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Share pledge lending, monetary policy, and shadow banking nexus

Cheng Yan [a], Yujun Lian [b,1], Xiangxiang Xu [c,*], Chang-Chih Chen [d]

[a] Essex Business School, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, United Kingdom
[b] Lingnan College, Sun Yat-sen University, No. 135, Xingang Xi Road, Guangzhou 510275, China
[c] Risk management department, Postal Savings Bank of China (Zhejiang branch), No. 206, Wuxing Road, Hangzhou, 310000, China
[d] Department of Finance, Providence University, Taiwan

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ABSTRACT

We study how monetary policy affects brokers' shadow banking activities in the context of share pledge lending. Using China loan-level data and the quantity-based monetary model of Chen et al. (2018), we find a strong positive association between brokers' share pledge loans and monetary policy shocks. This association is more pronounced among brokers with stronger profit-seeking motives. The broker-borrower relationship helps borrowers get through political shocks and shapes value-destroying collusion. Also, we conduct a difference-in-difference (DiD) test to identify a new broker lending channel of monetary policy — policies for restricting shadow banking significantly curb brokers' lending via share pledge loans, embodying the effectiveness of monetary policy. Our finding reveals the transmission mechanism through which monetary policies intervene shadow banking underlying the share pledge lending market.

1. Introduction

Does the effectiveness of monetary policies extend to non-bank lending activities outside normal banking regulations (i.e., shadow banking)? The present paper explores this question by putting the focus on non-bank financial intermediations' (NBFIs) share pledge lending. Several motives behind our focus are as follow. Firstly, as one of most prevalent financing services in the system of shadow banking, share pledge lending is easily accessible to all individuals and companies with stock ownership. Secondly, the yield rates of share pledge loans reasonably reflect asset prices in the capital markets. Share pledge loans often stem from brokers' asset management products (AMPs), which are broadly purchased by households or banks' wealth management products (WMPs). Share pledge loans often stem from brokers' asset management products (AMPs), which are broadly purchased by households or banks' wealth management products (WMPs). These two types of financial products are recognized as the paramount component of shadow banking assets.[2]

Banks and NBFIs (such as brokers or trust funds) both are permitted to offer share pledge lending in terms of collateralized loans.

* Corresponding author at: Risk management department, Postal Savings Bank of China (Zhejiang branch), No. 206, Wuxing Road, Hangzhou 310000, China.
E-mail addresses: cheng.yan@essex.ac.uk (C. Yan), xcubed93@gmail.com (X. Xu).

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[2] Chen et al. (2020) and Acharya et al. (2024) mention that, as the largest emerging market and the global second largest economy, China has achieved a substantial growth in shadow banking activities. A technical report on China Shadow Banking Monitor from Moody indicates that, in 2016, NBFIs' AMPs and WMPs together constituted 46.67 % of total shadow banking assets. The market value of shadow banking assets reaches 30.1 trillion RMB, and peaks one year later.

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But the issuances of these two financial entities' share pledge loans differ in the funding source and regulatory constraints. Banks take cash deposits and create loans by lending out deposits, while NBFIs offer loans by using their collected investment funds or own internal funds. Besides, banks are subject to various banking regulations and supervision on capital cap and credit allocation (for example, banks are prohibited from offering loans to risky or brown industries). In contrast, NBFIs are simply regulated by capital and liquidity requirements. These differences suggest that monetary policies might influence banks' and NBFIs' share pledge lending asymmetrically.

Given the above, this paper investigates the role of NBFIs in shaping the impact of monetary policy shocks on shadow banking underlying the share pledge lending market. We also propose the channels of broker lending and regulatory arbitrage through which monetary policy shocks intervene NBFIs' share pledge lending. By using the policy of regulating financial institutions' asset management business (AMB regulation hereafter) as a quasi-natural experiment, we disentangle the effect of broker lending channel from that of regulatory arbitrage channel. Lastly, we examine the NBFIs' incentive to engage in share pledge lending, and explore the economic consequences of relationship lending.

We begin by estimating the time-series proxy for monetary policy shock in China. Specifically, we obtain the estimate of monetary policy from the quantity-based model of monetary supply proposed by Chen et al. (2018), and use the associated residuals as a proxy for unexpected M2 growth. After controlling for various macro-level and micro -level economic characteristics, our analysis documents a positive association between monetary policy shocks and NBFIs' share pledge lending — brokers experiencing un- expected M2 growth provide share pledge loans at a larger volume and with a longer maturity. Each 1 % increase in unexpected M2 growth is associated with a 23.3 % expansion of share pledge loan originations and with a maturity extension of 1.67 months. These suggest that monetary policy shocks boost share pledge activities.

One natural follow-up question is how monetary policy affects share pledge loan. To do this, the broker lending channel and regulation arbitrage channel are introduced. The former lies in the effectiveness of monetary policy to influence brokers' financing costs, and the latter refers to the contractionary monetary policy creates incentives for banks to invest their funds on brokers' AMPs to grant more share pledge loans. Since the AMB regulation is an important policy that aims to dismantle the nexus of monetary policy and shadow banking system, we thus can isolate the broker lending channel from the regulation arbitrage channel and to evaluate the effectiveness of this regulatory policy by interacting our estimated monetary policy shock with this regulatory policy in several ways. Our results suggest that monetary policy affects share pledge loan through the broker lending channel and this regulatory policy has to some extent curbed the brokers' shadow banking and enhanced the effectiveness of the monetary policy in China, from the perspective of policy evaluation.

Moreover, in untabulated results, we examine brokers' incentives to provide share pledge loans. We infer that brokers achieving a high ROA engage less in shadow banking, while those enjoying high profitability from past share pledge lending engage more. To verify this inference, we run regression analysis allowing for the interaction terms of ROA, profitability, and monetary policy shocks. Results present that the positive association between monetary policy shocks and share pledge loans becomes more pronounced among brokers with low ROA or high profitability from past share pledge lending activities. Our main results remain valid after controlling for brokers' information asymmetry and for the effect of relationship lending. It is worth noting that relationship lending may motivate brokers to accept highly risky shares as collaterals, and further gives rise to collusion between brokers and borrowers. Such a collusion is detrimental to the value of NBFIs.

This paper is related to the literature on the nexus of monetary policy and shadow banking. The types of shadow banking instruments considered by prior studies include the off-balance-sheet assets of commercial banks[3] (e.g., Chen et al., 2018; Allen et al., 2019; Yang et al., 2019; Chen et al., 2020; Deng et al., 2021; Gong et al., 2021; Cheng and Wang, 2022; Le et al., 2022; Acharya et al., 2024), trust products offered by trust companies (Allen et al., 2023), NBFIs' mortgage lending (Agarwal et al., 2023; Buchak et al., 2024), and financial lending funded by non-bank financial intermediaries (such as funding corporations, government-sponsored enterprises, finance companies, agency-based mortgage pools, or issuers of asset-backed securities) via securitization or capital markets (Sunderam, 2015; Nelson et al., 2018; Agnello et al., 2020). Xiao (2020) and Hodula and Libich (2023) consider money market funds (MMF), non-MMF investment funds, and shadow bank deposits as proxies for shadow banking activities.[4] Existing evidence shows that unconventional monetary policies shape the expansion of shadow banking sectors through the funding cost channel, search-for-yield channel, bank lending channel, mortgage servicing channel, and regulatory arbitrage channel (see, e.g., Cheng and Wang, 2022; Le et al., 2022; Agarwal et al., 2023; and Hodula and Libich, 2023).

In contrast, our paper puts the focus on shadow banking lending in terms of share pledge loans issued by NBFIs (brokers). We complement the aforementioned literature by proposing a new broker lending channel of monetary policy. This channel, which is expected to function properly by monetary authorities, might be disabled when share pledge loans escalate into shadow banking.

