FinTech as a Financial Liberator *

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Abstract

Financial repression such as deposit ceiling regulation is a common form of financial distortion in developing economies and typically benefits incumbent banks. Using proprietary data from a leading FinTech company in China, we study how Fintech competes with banks by introducing money market funds (MMFs) with deposit-like features. Cities and banks whose depositor base are more exposed to FinTech see greater deposit outflows and slower deposit growth. Moreover, banks facing FinTech competition are more likely to offer deposit substitutes with market interest rates. Our results highlight the benefit of FinTech in aiding bottom-up interest rate liberalizations in emerging markets.

Keywords: FinTech, bank deposits, money market fund, financial repression, interest rate liberalization
JEL classification: G21, G28, G51

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1 Introduction

Financial repression—regulations that keep the interest rate on household savings below the unconstrained value—are a widespread phenomenon and a cause of underdevelopment (McKinnon et al. (1973), Shaw (1973)) in the developing world. Policies that ameliorate financial repression are therefore potentially important for improving aggregate economic efficiency. However, while such policies may enhance aggregate welfare, removing financial repression comes at the expense of some market participants, whose resistance may impede the liberalization reform efforts, especially when the reform process is top-down and politically determined. For instance, by lowering interest rates, financial repression may reduce the cost of capital for commercial banks and enhance the profitability of banks with market power. A first-order concern for regulators is therefore whether increased funding costs will lead to lower bank profits.

In this paper, we investigate the bottom-up liberalization role that FinTech plays in reducing financial repression. Importantly, unlike traditional banks, FinTech companies do not rely on existing deposits for funding and do not stand to lose from product cannibalization or the collapse of a low interest rate regime. We exploit the fast-developed FinTech industry and recent financial liberalization practice in China, the largest developing country, to conduct our analysis. Our paper starts with the introduction of the first FinTech money market fund (MMF) in China, Yu'ebao, and traces out the disruptive impact of this new financial technology on the broader Chinese banking system. In June 2013, Alipay, already a dominant player in FinTech payment technology, introduced a MMF product, Yu'ebao, which offered market interest rates and T+0 liquidity. The T+0 redemption feature, coupled with Alipay's payment system, allowed investors to use their Yu'ebao shares for both online and offline shopping. Thus, this product provided both deposit-like transaction services and interest rates unrestrained by repressive interest rate caps. Yu'ebao proved immensely popular almost immediately, with its number of users reaching 40 million people and assets under management exceeding 185 billion yuan (around 28 billion USD) within the first six months since its launch. Other internet-based financial technology companies quickly followed suit and introduced similar products, referred to as **bao** products (named after Yu'ebao).

With the introduction and growth of FinTech MMFs, the aggregate market share of bank deposits

relative to MMFs declined. While bank deposits flowed into Yu'ebao in aggregate, there is substantial cross-sectional heterogeneity among banks. In particular, banks' deposit bases have significant geographical heterogeneity, with some banks' deposit bases concentrated in cities that saw considerable Yu'ebao uptake, and other banks' deposit bases concentrated in cities that saw relatively less Yu'ebao uptake. We exploit this variation to show that banks with the most exposed deposit bases saw the greatest flows into Yu'ebao. Consistent with the tight connection between Alipay's consumer platform and Yu'ebao, we find that only household time and demand deposits are affected, while other categories of deposits, such as firm deposits, are not.

Moreover, we find strong evidence that greater exposure to Yu'ebao prompted banks to respond by investing in (defensive) innovation. Consistent with increased technological investment, we observe disproportionately rising costs at the most affected banks. This investment appears to be aimed, at least partially, at the introduction of MMFs designed to compete directly with FinTech MMFs. In particular, the most exposed commercial banks introduced Yu'ebao-like products and used these off-balance sheet activities to pass through higher interest rates to households, allowing them to engage in regulatory arbitrage and avoid interest rate caps. Thus, while the rise of Yu'ebao and similar products did in fact siphon deposits away from banks, these competitive pressures caused the most exposed banks to break the cartel-like market structure that had been in place before Yu'ebao's introduction and to introduce their own competing MMF products. The ultimate effect was not worse bank performance, but rather financial liberalization induced through a new channel of competition.

To check that the preceding results are not mechanical, i.e., that Yu'ebao penetration is highest in areas where banks saw significant outflows *because* significant outflows caused high Yu'ebao penetration, we introduce two instrumental variable strategies. First, we utilize the city-level penetration of the Alipay payment platform prior to the introduction of Yu'ebao. The instrument's relevance results from the fact that Yu'ebao adoption is less costly for users already using the platform for other purposes. Moreover, the instrument addresses the primary identification concern of simultaneity because users had already adopted the Alipay platform before it offered a substitute for bank deposits.

As a second instrument, we utilize the geographical distance from the Alipay's headquarter in Hangzhou city, which is near Shanghai. In this case, the instrument is relevant due to the staggered rollout of Yu'ebao: rollout was more convenient for Alipay in markets closer to its headquarters. As

with the case of pre-Yu'ebao platform adoption, the instrument is exogenous to the simultaneity concern because Ali's headquarter (and therefore any market's distance from it) was established in 1999, far before the introduction of Yu'ebao in 2013. Thus, it is unlikely to be correlated with customer demand for Yu'ebao caused by differences in their local banking markets. With both of these instruments, we find qualitatively similar results. Our interpretation of these findings is that FinTech, and in particular, the introduction of Yu'ebao, aided in reducing financial repression in China.

Our results also help examine hypotheses explaining the popularity of FinTech MMF among Chinese households. The first coming to one's mind is the regulatory arbitrage story: like the United States' Regulation Q, which was eventually lifted in 1986, China imposes an often-binding interest rate cap on bank deposits. Yu'ebao and other money market funds are not subject to interest rate ceiling regulation compared to commercial banks, hence able to offer market rates to attract depositors. However, this argument fails to explain the slow growth of the MMF industry prior to Yu'ebao, given the deposit ceiling rate always falls below the market rates. Besides, in principle, traditional banks could have introduced and aggressively marketed MMFs as a way to circumvent the interest rate cap. However, traditional banks in China are highly concentrated and have considerable market power. Therefore, possibly owing to the close substitutability of MMFs and bank deposits and the potential for profitability erosion by competing with their own funding sources, traditional banks have been hesitant to do so.

The second hypothesis focuses on the investment threshold or knowledge barriers to invest in non-deposit products: while there already exist market-rate products offered to individual investors (such as MMFs and bank WMPs), "grassroot" or common households (which comprise the vast majority of Chinese households) do not have the financial knowledge to open a brokerage account or the amount of money to meet the minimum investment threshold required by bank WMPs (which is at least 50,000 RMB, much higher than the median financial assets of 6,000 RMB held by households as in the 2011 China Household Finance Survey.) Yu'ebao is the first MMF demanding virtually no investment requirement; the subscription starts at 1 RMB (around 0.15 USD.) We find supporting evidence from the summary statistics of Yu'ebao subscription data: during the period between June 2013 and May 2014, 51.69% of single subscriptions (by count) is smaller than 1,000 RMB, 34.39% falls between 1,000 and 5,000 RMB, 7.90% between 5,000 and 10,000 RMB, and 5.64% between 10,000 and 50,000 RMB. In other words, over 99% of the purchase transactions fall below the investment threshold required by bank WMPs,

which is at least 50,000 RMB for low-risk products. Investors buying Yu'ebao MMF are those who are not qualified for market-rate products offered by banks.

The third hypothesis takes the view of household demand for money-like claims. Households in China indeed have a large appetite for safe, money-like assets. According to the CHFS data, over 75% of household financial assets are held in the form of bank deposits (58%) and cash (18%). This hypothesis highlights the critical value of payment services, which used to be dominated by commercial banks, to create money-like claims. Traditional banks benefit from deposit ceiling regulation and lack incentives to offer deposit substitutes with market interest rates. FinTech payment, while emerges as a strong competitor against traditional banks in the payment market, helps create money-like assets to compete with bank deposits. Filling gaps left by traditional banks, FinTech satisfy households' demand for money-like claims by adding payment features to MMFs. By introducing products that offered similar transaction and liquidity services as bank deposits but with uncapped rates FinTech brings competitive pressure to banks and stimulates them to pass through more interest rates to households.

FinTech is a major change in the financial landscape around the globe, and understanding how it affects depositors' choice and traditional bank performance is important for making forecasts and designing macro-prudential policies. While the potential impact of FinTech has been of intense academic interest, as in Philippon (2016), Claessens et al. (2018), and Goldstein et al. (2019), many questions remain concerning the impact of FinTech competing with traditional bank lenders and the macroeconomic implications of that competition. Our paper speaks to many of these questions.

Firstly, our paper provides empirical evidence on the competition between FinTech and traditional banks in the retail deposit market. Extensive literature has examined how banks and Fintech lenders compete (e.g., Navaretti et al. (2018), Thakor (2020)) and their competition across many product markets, for instance, lending (Buchak et al. (2018b) and Tang (2019)) and payments (Parlour et al. (2020) and Jack and Suri (2014)). Our paper joins Xiao (2020) and Ma et al. (2020) in examining the competitive structure for deposit-like products. Additionally, our paper contributes to the literature on banking theory and economies of scope by highlighting important synergies between payment and other bank services (e.g., wealth storage and lending) as in Parlour et al. (2020) and Jack and Suri (2014). Beyond the traditional synergies between traditional bank-like services, our paper points to important synergies between the traditional, narrowly defined financial services (payment, investment, lending) and other

financial services like e-commerce.

Secondly, our paper examines how the arrival of FinTech induces banks themselves to catch up in terms of introducing competing products. While many papers have examined the competitive effects of FinTech, few (such as Boot (2017) and Vallee and Zeng (2019)) have examined traditional banks' response. We show that contrary to the concerns of many regulators, banks' endogenous technological response enables them to avoid the worst-case outcomes to their profitability by introducing their own products that pay market interest rates. Our paper further connects to papers examining the broad trend of migration of traditional bank activity away from regulated depository institutions and towards less regulated shadow banks. Gennaioli et al. (2013) and Moreira and Savov (2017) model this phenomenon; Buchak et al. (2018a), Jiang et al. (2020), and Zhang (2021) study this question empirically in the context of residential mortgage lending in the United States. Our paper contributes by examining the migration of bank liabilities (as opposed to assets) outside of the regulated system (deposits) and towards a less regulated sector (MMFs). Acharya et al. (2020) analyzes the competitive impact of the expansion of big state-owned banks on the issuance of wealth-management products (WMPs) among small- and medium-sized banks. Our results highlight the significant rent that banks possessed before the competition from FinTech and how the endogenous response of the banks—introducing their own T+0 and shadow-banking products and improving efficiency elsewhere —can offset the losses they face due to competition.

Finally, particularly interesting in our setting is how the competitive interaction of FinTech and traditional lenders leads to significant macroeconomic changes. Prior to the explosive growth of Yu'ebao and banks' reactions to it, interest rates for household savers in China were constrained by binding interest rate caps. Highlighting a potentially bright side of FinTech shadow banking, Yu'ebao created space for bottom-up interest rate liberalization. Beyond improving the welfare of savers, these changes have the potential to lead to more efficient allocation of credit. Our paper echoes with Brunnermeier et al. (2017), Chen et al. (2018), Song and Xiong (2018), Xiong (2018) and Brunnermeier et al. (2020) in terms of potential benefits of shadow banking given the sub-optimal allocation in the formal financial system.

