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When banks' shadow fades and shadow banking rises: Securitization and loan performance in China

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Abstract

This study examines the relationship between securitization and loan performance using proprietary loan-level data from a Chinese bank. Securitized loans exhibit lower ex-post default rates and prepayment chances compared to the loans retained on the bank's balance sheet, suggesting no adverse selection or moral hazard within the Chinese securitization market. Our finding is robust to controlling for possible endogeneity of loan selection by employing propensity score matching and instrumental variable estimators. Exploiting the introduction of the New Asset Management Rule as a quasi-natural experiment, which alters banks' business model and eliminates other options of credit risk transfer except for securitization, we show worse loan performance after the new regulation, in line with deterioration of the bank's incentive. This unintended consequence of the New Asset Management Rule, aimed at curbing shadow banking activities of banks, highlights the emergence of risk in the securitization sector of the shadow banking.

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Non-technical summary

FOCUS

Contemporary banks have shifted away from the traditional "originate-to-hold" approach to adopting an "originate-to-distribute" model. Critics argue that, following the US subprime mortgage crisis, this shift has led to a reduced motivation for lenders to thoroughly assess and oversee borrowers. Although the concept of information challenges in securitization is widely acknowledged in theory, empirical findings have produced mixed results. To investigate whether adverse selection and moral hazard exist in the Chinese loan securitization, we compare the ex-post default risk and prepayment risk of securitized loans with those held by the originator on the balance sheet.

CONTRIBUTION

Our research contributes to the growing body of literature that explores the relationship between securitization and loan performance, information challenges, and agency issues in the securitization process. We offer three primary contributions. Firstly, while most previous empirical studies that use loan-level data have predominantly focused on developed economies, especially the U.S. mortgage market, there has been limited attention given to the practices of securitization in emerging markets. Secondly, the majority of prior investigations have concentrated on understanding information challenges in mortgage securitization or Collateralized Loan Obligation (CLO) markets, with only a few delving into the securitization of consumer credit and small business loans due to data constraints. Lastly, in contrast to earlier research that has either uncovered evidence of adverse selection and moral hazard or found no such evidence, we discover that a bank's inclination towards cream-skimming is influenced by bank regulations and its specific business model.

FINDINGS

In our analysis, we employ a dataset encompassing consumer and small business loans sourced from a Chinese commercial bank. Our findings reveal a noteworthy pattern: loans that the bank sells exhibit notably lower default and prepayment risks compared to those it

retains on its own balance sheet. This observation implies that there is no clear indication of adverse selection or moral hazard in the loan securitization process. Furthermore, we take advantage of the introduction of the New Asset Management Rule, treating it as a quasi-natural experiment. Our robust analysis provides compelling confirmation that loan performance tends to worsen when liquidity constraints are less stringent, alternative avenues for credit risk transfer are limited, and regulatory pressures are more pronounced.

1.   Introduction

Modern banks have switched from the conventional "originate-to-hold model" to an "originate-to-distribute" model (Purnanandam, 2011). Since the US subprime mortgage crisis, critics claim that securitization dampens originator incentive to properly screen and monitor borrowers. The critics echo the theoretical research which studies information frictions, adverse selection, and moral hazard problems in securitization and loan sales (Pennacchi, 1988; Gorton and Pennacchi, 1995; Parlour and Plantin, 2008; Drucker and Puri, 2009; Chari et al., 2014). While the theoretical importance of information frictions in securitization is well-recognized, empirical evidence is mixed. Most empirical studies use US data and confirm the existence of adverse selection by showing lower lending standards or higher ex-post default risk of the securitized assets in Commercial Mortgage-backed Securities (CMBS) markets (An et al., 2011), secondary loan markets (Berndt and Gupta, 2009), and mortgage markets (Keys et al., 2010, 2012; Agarwal et al., 2012; Elul, 2016; Begley and Purnanandam, 2017). On the contrary, Ambrose et al. (2005) and Jiang et al. (2014) document that securitized loans in fact have better ex-post performance (lower default rates) than similar loans held by the lender. In addition, a few studies find no evidence of adverse selection in certain segments of securitization markets. Benmelech et al. (2012) find no robust evidence of adverse selection in the securitization of corporate loans using Collateralized Loan Obligations (CLO) data. Albertazzi et al. (2021) document widespread adverse selection but limited moral hazard confined by lending relationships using Italian data, concluding no lax lending standards with credit risk transfer.

Compared to highly developed markets in US and Europe, the origin of Chinese securitization is relatively late. China first launched a pilot securitization program in 2005. Impressed by the collapse of securitization markets in the US, the Chinese pilot securitization program was halted in the wake of the US subprime mortgage crisis in 2008. In 2012, the securitization program was restarted and has experienced rapid growth since 2014. By the end of 2018, the total value of outstanding securitization products stood at 2.7 trillion yuan ($402 billion), making China the largest securitization market in Asia and the second

largest in the world.[2] While little is known about the securitization in the largest emerging market, we ask the following research questions in this study: As a follower in financial innovation, does China avoid the classic problems of adverse selection and moral hazard in the securitization markets? If so, what aligns the issuers' incentives?

We use a proprietary dataset of 21,125 consumer and small business loans from a Chinese commercial bank between 2015 to 2021. To investigate whether adverse selection and moral hazard exist in loan securitization, we compare the ex-post default risk and pre-payment risk of securitized loans with those held by the originator on the balance sheet. The baseline regressions show that loans sold by the bank have significantly lower default and prepayment risk than those retained on the bank's balance sheet, suggesting no evidence of adverse selection and moral hazard in the loan securitization.

Our results are insensitive to alternative estimation methods such as Probit regressions, or alternative definitions of default risk by using write-offs instead of being classified as non-performing loans. In addition, the better ex-post performance of securitized loans is both present in the subsamples of consumer loans and small business loans.

We carefully address the endogeneity concerns by employing propensity score matching techniques to deal with selection on observables and instrumental variable estimation to cope with selection on unobservables. One-to-one nearest neighbor matching, kernel matching, and radius matching yield similar results and continue to confirm our main findings. Specifically, we exploit two time-varying originator's features, namely, the bank-level share of non-loan businesses and share of interest incomes from non-loan businesses as instruments. The rapid expansion of non-loan businesses intensifies the need to recycle liquidity and rebalance portfolios. Therefore, the instruments satisfy the relevance condition. In addition, the instruments are unrelated to the riskiness of a single loan and therefore satisfy the exclusion condition. Last, we exploit the selection rule of securitized loans and the timing of the loan origination and settlement to construct a loan-specific instrument. Our baseline findings are unaltered in the instrumental variable estimation.

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[2] [The Rising And Booming Chinese Securitization Market – A Comparison With The European Securitization Market - Securitization & Structured Finance - United States (mondaq.com)](mondaq.com)

We continue our investigation of the bank's incentive to issue Asset-back Securities (ABS) and motives to avoid dilution in screening and monitoring incentives. Liquidity constraints and credit risk transfer are predominant incentives for issuing ABS. The high share of investment and interbank businesses and rapid asset growth incentivize the bank to securitize some loans to recycle funds. The bank chooses not to cherry-pick loans of inferior quality when liquidity needs are tight. But when liquidity needs are no longer urgent and the bank rebalances its portfolio towards loans, credit risk transfer becomes the dominant incentive for securitization. This effect is more pronounced when the bank faces regulatory pressure. We test the relations between time-varying incentives for securitization and ex-post loan performance. We also exploit the introduction of the New Asset Management Rule as a quasi-natural experiment. Robust evidence confirms that loan performance deteriorates when liquidity constraints are lax, other options for credit risk transfer are confined, and regulator pressure is high.