Besides, this paper is related to a growing stream of the literature on share pledges. Most of prior studies examine the demand-side implications of share/stock pledges for corporate financial policies and capital markets from the perspective of controlling share -holders or insiders. Wang and Chou (2018), Chen and Hu (2024), and Pan and Qian (2024) find that share pledges are associated with abnormal stock returns and with higher profitability. Anderson and Puleo (2020), Zhou et al. (2021), Hong et al. (2022), Singh and Singh (2022), and Qin and Wang (2023) document that share pledges (i) raise the likelihood of stock price crashes, (ii) facilitate the

[3] Commercial banks' off-balance-sheet assets supporting shadow banking credit predominantly consist of trust loans from trust companies and company-to-company entrusted loans (for detailed descriptions, see Figures 2, 4, and 5 in Yang et al. (2019)).

[4] Xiao (2020) define "shadow bank deposit" as shadow bank money supply consisting of liquid claims created by MMFs, which are shadow banks in the deposit market.

positive effect of government bailout funds on financial markets, (iii) deliver a bad signal about firms' debt-servicing capacity, (iv) shape credit-market systematic risks through financing networks, and (v) magnify equity risk by changing managerial risk-taking incentives. Many other attempts further find the role of share pledges in affecting shareholder wealth (Dou et al., 2019), corporate stock repurchases (Chan et al., 2018; and Chen et al., 2024), ESG/sustainability/greenwashing performance (Gao et al., 2024; Li, 2024; and Zhang et al., 2024), innovation (Pang and Wang, 2020; and Wang et al., 2020), investment efficiency (Huang et al., 2022), cash dividend payout policy (Li et al., 2020), and managerial interest-alignment incentives (Ouyang et al., 2019). Firm value, financing constraints, and the proportion of stock ownership are recognized as major firm-level influential factors or determinants of the cross-sectional variations in firms' share pledges (Li et al., 2019; Shi et al., 2023; and Pan and Qian, 2024).

Unlike existing studies, we examine the supply-side implications of share pledges for the effectiveness of monetary policy from the perspective of NBFIs or brokers. Our results about the negative effect of monetary supply on brokers' share pledge loans find monetary policy to be a unique systematic factor of affecting corporate share pledges. Therefore, share pledges serve as an alternative channel through which monetary policy not only intervenes shadow banking lending but also might influence non-financial firms' policies. Our research can inspire subsequent works to study how share pledge lending extends the impact of monetary actions to non-financial sectors.

The rest of the paper is organized as follows. Section 2 offers a detailed description of the institutional background in China. Section 3 describes our data and methodology. Section 4 presents the main empirical results. Section 5 concludes.

2. Institutional background, shadow banking, and share pledge

This section provides institutional background about China's quantity-based monetary policy, the unique role of NBFIs, the AMB regulation in 2017 and shares pledging in China.

2.1. China's quantity-based monetary policy

It is well-known that there are two intermediate targets of the monetary policy for the US monetary authority: inflation, employment/output. It is less known that since 2000 the intermediate target of monetary policy for China's monetary authority has been M2 growth only, in support of GDP growth beyond its annual target at a cost of mild inflation. Relevant laws in China dictate that, the State Council guides the monetary policy formulation and implementation of the People's Bank of China (PBC). At the Central Economic Work Conference in every December, the State Council together with the Central Committee of Communist Party of China (CPC) determine the targeted GDP and M2 growth for the next year, which will be reported to the annual assembly of the National People's Congress (NPC) during the next spring. Unlike the Federal Reserve System in the US, the PBC is not an independent unit but a department of the State Council of China. The PBC adjusts M2 growth rates on a quarterly basis via a plethora of instruments, but the annual targeted and annual actual rates of M2 growth are close. Chen et al. (2018) provide more details of the institutional background of China's monetary policy system.

2.2. Collusion between banks and non-banks

In order to combat the global financial crisis in 2008, the Chinese government injected several trillion RMBs and lifted credit scale constraints on commercial banks, resulting in an additional 9.6 trillion RMB in loans, and a 27.7 % growth rate in M2 (the highest levels since the 1990s). After achieving the intended economic impact, the monetary authorities began implementing contractionary policies in 2010 to curb the rapidly rising real estate prices. This tightening policy increased the likelihood of banks reaching the 75 % loan-to-deposit (LDR) ceiling monitored by the China Banking and Insurance Regulatory Commission (CBIRC), prompting banks to collude with trust companies to shift credit assets off their balance sheets to bypass regulatory constraints.

The CBIRC has issued multiple rules to prohibit such regulatory arbitrage, including: banks are prohibited from providing guarantees for bank-trust WMPs; trust companies must invest in a bank's credit assets via outright purchase, with no form of repurchase allowed by the bank; and bank-trust WMPs are not permitted to invest in the issuing bank's own credit assets. As the regulation targeting bank-trust businesses gradually refined, banks began colluding with brokers—who were not yet clearly regulated—by utilizing their channeling services to circumvent strict banking regulations.[5] As shown in the Panel A of Fig. 1, banks' WMPs and brokers' AMPs (especially targeted AMPs) upsurge simultaneously since 2013.

2.3. Regulating the asset management business of financial institutions

Defined in the regulation, the asset management business (AMB) refers to financial services in which banks, trusts, brokers, or any other financial institutions accept investor entrustment and invest or manage their assets/properties. The asset management products include banks' principle floating WMPs, brokers, trusts, and insurance companies' AMPs. The procedure of AMB is introduced at length

[5] China adopts a policy of "separate operation and separate supervision" which stipulated the China Banking and Insurance Regulatory Commission (CBIRC) supervised banks, trusts and insurance companies meanwhile the China Securities Regulatory Commission (CSRC) supervised brokers. The uncoordinated paces of supervision between CBIRC and CSRC leave considerable space for brokers to conduct regulatory arbitrage through passageway services.

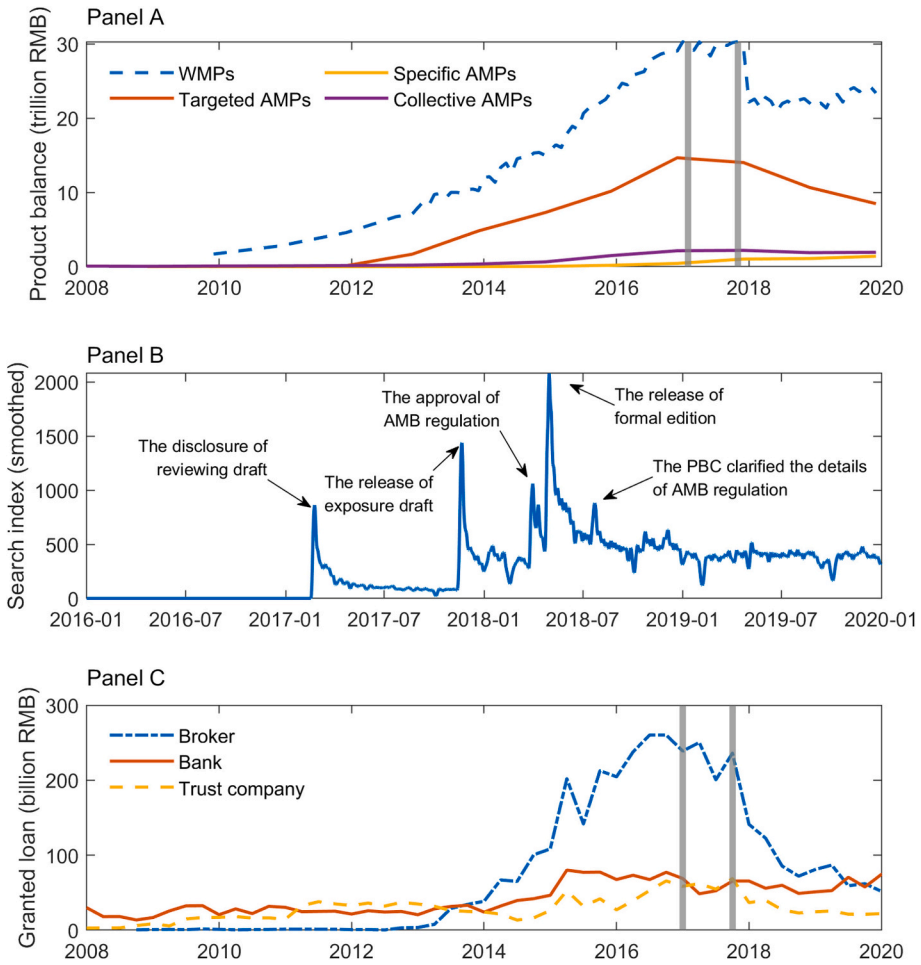

Fig. 1. Stylized facts regarding shadow banking in China.
Note: Panel A shows the evolution of WMPs and AMPs balances. There are three types of AMPs: targeted AMPs, specific AMPs and collective AMPs. Panel B shows the Baidu search index of AMB regulation. Baidu is the largest and most widely used search engine in China. Similar to the Google search index, Baidu constructs the Baidu search index to reflect public attention on the related topic. We use the AMB regulation as search keywords and achieve this figure. Panel C shows share pledge loan over time. The first shaded area in Panel A and C represents Feb. 2017 (when the reviewing draft was disclosed), and the second represents Nov. 2017 (when the exposure draft was released).
Source: Wind, Baidu and CSMAR.

