.

According to the analysis above, the regression equation model is established as follows:

$$spr_i = \alpha_0 + \alpha_1 * \ln(value_i) + \alpha_2 * BJSH_i + \alpha_3 * FWAL_i + \alpha_4 * after\_time_i + \alpha_5 * is\_internet_i + \alpha_6 * is\_cpxfjr_i + \mu_i$$

In the regression model above, the spread of type i product is spr (basis point), which is equal to the difference between the issuing interest rate and the benchmark interest rate of AAA grade with the same maturity (if the subject is a bank, the benchmark interest rate is AAA medium note, otherwise the benchmark interest rate is AAA corporate bond). BJSH represents the main issuer of ABS products is in Beijing or Shanghai (dummy variable), FWAL represents the weighted average life, value represents the issuance amount of the product (100 million yuan), and after_time represents the issuance date of the product is after the epidemic. The starting point of the epidemic is January 22, 2020 (dummy variable). Is_internet and is_cpxfjr are dummy variables. When $is\_internet$ is 1 and is_cpxfjr is 0, it means the subject is Internet company; when $is\_internet$ is 0 and is_cpxfjr is 1, it means the subject is licensed consumer finance company; when $is\_internet$ is 0 and is_cpxfjr is 0, it means the subject is bank. μ is a residual term that follows the standard normal distribution.

Descriptive statistics of variables are as follows:

Table 3: Descriptive Statistics of Variables

Variables	Unit	Observations	Mean	Standard deviation
spr	basis point	869	124.586	106.260
value	100 million yuan	869	11.183	17.714
BJSH	dummy variable	869	0.201	0.401
FWAL	year	869	1.110	0.497
after_time	dummy variable	869	0.066	0.248
is_internet	dummy variable	869	0.812	0.391
is_cpxfjr	dummy variable	869	0.055	0.229

Interest rate spread: The average spread between the issuing interest rate of sample consumer finance ABS securities and the benchmark interest rate is 124.586 basis points, the minimum is -33.110 basis points, and the maximum is 1027 basis points. There's a big difference between the maximum and the minimum. Furthermore, the value of 75% quintiles is 140.970 basis points, indicating that most of the spread levels are within 200 basis points.

Issuance amount: The average issuance amount of sample consumer finance ABS is 1.1183 billion yuan, the maximum amount is 14.3 billion yuan, and the minimum amount is 10 million yuan. Almost all the small issuance amount of consumer finance ABS is mezzanine securities.

Issuance area: It can be seen that 175 securities are issued in Beijing or Shanghai, accounting for 20.14%, which indicates that the issuance area of consumer finance ABS is not concentrated in Beijing or Shanghai, it is relatively scattered nationwide.

Risk characteristics: As can be seen from the figure below, spreads of consumer finance ABS products showed an overall rising trend after the epidemic.

spread of all products (bp)
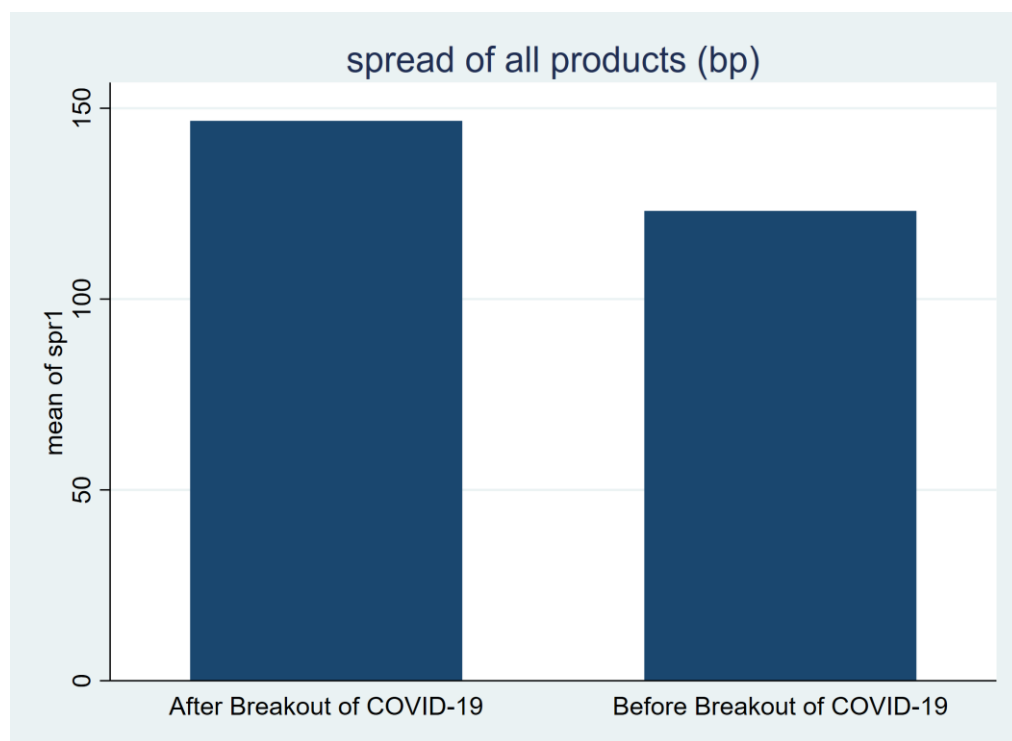
To further analyze the structure of ABS products, we find the interesting phenomenon as shown in the following figure. Senior tranche products were sought after by the funds, and Interest rate spread declined after the epidemic; while mezzanine products had higher risks than senior tranche products, and investors demanded higher risk premium compensation after the epidemic. The results show that with the arrival of the epidemic, the risk aversion of the market has increased, and safety assets have become the preferred harbor for liquidity.

spread of mezz products (bp) spread of priority products (bp)
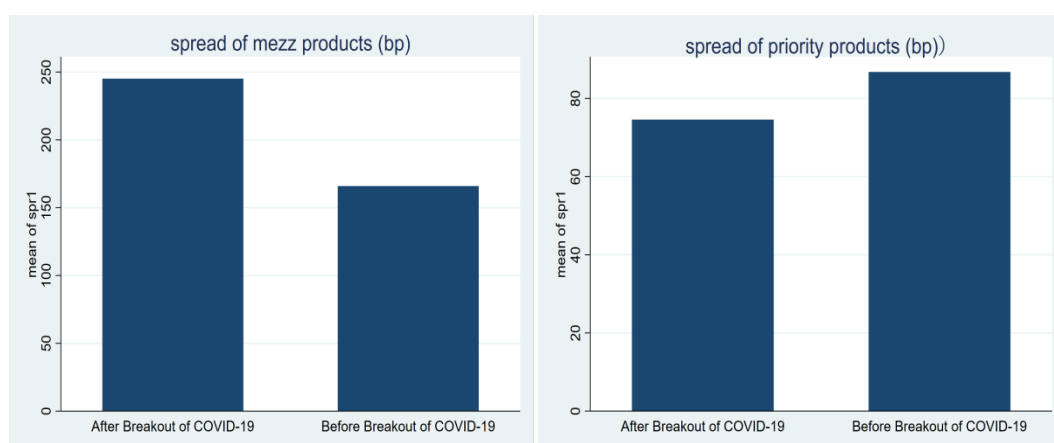
This indicates that it is necessary to distinguish the risk premium between the two different products (senior tranche and mezzanine products) in our study.

4.2 Analysis of Empirical Results

We use OLS to explore the influencing factors of consumer finance ABS spreads.

Empirical Analysis 1: The Overall Result.

From Table 4, after the epidemic, the Interest Rate Spread of all products has dropped significantly (about 27 basis points). Among them, the mezzanine tranche and senior products have dropped by about 27 and 18 basis points respectively, but they are not significant. Coefficient of weighted years of overall issuance is 9.47, indicating that the longer the weighted period of issuance, the larger the Interest Rate Spread of the security itself. When the weighted period of issuance of consumer finance ABS securities increases by one year, the spread will increase by 9.47 basis points. There is a slight difference between the mezzanine and senior tranche (the Model 1 and Model 2 in Table 4). In particular, the Interest Rate Spread of the mezzanine product has decreased, which is relatively rare in actual situations, indicating that we need to consider more product attributes, issuer attributes and other characteristics.

Table 4: OLS: The overall result.

	Model 1	Model 2	Model 3	Model4
	Spread of	Spread of	Spread of	
	Mezzanine	Senior	All products	
	products	products		
Dummy variable: after time	-27.34	-18.05	-8.93	-27.61*
	(0.26)	(0.22)	(0.43)	(0.04)
Issuance size	-9.96***	-0.49***	-0.67***	-0.65***
	(0.00)	(0.00)	(0.00)	(0.00)
Issuance weighted life	-45.11	12.96	17.37	9.47
	(0.07)	(0.39)	(0.11)	(0.42)

	Model 1	Model 2	Model 3	Model4
Control interest payment characteristics	Yes	Yes	No	Yes
Control rating characteristics	Yes	Yes	No	Yes
Control fixed year effect	Yes	Yes	No	Yes
N	406	512	918	918
R^2	0.594	0.540	0.568	0.592

Notes: *p*-values in parentheses。 $^{*} p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Considering the interactions of each variable, Table 4-1 shows that the cross-term coefficient was not significant, so the cross variables had no influence on the overall regression result.