Our paper adds to a burgeoning literature that analyzes the relation between securitization and loan performance, information frictions, and agency problems in securitization. We make three main contributions. First, most empirical studies using loan-level data focus on advanced economies, especially the U.S. mortgage market, leaving little attention to securitization practices in emerging markets. This paper fills the gap by exploiting loan-level data of both sold and retained loans in Chinese securitization markets. As the Chinese market formally started after the US subprime mortgage crisis, the regulation and security design are expected to mitigate the informational problems and improve the quality of securitized assets based on lessons from the US experiences.

Second, most prior studies examine the information frictions in mortgage securitization or CLO markets, few investigate the securitization of consumer credit and small business loans due to data availability. Unlike corporate loans which are larger and typically syndicated at origination, and partially securitized as CLOs, small business loans are fully securitized. In addition, most studies in the literature rely on commercial or government agency loan databases that usually lack information on loan contractual terms. The comprehensive information in our dataset as well as the lender's financial statements allow us to

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have a better understanding of the determinants of loan performance and securitization decisions.

Third, unlike prior studies that either document evidence of adverse selection/moral hazard or no evidence at all, we find that a bank's incentive to do cream-skimming is altered by bank regulations and its business model. The introduction of the New Asset Management Rule has significantly changed banks' balance sheet and risk transfer options, providing a unique laboratory to study securitization and loan performance when conventional Chinese shadow banking shrank while securitization-based shadow banking rose.

The remainder of the paper proceeds as follows. Section 2 provides an overview of the Chinese securitization market and the lender. Section 3 describes the sample and empirical methods. Section 4 presents baseline results and addresses the endogeneity issues using propensity score matching and instrumental variable estimation. Section 5 compares the bank's incentive to issue ABS before and after the regulatory shock in 2018 which changes its asset composition. We conclude in Section 6.

2.   Chinese securitization market and the issuer bank

In 2019, the total volume of ABS issuance in China reached USD340 billion, marking a 16.69% increase compared to 2018. The total outstanding volume of ABS by the end of 2019 stood at USD 566 billion, a 27% increase from 2018. Overall, the volume of securitization is still small relative to the combined balance sheets of Chinese banks.

From a product perspective, corporate ABS and credit ABS account for 47% and 46% of the issuance volume in 2019, respectively. Corporate ABS are issued by enterprises through special asset management plans (SAMP) mainly on stock exchanges, of which underlying assets include customer loans, trade receivables, factoring receivables, leasing receivables, trust beneficiaries, fee income, and Real Estate Investment Trusts (REITs). Credit ABS are issued by banks and non-banking financial institutions through special purpose trusts on the China Interbank Bond Market (CIBM), of which underlying assets include residential/commercial mortgage, auto loans, corporate SME loans, credit card receivables, and consumer loans.

The lender is a regional bank with total assets falling in the $20 billion and $35 billion range over the sample period. Due to geographical restrictions on market entry and branching, it only operates in three cities in two provinces. It has been approved by the China Banking Regulatory Commission (CBRC) as a qualified issuer of credit ABS.

3.   Sample and empirical strategy

3.1 Data

We use a proprietary dataset of 21,125 consumer loans and small business loans from a Chinese commercial bank between 2015 and 2021. All loans are issued by the retail banking division of the bank, rather than by different branches. Consumer loans are extended to households for consumption, while small business loans are extended to individual entrepreneurs who run small businesses. Consumer loans are usually unsecured, while small business loans usually require collateral. Our sample consists of 13,448 unsecured consumer loans, 1,186 secured consumer loans, 388 unsecured small business loans, and 6,103 secured small business loans. The unit of observation is a single loan.

Before proceeding, it is important to stress that a caveat may arise as our sample comprises loans from a medium-sized Chinese bank only, and therefore the conclusion builds upon the tradeoff between sample representativeness and data availability. Nevertheless, the asset structure and risk profile of the bank is very close to the sample mean of the city commercial banks as a whole. Figure 1 plots shares of investments, loans, and interbank businesses of the sample bank (Figure 1a) and the average of city commercial banks (CCBs) (Figure 1b). Figure 2 plots the trends of nonperforming loan ratios of the sample bank and the average of city commercial banks (CCBs). The similar patterns observed between the sample bank and its peers offer preliminary evidence suggesting that our sample is representative of the broader sector.

The dataset contains information on loan contract terms, securitization, and loan performance. Loan contract information includes types of loans, a consumer loan or a small business loan; interest rates; types of interest rates, fixed or floating rates; loan amount in RMB; maturity in the number of months; start and end dates; settlement dates, i.e., the date

of repayment or write-off; collateral, secured or unsecured; loan purpose, e.g., home reno-vation, durable consumption, travel, working capital, capital expenditure, and others; mode of repayment, e.g., amortized loans with varied principal payment, amortized loans with fixed principal payment, bullet repayment with interest-only installments, lump sum loan repayment; pricing benchmarks, i.e., PBoC benchmark interest rate or Loan Prime Rate (LPR). Information on securitization includes ABS deal ID and redemption status. In our sample, 11,082 loans are securitized as underlying assets for 4 privately-placed ABS issu-ances. Two ABS were issued in 2017, one in 2018, and one in 2019. Information on loan performance includes prepayment date, risk classification, and whether the loan has been written off. According to the five-category system in China, loans classified as "Substand-ard", "Doubtful", and "Loss" are nonperforming loans.[3] For confidentiality reasons, the pro-prietary dataset does not reveal borrowers' information on demographics, economic condi-tions, or locality.

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[3] The five-category system classifies bank loans according to their inherent risks, including Pass, Special-mention, Sub-standard, Doubtful, and Loss. "Pass" indicates that borrowers are able to honor the terms of the contracts and there is no reason to doubt their ability to repay the principal and interest of loans in full and in a timely manner. "Special-mention" means that borrowers are able to serve their loans currently, although repayment may be adversely affected by specific factors. "Substandard" means that borrowers' abilities to service their loans are in question. Borrowers cannot depend on their normal business revenues to pay back the principal and interest, so losses may ensue even if guarantees are invoked. "Doubtful" indicates that borrowers cannot pay back the principal and interest in full and significant losses will be in-curred, even if guarantees are invoked. "Loss" means that the principal and interest of loans cannot be recovered or only a small portion can be recovered after taking all possible measures and resorting to necessary legal procedures.

Figure 1.