and the rigid payment (guarantee of the principal and returns) which was implicit in the AMPs is strictly forbidden. Importantly, the AMB regulation closes the door on the passageway services that facilitate the cooperation and regulatory arbitrage between financial institutions.[6]

There are three versions of AMB regulation. That is the reviewing draft, exposure draft, and formal edition. Documented by the Baidu search index in Panel B of Fig. 1, the reviewing draft of AMB regulation was reported by the media and ignited a debate in February 2017. On November 17, 2017, the alliance released the AMB regulation (Exposure Draft) to canvass public opinions. On April 27, 2018, the formal edition of the AMB regulation was released. Despite some minor corrections, the spirit, and key articles are consistent across different versions of AMB regulation. We employ the reviewing draft of AMB regulation as an exogenous shock that gashes the shadow banking sector.[7]

[6] This goal is mainly achieved by Article XXII as follows: Financial institutions shall not provide passageway services for the AMPs of other financial institutions that circumvent the investment regulations, leverage constraints or any other regulatory requirements. AMPs can invest in another layer of AMPs, but the invested AMPs must not invest in AMPs other than publicly offered securities investment funds.

[7] In Appendix B, we develop a theoretical model to illustrate that the coordinated regulatory burden between banks and NBFIs, emphasized by the AMB regulation in 2017, undermines shadow banking.

2.4. Shares pledging in China

Both Shanghai Stock Exchange (SHSE) and Shenzhen Stock Exchange (SZSE) in China were officially established in 1990. Before 2013, China's shares pledging business were performed in the over-the-counter market and dominated by commercial banks and trusts, when the size of the market was small and the share pledging process was time-consuming.

On May 24, 2013, SHSE, SZSE together with the China Securities Depository and Clearing (CSDC) Ltd. jointly launched a centralized and standardized share pledging system, where brokers start to dominate the market and the market size surges (Panel C of Fig. 1). According to He et al. (2022), the amount of newly pledged shares grew at an average annual rate of 18.6 % from 2007 to 2020. At the peak of the shares pledging market in 2017, more than 95 % of the listed firms in China's A-share market have shares pledged by their shareholder(s), while the total value of pledged shares at that time takes greater than 10 % of the market capitalization. Both the average annual transaction amount and value of shares pledged between 2013 and 2020 is about five times of the ones during the period of 2007 and 2012. Hence, we focus on the post-2013 period in this study as the centralized and standardized share pledging system launched in 2013 greatly changed the landscape of China's share pledging market.

3. Data and stylized facts

This section explains the data sources that we use in this paper together with a preliminary data analysis.

3.1. Data

Our sample includes 99 brokers carrying out share pledge business between 2014Q1 and 2019Q4 and most of them are unlisted. According to the Securities Association of China (SAC), there were 133 brokers by the end of 2019, while some brokers are not qualified to conduct share pledge business. The mainstream brokers such as CITIC securities (the biggest broker in China), Huatai Securities, China International Capital Corporation, China securities, and Guotaijunan securities are all included in the sample.

Our data comes from multiple sources. First, we obtain brokers' financial information from the China Research Data Services Platform (CNRDS). Brokers might change their names, go bankrupt, or be involved in M&A during our sample period. Except for financial information, this dataset also allows us to get a complete name list and unique identification numbers of those brokers during their existence.

Second, we collect share pledge dataset from the China Stock Market & Accounting Research Database (CSMAR). The share pledge dataset documents large shareholders pledging as required by the stock exchange. The pledging shareholders, trading brokers, pledge amounts, and so on are recorded in the dataset. However, the broker revealed in the dataset lacks uniform identification and is often mixed with geographical or branch information. We manually correct it with the name list obtained from CNRDS and give each broker a unique identification number documented in over one hundred thousand pledging records. This loan-level data is aggregated at a broker-quarter level to match the frequency of monetary policy shocks proposed by Chen et al. (2018). Moreover, data in quarter frequency can give us cleaner identification in the assessment of the AMB regulation.

Third, we collect annual reports of brokers from the SAC. The SAC mandatorily requires all securities companies to post their annual report on SAC's official website. We read through over 700 annual reports and hand collect information about AMPs from those annual reports. The disclosure of AMPs is not mandatory, so we lose some observations when regressing with AMPs. The disclosure of AMPs can typically be found in the introduction where the broker discusses its operation condition, or in the notes to financial statements. We also download the performance ranking conducted by the SAC every year and obtain data with share pledge incomes and AMPs. Cross-validation of AMPs is performed, and it proves those two data sources fit well.

Finally, we obtain brokers' regulatory indicators such as risk coverage ratio (RCR), capital leverage ratio (CLR) and so on from iFind. The data source is labeled in each figure when the data is used for illustrations.

3.2. Preliminary data analysis

The scale of the share pledge booms right after 2013. Hence the AMPs become the primary passageway through which the WMPs originated from banks flow into brokers, and finally stream to shareholders who pledged shares to the brokers.

As Panel C of Fig. 1 shows, the release of the AMP regulation (Reviewing Draft) interrupted the upwelling trend in the share pledge loan originated from brokers. There are some rebounds during the following quarters, and it seems that financial institutions were confirming or accessing the validity of this regulation. However, the release of the AMP regulation (Exposure Draft) then threw a share pledge loan from the top.

Table 1 presents the summary statistics of variables in regressions. For the data, we delete missing values and winsorize all variables according to the baseline regression. The maturity of each share pledge transaction is not always available, and some brokers do not disclose their holdings of AMPs, incomes from share pledges or regulatory indicators, so the observations of these variables are slightly fewer.

Share pledge loans originations show great variations. The average logarithm of share pledge loans granted by a broker in one quarter is 20.34 (or 1.88 billion RMBs). The maximum can reach 23.4 (14.54 billion) and the minimum is 15.53 (5.55 million). The average maturity of share pledge loans is 15.52 months. The estimated monetary policy is small in magnitude, so it is multiplied by 100 to improve the readability of results, so as for GDP growth rate, CPI growth rate, and stock market return. The negative mean indicates that the monetary policy is, on average, contracting during the sample period. The last three rows of Table 1 provide a clear assessment

Table 1
Summary statistics.