<u>**Table 4 -1:**</u> **OLS: The overall result with interactions.**

	Model 1 Spread of Mezzanine products	Model 2 Spread of Senior products	Model 3 Spread of All products	Model4
Dummy variable: after time	36.37	-37.41	-5.48	-16.39
	(0.63)	(0.20)	(0.80)	(0.44)
Issuance size	-9.93***	-0.48***	-0.65***	-0.63***
	(0.00)	(0.00)	(0.00)	(0.00)
Issuance weighted life	-47.94*	11.28	14.00	6.94
	(0.05)	(0.48)	(0.23)	(0.57)

after time *Issuance life*	-148.78	-12.86	-28.24	-24.79
	(0.14)	(0.39)	(0.08)	(0.13)
after time *Tranching ratio*	13.78[*]	0.72	0.24	0.30
	(0.03)	(0.10)	(0.44)	(0.31)
after time *Issuance size*	-9.46	-0.33	-0.23	-0.31
	(0.08)	(0.39)	(0.57)	(0.44)
after time *Issuance weighted life*	100.61	1.55	40.88	20.85
	(0.26)	(0.96)	(0.16)	(0.48)
N	406	512	918	918
R^2	0.601	0.543	0.569	0.593

Notes: *p*-values in parentheses。 [*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$

Empirical Analysis 2: The Ownership Characteristics of an Enterprise Will Affect its Response to the Epidemic

Firstly, we focus on mezzanine products. From Table 5, the spread of the mezzanine products of state-owned companies increased by 102.06 basis points, foreign-owned companies also increased by nearly 70 basis points, while private

companies decreased by 86.30, which is somehow controversial to the conclusion that risk premium increase during the epidemic period. When we look at the coefficient of product issuance size, the larger the number of products issued by state-owned companies and foreign invested or joint ventures, the smaller the spread is ; but the larger the issuance size a of private enterprises, the larger the spread is. When we look at the coefficient of issuance WAL, the longer the WAL of the private and JV, the smaller the spread, the longer the WAL of state- owned, the larger the spread is, which means market is pursuing the long maturity ABS issued by private and Joint Venture, and short maturity issued by state-owned, which to a certain extent reflects the importance of institutional investors' product allocation in terms of term. To a certain extent, it reflects the increasing importance of institutional investor product allocation in terms of maturity.

Table 5: Mezzanine Products: Distinguishing Different Ownership Characteristics

	Model 1 state-owned enterprises	Model 2 private enterprises	Model 3 foreign-funded or joint ventures
Dummy variable: after time	102.06*	-86.30***	68.90*
	(0.02)	(0.00)	(0.04)
Issuance size	-4.17*	16.38*	-26.00***
	(0.01)	(0.01)	(0.00)
Issuance weighted life	60.04	-87.63***	-22.05
	(0.11)	(0.00)	(0.65)
Control interest payment characteristics	Yes	Yes	Yes
Control rating characteristics	Yes	Yes	Yes

control fixed year effect	Yes	Yes	Yes
N	512	918	918
R^2	0.540	0.568	0.592

Notes: *p*-values in parentheses。 $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 6 focuses on senior tranche products. After the epidemic, funds have a higher appetite for senior tranche products, but Interest Rate Spread on senior tranche products are already relatively small, so the changes of the spreads for state-owned companies and foreign capital or joint ventures are limited and not very significant. The spread of private companies has dropped significantly, which is consistent with the conclusion that senior tranche is the safe harbor.

Table 6: **Senior Tranche Products: Distinguishing Different Ownership Characteristics**

	Model 1 state-owned enterprises	Model 2 private enterprises	Model 3 foreign-funded or joint ventures
Dummy variable: after time	8.60	-46.88*	-0.01
	(0.79)	(0.04)	(1.00)
Issuance size	-0.31**	-0.47	-0.73*
	(0.01)	(0.07)	(0.05)
Issuance weighted life	-66.86**	-33.86*	65.35**
	(0.00)	(0.01)	(0.00)
Control interest payment characteristics	Yes	Yes	Yes
Control rating characteristics	Yes	Yes	Yes
control fixed year effect	Yes	Yes	Yes

N	109	237	148
R^2	0.597	0.568	0.529

Table 7 shows that, if all products are put together, after the outbreak of the epidemic, the spread of private enterprises, foreign-funded companies and joint ventures still experienced a significant decline in spreads, which dropped 44.54 and 29.70 basis points respectively; the spreads of products issued by state-owned companies have risen by 37.60 basis points, but it is not statistically significant.

Table 7 All products: distinguishing different ownership characteristics

	Model 1 state-owned enterprises	Model 2 private enterprises	Model 3 foreign-funded or joint ventures
Dummy variable: after time	37.60	-44.54***	-29.70*
	(0.10)	(0.00)	(0.02)
Issuance size	-0.87***	-0.29	-1.64***
	(0.00)	(0.38)	(0.00)
Issuance weighted life	11.33	-20.32	66.77**
	(0.57)	(0.18)	(0.00)
Control interest payment characteristics	Yes	Yes	Yes
Control rating characteristics	Yes	Yes	Yes
control fixed year effect	Yes	Yes	Yes
N	193	457	240
R^2	0.321	0.338	0.390

Notes: *p*-values in parentheses。 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Empirical Analysis 3: Spreads from Products of First-Tier Cities

Table 8 shows that the issuer location effect is obvious after the outbreak of the epidemic occurred. If the issuers are in the Beijing-Shanghai, the spreads of their products dropped significantly, among which the senior tranche spreads dropped by 42.15 basis points. For issuers that are not in Beijing and Shanghai, investors require a decrease in issuance WAL.

<u>Table 8</u>: **Whether The Issuer is in the Beijing-Shanghai Area or Not**

	The issuer is in the Beijing-Shanghai area			The issuer is not in the Beijing-Shanghai area		
	senior	Mezzanine	All	Priority	Mezzanine	All
Dummy variable: after time	-42.5**	8.44	-35.81**	3.89	-29.20	-15.64
	(0.01)	(0.83)	(0.01)	(0.83)	(0.19)	(0.30)
Issuance size	0.18	-1.03	0.30	-0.79***	-13.78***	-0.79***
	(0.28)	(0.64)	(0.09)	(0.00)	(0.00)	(0.00)
Issuance weighted life	-31.98*	-97.97**	-47.79**	30.28	-5.75	30.43*
	(0.03)	(0.00)	(0.01)	(0.12)	(0.82)	(0.03)
N	200	112	312	312	294	606
R^2	0.740	0.765	0.758	0.471	0.640	0.598

Notes: *p*-values in parentheses。 $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

Empirical Analysis 4: Whether the Issuer is an Internet Company

Table 9 shows that among Mezzanine products, after the outbreak of the epidemic, investors have more confidence in Internet companies with more platform information, or products issued by banks with higher credit risk management capabilities, and the spreads of non-Internet companies with insufficient comprehensive information advantages have risen.

	Model 1 General consumer lending companies	Model 2 Internet companies	Model 3 Banks
Dummy variable: after time	57.50	-2.56	-19.17
	(0.20)	(0.89)	(0.39)
Issuance size	-9.24	-2.84	-0.20
	(0.13)	(0.41)	(0.85)
Issuance weighted life	-37.55	69.57**	67.64**
	(0.19)	(0.00)	(0.00)
Control interest payment characteristics	Yes	Yes	Yes
Control rating characteristics	Yes	Yes	Yes
control fixed year effect	Yes	Yes	Yes
N	121	193	60
R^2	0.668	0.812	0.868

Notes: *p*-values in parentheses。 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10 shows that, after the outbreak of the epidemic, senior tranche products of Internet platform company (model 2) and banks (model 3) are more sought after, and the spread has dropped significantly, while the spread of non-Internet companies such as General consumer lending companies have increased.

<center>**Table 10**: Senior Tranche Products: Whether the Issuer is an Internet Company</center>

	Model 1 General consumer lending companies	Model 2 Internet companies	Model 3 Banks
Dummy variable: after time	28.13	-33.39[**]	-50.04[***]
	(0.12)	(0.01)	(0.00)
Issuance size	-0.99[***]	-0.49[*]	-0.10
	(0.00)	(0.02)	(0.27)
Issuance weighted life	61.18[***]	-5.60	11.02
	(0.00)	(0.75)	(0.27)
Control interest payment characteristics	Yes	Yes	Yes
Control rating characteristics	Yes	Yes	Yes
control fixed year effect	Yes	Yes	Yes
N	243	186	62
R^2	0.665	0.640	0.669

Notes: *p*-values in parentheses。 $^* p < 0.05,$ $^{**} p < 0.01,$ $^{***} p < 0.001$

Table 11 shows that after the two products are put together, it is impossible to identify the information advantage or credit risk management capability advantage of the issuer.

	Model 1 General consumer lending companies	Model 2 Internet companies	Model 3 Banks
Dummy variable: after time	30.51	-25.20	-16.76
	(0.05)	(0.07)	(0.17)
Issuance size	-0.74**	-0.43*	-0.04
	(0.00)	(0.05)	(0.59)
Issuance weighted life	25.30	50.41*	29.67**
	(0.20)	(0.01)	(0.00)
Control interest payment characteristics	Yes	Yes	Yes
Control rating characteristics	Yes	Yes	Yes
control fixed year effect	Yes	Yes	Yes
N	364	379	122
R^2	0.669	0.762	0.857

Notes: *p*-values in parentheses。 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Robustness Test: In Table 12, we use the interest rate of one-year corporate bonds to calculate the interest rate spreads. The results of regression are basically consistent with the basic regression in Table 4, this indicates that the analysis of spreads affected by the epidemic is robust and not affected by the standard for calculating spreads. Therefore, it may be considered that the model in this paper has strong robustness, and the conclusions based on it are reliable.