Figure 1a. Dynamics of the asset structure of the issuer bank
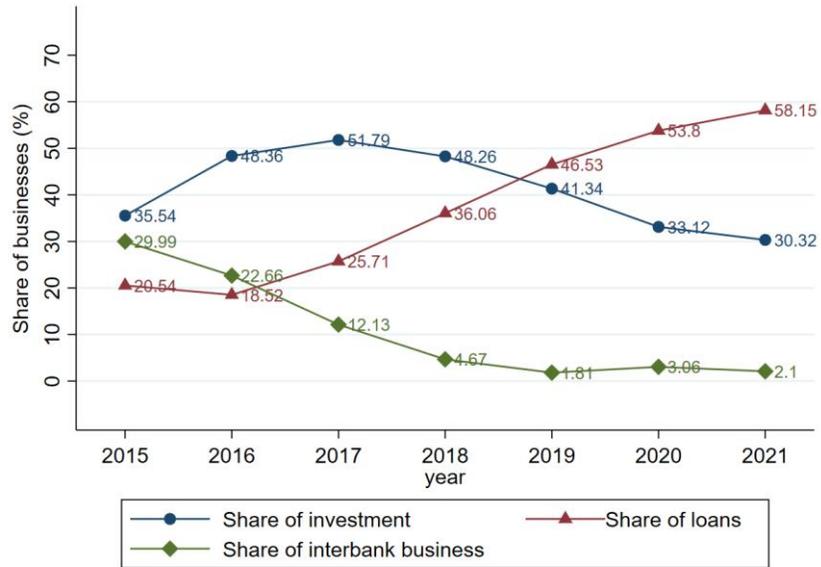
Figure 1b. Dynamics of the asset structure of the CCBs
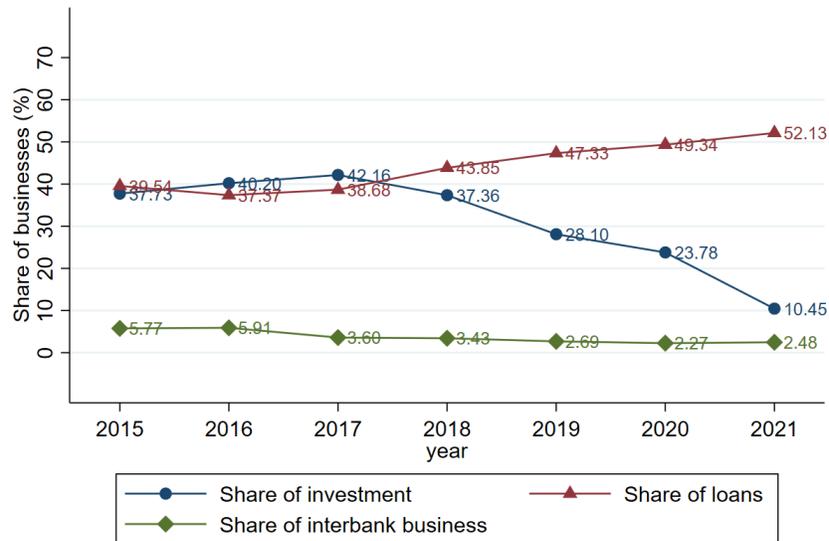
Figure 2. NPL of the sample bank and CCBs
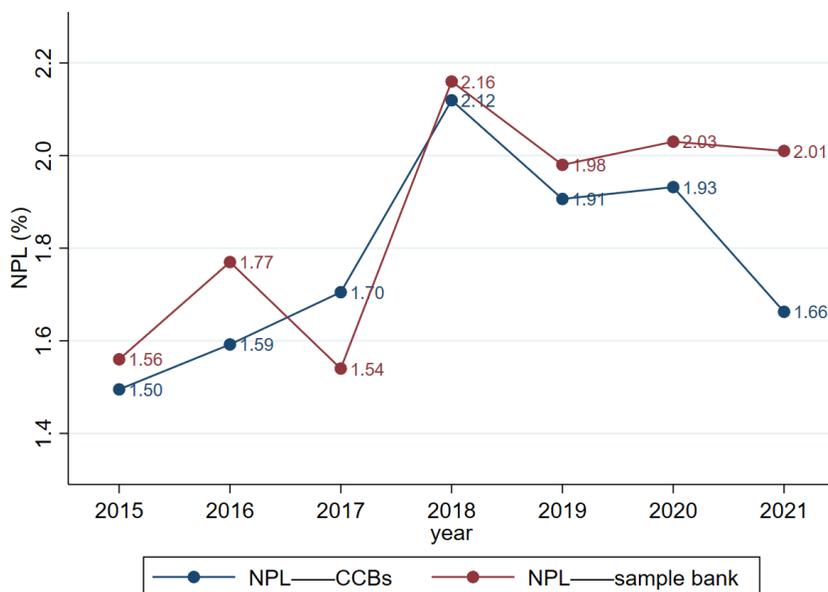
3.2 Empirical strategy

To examine the effect of securitization on ex post loan performance, we adopt the following model:

$$Risk_{it} = \beta ABS_i + \gamma \cdot \boldsymbol{controls}_i + \delta_t + \varepsilon_{it}$$

where dependent variable $Risk_{it}$ represents the default risk and prepayment risk of loan i originated in year-quarter t. Default risk is a dummy variable that equals one if the loan is classified as nonperforming loan, and zero otherwise. Prepayment risk is a dummy variable that equals one if the settlement date is earlier than the end date of the loan, and zero otherwise. ABS_i is a dummy variable that equals one if the loan is securitized, and zero otherwise. $\boldsymbol{Controls}_i$ denotes a set of loan-level control variables, including interest rates in percent, log of maturity in month, and log of loan amount. In addition, we control for a few loan features captured by dummies variables, including collateral, loan types, types of interest rates, loan purpose, mode of repayment, and pricing benchmarks. All major variables used in the paper are defined in Appendix Table A1. δ_t controls for the

year-quarter fixed effects at loan origination. In most specifications, we estimate pooled OLS with robust standard errors clustered at the year-quarter level.

3.3 Summary statistics

Table 1 reports summary statistics of our main variables. As a first step in examining the statistical relation between securitization and loan performance, we conduct a simple two-sample t-test. Table 2 reports t-tests of sample means for dependent variables and continuous explanatory variables in subsamples of securitized and held loans. The sold loans have default risk that is 9.6 percentage points *lower* than that of retained loans (significant at the 1% level). The average prepayment risk of securitized loans is 53.9 percentage points *lower* than that of non-securitized loans (significant at the 1% level). Yet, the average interest rate at origination is higher for securitized loans than non-securitized loans, reflecting higher risk ex-ante. This is in part because most of the underlying loans in the four ABSs are consumer credit loans that are unsecured (among these securitized loans, 10,235 are personal consumer credit loans and 847 are personal business loans).