	N	Mean	S·D	Min.	Median	Max.
Dependent variables						
logLoan	1696	20.34	1.67	15.53	20.44	23.40
Maturity	1564	15.52	6.47	3.00	13.37	36.00
Key independent variables						
g	1696	−1.12	0.88	−2.27	−1.45	0.99
Control variables						
Size	1696	24.49	1.17	20.39	24.41	26.98
Capital	1696	0.28	0.11	0.08	0.26	0.98
Liquidity	1696	0.25	0.11	0.00	0.24	0.95
ROA	1696	0.02	0.02	−0.11	0.02	0.12
GDPGrowth	1696	6.59	0.47	5.22	6.69	7.38
CPIGrowth	1696	1.97	0.58	1.24	1.90	4.20
MRtn	1696	0.90	12.53	−33.73	−0.92	31.46
Others						
RCR	1249	3.77	2.42	1.36	2.91	15.89
NC2NA	364	0.81	0.15	0.53	0.81	1.20
NC2D	353	0.52	0.38	0.20	0.42	3.66
CLR	846	0.28	0.11	0.12	0.27	0.85
Loan2AMP	1421	0.09	0.21	0.00	0.04	1.97
Int2Rev	1619	0.08	0.08	0.00	0.06	0.39
Int2NI	1619	0.42	0.80	−0.51	0.19	5.06

Notes: This table reports descriptive statistics for sample brokers for the period 2014Q1-2019Q4. All variables are winsorized at 1 %. To improve the readability of coefficients, variable g, GDPGrowth, CPIGrowth, and MRtn have been multiplied by 100. The definition of each variable is provided in Table A1 in the Appendix.

of the importance of share pledge loans to brokers. While share pledge loans account for a relatively small proportion of assets under management and total revenue, they generate significant profits for brokers, with interest income averaging 42 % of their net income.

4. Empirical results

In this section, we present our empirical results on how the monetary policy affects share pledge lending. We first gauge monetary policy shock in China. After that, we report our baseline regression results. To address potential endogeneity concerns, we exploit the AMB regulation as an exogenous policy shock to examine its impact on share pledge lending. Since the AMB regulation is to penetrate the fund flows from the banking system into shadow banking and stop banks' provision of liquidity in the regulatory arbitrage, we thus offer evidence on the effectiveness of monetary policy in restraining shadow banking post-regulation. Next, we shift focus back to monetary policy by analyzing the broker lending channel. Finally, we extend the bank relationship lending to the context of share pledge lending.

4.1. Estimation of China's monetary policy

We use the symbol g to denote the monetary policy shock, which is estimated through an adapted Taylor rule following the method of Chen et al. (2018):

$$g_{m,t} = \gamma_0 + \gamma_m g_{m,t-1} + \gamma_\pi(\pi_{t-1} - \pi^*) + \gamma_{x,t}\left(g_{x,t-1} - g^*_{x,t-1}\right) + \varepsilon_{m,t} \tag{1}$$

where $g_{m,t}$ stands for the quarterly growth of M2 at time t, π_{t-1} stands for the CPI inflation and $g_{x,t-1}$ stands for the actual GDP growth at time $t-1$. Variable with a superscript star represents targeted value. The targeted inflation can be found in the PBC's Monetary Policy Report (around 3 %–4 %). The GDP growth target $g^*_{x,t-1}$ set by the State Council and the CPC is documented in the Annual Report on the Work of Government. A time-varying coefficient $\gamma_{x,t}$ is set as:

$$\gamma_{x,t} = \begin{cases} \gamma_{x,a} \text{ if } g_{x,t-1} - g^*_{x,t-1} \geq 0 \\ \gamma_{x,b} \text{ if } g_{x,t-1} - g^*_{x,t-1} < 0 \end{cases} \tag{2}$$

Hence, the essence of this monetary policy is that the central government treats the GDP growth target as the overriding objective as the cost of mild inflation. We estimate the monetary policy in a sample period from 2000Q1 to 2019Q4[8] and obtain its residuals. Those residuals can be regarded as the unexpected M2 growth and we denote it as g.

[8] Since 2000, the intermediate target of monetary policy has been shifted from credit quota to M2. In 2020, due to the coronavirus pandemic, the Chinese government did not set GDP growth target for the first time. Hence, we choose 2000Q1 to 2019Q4 as our estimation period.

4.2. Baseline results

After gauging the monetary shock, we empirically examine the potential association between the monetary policy shock and share pledge loan. Share pledge loan is indeed credit allocation, as the brokers borrow and lend in the interbank market, and they also manage assets for their clients. We expect the monetary policy affects share pledge loans of brokers, just as the bank lending. As our baseline model, we run the following panel regression with fixed effects:

$$logLoan_{i,t} = \alpha + \alpha_1 g_{t-1} + \gamma_1 BCtrls_{i,t-1} + \gamma_2 MCtrls_{t-1} + \alpha_i + \lambda_t + \varepsilon_{it} \quad (3)$$

where the subscript i, t represents broker i that facilitates share pledge lending at time t. The *logLoan* stands for the logarithm of share pledge loan and share pledge loan is calculated as the product of pledged shares, pledging price, and the loan-to-value ratio. The pledging price is calculated as the average closing price of 7 trading days before the pledge. Following Guo et al. (2023), the loan-to-value ratios of stocks in the two main boards (Shanghai and Shenzhen stock exchanges), the SME board, and the ChiNext board are 50 %, 40 %, and 30 % respectively. We then aggregate the calculated share pledge loan in each transaction to the broker-quarter level. The *Maturity* of brokers' share pledge loans is calculated according to the start and end date revealed in each transaction, then aggregate the transaction maturity to broker-quarter level using a weighted average by loan amounts.

Following Jiménez et al. (2014), the individual broker control variables (*BCtrls*), including *Size*, *Capital*, *Liquidity* and *ROA*. α_i is the broker fixed effect and $\lambda_t (t = 1, 2, 3)$ represents the quarter fixed effects. We use three macro-control variables (*MCtrls*), including *GDPGrowth*, *CPIGrowth* and *MRtn* (GDP growth rate, CPI rate, and stock market return), to control macroeconomic factors leaked through three-quarter dummies.

Table 2 reports the regression results from our baseline model. The estimated coefficient of monetary policy shock is always positive and statistically significant at any conventional levels (i.e., 1 %, 5 %, and 10 %). This holds true for both loan volume and maturity. The economic significance is large since in column (3), 1 % increase in unexpected M2 growth is associated with an increase of 23.3 % in share pledge loan originations. In column (6), 1 % increase in the M2 growth rate leads to an increase of 10.76 % or 1.67 months in maturity. This finding suggests that as the monetary policy loosens, the brokers may not only obtain more liquidity from the interbank market but also accept more AMPs from clients, enabling them to issue more and longer share pledge loans. This "broker lending channel" has the same spirit as the bank lending channel proposed by Bernanke and Blinder (1988) in their seminal work.

Regarding control variables, our regression analysis also suggests that on average, larger brokers with a larger size, more liquidity and higher profitability engage more share pledge lending, consistent with the supply-side story since brokers with more resources can provide more loans to blockholders who pledge shares as collaterals.

4.3. How does monetary policy affect share pledge lending?

Table 2 presents a positive association between monetary policy and share pledge loan. We interpret it as brokers might acquire more liquidity from interbank market or AMPs when monetary policy loosens. There are two potential channels that monetary policy may work through. Fig. 2 depicts how monetary policy influence share pledge loan through these two channels.

The first channel is the broker lending channel. As mentioned before, it operates similarly to the bank lending channel, as brokers in China are regulated by the capital adequacy indicators, with one key measure being the Risk Coverage Ratio (RCR), which represents the ratio of net capital to the total risk capital reserves. The CSRC closely monitors brokers to ensure they meet the minimum regulatory requirements (e.g., RCR$\geq$100 %). Failure to comply with these requirements may result in severe penalties for brokers.

The share pledge is indeed capital-intensive.[9] As monetary policy contracts, the cost of complementing net capital upsurges and brokers face more difficulties in granting share pledge loans while complying with the capital adequacy requirements. We define the impact of monetary policy via those requirements as the broker lending channel.

The second channel is the regulation arbitrage channel. Brokers accept the entrustment of clients and operate clients' funds. However, brokers' AMPs can also serve as a passageway to help banks' deposit or WMPs avoid strict regulation, which is strictly forbidden by the AMB regulation. Fig. A1 in the Appendix presents an announcement related to pledging prosecutions, demonstrating that such collaboration is possible. As monetary policy contracts, on the one hand, banks are more likely to violate loan regulation thus banks may grant more share pledge loan by using brokers' AMPs to sidestep those loan regulations.