	Model 1	Model 2	Model 3	Model4
	Spread of	Spread of	Spread of	
	Mezzanine	Priority	All products	
	products	products		
Dummy variable: after time	26.30	-6.60	21.73	1.96
	(0.50)	(0.75)	(0.18)	(0.92)
Issuance size	-10.34***	-0.59***	-0.74***	-0.72***
	(0.00)	(0.00)	(0.00)	(0.00)
Issuance weighted life	-45.25	18.30	20.94	12.29
	(0.07)	(0.24)	(0.07)	(0.32)
Control interest payment characteristics	Yes	Yes	No	Yes
Control rating characteristics	Yes	Yes	No	Yes
control fixed year effect	Yes	Yes	No	Yes
N	406	512	918	918
R^2	0.508	0.406	0.472	0.498

Notes: *t* statistics in parentheses, $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

5 Calculate the OAS Values of Consumer Finance ABS in China

The research in this paper is specifically aimed at the pricing of consumer finance ABS products in asset securitization. This method is related to the interest rate term structure, prepayment, default risk and other issues, and is directly related to the default rate and early payment factors we mentioned above. Next, by calculating the OAS value of consumer

finance ABS products, we will focus on investigating and comparing the changes before and after the epidemic, and analyze the changes of the characteristics of this product in terms of credit and liquidity.

5.1 The Calculation of OAS Values

Process of OAS Values Calculation

Based on the review of OAS methods applied in asset securitization mentioned above, we know that options embedded in asset securitization products are mainly related to prepayment options, while OAS measures other risk premium of ABS products after removing prepayment options. Therefore, by calculating the OAS value of consumer finance ABS products, this paper can address the credit and liquidity risk of ABS products. Because consumer ABS are usually held to maturity, the liquidity effect is insignificant, and this paper mainly deals with the credit risk.

Now let's look at the specific calculation of OAS value.

5.2 Calculation of OAS

The specific steps of OAS calculation are comprised of the following four parts:

Step 1: Separate the term structure of the interest rate.

Step 2: Using stochastic process to describe the dynamic change of interest rates. Simulation methods are used to generate various paths of future interest rate changes. Since the term structure of the interest rate and interest rate volatility are taken as input variables in the simulation process, the whole simulation process can be regarded as arbitrage free.

Step 3: According to the nature of the embedded options in the bond, adjust and calculate the future cash flow under different scenarios along each possible path of interest rate change. This method is similar to the simulation of American options. When the cash flow occurs, it is necessary to decide whether to execute the option to determine the cash flow.

Step 4: Calculate OAS. OAS can be obtained by solving the following equation with one variable:

$$P = \frac{1}{N} \sum_{n=1}^{N} \sum_{t=1}^{T} \frac{cf_t'}{\prod\limits_{i=1}^{t} \left(1 + r_i^n + OAS\right)}$$

Where N is the total number of interest rate paths obtained by simulations, i is the set time step separation point during the simulation, and r_i^n is the benchmark interest rate level of each time. The value of OAS is to discount and sum up the possible cash flow cf' in the future time t in each simulated interest rate path to get the present value. The mean value of the present value in each path is the value V of the weighted bond. Since V is not always equal to the current market price of the ABS products, it is necessary to shift the current whole term structure of interest rate in parallel, and find a spread that makes V equal to P through univariate solution, the whole process is OAS.

Separate the Term Structure of the Interest Rate

In this paper, the yield to maturity of one-year AAA medium note is selected as the benchmark interest rate term structure to calculate the OAS value.
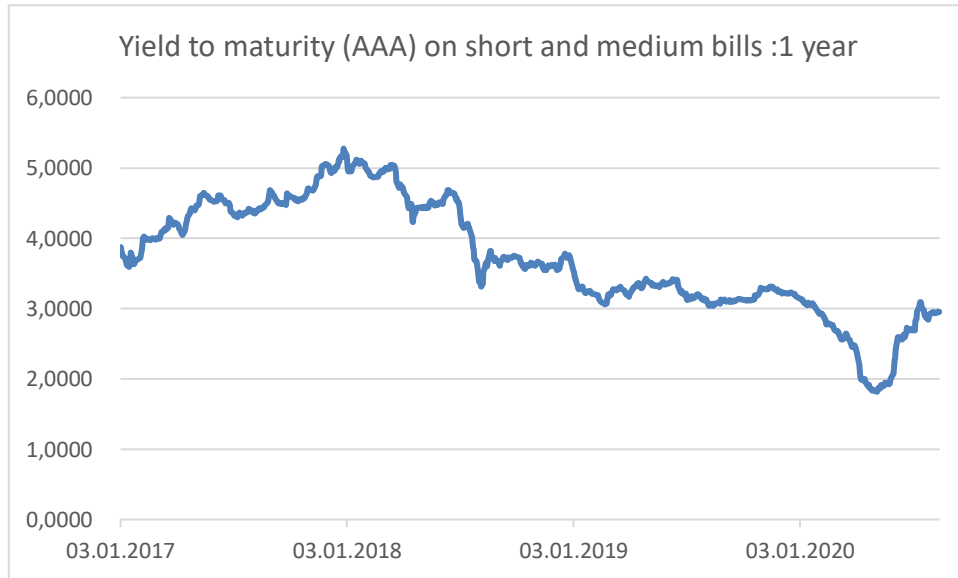

Figure 8: Yield to maturity (AAA) on short and medium bills : 1 year

Parameter Estimation

Future short-term interest rate paths for medium term notes are simulated by using CIR model and Monte-Carlo simulation. The CIR model uses the square root of mean reversion process to describe the instantaneous interest rate fluctuation, to make sure the non-negative characteristics of short-term rates. Set Drift term positive, and diffusion term approaching to 0, it means that the interest rate volatility also approaches to 0, therefore interest rate will always be non-negative. The CIR process can reach close to the boundary, but the drift term can make sure that the zero interest rate will not be reached.

Here, we use OLS method for parameter estimation to calculate k, θ, and σ. It is important to note that different securities have different issue dates and if we use the same parameters to simulate the interest rate paths using Monte-Carlo model for all securities, these interest paths may not be appropriate used to discount cash flow for securities. Therefore, for each security we use the AAA medium note rate on the initial interest accruing date for the corresponding ABS security to make sure that we have different k, θ, and σ for each security. The process ensures that each security has a set of interest rate path to discount its cash flows. We use the following steps to calculate coefficient parameters:

Firstly ,obtain the following results by Euler discretization of the CIR process：

$$r_{t+\Delta t} - r_t = \alpha(\mu - r_t)\Delta t + \sigma\sqrt{r_t}\varepsilon_t$$

Secondly, convert the formula above into：

$$\frac{r_{t+\Delta t}-r_t}{\sqrt{r_t}} = \frac{\alpha\mu\Delta t}{\sqrt{r_t}} - \alpha\sqrt{r_t}\Delta t + \sigma\varepsilon_t$$

Let $y_i = \frac{r_{t_{i+1}}-r_{t_i}}{\sqrt{r_{t_i}}}$, $x_{1i} = \frac{\Delta t}{\sqrt{r_{t_i}}}$, $x_{2i} = \sqrt{r_{t_i}}\Delta t$, $theta = \alpha\mu$, $kappa = -\alpha$, $sigma = \sigma$, $\xi_t = \sigma\varepsilon_t$

Then the objective function of least squares is：

$$argmin = \sum_{i=1}^{N-1}(y_i - thetax_{1i} - kappax_{2i})^2$$

After getting theta and kappa, we also got α and μ. We then brought these values into model to get the residual sequence of estimation, and sigma is the standard error of the residual sequence.

We do not use rolling window, but we estimate coefficients many times. Specifically, for each consumer finance ABS security, we choose the initial interest accruing date as starting point, select the period of rt sequence from the initial interest accruing date to present, estimate CIR model parameters mentioned above. Need to note that since the securities of the same product have the same initial interest accruing date, the coefficient estimation results obtained should be consistent, therefore we only demonstrate one result for each security.

For all consumer finance ABS products, calculate the standard deviation of the three coefficients estimated by CIR model, as shown below:

	Theta	Kappa	Sigma
Mean value	0.001705	0.061605	0.006639
Standard deviation	0.003742	0.125413	0.000917

It can be seen that the standard deviations of the three parameters are very small, so it can be concluded that the coefficients estimated by rt sequences with different have little fluctuation and good stability.