Table 1. Summary statistics

Panel A	N	Mean	SD	Min	Median	Max
Default risk	21125	0.126	0.332	0	0	1
Prepayment risk	18465	0.442	0.497	0	0	1
ABS	21125	0.525	0.499	0	1	1
Interest rate (%)	21125	11.34	3.827	3.96	12	16
Log amount	21125	12.862	1.347	10.309	12.612	16.524
Log maturity	21125	3.832	0.823	1.792	3.584	5.7

Panel B Loan features	Categories	N of loans	Percent
Collateral	Secured loans	7,289	34.5
	Unsecured loans	13,836	65.5
Types of loans	Consumer loans	14,634	69.27
	Small business loans	6,491	30.73
Types of interest rates	Fixed interest rates	17,912	84.79
	Floating interest rates	3,213	15.21
Mode of Repayment	Lump sum loan repayment	136	0.64

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	Bullet repayment with interest-only instalments	3,756	17.78
	Amortized loans with fixed principal payment	1	0
	Amortized loans with varied principal payment	17,232	81.57
Loan purpose	Decoration	13,437	63.61
	Capital turnover	382	1.8
	Purchase of operating equipments and goods	237	1.12
	Travelling	38	0.18
	Property redemption	136	0.64
	Others	6895	32.64
Pricing benchmarks	PBoC benchmark interest rate	1,520	7.2
	LPR	19,605	92.8

Table 2. T-tests of securitized and held loans

	Mean of securitized loans	Mean of held loans	Mean Difference
Default risk	0.080	0.176	-0.096***
Prepayment risk	0.201	0.740	-0.539***
Interest rate	13.502	8.955	4.547***
Log amount	12.170	13.626	-1.456***
Log maturity	3.531	4.164	-0.632***

4.   Empirical results

4.1 Baseline regression

Table 3 reports the baseline results. In the first two columns, we report the univariate regressions where dependent variables are default risk and prepayment risk, controlling for year-quarter fixed effects only. The ABS dummy obtains negative and significant estimates in both regressions, suggesting that securitized loans have lower default risk and prepayment risk compared to the loans remaining on the bank's balance sheet. This is tentative evidence of no adverse selection in securitization.

        In columns 3 and 4, we control for a set of loan characteristics. The estimates of ABS dummy remain highly significant at the 1% level. The estimated coefficient of 0.185 (0.280) in column 3 (4) suggests that default risk (prepayment) is 18.1 (28.0) percent lower in the securitized loans compared to those held on the balance sheet, which is an economically sizeable effect. Among the loan control variables, we find that the estimated coefficient

of interest rate is positively associated with default risk, reflecting the credit risk premium in loan pricing. In addition, the estimated coefficients of loan maturity are positive and significant, suggesting higher default and prepayment risk in longer maturity. For brevity, we include the full set of loan controls in all regressions but suppress the estimates in the following tables.

Table 3. Baseline regression

The unit of observation is a loan. The dependent variables are default risk in columns 1 and 3, and prepayment risk in columns 2 and 4, respectively. All regressions include year-quarter fixed effects for the year of loan origination. See variable definitions in Appendix Table A1. Robust standard errors are clustered at the year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Default risk	Prepayment risk	Default risk	Pre-payment risk
	(1)	(2)	(3)	(4)
ABS	-0.105***	-0.441***	-0.185***	-0.280***
	(0.037)	(0.053)	(0.030)	(0.035)
Interest rate			0.014***	-0.002
			(0.003)	(0.004)
Log amount			0.005	-0.009
			(0.007)	(0.010)
Log maturity			0.066***	0.225***
			(0.023)	(0.029)
Constant	0.181***	0.686***	-0.260**	-0.118
	(0.019)	(0.029)	(0.118)	(0.174)
Collateral FE	No	No	Yes	Yes
Loan type FE	No	No	Yes	Yes
Types of interest rates FE	No	No	Yes	Yes
Mode of Repayment FE	No	No	Yes	Yes
Loan purpose FE	No	No	Yes	Yes
Pricing benchmarks FE	No	No	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21125	18465	21121	18460
R-squared	0.035	0.359	0.094	0.467

4.2 Robustness checks

As our dependent variables are binary choice variables, we employ Probit regressions and report the results in columns 1 and 2 of Table 4. Probit estimations show similar findings in line with the pooled OLS estimation in the baseline regressions.

Unlike the default risk defined upon the bank's classification of ongoing loans, we choose an alternative definition of default risk by checking the status of write-off. We define a write-off dummy that equals one if the loan is written off, and zero otherwise. As shown in column 3 of Table 4, securitized loans are less likely to be written off than held loans, which lends further credence to our main findings.

Table 4. Robustness Checks

The dependent variables are default risk in column 1, prepayment risk in column 2, and write-off in column 3. We employ Probit estimation in columns 1 and 2, and OLS in column 3. All regressions include loan-level controls and year-quarter fixed effects for the year of loan origination, but their estimates are suppressed for brevity. See variable definitions in Appendix Table A1. Robust standard errors are clustered at the year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

| | Probit | | |
| | Default risk | Prepayment risk | Write-off |
	(3)	(4)	(5)
ABS	-0.948***	-0.956***	-0.084***
	(0.173)	(0.172)	(0.028)
Constant	-3.100***	-4.996***	-0.378**
	(0.697)	(1.307)	(0.169)
Controls	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes
N	20948	15606	10810
R-squared	.1198	.2703	0.313

4.3 Consumer loans versus small business loans

We examine whether the impact of securitization on loan performance differs between consumer loans and small business loans. Summary statistics suggest the interest rate of consumer loans is on average higher than that of small business loans, reflecting the higher riskiness of consumer loans. This is also related to collateral requirements, as consumer loans are unsecured while borrowers of small business loans usually pledge collateral. The first four columns of Table 5 confirm that both default and prepayment risk are lower in the pool of securitized loans than that of held loans. We interact the ABS dummy with the consumer loan dummy and report the analogous regressions in columns 5 and 6. The effect is more pronounced in the subsample of consumer loans, suggesting that in the market of consumer loan securitization in which no collateral requirement and asset quality is most relevant, the issuer bank tends to choose high-quality loans and monitor the sold loans more seriously.

Table 5. Consumer loans versus small business loans

This table examines whether the effects of securitization on default and prepayment risk are heterogenous in Consumer loans and small business loans. In columns 1 and 2, we use consumer loans only. In columns 3 and 4, we use small business loans only. In columns 5 and 6, we use the full sample. All regressions include loan-level controls and year-quarter fixed effects for the year of loan origination, but their estimates are suppressed for brevity. See variable definitions in Appendix Table A1. Robust standard errors are clustered at the year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Consumer loans		Small business loans		Full sample	
	Default risk	Prepayment risk	Default risk	Prepayment risk	Default risk	Prepayment risk
	(1)	(2)	(3)	(4)	(5)	(6)
ABS	-0.258***	-0.385***	-0.043**	-0.125**	-0.002	-0.077
	(0.023)	(0.040)	(0.020)	(0.060)	(0.031)	(0.066)
ABS*Consumer loans					-0.228***	-0.263***
					(0.034)	(0.088)
Constant	-0.608***	-0.202*	-0.252	-0.623*	-0.335***	-0.201
	(0.150)	(0.110)	(0.160)	(0.311)	(0.101)	(0.174)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
N	13833	12037	7288	6423	21121	18460
R-squared	0.150	0.179	0.046	0.288	0.102	0.473

4.4 Endogeneity issues

As the choice of loans to be designated into the ABS asset pool or held on the balance sheet is not randomly determined, we need to consider the endogeneity issues that may arise in our research design. First, our baseline regressions investigating the impact of loan securitization on default and prepayment risk might be biased by reverse causality, implying that the inherent riskiness of loans influences the bank's decision on whether to securitize a loan. Second, unobserved omitted variables which correlate with the loan securitization and the default and prepayment risk might bias our estimation.