The broker lending channel and regulation arbitrage channel mix together so it's difficult to tell which channel monetary policy mainly works through. Fortunately, the release of AMB regulation that aims to block the regulation arbitrage makes the identification possible. If the boom of share pledge mainly depends on the regulation arbitrage channel, we should observe an impact of the AMB regulation on share pledge. With the help of the AMB regulation, we can not only differentiate the broker lending channel from the regulation arbitrage channel, but also identify if share pledge belongs to shadow banking products.

4.3.1. A quasi-natural experiment based on the AMB regulation

We use the AMB regulation as an exogenous shock to prove whether the regulation arbitrage channel still exists after 2017 and share pledge loan belongs to the shadow banking product. The equation is specified as:

[9] To manage credit risk, brokers are required to allocate risk capital reserves equal to 20 % of share pledge balance.

Table 2
Monetary policy shock and share pledge loans.

Dep Var:		logLoan			Maturity	
	(1)	(2)	(3)	(4)	(5)	(6)
g	0.156***	0.149***	0.233***	1.091***	1.128***	1.668***
	(0.051)	(0.042)	(0.067)	(0.177)	(0.175)	(0.347)
Size			0.558***			0.908
			(0.131)			(0.775)
Capital			0.216			−1.706
			(0.645)			(3.417)
Liquidity			2.135***			5.760*
			(0.483)			(3.056)
ROA			16.108***			92.786***
			(4.720)			(22.121)
GDPGrowth			−0.048			−1.871**
			(0.178)			(0.846)
CPIGrowth			−0.855***			−2.291***
			(0.110)			(0.600)
MRtn			−0.006**			0.016
			(0.002)			(0.017)
Broker F.E.	No	Yes	Yes	No	Yes	Yes
Quarter dummies	No	Yes	Yes	No	Yes	Yes
N	1696	1696	1696	1564	1564	1564
R-squared	0.007	0.500	0.605	0.022	0.164	0.240

Notes: This table shows that brokers facilitated more and longer share pledge loan during monetary policy loosening. The dependent variables are logarithm of total share pledge loan amount and loan maturity (in months). Standard errors reported in parentheses are clustered by broker. We use ***, **, * to denote statistical significance at 1 %, 5 %, and 10 % level, respectively.

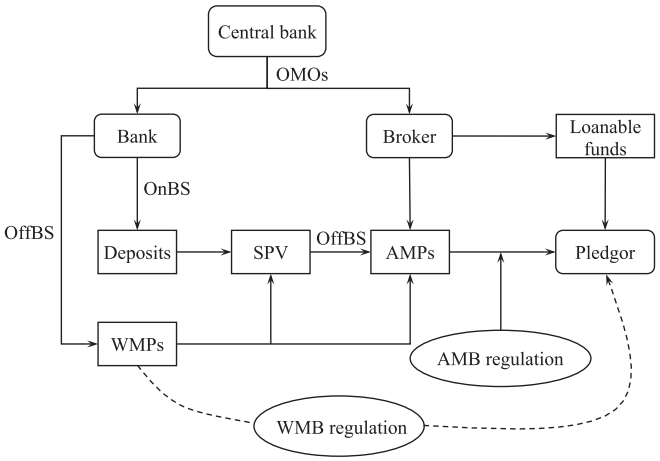

Fig. 2. An illustration of monetary policy, shadow banking activities and share pledges lending.
Notes: Items in rounded rectangles indicate participants of share pledge. Items in rectangles indicate some financial assets. Items in ellipses indicate administrative regulations. Specifically, OMOs refers to open market operations. OnBS refers to on balance sheet and OffBS off the balance sheet. SPV, AMPs and WMPs refer to special purpose vehicle, asset management products and wealth management products respectively. The WMB regulation curtails the amount that WMPs flows into share pledges loan so those two are connected by dashed line. The AMB regulation blocks AMPs from flowing into pledgor.

$$logLoan_{i,t} = \beta treat_i \times post_t + \gamma BCtrls_{i,t} + \alpha_i + \theta_t + \varepsilon_{it} \quad (4)$$

where *logLoan*, *BCtrls* and α_i are the same as eq. (3). We also include the time fixed effects θ_t in this DiD setting. As mentioned before, we employ the release of AMB regulation, the reviewing draft as the exogenous shock; hence variable $post_t$ takes value 1 if and only if the time is after 2017Q1.

Since there is no clear-cut treatment group in the regulation, we need to find a criterion that helps us to differentiate which brokers suffer most from the AMB regulation. We construct the treat group according to the following steps: first, the average ratio of share pledge loans granted in one year to the year-end AMP (*Loan2AMP*) between 2014 and 2016 is calculated. Second, using the median of those values as a threshold, brokers with ratios above the median are classified into the treatment group. If the share pledge loan supported by the AMPs is indeed originated from banks' shadow banking activities (no matter from special purpose vehicle or WMPs), this measurement should capture the extent to which the AMB regulation affects brokers since the AMB regulation prohibits AMPs

from providing regulatory circumventing services for banks. However, if the funds of share pledge loans are not originated from banks conducting shadow banking activities, we should not observe any impact of the AMB regulation on share pledge loans origination. In this way, the coefficient of interest β in eq. (4) should not be significantly different from zero.

As shown in Table 3, the interaction of treatment and post is always negative and statistically significant in column (1) to (3), which suggests that the share pledge loans by brokers are greatly affected by the new AMB regulation that intends to curtail shadow banking activities. As shown in column (4) to (6), we find limited evidence that the AMB regulation has a significant effect on loan maturity. This might be due to the fact that the contract of share pledge is highly formatted, and most share pledge loans have predefined 1- or 2-years' maturity. When the AMB regulation hits share pledge business, brokers directly choose to control the scale of business.

The magnitude is not only statistically but also economically significant. Compared with the control group, the AMB regulation curtailed 69.4 % of share pledge lending of brokers in the treatment group, which suggests that share pledge lending is highly related to shadow banking as banks seem to provide liquidity through vehicles to circumvent the usual regulations on banking.

4.3.2. Robustness test

Table 3 builds a direct causal relationship between the AMB regulation and share pledge lending, which suggests that the boom of share pledge lending largely depends on the shadow banking practices that had escaped regulatory oversight and proves the existence of the regulation arbitrage channel. We further provide tests to make sure that the DiD design meets the requirement for an exogenous event caused by the new policy. A prerequisite for the DiD regression is the parallel trends.

Fig. 3 presents the results from the test of the parallel trends. The AMB regulation starts to take effects from 2017Q3 and maintains its suppressing effect on shadow banking activities hereafter. This suggests that the parallel trends following the new regulation satisfy the exogeneity for DiD design.

As our choice of the treatment and control groups is not random, we further introduce propensity score matching (PSM) into our DiD research design.

Table 4 presents the results from PSM-DiD. The four broker control variables serve as covariates in the logit regression. Moreover, the matching between the treatment group and control group is done by each time point to isolate the impact of AMB regulation before and after 2017Q1. The results from columns (1) to (5) are consistent with the results in Table 3. Different matching methods lead to qualitatively similar results.

To exclude the possibility that the sharp decline in share pledge loan is random, we construct two fake time point $Treat_{15}$ and $Treat_{16}$, which take a value 1 only if the time is after 2015Q1 and 2016Q1, respectively. Table 5 presents the results of placebo test. The two insignificant interaction terms in Table 5 suggest that there is no difference between the treatment and control groups before the AMB regulation. Therefore, we can conclude that the drop in share pledge loan within treatment group is not random.

Overall, we prove that our quasi-natural experiment results are quite robust.

4.3.3. A closer look at the regulatory arbitrage channel

Fig. 2 illustrates how banks might sidestep loan regulations by collaborating with brokers. Through previous empirical work, we

Table 3
Results from the difference-in-differences approach.