By making Pareto graph for different theta, kappa, and sigma estimated by different time length sequences, we can see that for the same parameter, the distribution of the results estimated by different time length sequences RT is relatively concentrated, which indicates the robustness of parameter estimation.
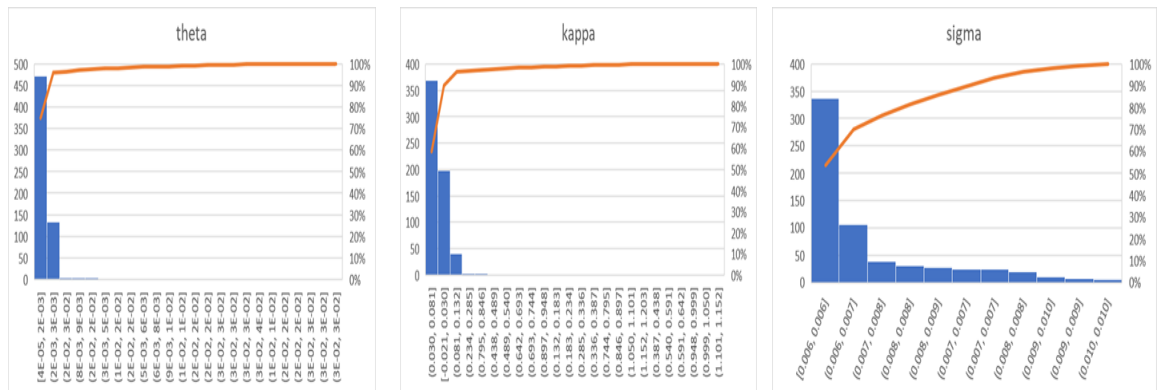

Figure 9: Pareto Graphs for Different Theta, Kappa, and Sigma

Simulated Interest Rate Path

For each security, we select its rt sequence from the initial interest accruing date, we estimate coefficients using CIR model based on this sequence, and then we simulate 10 interest rate paths. For the estimated model, given an initial value, we use Monte-Carlo simulation. The steps are as follows:

Step 1: Select a stochastic process and random variable distribution. Estimate the corresponding parameters, and construct a probability model that conforms to its characteristics.

Step 2: The pseudo-random sequence generated by the program is used as the sampling input of the system. A large number of digital simulation experiments are conducted to generate a path from r_{t+1} to r_{t+n} until the final target.

Step 3: Repeat the first two steps N times to generate N paths of interest rate change. In this paper, N is 10.

It should be noted that in this paper, when simulating the interest rate path of each security, the yield to maturity of the one-year AAA medium note on the issue date is taken as the initial interest rate to simulate, so as to eliminate the impact of the downward interest rate on the OAS value.

According to the monthly forward interest rate, the term structure of interest rate under each interest rate path can be determined and the cash flow can be discounted with the term structure of interest rate. It can be known that:

$$Z_t(N) = \left[\left(1+f_1(N)\right)\left(1+f_2(N)\right)\cdots\left(1+f_t(N)\right)\right]^{\frac{1}{t}} - 1$$

where, $Z_t(N)$ is the simulated spot rate of month t on path N, and $f_t(N)$ is the forward rate of month t in path N.

Here, for illustration purpose, we only demonstrates one sample. It can be seen that although the simulated interest rate path cannot perfectly match the actual interest rate curve, but to a certain extent it shows the trend of the real interest rate. *Maybe if I use rolling window, will get a better fitted curve.* At the same time, the trend of the simulated 10 paths matched closely each other, which further shows the robustness of the simulation results. The following is the randomly selected path output from R software.
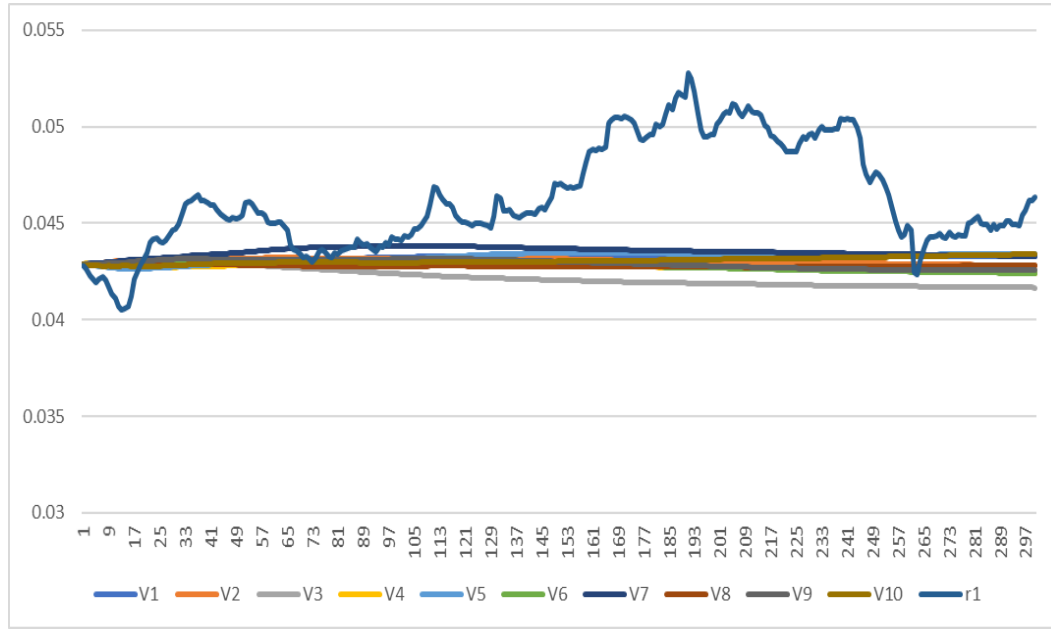
Figure 10: Interest Path Output from R Software

Predicting Future Cash Flows

After the interest rate path is generated through simulation, the future cash flow of consumer finance ABS products needs to be estimated, and the most important is the determination of cash flow of prepayment.

In this paper, the PSA model used in ABS products is referenced and analyzed. In combination with practical experience, considering that the prepayment rate of consumer finance ABS is usually higher than that of ABS, the 150%PSA model is adopted in this paper, and its mathematical expression is

$$\text{SMM}_t = \begin{cases} 0.002 * t * 1.5, & 1 \le t \le 30 \\ 0.06 * 1.5, & t > 30 \end{cases}$$

Where t is a positive integer.

Suppose MT_t is the total repayment amount of the loan in period t, MB_t is the principal amount that should be repaid in period t, and MIt is the interest amount that should be repaid in period t. There are:

$$\text{MT}_t = \text{MB}_t + \text{MI}_t$$

Based on the formula that the amount of each installment is equal on the total principal and interest, we can obtain that:

$$MT_t = B_t * \left[\frac{i*(1+i)^{n-t+1}}{(1+i)^{n-t+1}-1} \right]$$

Where B_t is the beginning principal balance in period t, i is the current interest rate, which is determined by the simulated benchmark interest rate.

Let C_t be the cash flow generated in period t, MTC_t is the prepayment amount in period t, and we can get:

$$C_t = MTC_t + MT_t$$

According to the prepayment model, let SMM_t be the prepayment rate of period t, then:

$$MTC_t = SMM_t * (B_t - MB_t)$$

At the same time, the beginning principal balance for the next principal payment is:

$$B_{t+1} = B_t - MB_t - MTC_t$$

After several times of this cycle, we can obtain the level of cash flow generated in each installment over the entire repayment time in a path of interest rate change. If we run the cash flow calculation process N times in each path, we can get the cash flow level under each path of interest rate in N paths.

5.3 Calculation Results of OAS Values

The selected sample range is to calculate the OAS value of the remaining 1,441 consumer finance ABS securities after the elimination of 5 securities maturing within 12 months and the deletion of 3 securities not matching the corresponding benchmark interest rate, and the results were shown as follows.

Table 13: Descriptive statistics of consumer Finance ABS securities OAS

Min	Lower 25th Quantiles	Medium	Mean	Upper 25th Quantiles	Max
67.63	61.26	103.45	128.91	158.59	1026.23

As can be seen, the average OAS of consumer finance ABS securities is 128.91 basis points, mainly distributed around 60 to 150 basis points.
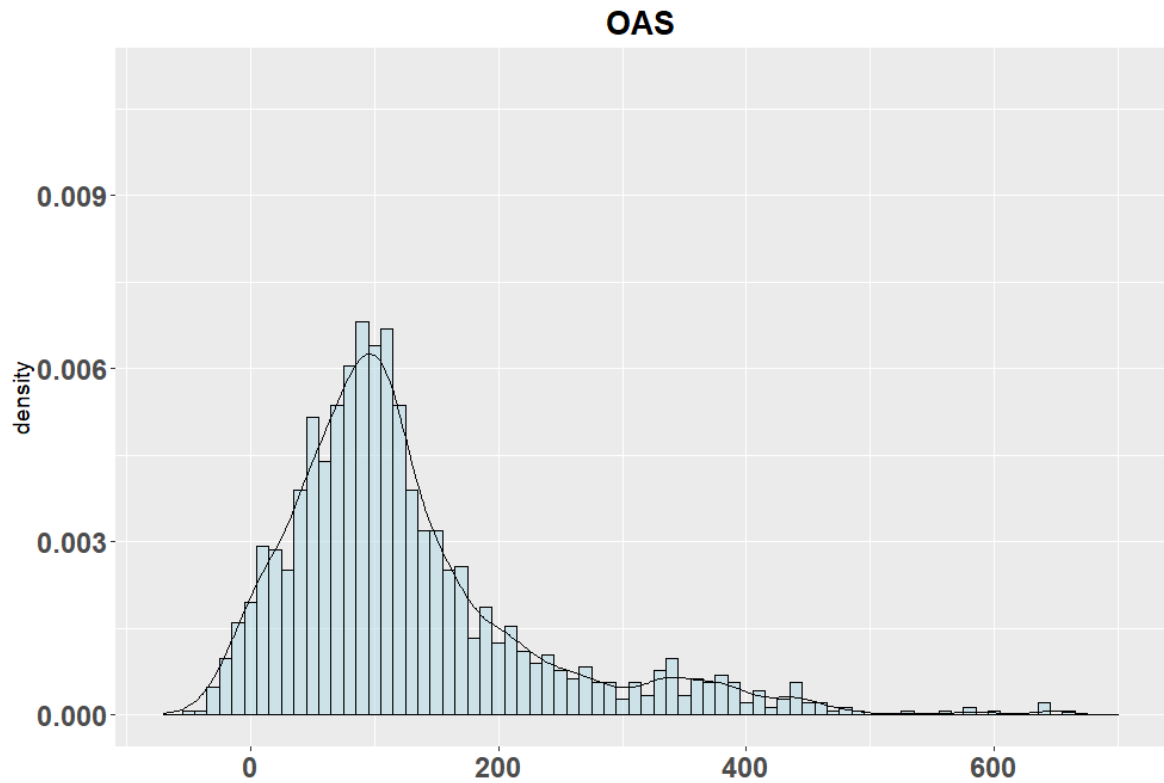