In this section, we attempt to address the endogeneity concerns by using the propensity score matching approach and instrumental variable approach. In specific, we address

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the concern that the selection of loans as ABS underlying assets might be correlated with loan characteristics using propensity score matching techniques. The PSM approach could better account for the observable differences between securitized and non-securitized loans that affect loan performance. In addition, we employ the bank's business model and time window for selecting loans into asset pools as instrumental variables.

4.4.1 Propensity score matched sample

We use one-to-one nearest-neighbor matching with replacement, radius matching, and kernel matching to construct matched samples of securitized loans and held loans. The matching variables for each matching method are consistent with the control variables in the baseline regression. We impose common support and exclude treatment observations whose propensity score is higher than the maximum or less than the minimum propensity score of the controls. The balancing property tests in Appendix Table A2 and common support tests in Figure A1 confirm that our matched sample achieves covariate balance. Table 6 reports the baseline regressions with a matched sample where our main findings are stronger.

Table 6. Endogeneity: PSM

Dependent variables are default risk in odd columns, and prepayment risk in even columns. Columns 1 and 2 show the results of a one-to-one nearest neighbor matched sample. Columns 3 and 4 show the results of a radius matched sample. Columns 5 and 6 show the results of a kernel matched sample. All regressions include loan-level controls and year-quarter fixed effects for the year of loan origination, but their estimates are suppressed for brevity. See variable definitions in Appendix Table A1. Robust standard errors are clustered at the year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Nearest neighbors matching		Radius matching		Kernel matching	
	Default risk	Prepayment risk	Default risk	Prepayment risk	Default risk	Prepayment risk
	(1)	(2)	(3)	(4)	(5)	(6)
ABS	-0.234***	-0.407***	-0.264***	-0.404***	-0.233***	-0.356***
	(0.051)	(0.069)	(0.037)	(0.058)	(0.038)	(0.051)
Constant	-0.675***	-0.560	-0.723***	-0.395**	-0.519***	-0.240
	(0.186)	(0.372)	(0.138)	(0.173)	(0.152)	(0.142)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1448	1160	11541	9984	13550	11785
R-squared	0.142	0.317	0.150	0.193	0.134	0.261

4.4.2 Instrumental variable estimation

To alleviate the possible endogeneity concerns, we employ a two-stage least squares (2SLS) instrumental variable regression. We consider three variables as candidates for instruments. First, the bank has three major businesses of loans, investment business, and interbank business. As a regional bank, limited loan origination capacity forces the bank to rely on investment and interbank businesses. To fund profitable investment and interbank businesses, it has strong incentives to securitize loans off the balance sheet to rebalance the portfolio. The incentive to securitize is more pronounced when the shares of investment and interbank business are higher. Therefore, the bank-level share of investment and interbank business is related to the probability of securitizing loans, which satisfies the relevance condition. In

addition, the bank-level asset composition is orthogonal to the riskiness of a single loan and therefore satisfies the exclusion condition. In sum, we first use the share of investment and interbank businesses in total assets (*asset share of non-loans*) of the securitization year as the instrument. Panel A of Table 7 reports IV estimation. Columns 1 and 3 report the first stage regression, where we find positive and highly significant estimates for the share of investment and interbank businesses, suggesting that the loan is more likely to be securitized when the issuer bank has liquidity constraints and needs to rebalance the portfolio. F statistics is greater than 10, suggesting no evidence of weak instruments. In addition, the second stage estimation in columns 2 and 4 show that the predicted value of ABS has a significantly negative effect on the default and prepayment risk of loans, providing compelling evidence that loans securitized have relatively lower ex-post default and prepayment risk than those held on the bank's balance sheet.

Second, we use the ratio of interest income from investment and interbank businesses to total interest income (*income share of non-loans*) as another instrumental variable for loan securitization. By the same token, the incentive to securitize loans is more pronounced when the investment and interbank businesses contribute more profits. Therefore, the bank's income share from investment and interbank business is related to the probability of securitizing loans, which satisfies the relevance condition, while it is orthogonal to the riskiness of a single loan and therefore satisfies the exclusion condition. Panel B of Table 7 reports similar findings.

Third, according to the criteria for selecting loans into the asset pool in the Chinese securitization market, ABS issuers can only choose those whose origination date is earlier than the ABS issuance date and whose settlement date is later than the ABS issuance date. Therefore, we construct an instrumental variable using the dates of ABS issuance and the timing of loan origination and settlement dates. Specifically, we construct a basic selection rule for each ABS issuance. A loan is more likely to be securitized if, it is originated earlier than the latest origination date of all underlying loans of this ABS; it matures later than the earliest maturity date of all underlying loans of this ABS; it is settled later than the issuance date of this ABS. We build the instrumental variable, *eligible loans*, a dummy variable that equals one if a loan meets the selection rule for any of four ABS included in our sample, and

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0 otherwise. The underlying logic is that whether a loan satisfies the selection rule is related to the probability of securitization, and therefore the relevance condition holds. Moreover, whether a loan satisfies the selection rule is determined by its timing and therefore is orthogonal to its riskiness. Panel C of Table 7 reports the estimation results of the instrumental variable regressions. As shown in columns 1 and 3, the instrumental variable has significant and positive estimates, suggesting that loans that meet the basic selection rule based on timing are more likely to be securitized than other loans. In addition, the coefficients of ABS in columns 2 and 4 continue to be significant and negative, confirming that our main findings of lower default risk and prepayment risk in the securitized loans are robust to the instrumental variable regressions.

Table 7. Instrumental variable estimation

Columns 1 and 3 report the first stage regression where ABS dummy is the dependent variable. Columns 2 and 4 report the second stage regression where default and prepayment risk are the dependent variable. Panels A, B, and C report the two-stage least square estimation where instrumental variables are the asset share of investment and interbank businesses (asset share of non-loans), share of interest income from investment and interbank businesses (income share of non-loans), and the eligible loans dummy. All regressions include loan-level controls and year-quarter fixed effects for the year of loan origination, but their estimates are suppressed for brevity. See variable definitions in Appendix Table A1. Robust standard errors are clustered at the year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A	ABS First stage (1)	Default risk Second stage (2)	ABS First stage (3)	Prepayment risk Second stage (4)
Asset share of non-loans	0.035*** (0.001)		0.034*** (0.001)	
ABS		-0.222*** (0.026)		-0.269*** (0.038)
Controls	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21121	21121	18460	18460
F-stat	698.460		664.308	
Panel B	ABS	Default risk	ABS	Prepayment risk

	First stage	Second stage	First stage	Second stage
	(1)	(2)	(3)	(4)
Income share of non-loans	2.624***		2.618***	
	(0.063)		(0.070)	
ABS		-0.202***		-0.279***
		(0.026)		(0.036)
Controls	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21121	21121	18460	18460
F-stat	1732.400		1412.551	
Panel C	ABS	Default risk	ABS	Prepayment risk
	First stage	Second stage	First stage	Second stage
	(1)	(2)	(3)	(4)
Eligible loans	0.306***		0.276***	
	(0.052)		(0.049)	
ABS		-0.156***		-2.160***
		(0.044)		(0.381)
Controls	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21121	21121	18460	18460
F-stat	34.746		31.617	

5.   Issuer's motives behind no adverse selection

Liquidity creation and credit risk transfer are two major reasons for banks to securitize loans off the balance sheet. The lemon problem is less likely to arise when the liquidity needs dominate credit risk transfer. But when risk transfer options become constrained or the issuer faces regulatory pressure, the bank's incentive is likely to be misaligned with external investors. In this section, we examine how variations in the bank's concerns over liquidity and risk transfer alter the performance of securitized loans.