Our paper proceeds as follows. Section 2 introduces the institutional background of FinTech and banking in China. Section 3 details the data and presents our empirical methodology. In Section 4, we show city-level regression results examining how FinTech payment contributes to the popularity

of FinTech MMFs. In Section 5, we examine the impact of the first and also the largest FinTech MMF (namely Yu'ebao) on bank deposit growth and banks' strategic response. Section 6 investigates the impact on bank balance sheet outcomes. We discuss our findings and conclude in Section 7.

2 Institutional Background on China's Financial System

Financial repression is a common phenomenon in many countries, especially in the developing world. This section provides a brief background of financial repression in China, the competitive landscape of the Chinese banking industry, and the development of FinTech in the retail market.

2.1 Financial Repression and Dual-Track Interest Rates under Ceiling Regulation

The banking industry plays a dominant role in China's financial system, accounting for more than 80% of credit and households' financial assets. Bank interest rates were once strictly regulated in China, where the central bank imposed both a floor and a ceiling on the deposit and lending interest rates. Interest rate liberalization has been on the central government's agenda of economic financial reforms since 1993, but it took decades for the deposit rate regulations to be lifted. The deposit floor and the lending ceiling were lifted in 2004, while the lending floor was liberalized almost ten years later in July 2013. The interest ceiling on bank deposits was the last to be lifted, eventually phasing out in October 2015. There is still unofficial "self-disciplinary organization" that monitors interest rates offered by commercial banks.

Figure 1 shows both the regulated deposit rates and the interest rate for a similar but unregulated market, the 3-month Shanghai Inter-Bank Offered Rates (SHIBOR, the most commonly used reference rates in China), from 2003 to 2018 [1]. We emphasize three key features of regulated interest rates and market interest rates. First, the interest rate ceilings on deposits almost always fall below the market interest rates. The demand deposit interest rate ceiling is approximately 0.35% and the 3-month time deposit ceiling ranges from 1.8% to 3%. During the same period, SHIBOR increased from 2% to over 6%, later hovering around 4%.

[1] The interbank market interest rate in China was already liberalized in 1996, seven years before the first MMF was founded in China in 2003.

Second, the interest ceilings seldom change. The central bank controls the timing and magnitude of benchmark rates and ceiling requirements, and the central bank has changed the ceiling fewer than ten times in more than twenty years, despite the central government's efforts to liberalize interest rates. Hence, despite daily fluctuations in the uncapped SHIBOR, deposit interest rates show essentially no sensitivity to market conditions.

Third, the yield of Yu'ebao, the FinTech MMF motivating this paper, co-moves with SHIBOR rather than sticks with the deposit ceiling. For retail investors, FinTech MMFs are able to provide more competitive yields than traditional banks while providing similar liquidity to demand deposits. For instance, during its first two years, Yu'ebao provided an average of 2% higher yield than 3-month time deposits, and a strikingly 5% higher yield than demand deposits. Hence, MMFs are able to provide and pass through market yields, providing incentives for investors to move money from banks to MMFs during monetary tightening.

2.2 High Concentration and Lack of Reform Incentives in the Banking Industry

Deposits are a major source of bank funding. Panel A of Figure 2 plots each bank's reliance on deposit funding against its branch market share as of May 2013. Deposits account for over 60% of the interest-bearing liabilities for the vast majority of banks. This ratio increases to over 80% for state-owned banks, which means banks with the greatest market share rely among the most on deposits for funding. Banks benefit from deposit ceiling regulations and do not have incentives to support interest rate liberalization reforms or roll out market-rate retail products similar to deposits.

One may expect the competition among banks will help drive up deposit interests. However, the banking industry is highly concentrated in China. Panel B of Figure 2 plots each bank's branch diversity against its branch market share as of May 2013. The largest 6 state-owned banks control 61.8% of the branches and have a nationwide branch network. The rest rely heavily on local and regional branches, with 95% of banks locating at least 80% of their branches in one city. Banks with the greatest share in terms of branches also command the most diverse branch network. The diverse spatial location of branches enables large banks to provide strong payment service and convenience yield for their depositors, making it difficult for small- and medium-sized banks (SMBs) to compete with them in terms

of payment technology. Given the deposit ceiling restrictions, these SMBs cannot compete by raising deposit interest rates either, which help cement large banks' dominance in the retail funding market.

Moreover, state-owned banks are politically resourceful: executives of state-owned banks have political cadre, and regulatory authorities often come from large state-owned banks, such as the People's Bank of China (PBOC), China Banking and Insurance Regulatory Commission (CBIRC), and China Securities Regulatory Commission (CSRC). Hence, state-owned banks can have tremendous direct and indirect influence over regulation policies.

Other things being equal, large traditional banks benefit from interest cap regulation since it both lowers their cost of funding and serves as a mechanism to prevent deviations by individual banks. This setting generates resistance to interest rate liberalization reforms by these banks, fueled by the political influence of large state-owned banks. Additionally, given the significant concentration, banks historically had little incentive to introduce or innovate in unregulated products that could cannibalize their inexpensive deposit funding.

2.3 Weak Presence of the MMF Industry Prior to FinTech Innovation

MMFs do not take deposits and are not constrained by interest rate ceiling regulations that commercial banks are subject to. Therefore, MMFs have incentives and capabilities to offer higher yields to compete for depositors. As demonstrated by the cases of the United States and other developed countries, the MMF industry plays a crucial role in the process of removing financial repression, passing through market interest rates to retail investors when the banking sector is under strict regulation.

However, regulatory arbitrage alone does not naturally lead to a more liberalized financial system. The MMF industry in China, while providing uncapped market yields, experienced modest growth and remained almost invisible in terms of relative size to bank deposits since their inception in 2003. As shown in the upper panel of Figure 3, the absolute and relative sizes of the MMF industry compared to the size of household deposits in traditional banks remained at a low level since 2003, when the first MMF was founded in China.

The MMF industry did not grow substantially for ten years until 2013, when Yu'ebao, the first FinTech MMF combining FinTech payment and market yields, was introduced. It is the combination of

money-market funds and payment services (including T+0 real-time redemption feature) [2] that creates close substitutes to bank deposits and therefore brings competitive pressure to traditional banks that dominate the deposit market.

2.4 FinTech MMFs Create Deposit-Like Products

FinTech changed the landscape in the payment industry. Alipay, incorporated in 2004, has been leading in the third-party online digital payment market in China. As of 2013, "Alipay led the market with absolute dominance of 48.7%, Tencent Tenpay ranked second with 19.4%, followed by Unionpay with 11.2%," according to iResearch.

Yu'ebao is the first of its kind combining FinTech payment and MMFs together. Launched in June 2013 [3], Yu'ebao is a MMF uniquely designed for and sold on Alipay, the largest digital payment tool in China. Compared to existing savings products available from banks, Yu'ebao has two innovative features: T+0 real-time unlimited redemption (hereafter "real-time redemption") and instant and seamless conversion from redemption of the MMFs to the use of the proceeds for payment on Alipay (hereafter "share payment"). First, the real-time redemption feature allows investors to receive fund redemption within seconds. Second, the share payment function enables investors to use Yu'ebao shares to pay for purchases of goods or services both online and offline. Critically, FinTech payment greatly enhanced the liquidity of the Tianhong Yu'ebao MMF, enabling it to become a close substitute to bank demand deposits.

We define "*bao*" products[4] as MMFs combined with payment features. Administering a *bao* requires combining payment technology with a wealth-management product, which is difficult for companies that are not commercial banks or FinTech companies. We therefore focus only on *bao* products distributed either by FinTech ("FinTech bao", led by Yu'ebao) and commercial banks ("bank bao", which sprang up after the launch of Yu'ebao). This focus on the bundling of MMF and payment services distin-

[2] The first exchange-traded MMF with the T+0 feature was launched by Huitianbao in October 2012. As indicated in the name, this type of T+0 MMF is subscribed and redeemed in the exchange and is therefore limited to stock market account holders. This type of MMFs is vastly different from Yu'ebao, which provides free T+0 services for all investors with an Alipay account for daily expenditures.

[3] In May 2013, Tianhong Fund announced that it would cooperate with Alipay to launch Yu'ebao by providing real-time fast redemption and payment using MMF shares starting on June 14, 2013.

[4] Yu'ebao is the first and the most conspicuous of the "bao" products. Users in China often refer to "bao" or "bao-type products," named after Yu'ebao, loosely in daily lives and in fund sales.

guishes our paper from those examining the impact of FinTech distribution platforms without payment features, for instance, Hong et al. (2019).

2.5 Initial Resistance from and Strategic Response of Traditional Banks

Yu'ebao benefited from the high market rate during the liquidity crunch in June 2013 (due to monetary tightening policies). The liquidity crunch leads to a substantial spread between the market interest rate and the regulated deposit rate, working in favor of market-rate products. This interest rate gap fuels the popularity of Yu'ebao relative to bank deposits, since the bank deposit interest rate was not able to respond under ceiling regulation.

Resistance comes from the commercial banking industry, which have seen the huge popularity of and potential threat posed by Yu'ebao and other FinTech products alike. In the media, there were news reports calling Yu'ebao "the vampire sucking blood from banks", because the majority of Yu'ebao assets are negotiated deposits with banks. However, this accusation goes the wrong way: it is the liquidity crunch and high market rates that enables Yu'ebao, as well as other MMFs, to pass through high yields to investors. Yu'ebao does not offer a yield different from the average of MMF industry. Some high-level executives of large state-owned banks, who served as zhengxie weiyuan (members of the China People's Political Consultative Conference, CPPCC), proposed to the central government to enhance regulation on FinTech during lianghui ("Two Sessions") in March 2014, the largest annual political event in China.

Oppositely, the regulatory environment was overall encouraging for FinTech innovations. The then-governor of PBOC, Xiaochuan Zhou, seemed to take a different perspective on FinTech development from large banks. He clearly stated during an interview on March 4, 2014 that Yu'ebao would not be banned. It is also worth noting that 2014 is the year when Premier Keqiang Li first mentioned "promote the healthy development of Internet finance" in the annual government report. Given its long agenda on interest rate liberalization, it could be possible that the the government may view FinTech as a good candidate for introducing competitive pressure to the highly concentrated banking industry so as to facilitate the liberalization reforms.

Although some state-owned banks still fought back by their own measures [5], many more banks

[5]Such as placing restrictions on the amount of money depositors are able to move from their bank accounts to Yu'ebao per day. The fighting back measures also include bank headquarters ordering their branches not to deal with Yu'ebao and other MMFs

start to offer retail products similar Yu'ebao through cooperation with other MMFs. Commercial banks, however, have very different incentives for launching *bao* compared to FinTech companies. In particular, while FinTech companies do not take deposits, banks do, meaning that they would potentially compete with their own *bao*. Hence, in the absence of FinTech competition, commercial banks have much weaker incentives to engage in technological innovation on MMFs by levering their natural advantage in processing payments [6]. Additionally, commercial banks have incentives to prevent the emergence and popularity of potential competitors such as Yu'ebao. Since the Yu'ebao product came relatively suddenly, banks were not able to prevent it before its launch. After the launch of Yu'ebao, however, banks did lobby the regulators, as shown earlier. Given the fact that Yu'ebao and other FinTech MMFs were here to stay, banks changed their mindsets by adopting a defensive strategy and offering their own *bao*-type products.