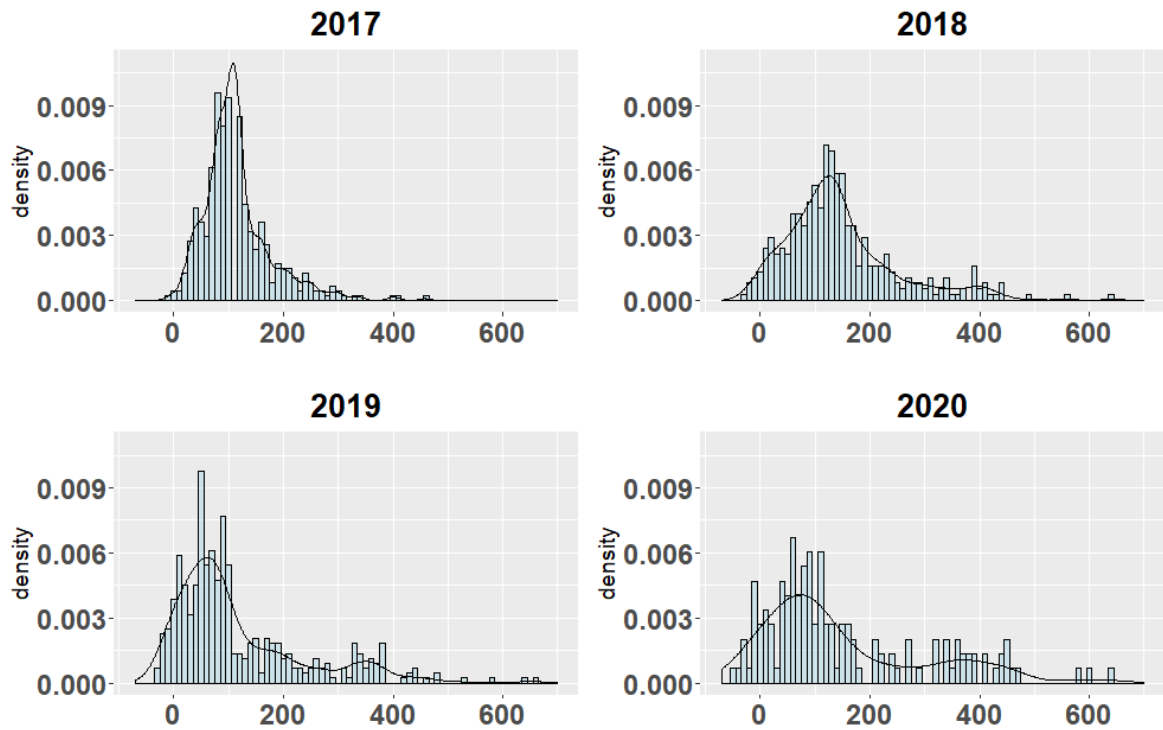Figure 11: Distribution of OAS Values of Consumer Finance ABS Securities

Figure 12: Distribution of OAS Values of Consumer Finance ABS from 2017 to 2020:

Table 14: Descriptive Statistics of Consumer Finance ABS Securities OAS from 2017 to 2020

	Min	Lower 25th Quantiles	Medium	Mean	Upper 25th Quantiles	Max
2017	-11.98	80.07	106.01	114.30	130.98	458.17
2018	-29.54	60.61	116.43	127.83	142.09	894.98
2019	-32.68	39.84	77.64	121.72	166.97	926.23
2020	-67.63	50.34	96.20	148.71	215.86	643.78

By analyzing OAS of the consumer finance ABS securities between 2017 and 2020, we can see that 2020 consumer finance ABS securities OAS value is significantly higher than that of the rest of the year, it means that the OAS value of consumer finance ABS securities increased significantly after the epidemic, the OAS value actually reflects the risk factors to

securities in default risk and liquidity risk, removing the prepayment, considering China's ABS liquidity has been very weak (this is another theme), so it shows that to some extent epidemic increases the consumer finance ABS securities risk of default, What this paper is most concerned about is the change of default rate brought by the epidemic.

Next, we further verify the impact of the epidemic on China's consumer finance ABS products from several dimensions.

Personal Consumer Finance ABS

As can be seen from figure 5 and figure 6 above, personal consumer finance ABS securities are more affected by the epidemic than auto consumer finance ABS securities. Next, we will focus on the study of personal consumer finance ABS securities. Firstly, the distribution of OAS values of personal consumer finance ABS securities from 2017 to 2020 is discussed.
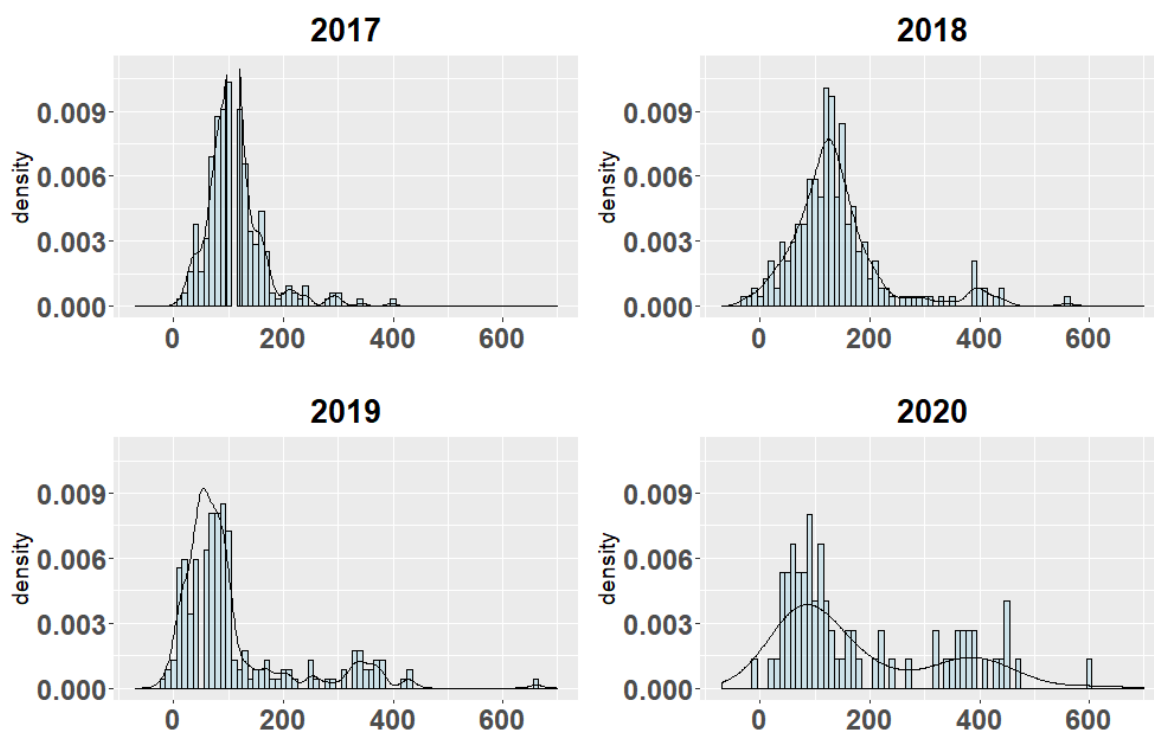

Figure 13: Distribution of OAS Values of Consumer Finance ABS from 2017 to 2020

According to the analysis of personal consumer finance ABS securities in Table 15, it can be seen more clearly that the average OAS value of consumer finance ABS in 2020 is 181.64 basis points, which is much higher than the OAS value level from 2017 to 2019. This further demonstrates that the epidemic has increased the default risk of personal consumer finance ABS securities, reflecting the impact of the epidemic on people's consumption.