Dep Var:		logLoan			Maturity	
	(1)	(2)	(3)	(4)	(5)	(6)
Treat*Post	−0.402**	−0.750***	−0.694***	−0.991	−1.677*	−1.288
	(0.190)	(0.163)	(0.166)	(0.969)	(0.999)	(1.028)
Treat	0.458*			−0.086		
	(0.270)			(0.753)		
Post	−0.298**			−2.133***		
	(0.147)			(0.805)		
Size			−0.001			0.445
			(0.221)			(1.076)
Capital			1.302			4.231
			(0.789)			(3.473)
Liquidity			−0.120			−3.311
			(0.746)			(3.857)
ROA			1.884			28.587
			(5.086)			(29.721)
Broker F.E.	No	Yes	Yes	No	Yes	Yes
Time F.E.	No	Yes	Yes	No	Yes	Yes
N	1637	1637	1637	1535	1535	1535
R-squared	0.036	0.651	0.653	0.047	0.285	0.287

Notes: This table shows that AMB regulation reduced the share pledge loan which can thus be considered as shadow banking loan. The dependent variables are logarithm of total share pledge loan amount and loan maturity (in months). The key independent variable Treat is constructed as follows: first, the average ratio of share pledge loans granted in one year to the year-end AMP between 2014 and 2016 is calculated. Second, using the median of those values as a threshold, brokers with ratios above the median are classified into the treatment group (Treat = 1). The variable POST is assigned a value of 1 from 2017Q1 onwards. Standard errors reported in parentheses are clustered by broker. We use ***, **, * to denote statistical significance at 1 %, 5 %, and 10 % level, respectively.

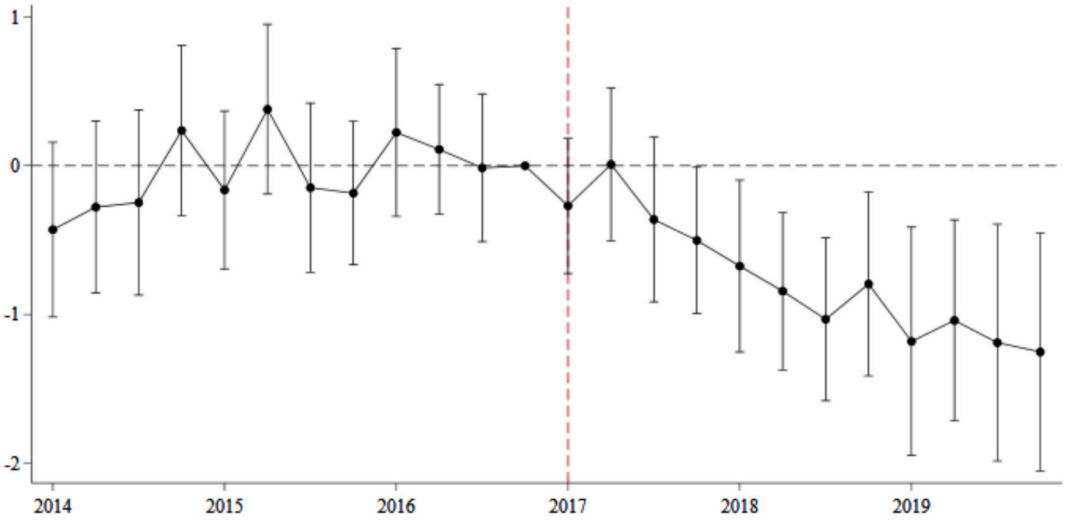

Fig. 3. Parallel trend of the DiD regression.
Notes: The benchmark is 2016Q4 so there are only 11 quarters in the pre-regulation period. On each quarter, the upper and lower confidence spikes constitute the 90 % confidence interval and the black dot in the middle of the confidence interval is the estimated coefficient.

Table 4
Results from the PSM-DID method.

Dep Var: logLoan	1NN	2NN	3NN	Cal	1NN + Cal
	(1)	(2)	(3)	(4)	(5)
Treat*Post	−0.764***	−0.733***	−0.738***	−0.715***	−0.688***
	(0.172)	(0.173)	(0.170)	(0.169)	(0.173)
Size	0.079	−0.117	−0.062	−0.035	−0.063
	(0.241)	(0.222)	(0.224)	(0.206)	(0.223)
Capital	0.517	0.832	0.902	1.329	1.385
	(0.851)	(0.816)	(0.801)	(0.827)	(0.898)
Liquidity	0.151	−0.570	−0.485	−1.032	−1.170
	(0.715)	(0.804)	(0.803)	(0.956)	(1.043)
ROA	0.963	−0.577	−1.848	−0.297	0.691
	(5.578)	(5.938)	(5.603)	(5.807)	(6.331)
Broker F.E.	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes
N	1262	1448	1492	1492	1318
R-squared	0.652	0.662	0.660	0.661	0.665

Notes: This table shows that the propensity score matching results of DiD regression. The dependent variable is logarithm of total share pledge loan amount. We repeat the PSM procedure at each time point (i.e. find the similar brokers at each time point) to prevent matching between pre- and post-policy periods, which could possibly bias the estimated policy effect. We also conduct the matching in pre- and post-policy periods and the results are robust. The notation kNN in the column title refers to the k-nearest neighbor matching. The notation Cal refers to the caliper matching and 1NN + Cal is nearest-neighbor matching within the caliper. Standard errors reported in parentheses are clustered by broker. We use ***, **, * to denote statistical significance at 1 %, 5 %, and 10 % level, respectively.

identified that the AMP is a key tool used by brokers to engage in regulatory arbitrage. In this subsection, we take a closer look at this channel by breaking down the AMP.

There are three types of AMPs: targeted AMPs (TAMPs), collective AMPs (CAMPs), and specific AMPs (SAMPs). TAMPs refer to AMPs that accept commissions from individual customers and are highly personalized, allowing the customer to designate the investment target. CAMPs, on the other hand, pool funds from multiple investors and can be treated as either public or private funds. Finally, SAMPs function similarly to ABS and must be reported to the CSRC on an item-by-item basis.

As shown in Panel A of Fig. 1, TAMPs hold the largest market share among AMPs and co-moved with the bursting WMPs prior to 2017Q1. However, after the release of the AMB regulation (reviewing draft), the upward trend of both WMPs and AMPs, as well as their co-movement, was interrupted. Following the AMB regulation (exposure draft), both WMPs and TAMPs began to decline at a faster pace.

This phenomenon is not a coincidence. Following the same logic used to construct the treatment group in Table 3, we create $Treat_{TAMP}$, $Treat_{CAMP}$, and $Treat_{SAMP}$ using the three types of AMPs. Some observations are smaller because certain brokers do not disclose the detailed types of AMPs, but the main result from Table 3 remains, as shown in Column (1) in Table 6. The significantly

Table 5
Placebo Test for DID regression.

Fake policy time:	2015Q1		2016Q1	
	(1)	(2)	(3)	(4)
Treat*Post	−0.238	−0.304	−0.025	−0.101
	(0.239)	(0.228)	(0.160)	(0.147)
Size		0.326		0.380
		(0.433)		(0.402)
Capital		0.477		0.653
		(0.965)		(0.822)
Liquidity		1.391		0.954
		(1.173)		(0.902)
ROA		−12.218		−10.959
		(7.460)		(7.069)
Broker F.E.	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes
N	738	738	757	757
R-squared	0.714	0.718	0.711	0.714

Notes: This table shows that the DiD yields no results if the policy time are assumed to have occurred in 2015Q1 or 2016Q1. The sample period is 2014Q1 ~ 2016Q4. The dependent variable is logarithm of total share pledge loan amount. Standard errors reported in parentheses are clustered by broker. We use ***, **, * to denote statistical significance at 1 %, 5 %, and 10 % level, respectively.

negative interaction terms in Columns (2) and (3) indicate that brokers use TAMPs and CAMPs—particularly TAMPs, given the larger coefficient and higher significance—to engage in regulatory arbitrage.

4.3.4. Policy evaluation using the AMB regulatory shock

In this subsection, we show how monetary policy affects share pledge loan through the broker lending channel and regulation arbitrage channel, and evaluate the effectiveness of this regulatory policy by interacting our estimated monetary policy shock with the AMB regulation in several ways.