Yu'ebao's entry spurred rapid growth and structural changes in the MMF industry. Panel C of Figure 3 plots the number of T+0 MMFs distributed by banks ("$number_bao$") and the number of unique banks distributing T+0 MMFs ("$number_bao_bank$") over time. Notably, banks only began to offer MMFs with T+0 real-time redemption after the introduction of Yu'ebao in June 2013. Following this date, the number of unique banks offering T+0 MMFs rapidly increased to more than 20 in 2014, subsequently doubling by the end of 2016. The total number of bank *bao* products follows a similar pattern at higher levels, meaning that individual banks were offering multiple *bao* products. Is this a coincidence in timing, or did Yu'ebao cause banks to offer their own *bao*-type products that pay market interest rates? This question will be examined in detail in the following sections.

alike. See, for instance, the news report in 2014 (http://finance.sina.com.cn/money/bank/bankvsyuebao/).

[6]Notably, few banks had implemented T+0 fast redemption features through cooperation with fund companies. On January 5th, 2007, the Industrial and Commercial Bank of China started cooperating with fund companies to offer T+0 redemption service for its clients. The main purpose was to "enable MMF to be as liquid as demand deposits." However, there is still a 500-yuan investment minimum for retail investors with increments of 100 yuan, making it inconvenient for daily transactions. Moreover, ICBC charges fees for the fast redemption service. In July and August 2009, Jiaotong Bank also provided T+0 fast redemption service, and redemption was made possible through the form of bank loans with an interest rate. In sum, although some commercial banks took steps toward improving MMFs, they did not offer products with no-fee redemption and no minimum investment requirement. In other words, prior to Yu'ebao, banks did not supply substitutes for bank deposits that pay market interest rates.

3 Data and Empirical Methodology

In this section we outline our data sources and empirical methodology. Broadly, from underlying flow and application use data, we calculate measures of Yu'ebao and Alipay use, as well as Yu'ebao and deposit flows at the city and bank levels. Our empirical methodology then examines how outcomes at cities and banks—principally deposit flows, bank profitability, and bank innovation—vary across cities and banks with exposure to Yu'ebao.

3.1 Data

We combine three sources of data: (1) data on fund flows and digital platform from Alipay, the largest digital payment tool in China, (2) data on Chinese banks and MMFs, and (3) city- and regional-level economic data, which serve as important control variables in our analyses.

Alipay data. Our data on Yu'ebao and Alipay come from Ant Group (formerly Ant Financial), the parent company. Alipay was launched in 2004 and has since been the largest third-party digital payment tool in China (with a market share of nearly 50 percent, followed by the second largest payment app, Wechat Pay, with a market share of approximately 25 percent). Yu'ebao, launched in June 2013, possesses many important features that distinguish it from existing MMF products, as discussed earlier.

Our unique data from Ant Group include the city-month-level number of active Yu'ebao and Alipay users. We can further decompose users by device type: web-end and mobile-end. With this data we are able to track the penetration ratio of Yu'ebao (Alipay) as the number of active users on Yu'ebao (Alipay) divided by the local population. As we discuss below, we lever pre-Yu'ebao Alipay penetration as a key source of identification, as it strongly predicts Yu'ebao takeup while being plausibly exogenous to local deposit market conditions.

We also have transaction-level Yu'ebao purchase records starting from its launch date. Since Yu'ebao is embedded in Alipay, investors must first register to become Alipay users if they have not done so. For the purpose of our research, we use only the following four characteristics of each anonymized transaction: the time stamp, the Yu'ebao purchase amount, whether it comes from a bank card, and the user's residence city, which enables us to match Yu'ebao purchases with cities. Thus, we can track total flows from banks into Yu'ebao at a highly granular level. We aggregate transaction-level purchases to

the city-month level. Specifically, we focus on cumulative fund flows into Yu'ebao as of May 2014, i.e., the first twelve months after its launch in June 2013. We also examine users' net Yu'ebao position as of May 2014.

Bank data. Our data on commercial banks and their registered branches come from CBIRC (formerly CBRC and CIRC), the official regulatory authority of the banking industry in China. Banks are required by the law to obtain CBIRC's approval before opening a new branch. The registration form lists each branch's full name, full address, head office name, approval date, and exit date. We merge this branch data with the list of commercial banks and the list of 337 prefecture- and above level cities. We obtain the number of active branches at the bank-city-month level to calculate each city's importance (in terms of branch number) to each bank ($city_importance_{bc}$), each bank's share in the national branch network ($bank_branchshare_b$), and each city's share in the national branch network ($city_branchshare_c$) at the month level.

We remove from our sample banks without any branches and those not founded by December 2010. We focus on major banks operating in the urban area, keeping state-owned ("big"), joint-stock ("gufen"), and city commercial banks while excluding rural commercial banks, village banks ("cunzhen"), privately-owned banks ("minying"), and foreign banks. The refinement leaves 145 banks operating 138,231 branches, representing more than 70% of bank branches in China.

To analyze the impact of FinTech shock on banks, we combine the basic information of commercial banks from WIND, CSMAR, and RESSET, the most comprehensive financial and economic data sets in China. The bank-level data compilation includes: (1) basic registration information, such as the full name, inception date, bank type, and headquarters city; (2) bank-year-level deposits data, including eight subcategories, namely, demand vs. time deposits, household vs. firm deposits, household demand and household time deposits, firm demand and firm time deposits; (3) bank balance sheet data, including net interest margin (NIM), cost-to-income ratio, bad loan ratio, and risky asset ratio.

We further complement our bank-level data using wealth-management products (WMPs) data from WIND. The WMP data provides detailed product-level information on each WMP issued by commercial banks, including the product name, issuing date, issuing bank, investment type, target clients, investment threshold, expected yield, realized yield, guarantees, and so on. We derive the number and average yield of WMPs at the bank-month level. The WMPs are not subject to the interest rate ceiling

regulation, either, but they are required to hold an investment threshold no less than RMB 500,000. Although most of the WMPs are marketed to individuals, the high investment threshold positions them on a different niche compared to Yu'ebao and bank deposits. Therefore, WMPs provide a nice comparison group for us to examine banks' differentiated response to FinTech competition on products with different substitutability to deposits.

MMF data. We hand-collect information on bank *bao* products, i.e., MMFs distributed by banks with $T + 0$ redemption, no minimum investment, zero fees, and unlimited transactions, similar to Yu'ebao. We identify the exact dates when each *bao* product was launched by searching key words in all MMF announcements compiled by WIND [7], the most comprehensive database on financial and economic information that is widely used by practitioners and researchers of Chinese financial markets. The key words include variations of "T+0 fast redemption" and exclude words such as "halt", "pause", "adjust", and "change", so that we could date the first announcement of a bao-type product. Since the titles of the announcements are already informative, we restrict the key word search to announcement titles. The key word search focuses on the period from 2003, the inception year of the first MMF in China, to 2017, four years after the launch of Yu'ebao when the regulatory authority started to restrict the T+0 redemption practice in the MMF industry. The search yields the precise date when a bank offers its first bao-type product. These dates are cross-checked with news releases on banks' official websites and in the media.

City-level and macro economic data. Our city-year-level macro data come from CSMAR and WIND and include panel data of GDP and population. These data are combined with the administrative data of city-level information, such as full name, province, longitude and latitude, available from the Ministry of Civil Affairs and the National Bureau for Geographics. Each city's distance to Hangzhou city is calculated using the geodist package in $Stata$. These data sets are merged using the full names of cities and banks.

The benchmark policy interest rates come from PBOC, the central bank in China. The interbank market rate SHIBOR comes from chinamoney.com, the official website for the China Interbank Market.

[7] WIND and other database also provide a list of bao products, but the launching dates of bao products are missing. Instead, they use the founding date of the money market fund behind each bao product, which could be vastly different from the actual launching date of bao product. For instance, a MMF founded in October 2005 started to offer T+0 redemption through a bank in May 2014. Then the launching month of the bao product should be May 2014 instead of October 2005.

The interest rates of bank bonds are available from chinabond.com. We download the data from WIND and then cross-check them using the official data sources.

3.2 Key Variable Definitions

City-level variables: The main independent variables of interest are the penetration ratio of Yu'ebao, the penetration ratio of the Alipay platform more broadly, and as an instrumental variable, the distance of the city from Alipay's headquarters in Hangzhou. The Yu'ebao (or Alipay) penetration ratio is defined as the number of active users of Yu'ebao (or Alipay) in a geographical region divided by the local population, at a monthly frequency. The Hangzhou distance of a city is simply city c's distance from Hangzhou. In particular,

$$E_{ct}^{YEB} = \frac{Users_{ct}^{YEB}}{Population_{ct}} \tag{1}$$

$$E_{ct}^{ALI} = \frac{Users_{ct}^{ALI}}{Population_{ct}} \tag{2}$$

$$HZDistance_c = \text{Distance of } c \text{ to Hangzhou} \tag{3}$$

This yields a city-level monthly time series beginning in January 2012 for E_{ct}^{ALI} and in June 2013 for E_{ct}^{YEB} (or alternatively, E_{ct}^{YEB} is identically zero prior to Yu'ebao's introduction.) Then, for confidentiality reasons, the data provider normalizes the raw penetration ratios to an index, using the values in January 2014 in Hangzhou as a benchmark (penetration = 100). Unsurprisingly, E_{ct}^{YEB} and E_{ct}^{ALI} are 95% correlated, suggesting a striking synergy between the use of Yu'ebao and the use of the Alipay platform more broadly.

Our identification exploits geographical variation in Alipay and Yu'ebao exposure. To provide context, Figure 4 provides a visual demonstration of such variation in city-level FinTech penetration, with Panel A showing Yu'ebao penetration and Panel B showing Alipay penetration. We focus on Alipay penetration fixed as of May 2013, one month before Yu'ebao's introduction, and Yu'ebao penetration as of December 2013, six months after its launch. Panel A of Figure 6 shows the distribution of these variables.

Bank-level variables: The preceding variables are defined at the city-month level. We also exploit bank variation across several dimensions. Using the bank branch network, we define the city's importance to the bank, ω_{bct}, as

$$\omega_{bct} = \frac{\#Branches_{bct}}{\sum_k \#Branches_{bkt}} \tag{4}$$

where k sums over cities. That is, a high ω_{bct} indicates that a greater share of bank b's branches are located in city c. Approximately, a high ω_{bct} also captures a larger clientele base in city c and, hence, a greater exposure to FinTech competition when city c is penetrated.

We then aggregate Yu'ebao and Alipay exposure to the bank level as follows

$$E_{bt}^{YEB} = \sum_c \omega_{bct} E_{ct}^{YEB} \tag{5}$$

$$E_{bt}^{ALI} = \sum_c \omega_{bct} E_{ct}^{ALI} \tag{6}$$

Other city-level variables, such as the distance to Hangzhou, GDP, and GDP growth rate, are aggregated to bank level in the following method:

$$bank_lnHZDistance_{bt} = \sum_c \omega_{bct} log(HZDistance_c) \tag{7}$$

$$bank_lngdp_{bt} = \sum_c \omega_{bct} log(GDP_c) \tag{8}$$

$$bank_grgdp_{bt} = \sum_c \omega_{bct} gr_GDP_c \tag{9}$$

As above, for the cross-sectional analysis, we fix E_b^{YEB} to December 2013, E_b^{ALI} to May 2013, and $bank_lnHZDistance_{bt}$ to May 2013 (because while distances do not change, the bank branch network might change). Panel B of Figure 6 shows the distributions of these variables.