5.1 Business expansion and liquidity constraints

By converting illiquid loans into marketable assets, securitization increases banks' lending ability (Loutskina, 2011). The bank's incentive to securitize is strong when it faces liquidity

constraints. This is particularly true for our sample bank, although the driver for securitization is asset expansion rather than lending capacity.

As a medium-sized regional bank that has been geographically restricted to operate in two provinces only, it has weak deposit-taking capacities and limited lending opportunities. To expand its scale, its core business relies on investments in non-standard assets and interbank assets[4], instead of traditional loans. Figure 1 plots the trends of shares of investment, interbank business, and loans in total assets over the sample period for both the issuer bank (Figure 1a) and the sector of CCBs (Figure 1b). The share of investment had been increasing until 2017 and remained higher than that of loans until 2018. The share of investment was more than two times larger than that of loans. Therefore, the originator has incentives to recycle funds to sustain the growth of investment and interbank businesses by offloading loans off the balance sheet. In other words, the incentive to transfer credit risk has been dominated by the incentive to rebalance portfolios. To maintain access to the securitization market, the bank values its reputation and consequently tends to choose high-quality loans based on private information or strengthen bank monitoring. The good ex-post loan performance has a positive feedback effect to increase the attractiveness of the bank's ABS.

To test the liquidity-related incentive to issue ABS, we employ bank-level features in the year of loan origination to identify the impact of the bank's business structure on the ex-post performance of a single loan. The underlying assumption that the bank's liquidity constraint influences contemporaneous loan origination is a strong assumption and will be relaxed later. Table 8 reports the results. First, we consider the share of investment and interbank businesses as a proxy for liquidity needs, as a higher share of profitable non-loan business incentivizes the bank to cherry-pick good loans into the ABS asset pool and keep an eye on the loans after ABS issuance (Greenbaum and Thakor, 1987). Therefore, we include an interaction term of ABS dummy and a dummy for a higher share of investment and interbank businesses (it takes a value of 1 for years when the share is higher than the sample

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[4] Non-standard assets are debt assets not traded in the interbank and stock exchange markets, including, but not limited to, credit assets, trust loans, entrusted claims, acceptance bills, letters of credit, accounts receivable, various types of beneficial rights (rights to yields) and equity financing with repurchase terms. Non-standard assets are the major part of shadow banking in China.

median) into the baseline regression. The bank-level share of investment and interbank businesses is absorbed by year-quarter fixed effects and cannot be identified. The first two columns in Panel A show that the ABS dummy continues to obtain negative and significant estimates, implying no adverse selection. In addition, the interaction term also obtains negative and significant estimates, suggesting that lower default and prepayment risk of securitized loans is more pronounced when the issuer bank has a higher share of investment and interbank businesses. Second, we replace the dummy for a higher share of investment and interbank businesses with a dummy for a higher share of interest income from investment and interbank businesses. Columns 3 and 4 show further evidence of good ex-post loan performance when the bank relies on the interest income from investment and interbank businesses. Third, unlike its US counterparts, the bank relies on securitization to expand investment and interbank businesses rather than lending. Therefore, we expect a higher share of loans in total assets instead to weaken the incentive alignment and result in adverse selection and moral hazard problems. To test this conjecture, we include an interaction term of the ABS dummy and a dummy for a higher share of loans. The first two columns in Panel B show that, while the estimates of ABS dummy continue to be negative and significant, the interaction term obtains positive and significant estimates, suggesting that the bank no longer selects good loans as underlying assets of ABS when loans are becoming important. Forth, we consider the asset growth rate as a direct proxy for the bank's needs for funding. Likewise, we interact the ABS dummy with a dummy of higher asset growth and report the results in columns 3 and 4. Again, the negative and significant estimates of the interaction term imply that securitized loans show better ex-post performance when the bank rapidly expands in size. Taken together, we find robust evidence that the bank securitizes good loans when it has liquidity concerns stemming from investment and interbank businesses and asset expansion.

Table 8. Liquidity constraint

The dependent variables are default risk in columns 1 and 3, and prepayment risk in columns 2 and 4, respectively. All regressions include loan-level controls and year-quarter fixed effects for the year of loan origination, but their estimates are suppressed for brevity. See variable definitions in Appendix Table A1. Robust standard errors are clustered at the year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A	Default risk	Prepayment risk	Default risk	Prepayment risk
	(1)	(2)	(3)	(4)
ABS	-0.097***	-0.222***	-0.009	-0.185***
	(0.034)	(0.040)	(0.008)	(0.035)
ABS*High asset share of non-loans	-0.147***	-0.096**		
	(0.038)	(0.045)		
ABS* High income share of non-loans			-0.205***	-0.118**
			(0.028)	(0.055)
Constant	-0.330***	-0.161	-0.308**	-0.143
	(0.089)	(0.176)	(0.110)	(0.201)
Controls	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21121	18460	19652	17167
R-squared	0.101	0.469	0.099	0.473

Panel B	Default risk	Prepayment risk	Default risk	Prepayment risk
	(1)	(2)	(3)	(4)
ABS	-0.212***	-0.295***	-0.009	-0.185***
	(0.022)	(0.036)	(0.008)	(0.035)
ABS*High asset share of loans	0.206***	0.113**		
	(0.025)	(0.052)		
ABS*High asset growth			-0.205***	-0.118**
			(0.028)	(0.055)
Constant	-0.331***	-0.156	-0.308**	-0.143
	(0.099)	(0.174)	(0.110)	(0.201)
Controls	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21121	18460	19652	17167
R-squared	0.100	0.468	0.099	0.473

As the assumption that the bank's liquidity constraints affect contemporaneous loan origination is so strong, we instead assume the liquidity needs in the years of securitization affect loan performance. Therefore, we match loans with bank-level variables on the years of securitization. We repeat the exercises in Table 8 and report the analogous regressions in Appendix Table A3. We find consistent evidence that the lower default risk of securitized loans is associated with the bank's liquidity concerns stemming from investment and inter-bank businesses and asset expansion, although the effect on prepayment risk is not robust.

5.2 New asset management rules as a quasi-natural experiment

In this subsection, we exploit the New Asset Management Rules introduced in April 2018 as a quasi-natural experiment, as it alters banks' tradeoff between liquidity needs and credit risk transfer. Securitization of riskier credit could be an effective way of laying off risk (Parlour and Winton, 2013). We show this is particularly true when other options of risk shifting are confined.