The estimated coefficient α_1 in eq. (3) is a measurement of the effectiveness of the monetary policy on share pledge lending. If α_1 is significantly positive, then the share pledge lending is controlled by the PBC. If α_1 is insignificant, then there is little effect of monetary policy on share pledge lending. If α_1 is significantly negative, the effectiveness of monetary policy is hampered since it's the total credit that matters. To evaluate the effectiveness of monetary policy around the AMB regulation, we estimate the following regression:

$$logLoan_{it} = \alpha + \alpha_1 g_{t-1} \times post_t + \alpha_2 g_{t-1} + \alpha_3 post_t + \gamma_1 BCtrls_{i,t-1} + \gamma_2 MCtrls_{t-1} + \alpha_i + \lambda_t + \varepsilon_{it} \quad (5)$$

Table 6
How brokers created regulation arbitrage channel.

	(1)	(2)	(3)	(4)
Treat*Post	−0.757***			
	(0.182)			
Treat_TAMP*Post		−0.593***		
		(0.206)		
Treat_CAMP*Post			−0.488**	
			(0.196)	
Treat_SAMP*Post				−0.117
				(0.224)
Size	−0.562**	−0.533*	−0.763**	−0.771**
	(0.262)	(0.292)	(0.300)	(0.307)
Capital	0.755	1.055	1.025	1.472
	(1.026)	(0.962)	(0.983)	(0.998)
Liquidity	−0.499	−0.703	−1.113	−1.097
	(0.797)	(0.850)	(0.911)	(0.909)
ROA	3.547	4.701	5.025	7.689
	(8.870)	(9.275)	(9.048)	(9.340)
Broker F.E.	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes
N	857	857	857	857
R-squared	0.72	0.72	0.72	0.71

Notes: This table shows that brokers mainly employed the targeted AMP (TAMP) and collective AMP (CAMP), instead of specific AMP (SAMP) to conduct regulation arbitrage. The dependent variable is logarithm of total share pledge loan amount. The key independent variables Treat (Treat_TAMP and so on) are constructed as follows: first, the average ratio of share pledge loan to AMP (TAMP and so on) for brokers between 2014 and 2016 is calculated. Second, using the median of this value as a threshold, brokers with ratios above the median are classified into the treatment group (Treat = 1). Standard errors reported in parentheses are clustered by broker. We use ***, **, * to denote statistical significance at 1 %, 5 %, and 10 % level, respectively.

$$logLoan_{it} = \alpha + \alpha_1 g_{t-1} \times treat_i \times post_t + \alpha_2 g_{t-1} \times treat_i + \alpha_3 g_{t-1} \times post_t + \alpha_4 treat_i \times post_t + \alpha_5 g_{t-1} + \alpha_6 post_t + \gamma_1 BCtrls_{i,t-1} + \gamma_2 MCtrls_{t-1} + \alpha_i + \lambda_t + \varepsilon_{it} \quad (6)$$

We estimate eq. (5) in the subsamples of treat and control groups. The coefficient α_1 examines if there is any difference in the power of monetary policy around the AMB regulation. Eq. (6) further introduces the triple interaction to examine the difference of treat and control groups, before and after the AMB regulation respectively does exist.

Since the monetary policy shocks impact share pledge lending through broker lending channel and regulatory arbitrage channel in opposite directions, the effectiveness of monetary should be hampered before the AMB regulation. The coefficients of *g* and its interactive terms with treat dummy and post dummy capture the effectiveness of monetary policy after the new AMB regulation. Table 7 presents the multivariate regression results.

We first divide the sample into pre- and post-regulation periods, as shown in Columns (1) and (2). The results indicate that the monetary policy shock is only significantly positive in the post-regulation period, suggesting that the broker lending channel takes a dominant place. We then regress the interaction of *g* and *post* in control and treat sub-sample. While there is little difference in the effectiveness of monetary policy in control groups before and after the AMB regulation, the effectiveness of monetary policy is enhanced by the AMB regulation in the treatment group. In the treatment group, the central bank can use the monetary policy toolbox to control the credit through share pledges after the AMB regulation.

Column (5) examines whether this difference indeed exists by including a triple interaction. Moreover, since only the triple interaction matters, we can control the time fixed effect in column (6) to absorb all-time series variations coming from the macro-economy. The coefficient of triple interaction remains statistically significant positive at the 1 % level.

This finding has meaningful economic interpretation. First, it indicates that it's the broker lending channel through which the monetary policy affects share pledge loan. Second, it implies that the monetary policy has opposite effect on share pledge loan in the broker lending channel and regulation arbitrage channel. The regulation arbitrage channel hampers the effectiveness of monetary policy which is enhanced by the AMB regulation in 2017. The previous results in Table 2 can be partly attributed to the AMB regulation. To sum up, our results suggest that this regulatory policy has to some extent curbed the brokers' shadow banking and enhanced the effectiveness of the monetary policy in China.

4.3.5. *The broker lending channel*

By leveraging the AMB regulation, we can now further explore the broker lending channel. Since brokers are regulated by a set of indicators primarily focused on net capital (see detailed requirements in the Table A1 in Appendix A), a slowdown in M2 growth

Table 7
The effectiveness of monetary policy.

	Before	After	Control	Treat	Full	Full
	(1)	(2)	(3)	(4)	(5)	(6)
g	0.120	0.396***	−0.006	0.137*	0.127	
	(0.084)	(0.141)	(0.108)	(0.077)	(0.083)	
g*Post			0.275	0.848***	0.216	
			(0.170)	(0.179)	(0.163)	
g*Treat*Post					0.689***	0.719***
					(0.226)	(0.228)
Size	0.549**	0.709**	0.568***	0.321	0.436***	−0.067
	(0.260)	(0.326)	(0.134)	(0.196)	(0.128)	(0.216)
Capital	0.458	−0.314	−0.845	0.378	0.056	1.099
	(0.786)	(1.210)	(1.249)	(0.982)	(0.744)	(0.794)
Liquidity	1.253*	3.615***	2.356***	1.538*	1.915***	−0.173
	(0.731)	(1.205)	(0.747)	(0.802)	(0.528)	(0.735)
ROA	−9.781**	17.515**	10.304*	18.358**	14.204***	1.303
	(4.269)	(7.613)	(5.396)	(7.643)	(4.554)	(4.954)
GDPGrowth	−1.536***	0.324	0.127	−0.494*	−0.250	
	(0.551)	(0.222)	(0.210)	(0.265)	(0.184)	
CPIGrowth	−0.238*	−0.428**	−0.376**	−0.927***	−0.722***	
	(0.141)	(0.169)	(0.154)	(0.124)	(0.102)	
MRtn	−0.000	0.012**	−0.010**	−0.006**	−0.008***	
	(0.004)	(0.006)	(0.004)	(0.003)	(0.002)	
Broker F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Quarter dummies	Yes	Yes	Yes	Yes	Yes	–
Time F.E.	No	No	No	No	No	Yes
N	788	908	639	998	1637	1637
R-squared	0.714	0.660	0.656	0.618	0.633	0.657

Notes: This table shows that the effectiveness of monetary policy on share pledge loan is enhanced after the AMB regulation. The dependent variable is the logarithm of total share pledge loan amount. The column title Before, After, Control, Treat and Full refers to the sub-sample regressions in the pre (post)-policy period, control (treatment) group and full sample respectively. Notation "-" represents that quarter dummies are spanned by time fixed effect. We do not report some lower order interactions and variable (g*treat, treat*post, post) to formulate a clearer representation. Standard errors reported in parentheses are clustered by broker. We use ***, **, * to denote statistical significance at 1 %, 5 %, and 10 % level, respectively.

exposes them to the risk of violating capital regulations. As a result, brokers must incur higher costs to replenish their capital, which in turn reduces the effective return of share pledge lending. Consequently, monetary policy shocks and share pledge lending tend to move in the same direction.

Now consider two brokers, both of which face constraints and frictions in replenishing capital. The brokers are similar, except that one has a much stronger balance sheet (i.e., higher net capital above the regulatory requirements) than the other. When both brokers are hit by a contractionary monetary policy shock, their lending is reduced through the broker lending channel. However, the broker with the stronger balance sheet can shield its lending to some extent by using its capital buffer.