3.3 Empirical Design

We study the impact of the launch of Yu'ebao across a number of outcomes: deposit flows, banks' competitive response, and ultimately, banks' profitability and risk-taking activities. The empirical design is

similar in each case, so we detail our strategy here.

OLS specifications. The primary specification exploits variation in Yu'ebao penetration as of December 2013 to examine the impact of FinTech exposure on a number of outcome variables. In particular, at the city level, we regress[8]:

$$Y_c = \beta_0 + \beta_1 \log E^{YEB}_{c,2013} + X'_c\beta + \epsilon_c \tag{11}$$

where Y_c are city-level outcomes, which include city-level deposit outflows and deposit growth rates, while X'_c represents a number of city-level controls, including GDP per capita, log GDP growth, log population, and an indicator for whether the city is a provincial capital.

Our cross-sectional setting accentuates the differentiated response by banks with varied exposure to FinTech competition, facing the same interest rate policy and macroeconomic conditions. While the spread between market and regulated interest rates is a major factor driving the yield advantage of FinTech products compared to capped bank deposits, this macro factor would cancel out in the cross-bank analysis. Our focus is on whether FinTech competition would induce banks to respond to interest rate liberalization, given the macro policies and environment.

Instrumental variable (IV) approach. Our primary concern is that fund flows from banks into Yu'ebao are mechanically related to participation rates in Yu'ebao, i.e., that users withdraw funds from banks in order to open Yu'ebao accounts. To address this endogeneity concern, we adopt two instrumental variable strategies that utilize pre-Yu'ebao Alipay penetration and the city's distance (or bank's branch-weighted distance) from the Alipay headquarter in Hangzhou city. The IV analogs to the OLS specifications for the city-level regression, (11), and the bank-level regression, (10), are as follows:

$$Y_c = \beta_0 + \beta_1 \log \hat{E^{YEB}}_{c,2013} + X'_c\beta + \epsilon_c \tag{12}$$

$$Y_b = \beta_0 + \beta_1 \log \hat{E^{YEB}}_{b,2013} + X'_b\beta + \epsilon_b \tag{13}$$

[8]For the bank-level analysis, we regress:

$$Y_b = \beta_0 + \beta_1 \log E^{YEB}_{b,2013} + X'_b\beta + \epsilon_b \tag{10}$$

where Y_b represents bank-level outcomes, including aggregated fund flows, deposit growth rates, the financial performance variables, and the introduction of competing Bao. As a robustness check, we run this specification as a hazard model, which we detail in later sections.

where $\log \hat{E^{YEB}}_{c,2013}$ and $\log \hat{E^{YEB}}_{b,2013}$ are the predicted city- and bank-level market shares given the Alipay exposure IV, the Hangzhou distance IV, and both used simultaneously.

4 FinTech Payment Creates Liquid Assets: City-Level Evidence

In this section, we test the relevance of our IVs and investigate the relationship between FinTech payment and FinTech MMF popularity through city-level first-stage regressions. Then we examine the aggregate impact on deposit flows into FinTech MMFs using city-level penetration and Yu'ebao MMF subscription data.

4.1 First-Stage Results: Alipay Penetration and Distance to Hangzhou

We first examine the relevance of our two instruments graphically. As shown in Panel A of Figure 5, the expansion of the Yu'ebao user base is highly dependent on the existing geographical patterns of Alipay users. Past Alipay penetration ratios predict future Yu'ebao penetration: the higher the Alipay penetration is prior to the introduction of Yu'ebao (May 2013 value), the higher the Yu'ebao penetration will be (December 2013 value). We exploit this predetermined spatial variation as an instrument for the uptake of Yu'ebao. In terms of the exclusion condition, payment technology per se does not compete with bank deposits: FinTech payment users still need to associate bank cards with their FinTech payment accounts to make payments, which should have no impact on (if any, it would be an increase) bank deposits. In later sections, we test the validity of our IVs by using pre-Yu'ebao outcomes as dependent variables and find no statistically significant results to reject the exclusion restriction hypothesis.

Panel A of Table 2 summarizes the city-level first-stage regressions. In particular, the first-stage regressions for the city level are as follows,

$$\log E^{YEB}_{c,2013} = \beta_0 + \beta_1 \log E^{ALI}_{c,2013} + X'_c\beta + \epsilon_c \tag{14}$$

$$\log E^{YEB}_{c,2013} = \beta_0 + \beta_1 \log HZDistance_{c,2013} + X'_c\beta + \epsilon_c \tag{15}$$

$$\log E^{YEB}_{c,2013} = \beta_0 + \beta_1 \log E^{ALI}_{c,2013} + \beta_2 \log HZDistance_{c,2013} + X'_c\beta + \epsilon_c \tag{16}$$

The initial expansion of Yu'ebao highly relies on the existing Alipay user base rather than attracting

non-users without Alipay accounts. Columns (1) and (2) present the results using pre-Yu'ebao Alipay penetration (May 2013 value) as an IV for Yu'ebao penetration (December 2013 value). We find that a one unit increase in log Alipay penetration would lead to a significant 1.142 unit increase in log Yu'ebao penetration in the univariate regression in Column (1), and the estimate shrinks slightly to 1.102 when we add city-level controls in Column (2). The R-squared values from these regressions are 0.949 and 0.958, respectively. The state-of-the-art FinTech payment technology lays a solid foundation for the popularity of FinTech wealth management services.

To further ensure the exogeneity of our IVs, we use the geographical distance to Hangzhou, the headquarter city of Alipay and Yu'ebao (which is pre-determined), as a second instrument. Distance matters for the diffusion and marketing of FinTech products. Panel B of Figure 5 demonstrates a negative correlation between geographical distance and Yu'ebao penetration. As shown in Panel A of Table 2, distance to Hangzhou is another statistically significant instrumental variable, though weaker than the lagged Alipay penetration instrument. Columns (3) and (4) present the first-stage regression results using distance to Hangzhou as an instrument for Yu'ebao penetration. The coefficients on log Hangzhou distance are both significantly negative: -0.579 for the univariate regression and -0.35 for the regression with city-level controls. Therefore, each city's geographical distance to Hangzhou is highly relevant, although weaker than the lagged Alipay penetration with an R-squared of only 0.259 in the univariate regression. The results are robust when including both IVs in the first-stage regressions, as shown in Columns (5) and (6). The coefficients before lagged Alipay penetration and distance to Hangzhou are all significant and have the same signs.

Notably, the coefficients before $ln(city_branchshare)$, the log value of each city's share in the national bank branch network, are negative. This result implies the inclusiveness of FinTech banking: Yu'ebao gains more popularity in cities with fewer traditional bank branches, other things being equal. FinTech helps meet the demand for financial services not fully provided by traditional brick-and-mortar bank branches.

4.2 Deposit Funds into Yu'ebao MMF

Next, we explore the causal relationship between FinTech user penetration and the deposit funds into the Yu'ebao MMF, since registering a Yu'ebao account does not necessarily leads to Yu'ebao MMF subscription. The Yu'ebao MMF purchase and holding balance reflects depositors' preference of Yu'ebao MMF over bank deposits.

The first outcome variable we consider is fund flows into Yu'ebao, which we track at the city level within the first twelve months following the introduction of Yu'ebao. We focus exclusively on fund flows from bank deposits directly into Yu'ebao. Then we look at the city-level Yu'ebao balance as of May 2014. In particular, we define for city c,

$$FundFlow_c = \text{Cumulative Yu'ebao flows, June 2013 – May 2014} \tag{17}$$

$$Balance_c = \text{Yu'ebao net position as of May 2014} \tag{18}$$

Panel A of Figure 7 shows that Yu'ebao user penetration predicts (per capita) fund flows into Tianhong Yu'ebao MMF. Moreover, FinTech payment facilitates Yu'ebao sales: each city's pre-Yu'ebao penetration ratio of FinTech payment (Alipay) positively predicts fund flows into Yu'ebao in that city in the 12 months following Yu'ebao's introduction, as shown in Panel B of Figure 7. Additionally, distance to the FinTech headquarter also matters for FinTech product sales. As shown in Panel C of Figure 7, the further away from Hangzhou a city is, the smaller the fund inflows.

Table 3 presents the city-level cross-sectional regressions results. We begin by running specification (11), the city-level regression, using fund flows as the outcome variable. We expect to see a significantly positive coefficient before the FinTech indicators; i.e., if a city is more exposed to FinTech competition, it will see larger deposit flows into the newly introduced FinTech wealth-management product Yu'ebao. Column (1) shows the univariate baseline OLS results using the log value of the Yu'ebao penetration ratios as of December 2013 as the regressor. This simple regression shows that a one-unit increase in Yu'ebao penetration would cause the future log deposit flows into Yu'ebao to increase by 1.55 units.

In Column (2), we include city characteristics [9] in the regression to control for factors that affect both

[9] These characteristics include whether the city is a provincial capital (the $provincial_capital$ indicator), log GDP ($lngdp$), log population ($lnpopulation$), and the share of the city's bank branches in the national bank branch network ($city_bankshare$). We

FinTech user penetration and future fund flows into Yu'ebao MMF. As shown in Column (2), controlling for these city characteristics does not affect the sign nor the statistical significance of the coefficients but reduces the economic magnitude: in the regression with controls, the magnitude of the coefficient drops to 0.994. These results show that cities with higher GDP or larger population would experience a larger deposit outflow to Yu'ebao. The inclusion of these variables fully absorbs the impact of being a provincial capital city, which we find to be statistically nonsignificant.

Moreover, cities with more traditional bank branches (represented by a larger share in the national bank branch network) face greater deposit outflows, after controlling for GDP, population, and FinTech penetration. Our interpretation is that more bank branches indicate more severe financial repression since a larger fraction of funding would have been kept in regulated deposit accounts prior to Yu'ebao. This finding also indicates that Yu'ebao has emerged as a strong competitor to bank deposits: cities with more bank branches would also have more bank deposits, therefore experiencing larger fund outflows when Yu'ebao is launched.

A caveat of the OLS regression with controls is that it is subject to reverse causality: cities with larger deposit flows into Yu'ebao consequently have a higher Yu'ebao penetration. To address endogeneity concerns, we then instrument Yu'ebao penetration and exposure using log pre-Yu'ebao Alipay penetration ratios as of May 2013 and the log distance of the city's distance to Hangzhou, as described in specification (12), again using fund flows as the outcome variable. Specifically, we fix the city-level Alipay penetration ratio to its level in May 2013, one month prior to the launch of Yu'ebao. Furthermore, we use each city's geographical distance to Hangzhou city, the headquarter of Alipay (and hence Yu'ebao), as a second IV. We present these results in Columns (3) and (4), respectively. Additionally, in Column (5) we utilize both instruments simultaneously. All IV regression results are robustly statistically significant and have a magnitude similar to that of the baseline regression.