China has a large and fast-growing shadow banking sector. Moody's Investor Service, in its 'Quarterly China Shadow Banking Monitor' released in January 2016, has estimated that its size is approximately 65 percent of the nation's GDP, nearly RMB 45 trillion through 2015Q1.[5] The shadow banking system is largely composed of wealth management products, which are the target of investment business for small and medium-sized banks such as the bank in our sample. High returns of the wealth management products attract banks' funds moving from lending to real sectors to the investment business. At the same time, off-balance-sheet financial activities funded by largely unregulated asset management products have helped push China's debt-to-GDP ratio to potentially unsustainable levels. Chinese regulators were worried about the systemic risk of the shadow banking system and the excessively high macro leverage ratio. Therefore, PBoC introduced the New Asset Management Rules as a concerted attempt by China's regulators to curtail the shadow banking

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[5] https://www.financierworldwide.com/shadow-banking-in-china-boon-or-threat#.Ys_JQzdBxdg

sector and curb financial risks. In addition, CBRC called on banks to expand lending to real sectors and households.

The new regulation rule has far-reaching impacts on banks like the issuer in our study. First, the market for wealth management products has shrunk remarkably, implying banks have to rebalance asset portfolios from investment business to loans. It also increases the difficulty to expand the asset scale for regional banks. Therefore, funding pressure is no longer urgent for the issuer since the new rule phase in. Second, the New Asset Management Rules have imposed restrictions on most off-balance sheet businesses, but left securitization as the only option to transfer credit risk off the balance sheet. Taken together, we expect the incentive for credit risk transfer to dominate the liquidity needs, and therefore loan quality and ex-post performance might deteriorate since the new rule has been in place.

The bank's balance sheet items plotted in Figure 1 confirm the changes in asset composition. Figure 1a shows that the issuer drastically cut investment business but expanded credit. The share of investment plummeted from 48 percent to 30 percent, while the share of loans increased from 36 percent to 58 percent. Rebalancing the portfolio by switching funds from investment business to making loans helps keep the bank's size stable but at the expense of worsening asset quality. Plotting the dynamics of nonperforming loan ratio (NPL), Figure 2 confirms a rise in the bank's credit risk. Meanwhile, the Chinese version of Basel III requires all banks to meet the capital adequacy criteria by the end of 2018. Therefore, regulatory pressure on capital adequacy, nonperforming loans, and provisions induces a much stronger incentive to sell riskier loans to the secondary market than before 2018.

To test whether changes in the bank's incentives for liquidity needs and risk transfer influence loan performance, we exploit the introduction of the New Asset Management Rules in 2018 as an exogenous shock to the issuer bank and adopt a difference-in-differences approach. Specifically, we define a post dummy which takes a value of 1 if the ABS was issued in 2018 or after 2018 (essentially, we have two ABS issued in 2018 and 2019), and zero for loans securitized before the introduction of the new rule or non-securitized loans. We include the interaction of ABS and post dummy into the baseline regression and report the results in the first two columns of Table 9.

Table 9. The new asset management rules in 2018 as an exogenous shock

The dependent variables are default risk in columns 1 and 3, and prepayment risk in columns 2 and 4, respectively. Post is a dummy variable that equals 1 if years of securitization are later than the announcement of the new asset management regulations in 2018, and zero otherwise. We use the subsample of securitized loans only in columns 3 and 4. All regressions include loan-level controls and year-quarter fixed effects for the year of loan origination, but their estimates are suppressed for brevity. See variable definitions in Appendix Table A1. Robust standard errors are clustered at the year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

| | Full sample | | Securitized loans only | |
| | Default risk | Prepayment risk | Default risk | Prepayment risk |
	(1)	(2)	(3)	(4)
ABS	-0.225***	-0.263***		
	(0.021)	(0.039)		
ABS*Post	0.105***	-0.046	0.088***	-0.068***
	(0.025)	(0.027)	(0.019)	(0.007)
Constant	-0.218**	-0.136	-0.771***	-0.463***
	(0.099)	(0.171)	(0.188)	(0.140)
Controls	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21121	18460	11080	10191
R-squared	0.101	0.468	0.116	0.078

The ABS dummy continues to obtain negative and significant estimates, suggesting the general effects of securitization on default and prepayment risk. The estimate of the interaction term is positive and significant in the default risk regression, suggesting default risk for loans securitized increased significantly after the new rule was introduced in 2018. While the incentive to lay off credit risk has been altered by the new rule, the insignificant interaction term in the prepayment risk regression shows no significant changes in the prepayment risk of securitized loans around the shock. We use the subsample of securitized loans only and directly compare the performance of securitized loans before and after the new rule in columns 3 and 4. We find further evidence that the default risk of securitized loans after 2018 is significantly higher than that of the loans securitized before, suggesting a strengthened incentive to cherry-pick riskier loans into the asset pool, in line with the credit risk transfer incentive. However, we find that prepayment risk is even lower after 2018 for securitized

loans, perhaps to minimize the loss stemming from the increase of default risk to the ABS buyers to maintain its reputation.

5.3 Regulatory pressure

The shift in asset composition from investment and interbank businesses to corporate and household credit led to deteriorating loan quality for the lender which is restricted by geographical operation, confirmed by the rising trend in nonperforming loan ratios and declining trend in provision coverage ratios in Figure 2. Meanwhile, all options to lay off credit risk except securitization, have been forbidden by the New Asset Management Rules. Furthermore, the Chinese version of Basel III requires all banks to meet the capital adequacy criteria by the end of 2018. Therefore, we expect that banks with higher regulatory pressure on capital adequacy, nonperforming loans, and loan loss provisions have stronger incentives to sell riskier loans via securitization.

We define low CAR (high NPL/low PCR) as years when the bank's capital adequacy ratio (nonperforming loan ratio/provision coverage ratio) is lower(higher/lower) than the sample median, as proxies for regulatory pressure. We include the interaction of the ABS dummy and the regulatory pressure dummies into the baseline regression, leaving the regulatory pressure dummies per se absorbed by time-fixed effects. Table 10 reports the tests for regulatory pressure and loan performance. Estimates of the interaction term of ABS dummy and regulatory pressure dummies in all specifications are positive and significant, suggesting that securitized loans originated in years with lower capitalization, higher nonperforming loans, or lower provisions are more likely to default and be prepaid. In sum, when the issuer bank faces tight regulatory pressure, the loans originated and securitized are more likely to perform worse, indicating misaligned incentives.

Table 10. Capital coverage ratio and provision coverage

Dependent variables are default risk in odd columns, and prepayment risk in even columns. All regressions include loan-level controls and year-quarter fixed effects for the year of loan origination, but their estimates are suppressed for brevity. See variable definitions in Appendix Table A1. Robust standard errors are clustered at the year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	CAR		NPL		PCR	
	Default risk	Prepayment risk	Default risk	Prepayment risk	Default risk	Prepayment risk
	(1)	(2)	(3)	(4)	(5)	(6)
ABS	-0.254***	-0.334***	-0.214***	-0.303***	-0.254***	-0.334***
	(0.017)	(0.034)	(0.026)	(0.040)	(0.017)	(0.034)
ABS*Low CAR	0.154***	0.107**				
	(0.039)	(0.046)				
ABS*High NPL			0.205***	0.118**		
			(0.028)	(0.055)		
ABS*Low PCR					0.154***	0.107**
					(0.039)	(0.046)
Constant	-0.300***	-0.143	-0.308**	-0.143	-0.300***	-0.143
	(0.096)	(0.201)	(0.110)	(0.201)	(0.096)	(0.201)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
N	19652	17167	19652	17167	19652	17167
R-squared	0.100	0.473	0.099	0.473	0.100	0.473

6. Conclusion

Although being the largest market in Asia and the second largest in the world, the Chinese securitization market remains a black box to outside observers. The lack of investigation into the information frictions, agency issues, and incentive problems limits the policy debate over the development and regulation of the securitization market. We hope our research unfolds the black box of Chinese securitization practices and sheds light on the bank's incentives and loan performance.