We test this hypothesis in Table 8, with the regression conducted in the pre- and post-AMB regulation period to avoid contamination from the regulatory arbitrage channel. In pre-regulation period when monetary policy is ineffective, the interactions between monetary policy shocks and the regulated indicators are all insignificant. Regulatory arbitrage completely undermined the effectiveness of monetary policy, regardless of the brokers' balance sheet strength.

Columns (4) and (5) show that in the post-regulation period, brokers with higher net capital buffer can protect them from the constraints of monetary policy. This result supports the hypothesis proposed above.

5. Conclusion

In this study, we empirically examine how monetary policy in China influences brokers' shadow lending activities: share pledge loans. Relying on the quantity-based monetary model proposed by Chen et al. (2018), we find a strong positive association between monetary policy shock and brokers' share pledge loans. We establish causality inference by relying on a difference-in-differences approach based on the quasi-natural experiment of a regulatory policy shock in 2017 as well as propensity score matching.

In untabulated results, we further propose two possible channels (i.e., the profitability of brokers and information asymmetry channels) and find supportive fresh empirical evidence for both. Specifically, we find that this relationship is more pronounced among brokers with low ROA, high profit from share pledge lending, which is consistent with the channel of profitability of brokers on the one hand. On the other hand, we split our sample into subsamples according to three criteria (i.e., whether the broker has issued share pledge loans to the shareholders of this listed firm in the past, whether the listed firm is covered by any analyst of the broker, and whether the broker is the lead-underwriter in the IPO of the listed firm), also find that this relationship is more pronounced among brokers with little familiarity about pledgors, which is consistent with the information asymmetry channel. Moreover, lending with

Table 8
The mechanism of broker lending channel.

		Pre-regulation		Post-regulation	
	(1)	(2)	(3)	(4)	(5)
g	0.050	0.036	0.108	1.051***	0.591*
	(0.128)	(0.226)	(0.090)	(0.348)	(0.346)
g*RCR	0.013			−0.325***	
	(0.017)			(0.111)	
g*NC2NA		0.111			
		(0.265)			
g*NC2D			0.022		
			(0.031)		
g*CLR					−1.643*
					(0.964)
Size	0.426	0.462*	0.508*	0.337	0.213
	(0.274)	(0.272)	(0.270)	(1.282)	(1.419)
Capital	−0.157	0.274	1.104	1.057	−5.374
	(1.475)	(1.368)	(1.533)	(3.438)	(6.776)
Liquidity	1.196	1.094	1.273	4.317	1.056
	(1.096)	(1.069)	(1.140)	(3.013)	(3.294)
ROA	−5.151	−3.584	−4.856	44.456***	47.628***
	(8.896)	(9.120)	(9.282)	(14.934)	(14.913)
GDPGrowth	−1.436**	−1.360**	−1.457**	0.486	0.413
	(0.576)	(0.571)	(0.587)	(0.311)	(0.304)
CPIGrowth	−0.270	−0.277*	−0.295*	−0.285	−0.255
	(0.167)	(0.165)	(0.171)	(0.225)	(0.235)
MRtn	0.001	0.001	0.001	0.017***	0.018***
	(0.004)	(0.005)	(0.004)	(0.006)	(0.006)
Broker F.E.	Yes	Yes	Yes	Yes	Yes
Quarter dummies	Yes	Yes	Yes	Yes	Yes
N	542	542	542	599	599
R-squared	0.741	0.741	0.741	0.716	0.710

Note: This table shows that after the AMB regulation, brokers constrained by risk coverage ratio (RCR) and capital leverage ratio (CLR) granted more share pledge loans during monetary policy loosening. The dependent variable is the logarithm of total share pledge loan amount. We do not report some first order interactions (RCR, NC2NA, NC2D and CLR) to formulate a clearer representation. Standard errors reported in parentheses are clustered by broker. We use ***, **, * to denote statistical significance at 1 %, 5 %, and 10 % level, respectively.

relationship does not create value for lenders and may even decrease value. In terms of policy evaluation, we find evidence suggesting that the regulatory policy has to some extent curbed the brokers' shadow banking and enhanced the effectiveness of the monetary policy in China.

To sum up, our research sheds light on the brokers' shadow banking activities: share pledge loans. The financial innovation deeply erodes the effectiveness of the regulator's well-intended policies, and our paper calls for building a collaborative and penetrating regulation system to coordinate capital market regulations.

CRediT authorship contribution statement

Cheng Yan: Writing – review & editing, Validation, Supervision, Resources, Project administration, Investigation. **Yujun Lian:** Visualization, Software, Data curation. **Xiangxiang Xu:** Writing – original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation. **Chang-Chih Chen:** Writing – review & editing, Validation, Resources.

Appendix A. Appendix

Table A1
Variables definition.

Variables	Definition
Dependent variables	
logLoan	The logarithm of the volume of share pledge loan granted in one quarter by the broker. The volume of share pledge loan is calculated as the product of the pledge ratio, the number of pledged shares and the pledge price. Following Guo et al. (2023), the pledge ratio is assumed to be 0.5 in the main board, 0.4 in SME (Small and Medium Enterprise) Board and 0.3 in ChiNext board. The pledge price is the average closing price over the 7 trading days prior to the occurrence of the pledge.
Maturity	Average maturity (in months) of the share pledge loan that a broker grants in a quarter, weighted by loan volume (calculated in the same way as LnPldg).
Key independent variables	
g	An exogenous M2 growth rate whose estimation method is provided by Chen et al. (2018).
Control variables	
Size	The logarithm of the total assets of the broker.
Capital	The ratio of capital over the total assets of the broker.
Liquidity	The ratio of the monetary funds held by the broker over the total assets of the broker.
ROA	The total net income over assets of the broker.
GDPGrowth	An annual change in real GDP.
CPIGrowth	An annual change in CPI.
MRtn	The return of stock market whose performance is measured by the Shanghai composite index.
Others	
RCR	Risk coverage ratio. The ratio of net capital over the sum of all risk capital reserves. The China Securities Regulatory Commission (CSRC) mandates that brokers maintain a RCR above 100 % at all times. This indicator is legally effective and available throughout our entire sample period.
NC2NA	The ratio of net capital over net assets. The CSRC mandated that brokers maintain a NC2NA above 40 %. This indicator is legally effective and available before 2016.
NC2D	The ratio of net capital to debt. The CSRC mandated that brokers maintain a NC2D above 8 %. This indicator is legally effective and available before 2016.
CLR	Capital leverage ratio which is calculated as the ratio of core net capital over on- and off-balance sheet assets. The CSRC mandates that brokers maintain a CLR above 8 %. This indicator is legally effective and available after 2016.
Loan2AMP	The ratio of the volume of share pledge loan granted in a year over the volume of asset management products held by the broker by the end of the year.
Int2Rev	The ratio of the interest income of share pledge over the operating revenue of the broker.
Int2NI	The ratio of the interest income of share pledge over the net income of the broker.

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花王生态工程股份有限公司
关于控股股东涉及诉讼的进展公告

Flower King Eco-Engineering Inc. Announcement on the progress of the controlling shareholder involved in prosecutions

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质出方名称 Pledgor	质权人名称 Pledgee	是否存在通道业务 Passageway services	资金方 Funder	质押股数（万股） Pledging num	待偿还金额（万元） Loan amount	融资到期日（年/月/日） Maturity	是否逾期 Overdue
花王集团	中信建投证券股份有限公司 China Securities	否	中信建投证券	7,386.00	24,244.69	2017/04/24-2020/07/23	是
花王集团	中信建投证券股份有限公司	是	宁波银行 Bank of Ningbo	5,488.50	19,819.84	2017/08/25-2020/08/24	是
花王集团	农村小额贷款有限公司	否	农村小额贷款有限公司	489.80	1,500.00	2020/4/27-2020/10/27	是
肖姣君	白彦军	否	白彦军	150.00	1,000.00	2020/8/24-2021/8/23	是

Fig. A1. A snapshot of the announcement of Flower King Eco-Engineering Inc.
Source: CNINFO.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pacfin.2025.102772.

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