To summarize, we find that greater Yu'ebao penetration in a city robustly leads to greater flows out of bank deposits and into Yu'ebao. This finding is true in both the OLS setting and the quasi-experimental setting using pre-Yu'ebao Alipay penetration and distance from Hangzhou as instruments. The city-level analysis demonstrates the competitive relationship between Yu'ebao and bank deposits and highlights the importance of FinTech payment to the expansion of Yu'ebao's user base. Next section,

fix these values to the year-end value of 2012 and take the log of the latter three characteristics.

we will have a closer examination of deposit competition in the bank-level analysis.

5 FinTech Competition and Banks' Response

In this section, we motivate our bank-level analysis by examining the breakdown of household versus firm, and time versus demand deposits, which are available at the bank level but not the city level. This approach allows for a more detailed decomposition into types of deposits, which enables us to examine which types are more affected by FinTech entry. We also examine the differentiated impact on banks with different characteristics, such as bank size, bank branch share, and banks' reliance on deposits for funding.

Since the FinTech exposure of banks is merely a linear combination of the city-level FinTech penetration ratios, the relationship between exposure and the synthetic geographical distance to Hangzhou remains unchanged. Panel B of Table 2 presents bank-level first-stage regression results. Similar to the city-level results, the IVs are significant and robust. As with the city-level regressions, banks with greater exposure to Alipay have significantly higher exposure to Yu'ebao as shown in Columns (1) and (2). Similarly, banks with a greater distance from Hangzhou have less exposure to Yu'ebao, as shown in Columns (3) and (4). The instruments are statistically significant and robust both when used alone and when used together, as shown in Columns (5) and (6).

5.1 Bank Deposit Growth and FinTech Competition in Retail Funding

Yu'ebao is the best substitute particularly for retail demand deposits; that is, it offers immediate liquidity though a platform oriented towards retail users. Therefore, the launch of Yu'ebao should mainly affect the growth rate of personal/household deposits rather than that of corporate/firm deposits and have a larger impact on retail demand deposits than retail time deposits.

Table 4 shows results consistent with this hypothesis obtained by regressing banks' subcategory deposit growth rate between 2012-2014 on their exposure to FinTech competition. Indeed, we find the effects are significantly negative for bank-level household deposit growth but nonsignificant for bank-level firm deposit growth, after the initial level and mean reversion channel are controlled. Recall that

due to data restrictions, this analysis was not possible at the county level, but is possible at the bank level. These results are strong and robust for both the OLS and IV approaches.

Breaking down the categories of deposits further, Table 5 shows significant results for household demand deposit growth but not household time deposit growth. The negative impact of FinTech competition on household demand deposit growth is statistically significant, while that on household time deposit growth is not; the IV results are robust.

Much stronger results emerge when considering the subcategories of deposits for which Yu'ebao is the best substitute: household, as opposed to firm, deposits (summarized in Table 4), and retail demand, as opposed to retail time, deposits (summarized in Table 5). These results further support the FinTech competition channel: (1) FinTech creates a close substitute to bank demand deposits since $T + 0$ fast redemption is a major selling point of the FinTech product; (2) the competition between Yu'ebao and bank deposits is strongest for retail depositors, rather than the wholesale or institutional clientele, since the low investment threshold and no cash-out fee features of Yu'ebao appeal mainly to retail investors.

5.2 Banks Rolling Out Market-Rate Retail Products Similar to Yu'ebao

The previous section highlighted significant deposit outflows—particularly among household demand deposits, which are close substitutes for Yu'ebao—from the banks most exposed to Yu'ebao. In this section we look for direct evidence of their response. In particular, we ask whether the exposed banks begin to offer competing *bao* products.

While Yu'ebao was the first of its kind, banks had the capacity to respond by introducing their own *bao* products. We hand collect a dataset of MMFs with T+0 real-time redemption offered by banks to their deposit customers, together with the identity of the offering banks and the dates at which the banks began to offer funds with these features. We define a bank b as offering a competing Yu'ebao-like MMF if it begins to offer one by the end of 2017, roughly four-and-a-half years after Yu'ebao's introduction, around the time that Yu'ebao crossed the one-trillion yuan assets-under-management mark. We then ask whether banks with greater Yu'ebao exposure were more likely to introduce these products than other banks, regressing the dummy variable bao_b on Yu'ebao exposure and bank-level controls.

We find strong affirmative evidence through the linear regressions, as summarized in Panel A of

Table 6. Column (1) shows the baseline OLS result with control variables. A one-standard-deviation increase in Yu'ebao exposure is associated with a roughly 10% greater likelihood of the bank introducing a *bao* product within the time frame. Column (2) shows the IV estimate, showing that banks with greater Yu'ebao exposure, as predicted by their ex ante Alipay exposure, were much more likely to introduce competing *bao* products. We find similar results when using the Hangzhou distance instruments, as shown in columns (3). The results are robust, and the magnitudes of the coefficients are similar.

The control variables in these regressions provide additional insight into which banks introduced *bao* products beyond their differential exposure to Yu'ebao. Other things being equal, banks with a larger size or a greater reliance on deposits as a funding source are more likely to launch *bao*-type products. Interestingly, banks with more branches are less likely to keep up with the FinTech competition. Several potential explanations exist. One is the replacement cost: banks with more brick-and-mortar bank branches may find it more expensive to introduce innovations that would attract fund flows away from bank deposits. Another explanation is clientele differentiation: banks with more brick-and-mortar branches may appeal to a clientele that differs from the target users of FinTech products. Therefore, the actual exposure to FinTech competition would be smaller for these banks.

As a robustness check, we run the preceding analysis with a hazard model, which allows us to take advantage of the time-dependent structure of the starting time of the *bao* products. The hazard specification uses the (potentially truncated) time to introduce bao products as the outcome variable, and we follow a standard hazard specification modeling the hazard rate $\lambda(t; X)$ as

$$\lambda(t; X) = \lambda_0(t) \exp(\beta_0 + \beta_1 \log E_{b,2013}^{YEB} + X_b' \beta) \tag{19}$$

where $\log E_{b,2013}^{YEB}$ is the bank's direct or instrumented exposure to Yu'ebao and X_b' represents the bank-level controls. As shown in Panel B of Table 6, the coefficients derived from the hazard model are even larger than those in the OLS analysis, and the IV results are consistent with the baseline. In addition, banks with a larger size and fewer brick-and-mortar branches are more likely to launch *bao* products.

5.3 Comparison: WMPs that are not Deposit Substitutes

Finally, we examine issuance and yields of wealth-management products (WMPs) that are issued by banks but are not close substitutes to bank deposits. These products serve as a useful comparison group because they often require minimum investments in excess of 50,000 yuan. Therefore, WMPs and FinTech products such as Yu'ebao target different clientele. If the channel for our findings is through the competitive pressures that banks face from Yu'ebao competing with the household demand deposits business, we should find little effect on WMPs.

Contrary to their response in rolling out bao products, banks do not appear to change WMP issuance and yields according to their exposure to FinTech, as shown in Table 7. This result is consistent with our main idea that it is the FinTech competition that induces banks to innovate and launch *bao* products, which benefits households with higher market interest rates and facilitates interest rate liberalization reform in China.

6 Impact of FinTech on Traditional Banks' Performance

In this section, we analyze the impact of the entry of FinTech/Yu'ebao competition on traditional bank profitability and risk-taking activities. We examine the impact on bank balance sheet measures of profitability and costs, including net interest margin, interest income, net profits, cost-to-income ratio, bank risky asset ratio, bad loan ratio, and bank loan structure.

6.1 Bank Interest Rate Spread and Profitability

The previous analysis suggests that banks and cities lose deposits to Yu'ebao—particularly those closely substitutable for household demand deposits—and a potentially significant policy concern is that these outflows negatively impact bank profitability and financial stability. To examine this question, we use the bank-level OLS and IV specifications to examine changes in bank net interest margin (NIM) from 2012 to 2014.[10]. We also consider the cost-income ratio, which represents banks' operating cost relative

[10]There was a regulatory change in the reporting standard of commercial bank balance sheets in 2013. However, to the extent that the impact of the reporting standard change is not proportional to banks' exposure to the Yu'ebao shock, our regression results are not affected by this change.

to revenue.

While the large aggregate outflow from the banking system is a potential cause for concern among banking regulators, we find that, surprisingly, cross-sectional differences in outflows had little differential impact on bank balance sheets. As shown in Table 8, the most exposed banks saw no differential impact on banks' performance measured as net interest margins (NIMs), suggesting that the deposit outflows did not significantly hamper banks' ability to engage in traditional spread lending. Most of the variation in NIMs is absorbed by the initial values, i.e., the starting value in 2012, suggesting significant mean reversion in these measures. These balance sheet variables, similar to bank deposit growth, demonstrate a strong pattern of mean reversion. Thus, we do not find evidence that FinTech competition would reduce bank profits or threaten financial stability.

Interestingly, however, we find strong evidence that bank cost-to-income ratios increase significantly. This finding is robust across all specifications, with the exception of the Hangzhou distance instrument, where the coefficient is still positive. We interpret this finding as suggesting that (state-owned) banks operated inside the efficiency frontier before the FinTech competition and those most exposed to Yu'ebao competition are able to cut costs or otherwise improve their efficiency, for example, by investing in technological improvements themselves. In other words, FinTech entry appears to give traditional, incumbent banks, incentives to innovate and to improve efficiency. In the next section, we closely examine banks' incentives to innovate, specifically in terms of launching new products that directly compete with Yu'ebao and Yu'ebao-like products; however, the results suggest that FinTech entry may induce efficiency improvements by banks along many dimensions.

Examining bank balance sheets, we found that while bank NIM does not decrease for more exposed banks, banks' cost-to-income ratios appear to increase with Yu'ebao exposure. This finding suggests that banks were operating inside their efficiency frontier before the FinTech competition and are responding to the Yu'ebao competitive threat.

6.2 Bank Lending and Risk-taking Activities

Moreover, the most exposed banks did not deferentially increase the risk of their assets measured as bad loan ratios and risky asset ratios, as shown in Table 9. More exposure to Yu'ebao does not lead to

a significant change in banks' bad loan ratios [11], while resulting in a lower risky asset ratio [12]. There appears to be a limited impact on banks' on-balance-sheet risk-taking activities.

Given the possibility of banks migrating riskier loans off their balance sheets, we may underestimate the potential impact of FinTech on banks' risk-taking behaviors. Additionally, our paper focuses on Yu'ebao in its early stage, without analyzing the long-term impact of FinTech competition on traditional banks. In April 2017, Yu'ebao became the largest money-market fund in the world, with assets under management totaling $165.6 billion, surpassing JP Morgan Chase's US Government market fund ($150 billion). This unprecedented size could bring significant liquidity and systemic risks, and regulators in China began to enhance regulations on MMFs, for example, by restricting or prohibiting the use of T+0 redemption and limiting the size of a single MMF. Admittedly, the impact of a FinTech product in its early stages is vastly different from that in its mature stages. Examining the long-term impact of FinTech competition could be a meaningful and fruitful path in future research.

6.3 Comparison with Regulation Q in the U.S.

The phasing out of Regulation Q in the United States was also helped/triggered by the growth of the money market funds. While sharing the common points of deposit ceiling regulation and MMF competition with commercial banks, the interest rate liberalization reforms in China and in the U.S. have different motivations and mechanisms.

The special role of FinTech in our case comes from the lack of competition against the highly concentrated banking sector. In the U.S. case, the thrifts/savings and loans, which were small and highly fragmented, had a relatively high market share in other consumer finance products like mortgages. These S&Ls were already exempt from regulation Q and were already competing with commercial banks. So market competition within the existing financial sector can lead to an end of financial repression.