By examining the relations between securitization and ex-post loan performance, our study offers several interesting implications. First, we document that the quality and

performance of securitized loans are not inferior to that of the held ones, suggesting no evidence of adverse selection or moral hazard. Second, the bank's incentive varies with liquidity needs, credit risk transfer, and regulatory pressure.

Our study has direct policy implications. The exclusion of securitization from the New Asset Management Rule can potentially be exploited by financial institutions as a risk transfer loophole. Financial regulators should closely monitor risk transfer activities within the securitization market, even though the current securitization business presents a moderate level of risk.

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APPENDIX

Table A1 Variable descriptions

Variable	Definition
Default risk	Dummy variable that equals one if the loan is classified as nonperforming loans, and zero otherwise.
Prepayment risk	Dummy variable that equals one if the settlement date is earlier than the end date of the loan, and zero otherwise.
ABS	Dummy variable that equals one if a loan is securitized, and zero otherwise.
Interest rate	The interest rate of the loan.
Log amount	The natural logarithm of loan amount.
Log maturity	The natural logarithm of maturity in months.
Secured	Dummy variable that equals one if the loan has collateral pledged, and zero otherwise.
Types of loans	Category variables that include consumer loans and small business loans.
Types of interest rates	Category variables that include "fixed interest rates" and "floating interest rates"
Mode of Repayment	Category variables that include "amortized loans with varied principal payment", "amortized loans with fixed principal payment", "bullet repayment with interest-only instalments" and "lump sum loan repayment"
Loan purpose	Category variables that include "home renovation", "durable consumption", "travel", "working capital", "capital expenditure", and others.
Pricing benchmarks	Category variables that include People's Bank of China benchmark interest rate and LPR.

Table A2. Balancing tests for propensity score matching

Variable	Unmatched /Matched	Treated	Control	%bias	t	p>|t|
Panel A Nearest neighbor matching						
Interest rate	U	13.502	10.741	85.1	56.78	0.000
	M	13.808	13.813	-0.2	-0.18	0.857
Log amount	U	12.17	13.052	-75.2	-50.06	0.000
	M	12.093	12.094	-0.1	-0.13	0.896
Log maturity	U	3.5315	3.3822	51.2	35.38	0.000
	M	3.5556	3.5555	0.0	0.05	0.959
Panel B Radius matching						
Interest rate	U	13.502	10.741	85.1	56.78	0.000
	M	13.808	13.816	-0.2	-0.27	0.790
Log amount	U	12.17	13.052	-75.2	-50.06	0.000
	M	12.093	12.09	0.2	0.22	0.827
Log maturity	U	3.5315	3.3822	51.2	35.38	0.000
	M	3.5556	3.554	0.5	0.79	0.430
Panel C Kernel matching						
Interest rate	U	13.502	10.741	85.1	56.78	0.000
	M	13.808	13.815	-0.2	-0.23	0.820
Log amount	U	12.17	13.052	-75.2	-50.06	0.000
	M	12.093	12.092	0.1	0.09	0.928
Log maturity	U	3.5315	3.3822	51.2	35.38	0.000
	M	3.5556	3.5546	0.3	0.51	0.608

Table A3. Liquidity constraints (bank covariates in the years of securitization)

All regressions include loan-level controls and year-quarter fixed effects for the year of loan origination, but their estimates are suppressed for brevity. See variable definitions in Appendix Table A1. Robust standard errors are clustered at year-quarter level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A	Default risk	Prepayment risk	Default risk	Prepayment risk
	(1)	(2)	(3)	(4)
ABS	0.020	-0.191***	-0.120***	-0.309***
	(0.020)	(0.059)	(0.030)	(0.040)
ABS*High asset share of non-loans	-0.227***	-0.099		
	(0.032)	(0.082)		
ABS* High income share of non-loans			-0.105***	0.046
			(0.025)	(0.027)
Constant	-0.380***	-0.169	-0.218**	-0.136
	(0.098)	(0.179)	(0.099)	(0.171)
Controls	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21121	18460	21121	18460
R-squared	0.099	0.468	0.101	0.468
Panel B	Default risk	Prepayment risk	Default risk	Prepayment risk
	(1)	(2)	(3)	(4)
ABS	-0.208***	-0.291***	-0.129***	-0.329***
	(0.023)	(0.038)	(0.030)	(0.038)
ABS*High asset share of loans	0.227***	0.099		
	(0.032)	(0.082)		
ABS*High asset growth			-0.078***	0.065***
			(0.024)	(0.023)
Constant	-0.380***	-0.169	-0.187*	-0.177
	(0.098)	(0.179)	(0.109)	(0.174)
Controls	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
N	21121	18460	21121	18460
R-squared	0.099	0.468	0.098	0.469

Figure A1. Propensity score matching. common support test

This figure shows the common support test for the propensity score matching. The vertical axis is density, and the horizontal axis is propensity score. The probabilities of being securitized for treated group and control group are different before matching. More loans in treated group have higher probability in being sold into a secondary market. After matching, this difference disappears in nearest neighbor matching and reduces dramatically in radius and kernel matching.

Before matching
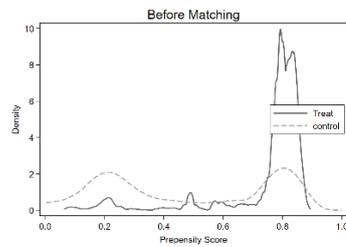
After matching
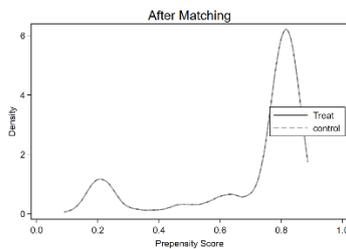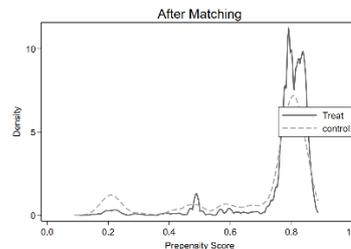
| Nearest neighbor | Radius | Kernel |
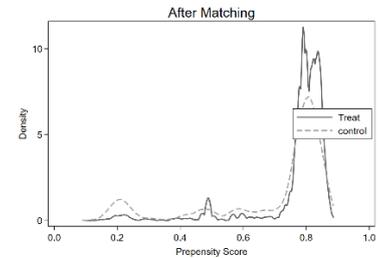
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