Table 15: Descriptive Statistics of Consumer Finance ABS Securities OAS

	Min	Lower 25th Quantiles	Medium	Mean	Upper 25th Quantiles	Max
2017	8.054	84.103	107.273	111.541	126.593	397.552
2018	-29.54	61.90	115.73	113.88	134.19	894.98
2019	-21.38	47.18	70.75	108.06	101.50	926.23
2020	-6.384	68.819	110.380	181.64	322.315	601.556

By analyzing the time trend of personal consumer finance ABS securities, this paper comes to the conclusion that the epidemic situation increases the risk of consumer finance ABS securities, which is highly consistent with the conclusion of our previous regression analysis in part 4 (Table 3 OLS: The overall result). Next, we analyze the different issuers of consumer finance ABS securities, that is, we focus on analyzing the OAS performance of consumer finance ABS securities of different types of issuers.

The Issuer With Different Ownership Characteristics

According to the different ownership nature of consumer finance ABS securities issuer, it can be classified into three categories, namely private enterprises, state-owned companies and foreign capital or joint ventures. The OAS values of these three types of subjects is as follows:

Table 16: Descriptive Statistics of Consumer Finance ABS Securities OAS with Different Ownership Characteristics

	Min	Lower 25th Quantiles	Medium	Mean	Upper 25th Quantiles	Max
private	-19.56	82.26	108.13	126.15	140.38	1026.23
state-owned	-29.54	23.80	42.00	51.61	64.37	216.20
foreign capital or joint ventures	-6.38	72.24	114.65	165.41	247.18	450.73

It can be seen that the OAS value of state-owned companies is significantly lower than that of private companies and foreign capital or joint ventures, which indicates that the default risk of consumer finance ABS securities issued by state-owned companies is lower. In China, state-owned companies have government credit to a certain extent because of the government's role in the backstop, which is understandable.
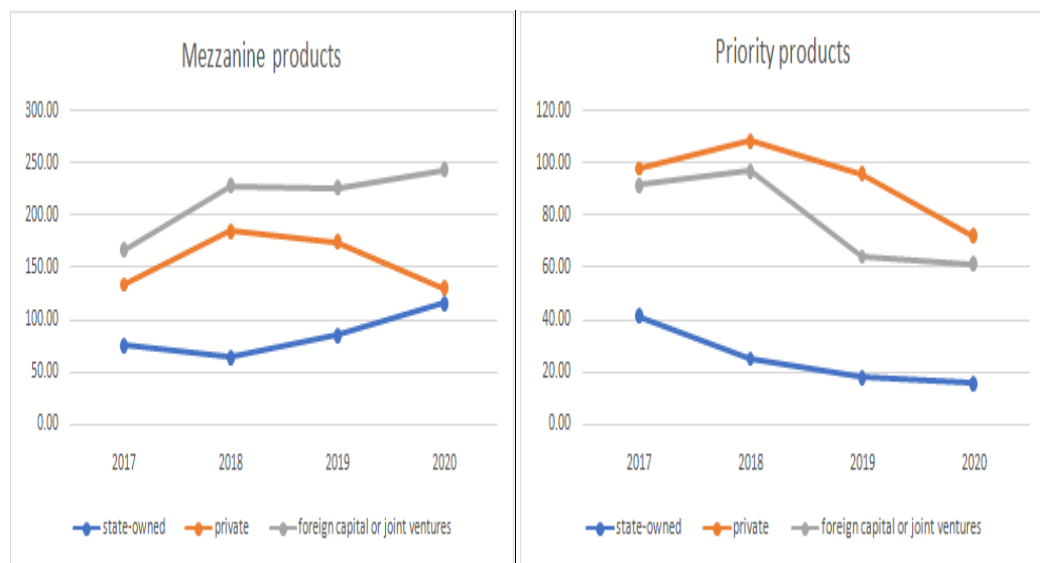

Figure 14: Mezzanine and Senior Tranche OAS Mean Values of Three Different Ownership Characteristics

Figure 14 shows that mean OAS values of the mezzanine products of state-owned companies increased in 2020, on the contrary, the mean OAS value of private companies decline, which is consistent with the conclusion of Empirical analysis 2, the ownership characteristics of an enterprise will affect its response to the epidemic.

Whether the Issuer is an Internet Company

Considering the development of Internet finance and the scientific and technological support of Internet companies, consumer finance ABS securities are firstly divided into those whose subject type is Internet company and those whose subject type is not Internet company.
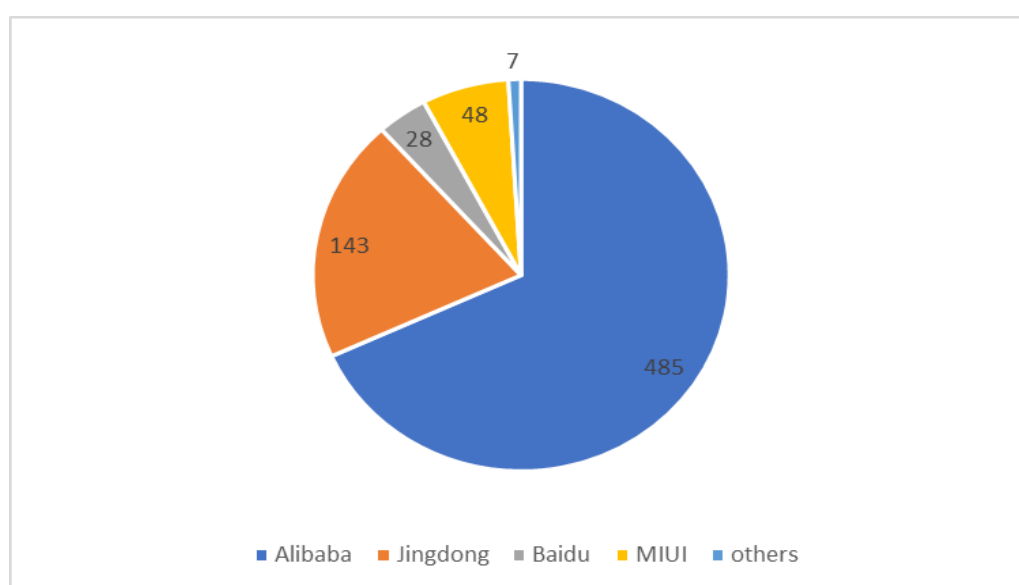

Figure 15: Number of Consumer Finance ABS Issued by Different Internet Platforms

Major Internet consumer finance ABS issuers in China include Alibaba, Jingdong, Baidu, Xiaomi, Anxin, Lakala , S.F, and Suning, among which Alibaba accounted for 68% of the total issuance amount, Jingdong accounted for 20%, the issuance amount of the top two added up to more than 80% of the total issuance amount of the Internet consumer finance ABS. Alibaba and Jingdong have accumulated significant experience on issuing consumer finance ABS securities.   Consumer finance ABS securities issued by other Internet companies accounted for only 12%, with MIUI (7%) and Baidu (4%) totaling another 11%. The remaining Internet companies shared the remaining 1% market share. Therefore, in the analysis of consumer finance ABS securities issued by Internet companies, Alibaba,

Jingdong, Baidu and MIUI are mainly examined in the following text. Besides, Alibaba, the head Internet company, will be further analyzed separately in the following text. Figure 16 shows the difference in OAS value between consumer finance ABS securities of Internet companies and ABS securities of non-Internet companies:
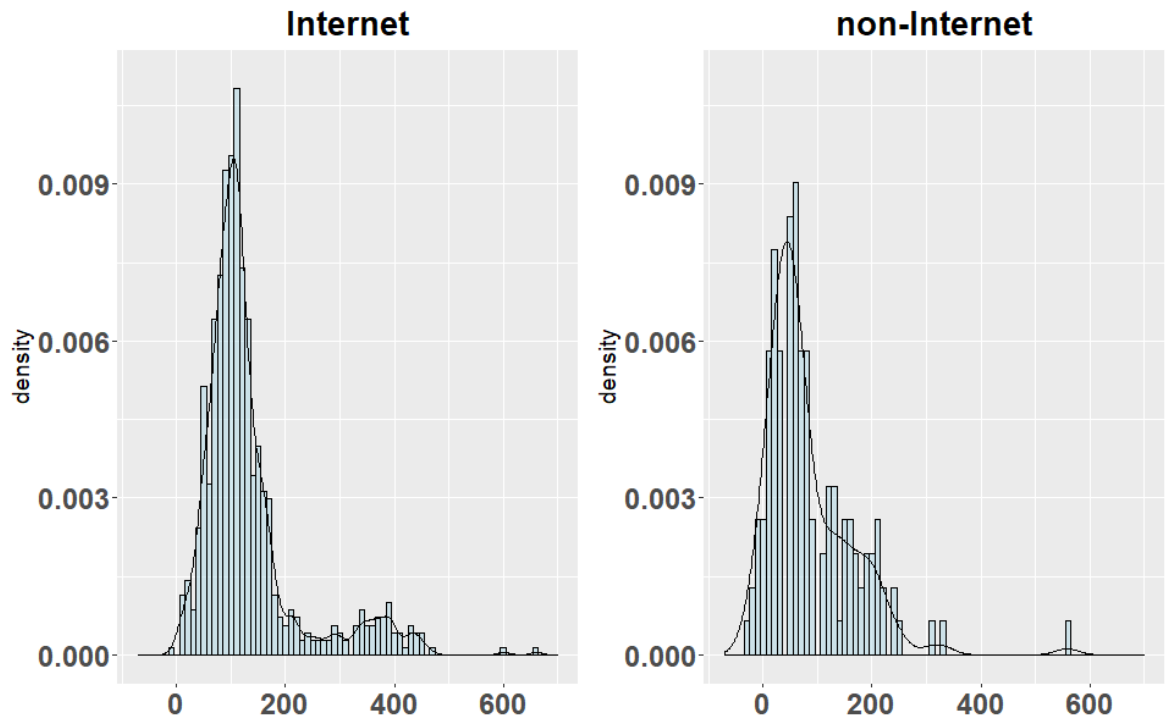