There are fewer "cracks" in emerging market counties since their financial sector tends to be more concentrated. For instance, in China, there isn't much strong competition coming from inside the banking industry: big banks control the majority of bank branches and therefore the access to individual

[11] The bad loan ratio (*bulianglv*) is a commonly used measure of nonperforming loans based on the five-category classification of bank loans in China. Loans are categorized into five types in descending order of loan quality: (1) normal (*zhengchang*), (2) under-watch (*guanzhu*), (3) subprime (*ciji*), (4) suspicious (*keyi*), (5) loss (*sunshi*). The last three categories are considered bad loans.

[12] The risky asset ratio is risky assets (risky weights determined by the regulatory authority based on the Basel Accords) divided by the total assets of a bank.

depositors/cheap funding. Additionally, they provide greater convenience yield to their clients thanks to their nationwide branch network. Small- and medium-sized banks often are local banks and cannot compete in these aspects. In fact, an interest rate cap serves as a coordination device that guides the banks away from competing on interest rates.

Compared to the banking industry, FinTech is “banking without deposits". It doesn't benefit from interest rate caps and doesn't have incentives to prevent liberalization. Moreover, financial technology unprecedentedly reduces the cost of reaching customers across the country. There is no need for FinTech companies to build brick-and-mortar branches city by city, which makes it a real competitor to big banks dominating China's household finance market.

7 Conclusion

We examined the equilibrium effect of a new FinTech entrant that competes directly with bank household demand deposits. Bank deposits in China were subject to financial repression, constraining interest rates far below the apparent laissez-fair level. Interest rate regulation of such type is common among developing countries and is known as “financial repression" in the development finance literature. The entry of Yu'ebao, China's first FinTech MMF that offers T+0 liquidity and transaction services, while not being subject to interest rate caps, has the effect of siphoning deposits out of the traditional banking system. In the cross-sectional analysis, cities and banks with the greatest exposure to Yu'ebao faced significant deposit outflows. These findings are robust to several instrumental variable approaches that address potential endogeneity problems.

The exit of bank deposits from the traditional banking system is potentially a concern for regulators. One possibility is that, facing greater deposit competition, banks become less profitable and the stability of the financial system is undermined. However, we find that the banks most exposed to Yu'ebao did not see compressed net interest margins. Rather, we observe increases in costs at these banks, consistent with the idea that the banks used to operate inside their efficiency frontier and the FinTech competition spurred them to improve their efficiency, for example, by pursuing their own financial innovation. Indeed, we find that the most exposed banks launched their own competing T+0 MMF products, further undermining financial repression. Furthermore, less exposed banks were more reluctant to adopt the

innovation to avoid cannibalism on deposits.

Our results highlight the potential of FinTech to be a bottom-up liberalizing force in developing economies that are potentially hampered by a history of financial repression. The findings highlight both the direct effect of Yu'ebao, a deposit-like product that was not subject to interest rate caps, and the indirect effect of banks introducing their own competing products due to competitive pressure, on passing through more market rates to common households. Consistent with our results, these actions allowed these exposed lenders to avoid suffering particularly large losses relative to banks who were less exposed but did not introduce their own competing products.

Finally, our results highlight important synergies between FinTech savings platforms and mobile payment and e-commerce. This synergy has historically fallen outside the purview of traditional banking services but allowed Yu'ebao to rapidly gain market share among consumers already on the Alipay platform. As China leads the world in FinTech innovation and because the combination of digital payment and wealth management is still uncommon but may develop in other countries, the Chinese experience may hold important lessons for understanding the efficiency and financial stability consequences of FinTech innovations in other countries.

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List of Variables

	A. City-level variables
Dependent variables	
city_fundflow	*Purchase fund flows from bank accounts to Yu'ebao, city level cumulative aggregate as of May 2014. Ant Group.*
city_grdepositpc	*City level average annual growth rate of deposit per capita between 2012-2014. WIND, authors' calculation.*
Key explanatory variables	
penetration_YEB	*A penetration index based on active mobile-end Yu'ebao users divided by local population, December 2013 value. Ant Group.*
penetration_Alipay	*A penetration index based on active mobile-end Alipay users divided by local population, May 2013 value. Ant Group.*
HZdistance	*A city's great-circle distance to Hangzhou city, Ali's headquarter. National Bureau for Geographics, authors' calculation.*
Control variables	
provincial_capital	*An indicator which equals one if a city is a provincial capital city and zero otherwise. Ministry of Civil Affairs, authors' calculation.*
depositpc	*A city's deposits per capita, 2012 year-end value.*
city_branchshare	*A city's share in the national bank branch network; i.e., the number of bank branches in a city divided by total bank branches nationwide. CBIRC, authors' calculation.*
lngdp	*Log of a city's GDP, 2012 year-end value. WIND, authors' calculation.*
lnpop	*Log of a city's population, 2012 year-end value. WIND, authors' calculation.*
grgdppc	*Average annual growth rate of a city's GDP per capita between 2012-2014. WIND, authors' calculation.*

	B. Bank-level variables
Dependent variables	
bank_fundflow	*Purchase fund flows from bank accounts to Yu'ebao, bank level cumulative aggregate as of May 2014. Ant Group.*
bank_grdeposit	*Bank level average annual growth rate of deposits between 2012-2014. Adding _hh, _firm, _demand, and _time after it means subcategories: household deposits, firm deposits, demand deposits, and time deposits, respectively. RESSET, authors' calculation.*
bao	*Indicator of whether a bank has launched bao-type products by December 2017 (= 1 if yes and = 0 otherwise). Authors' calculation.*
Key explanatory variables	
exposureYEB	*A bank's exposure to Yu'ebao using branch-weighted sum of city-level Yu'ebao penetration, December 2013 value. Ant Group, authors' calculation.*
exposureAlipay	*A bank's exposure to Alipay using branch-weighted sum of city-level Alipay penetration, May 2013 value. Ant Group, authors' calculation.*
bank_lnHZdistance	*A bank's branch-weighted sum of city-level distance to Hangzhou city, May 2013 value. Ant Group, authors' calculation.*
Control variables	
bank_deposit	*The year-end deposits of a bank, 2012 value. Adding _hh, _firm, _demand, and _time after it means subcategories: household deposits, firm deposits, demand deposits, and time deposits, respectively. RESSET.*
bank_branchshare	*The number of a bank's branches divided by total bank branches nationwide, May 2013 value. CBIRC, authors' calculation.*
lnsize	*Log of a bank's size proxied by total assets, 2012 value. RESSET.*
bank_lngdppc	*A bank's branch-weighted sum of lngdppc, 2012 value. WIND, authors' calculation.*
bank_grgdppc	*A bank's branch-weighted sum of gr_gdppc_1214. WIND, authors' calculation.*
NIM	*Net interest margin, 2012 value. A delta_ prefix means the change between 2012-2014. RESSET.*
CostIncomeRatio	*Operating cost-to-income ratio, 2012 value. RESSET.*
ratio_badloans	*Bad loan ratio, 2012 value. RESSET.*
ratio_riskyassets	*Risky assets divided by total assets, 2012 value. RESSET.*

FIGURE 1: DUAL-TRACK INTEREST RATES

Note: This figure shows the interest rates of bank deposits and the MMF industry in China during 2010-2018: The red solid line represents the 7-day annualized yield of Yu'ebao, while the blue dashed line refers to the 3-month Shanghai Inter-bank Offered Rates (SHIBOR). The grey dash-dot line is the maximum interest rate banks are allowed to offer on 3-month time deposits, while the black solid line is the interest rate cap on demand deposits (both were lifted in October 2015). The grey dashed vertical line marks the launching month of Yu'ebao (June 2013).

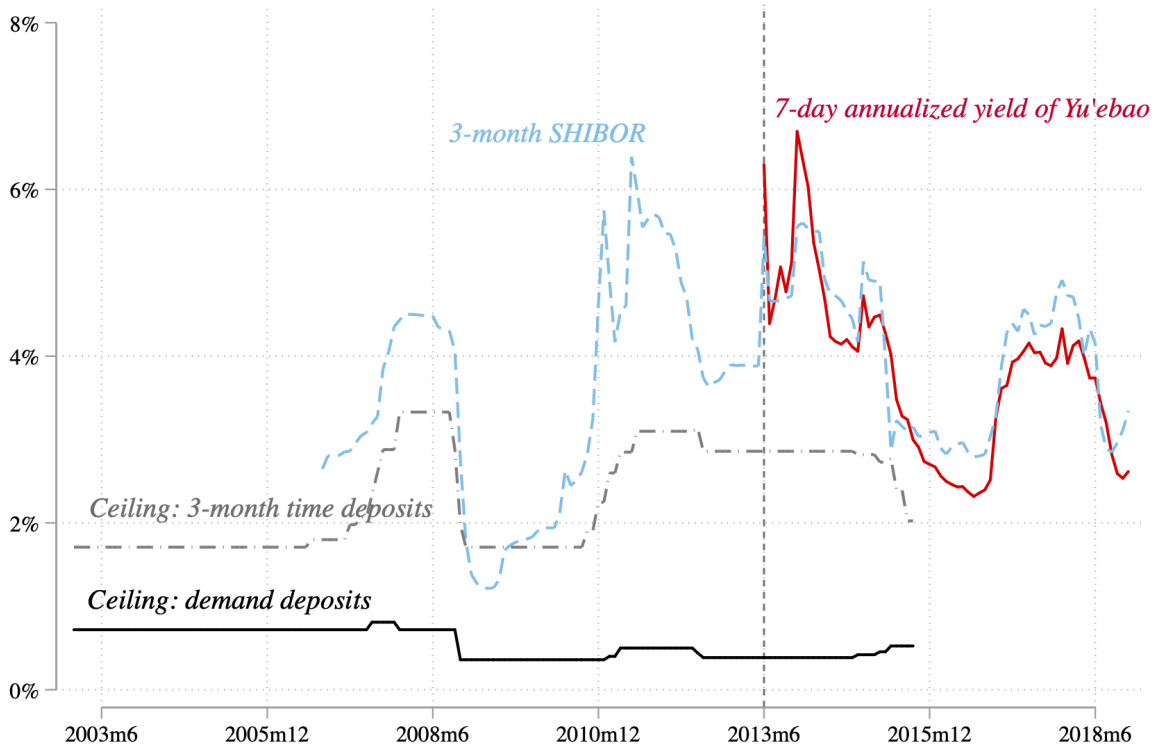
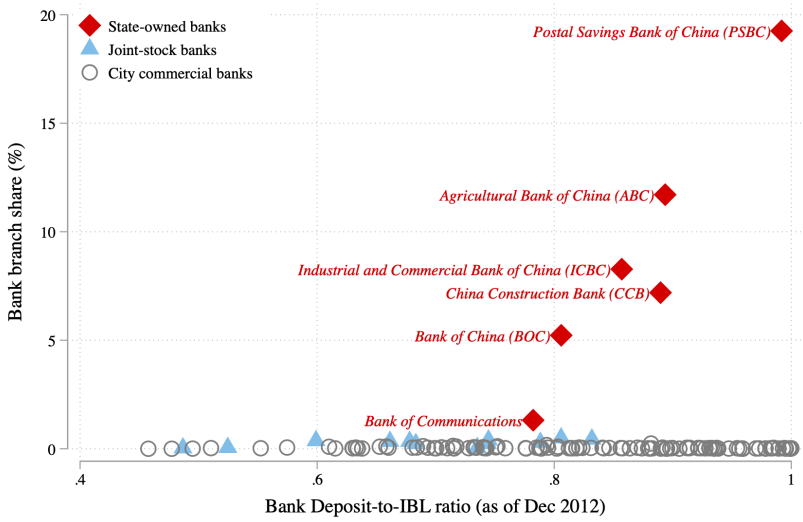
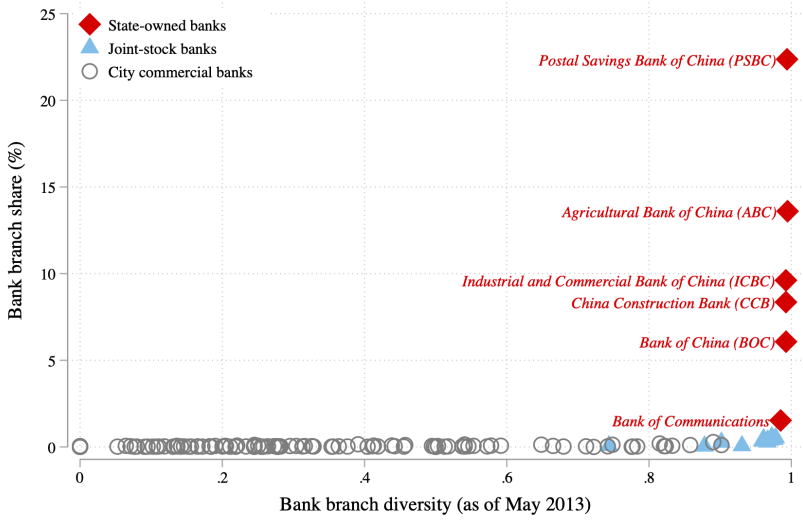