Figure 16: Comparison of OAS Values Between Internet Companies and Non-Internet Companies

Table 16: Descriptive Statistics of OAS Values of Internet Companies and Non-Internet Companies

	Min	Lower 25%	Medium	Mean	Upper 25%	Max
Internet companies	-6.384	81.361	108.097	134.121	145.536	1026.226
non-Internet companies	-29.54	31.53	57.68	82.29	121.75	558.70

Comparing OAS value of the personal consumer finance ABS securities which belongs to Internet companies (including Alibaba and Jingdong) to OAS value of others which belongs to non-Internet companies, we can see that OAS value of personal consumer finance ABS securities which belongs to Internet is significantly higher than that of the non-Internet, it shows that the default risk of Internet consumer finance ABS securities is higher than that of non-Internet consumer finance ABS securities. Further, we divide non-Internet companies into banking and general consumer lending companies:

Table 17: Descriptive Statistics of OAS Values Between Internet Companies and Banks and General Consumer Lending Companies

	Min	Lower 25%	Medium	Mean	Upper 25%	Max
Internet companies	-6.384	81.361	108.097	134.121	145.536	1026.226
General consumer lending companies	19.41	84.03	129.82	146.96	191.13	558.7
Banks	-29.54	23.72	40.94	50.57	61.47	216.2
Bank - Credit card installment	-29.54	17.47	37.94	45.94	59.18	216.2
Bank - General consumer lending	12.73	41.45	54.18	71.29	99.86	172.25

As a result, we find that the OAS value of Internet enterprise consumer finance ABS securities is significantly lower than that of General consumer lending companies, but much higher than that of Banks. At the same time, the credit card installment in the bank is much lower than the general consumer loan. Since the OAS value here mainly measures the default risk, it indicates that Banks, as established financial institutions, are better at risk control than Internet companies. The Internet companies, relying on its own technological level, is better at risk control than General consumer lending companies.
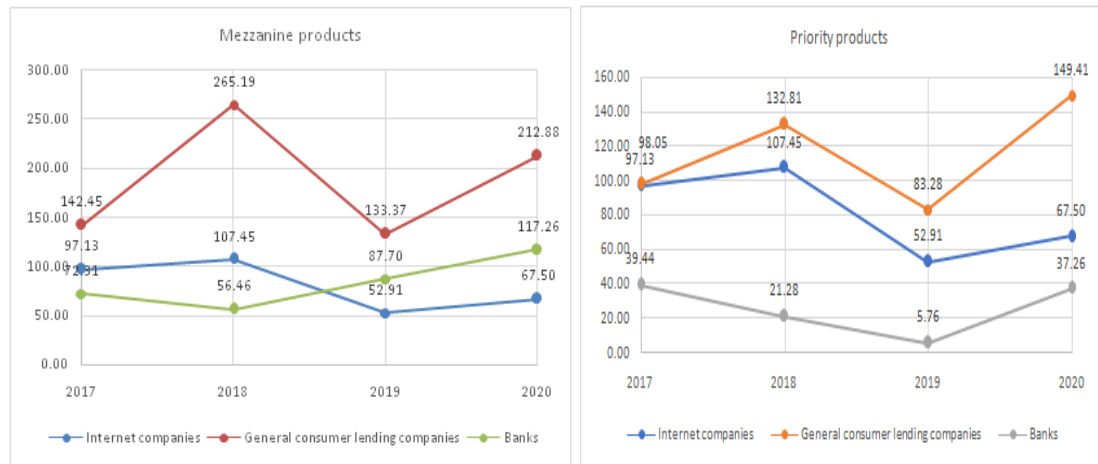
Figure 17: Mezzanine and Senior Tranche OAS Mean Values of Three Types

Figure 17 shows that mean OAS values of the products of Internet companies increased the least among three types in 2020, on the contrary, mean OAS values of General consumer lending companies increased the most, which is consistent with the conclusion of Empirical analysis 4, after the outbreak of the epidemic, senior tranche products issued by Internet platform company and banks are more sought after, and the spread has dropped significantly, while the spread of General consumer lending companies has increased.

Based on the description of the Internet issuers, it can be seen that there are mainly the following four companies, which are Alibaba, Jingdong, Baidu and MIUI. Descriptive statistics and time-trend change analysis are made on the OAS value of consumer finance ABS securities under these four issuers respectively. The results are as follows:

Table 18: Descriptive Statistics of OAS Values of Internet Companies

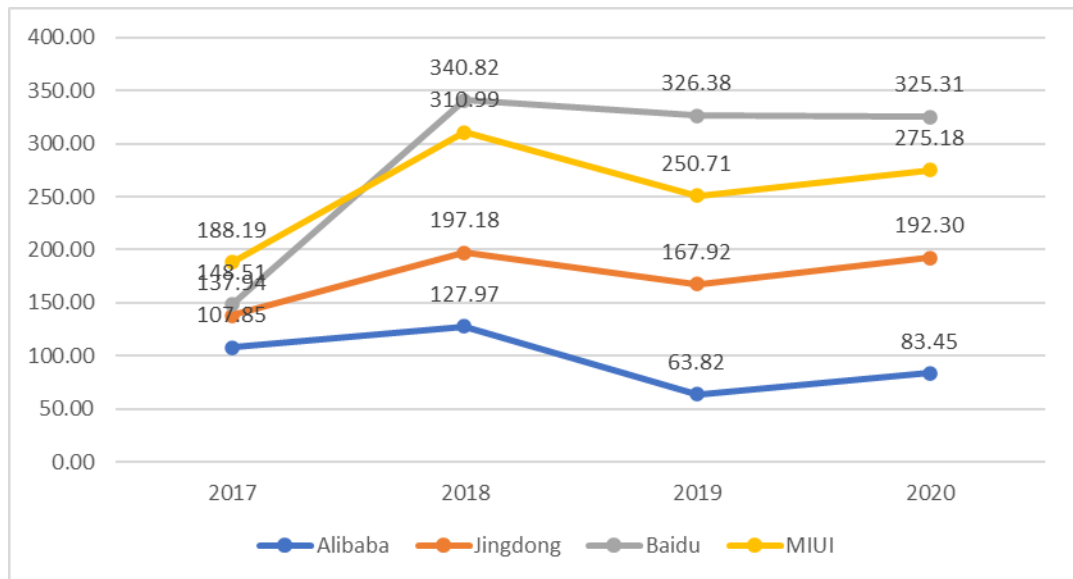|	Min	Lower 25%	Medium	Mean	Upper 25%	Max
Alibaba	7.261	78.817	104.066	103.631	125.773	229.287
Jingdong	-6.384	69.050	108.407	173.333	321.346	450.726
Baidu	35.9	109.8	193.0	277.9	327.2	1026.2
MIUI	87.89	151.86	212.12	241.49	354.73	465.86

Figure 18: Variation Trend of Average OAS of Internet Companies

It can be seen that the OAS of ABS securities of Alibaba and Jingdong are significantly lower than those of Baidu and MIUI. Based on the above analysis of the number of consumer finance ABS issued by Internet companies, it can be concluded that, as Internet companies issuing the largest number of consumer finance ABS, Alibaba and Jingdong have relatively mature risk control ability, and their risk control ability is obviously better than Baidu and MIUI. Among them, Alibaba, as an Internet company with more than 60% securities issued, has the lowest OAS level among Internet companies, far lower than Jingdong and other Internet companies. This shows that Alibaba, as a leading company in the Internet, has more advanced technical means and is particularly mature in the risk control of underlying loan underwriting.

Further analysis of the consumer finance ABS securities issued by Banks shows that the consumer finance ABS securities issued by joint-stock Banks account for 68%, while those issued by five major Banks and city commercial Banks account for 14% and 18% respectively. Considering that the amount of consumer finance ABS securities actually issued by the five Banks is not large, and the scale of five major Banks is not significantly different from that of other joint-stock Banks, therefore the securities issued by five major Banks are classified into the category of joint-stock Banks issuance in the analysis below. Therefore, bank issuance is divided into two categories: urban commercial Banks and joint-stock Banks.

Table 19: Descriptive Statistics of OAS Values of Consumer Finance ABS Securities of Bank Subjects

	Min	Lower 25%	Medium	Mean	Upper 25%	Max
city commercial Banks	-21.38	38.44	49.83	63.32	99.86	172.25
joint-stock Banks	-29.54	21.22	38.86	47.72	59.99	216.20

Through descriptive statistics of the OAS values of urban commercial Banks and joint-stock Banks and the variation trend of their average OAS values, it can be seen that the OAS value of consumer finance ABS securities issued by urban commercial Banks is significantly higher than that of joint-stock Banks, that is, the risk control ability of city commercial Banks on consumer finance ABS securities is weaker than that of joint-stock Banks. Combined with the above analysis of the OAS values of different subject types of Internet companies, and considering that the investment in technology of city commercial Banks is inevitably lower than that of joint-stock Banks, this further illustrates the importance of fintech technology, and it can be speculated that increasing the investment in technology can effectively control the risk of consumer loans.

Finally, considering that Alibaba is the most mature company issuing consumer finance ABS securities by Internet companies and is also recognized as the technological leader of Internet companies, the OAS value of Consumer finance ABS issued by Alibaba, General consumer lending companies and Banks will be compared.

Table 20: Descriptive Statistics of OAS of Alibaba, Banks and General Consumer Lending Companies

	Min	Lower 25%	Medium	Mean	Upper 25%	Max
Alibaba	7.261	78.817	104.066	103.631	125.773	229.287
Bank - Credit card installment	-29.54	17.47	37.94	45.94	59.18	216.20
Bank General consumer lending companies	12.73	41.45	54.18	71.29	99.86	172.25

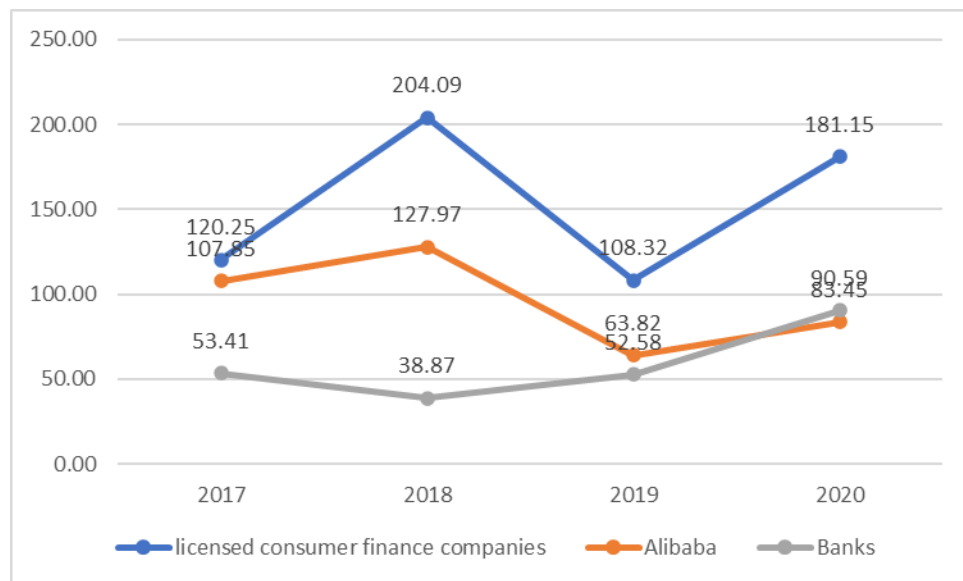|						
General consumer lending companies	19.41	84.03	129.82	146.96	191.13	558.70

Figure 19: OAS Mean Variation Trend of Alibaba, Banks and General Consumer
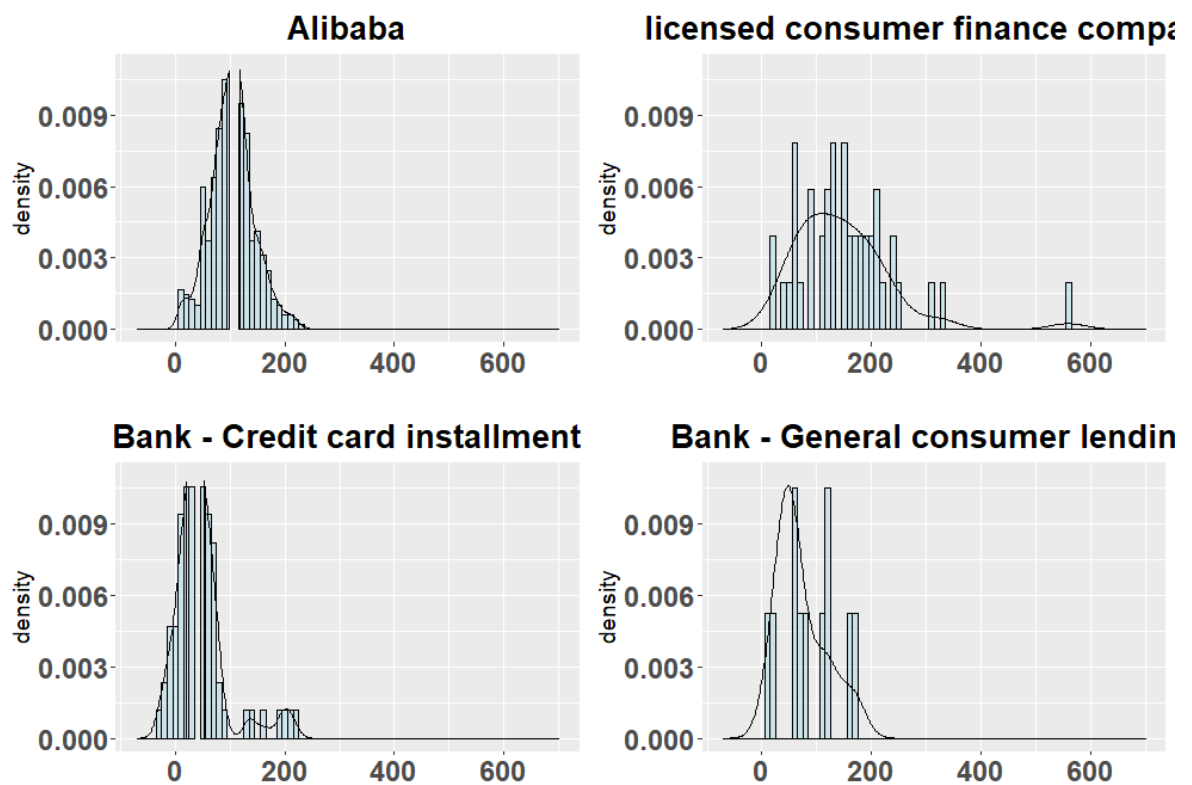
Lending Companies

Figure 20: Distribution of OAS Among Alibaba, Banks and General Consumer Lending

Companies.

Through descriptive statistics of the OAS values of the three, we can see the following characteristics: (1) the OAS value of Alibaba is much lower than that of General consumer lending companies; (2) Compared with the OAS value of the Internet as a whole, the OAS value of Alibaba series is also closer to the OAS value of general consumer ABS of Banks; (3) From the perspective of distribution, the distribution of OAS values of Alibaba is also similar to the distribution of OAS values of Banks. At the same time, through the analysis of the variation trend of the mean OAS of the three factors, we can also see that (4) the OAS value of Alibaba is gradually close to that of the bank's consumer finance ABS securities, and the OAS value of Alibaba is lower than that of the bank after the epidemic. This shows that Ali's response to the epidemic is even better than some banks. This proves from the side, as the passage of time, the Internet enterprise leader Alibaba generation of the advantage of risk control is becoming increasingly clear. It can be considered that this reflects the technical advantages in the financial field. It is Alibaba investment in technology that makes it gradually surpass the traditional bank risk management model, and it has been tested to a certain extent in the epidemic.

6 Conclusion

At the end of 2019, a sudden global epidemic reduced consumer demand. This paper intends to take the epidemic as an emergency in the financial market and observe the performance of securitized products in combination with the underlying assets of Asset securitization in China and the corresponding market changes in the industry. Specifically, we chose consumer finance, which is the greatly influenced by the outbreak of industries and fields, considering about the underlying asset defaults and prepayment rate, to do empirical analysis of China's asset securitization market performance during June 2018 to June 2020 (3 years). We found that the main consumer loans, car loans, credit cards, general consumer loans) at the end of February hard hit by the outbreak, then appeared delinquent soared, a default rates soared in May.

The main findings of this study are as follows: (1) COVID-19 has increased the default risk of China's consumer finance ABS securities, and the spread of consumer finance ABS products has shown an overall trend of rising after the epidemic. However, with the rapid control of the epidemic and the effective resumption of work and production, macroeconomic policies and government stimulus measures have had a certain positive impact on the recovery of various index. (2) There is a structural difference in the spread of consumer finance ABS products. On the whole, the senior tranche products are sought after by funds, and the spread decreases after the epidemic. The risk of mezzanine products is higher than that of the senior tranche products, and investors demand a higher risk premium compensation after the epidemic. This shows that with the arrival of the epidemic, risk aversion in the market rises, and safe assets become the first port of choice for liquidity. (3) From the perspective of different types of issuers, the OAS value of Internet enterprise consumer finance ABS securities is significantly lower than that of General consumer lending companies, but higher than that of general consumer loans of Banks. (4) The extent of the use of fintech affected the performance of ABS products during the epidemic, and the advantages of the leading Internet enterprise Alibaba for risk control were obvious in the epidemic. Internet platform companies rely on big data to establish risk control systems and analyze consumer credit through user data accumulated in trade scenarios, so as to guarantee the quality of ABS underlying assets to a certain extent, which has been tested in the epidemic and finally recognized by investors. It can be said that Alibaba's investment in technology makes it gradually surpass the traditional bank risk management model, and it has been tested to some extent in the epidemic. This also means that the timing is right for China to promote fintech development.

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