FIGURE 2: HEAVY RELIANCE ON DEPOSIT FUNDING AND HIGH CONCENTRATION IN THE TRADITIONAL BANKING INDUSTRY

Note: Panel A of this figure plots deposit-to-interest-bearing-liabilities ($depositIBL$) ratios as of December 2012. Panel B shows the concentration of bank branches measured by bank branch diversity as of May 2013. The vertical axis is bank market share as of May 2013 for both panels. Bank branch diversity is defined as one minus the HHI of bank branches within a given bank; i.e., $1 - \sum_c (\omega_{bct})^2$, where $\omega_{bct} = \frac{\#Branches_{bct}}{\sum_k \#Branches_{bkt}}$ measures city c's importance to bank b in time t in terms of the number of branches. Red diamonds are the large state-owned banks, blue triangles are joint-stock banks, circles are city commercial banks, and triangles are rural community banks. The names of the six state-owned banks, which together make up 61.83% of bank branches, are labeled alongside the corresponding diamonds.



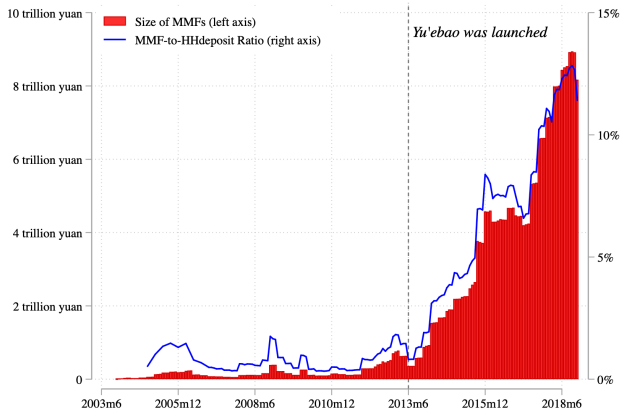
(A) BANK RELIANCE ON DEPOSIT FUNDING



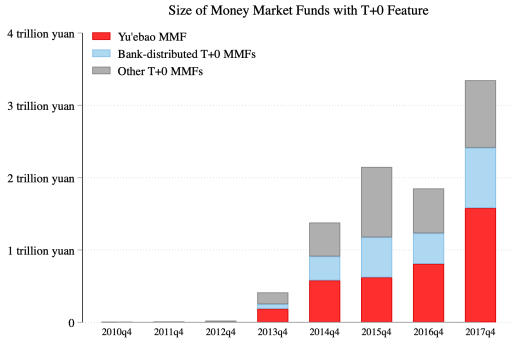
(B) BANK BRANCH CONCENTRATION

FIGURE 3: STRUCTURAL CHANGE IN THE MMF INDUSTRY

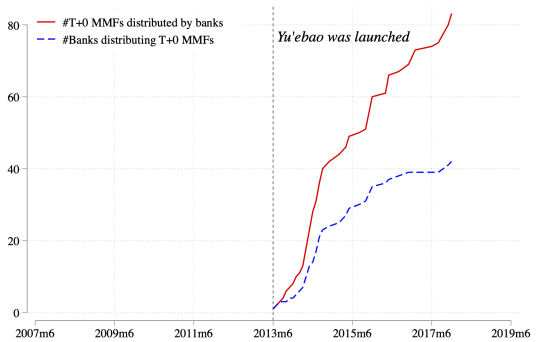
Note: Panel A of this figure shows the absolute and relative size (compared to bank deposits) of the money-market fund (MMF) industry in China since 2003. The red bars show the absolute size (left axis), while the blue line depicts the relative size (right axis). The gray dashed vertical line represents the launching month of Yu'ebao (June 2013). Panel B and C show the structural change in the MMF industry around the time of Yu'ebao's introduction, indicated by the dashed vertical gray line. Panel B shows the size of MMFs with $T+0$ fast redemption features distributed by Alipay, commercial banks, and other institutions (such as broker-dealers). Panel C shows the number of $T+0$ MMFs distributed by banks (red, left axis) and the number of unique banks distributing $T+0$ MMFs (blue, right axis).



(A) MMF INDUSTRY COMPARED TO BANK DEPOSITS



(B) SIZE OF T+0 MMFS DISTRIBUTED BY ALIPAY, BANKS, AND OTHERS



(C) NUMBER OF BANK-DISTRIBUTED T+0 MMFS

FIGURE 4: FINTECH PENETRATION ACROSS CITIES

Note: The figure plots city-level FinTech penetration ratios, defined as active mobile-end FinTech users divided by local population, in a gradient map. The upper panel A shows the penetration ratios of Alipay in May 2013, one month prior to the introduction of Yu'ebao, while the lower panel shows the penetration ratios of Yu'ebao in December 2013, six months since its introduction.

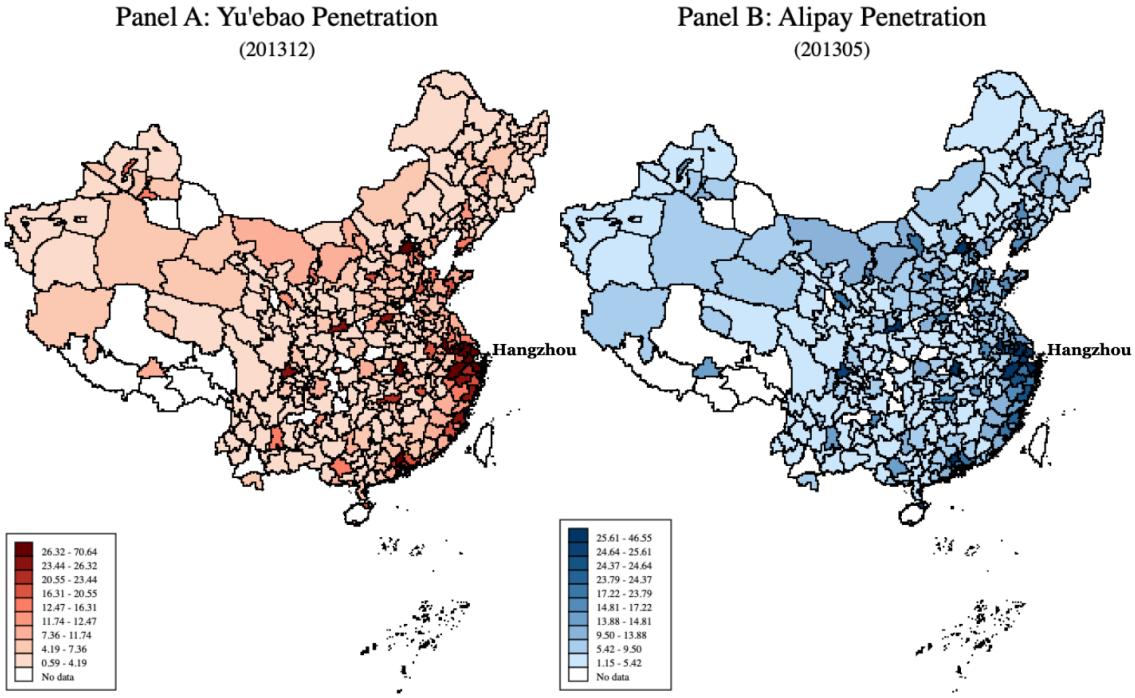


FIGURE 5: CITY-LEVEL FIRST STAGE

Note: This figure demonstrate relationships between key FinTech penetrations and geographical distances. Panel A plots the relationship between city-level Yu'ebao (YEB) penetration ratios (log value as of December 2013, y-axis) and Alipay penetration ratios (log value as of May 2013, x-axis). Panel B shows the correlation between city-level Yu'ebao (YEB) penetration ratios (log value as of December 2013, y-axis) and each city's great-circle distance (log value) to Hangzhou city, the headquarter of Alipay and Yu'ebao (May 2013 value, x-axis). We distinguish between provincial capitals (plotted as diamonds) and non-provincial capital cities (plotted as circles). The fitted line is accompanied with a 90% confidence interval, plotted as the grey area.

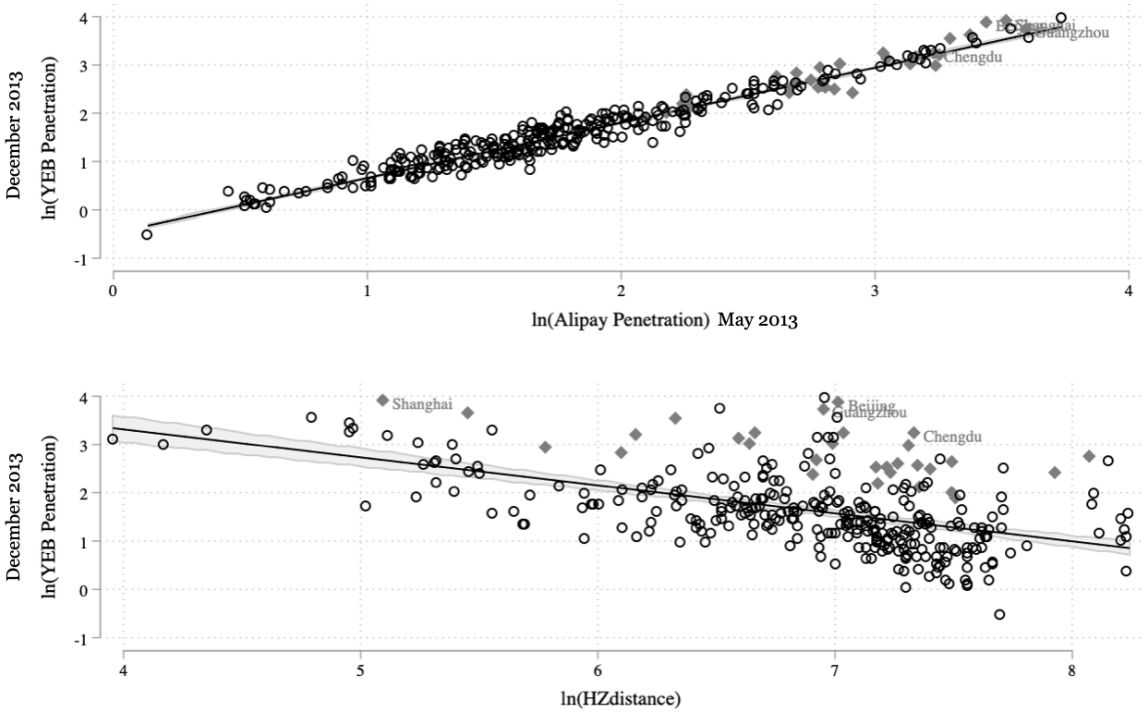
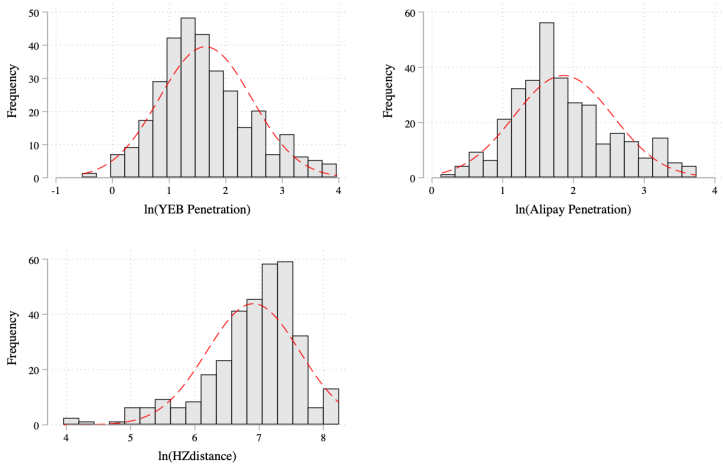


FIGURE 6: DISTRIBUTION OF KEY FINTECH VARIABLES

Note: The figure plots the distribution of banks' exposure to FinTech. A bank's exposure to FinTech is calculated as a weighted sum of city-level FinTech penetration ratios, weighted by the fraction of branches in each city. $ExposureYEB$ (log value as of December 2013) and $ExposureAlipay$ (log value as of May 2013) are banks' exposure to Yu'ebao and Alipay, respectively. A bank's weighted distance to Hangzhou, $Bank_HZdistance$ (log value as of May 2013), is calculated as a weighted sum of city-level distance-to-Hangzhou, weighted by the fraction of branches in each city. A bank's cumulative deposit outflows to Yu'ebao between June 2013 and May 2014 (the first twelve months), $fundflow$, are also presented in logs.

(A) DISTRIBUTION OF CITY-LEVEL FINTECH PENETRATION



(B) DISTRIBUTION OF BANK-LEVEL FINTECH EXPOSURE

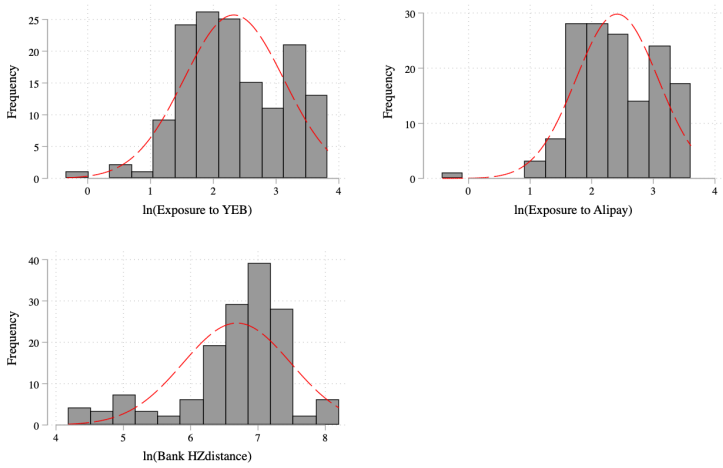
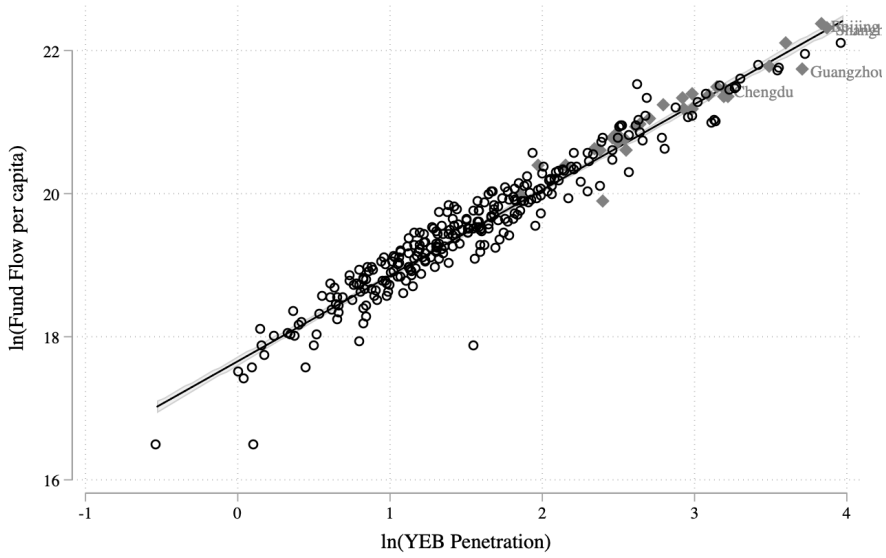
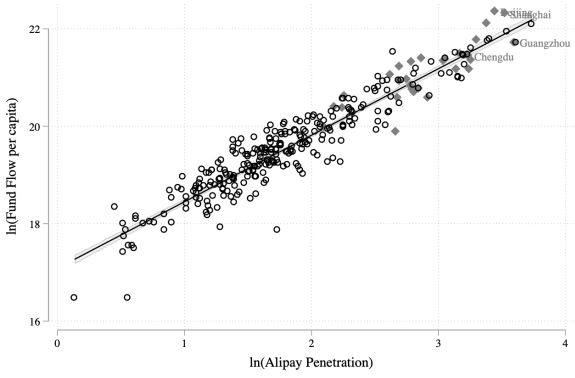


FIGURE 7: CITY-LEVEL FINTECH PENETRATION AND DEPOSIT OUTFLOWS PER CAPITA

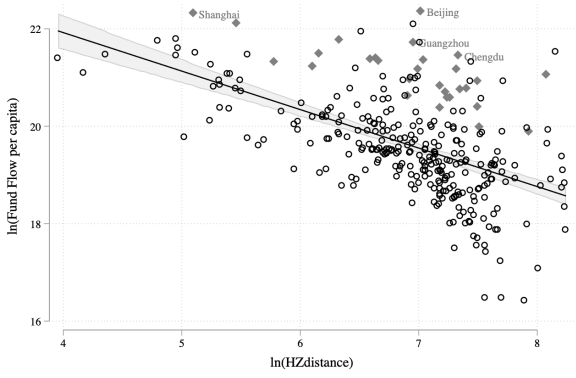
Note: This figure shows the relationship between Yu'ebao fund flows and Ye'ebao penetration. Panel (A) shows the direct relationship between log fund flows per capita and Ye'ebao adoption. Panel (B) shows the relationship between log fund flows per capita and the first instrument, pre-Yu'ebao Alipay Penetration. Panel (C) shows the relationship between log fund flows per capita and the second instrument, the log of the city's distance from Hangzhou (Ali's headquarter city). The solid line shows the best-fit regression with the gray region showing the confidence interval.



(A) YU'EBAO PENETRATION



(B) ALIPAY PENETRATION



(C) HANGZHOU DISTANCE

TABLE 1: SUMMARY STATISTICS

Note: This table shows the summary statistics of the city-level and bank-level cross-section data. We exclude cities with extreme low or high values of distance to Hangzhou city, including Hangzhou city itself, Kizilsu Kyrgyz Autonomous Prefecture in Xinjiang Uyghur Autonomous Region, and Kashgar Prefecture in Tibet Autonomous Region. Alipay penetration/exposure and Hangzhou distance variables are May 2013 values, Yu'ebao penetration/exposure variables are December 2013 values, and deposit outflows are the cumulative fund flows from banks to Yu'ebao as of May 2014. All other stock variables are end-of-year values in 2012 and all change/growth variables are 2014 year-end minus 2012 year-end, if not otherwise specified.

	Bank-level Summary Stats				
	A. Outcome variables				
	count	mean	sd	min	max
ln(bank_fundflow)	117	23.65163	2.414326	19.0181	31.01434
bank_grdeposit	135	17.80987	11.21161	.2243996	83.02235
	B. Key explanatory and instrumental variables				
	count	mean	sd	min	max
ln(exposureYEB)	148	2.327715	.7959945	-.3312423	3.824615
ln(exposureAlipay)	148	2.412073	.6662907	-.4245275	3.610213
bank_lnHZdistance	148	6.686742	.8024715	4.183307	8.201095
	C. Bank control variables				
	count	mean	sd	min	max
lnsize	136	16.05868	1.72948	13.03093	21.28529
lndeposit	136	15.7447	1.676612	12.7342	21.0339
ratio_demanddeposit	41	42.7509	9.886924	20.7336	68.50117
ratio_hhdeposit	40	27.39017	12.28749	8.246496	59.11732
depositIBL	134	81.30215	13.50809	45.76217	100
bank_branchshare	148	.0048119	.0242103	.0000103	.2243687
bank_lngdppc	148	1.568391	.476651	.0291196	2.808788
bank_grgdppc	146	.0658242	.0317923	-.0245439	.1778945
Net interest margin (NIM)	128	3.388523	1.010576	1.5922	7.4876
CostIncomeRatio	135	34.11672	12.9191	16.18	152.89
ratio_badloans	126	.8208603	.429236	.04	2.6
ratio_riskyassets	95	57.11381	10.17647	30.40523	81.90645
N	148				

TABLE 2: FIRST-STAGE REGRESSIONS

Note: Column 1-2 show the first-stage regression results of using lagged Alipay penetration/exposure (May 2013 value) as IV for Yu'ebao penetration/exposure (December 2013 value), Column 3-4 show the first-stage regression results of using distance-to-Hangzhou as IV for Yu'ebao penetration/exposure (December 2013 value), and column 5-6 use both IVs. Results without and with controls are shown in odd and even columns, respectively. City- and bank-level controls take the values in December 2012. Standard errors are shown in parentheses. We use * for p<0.10, ** for p<0.05, and *** for p<0.010.

	Log of Yu'ebao Penetration (December 2013 value)					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(penetration_Alipay)	1.142***	1.102***			1.097***	1.040***
(May 2013 value)	(0.014)	(0.027)			(0.016)	(0.030)
lnHZdistance			-0.579***	-0.350***	-0.098***	-0.091***
			(0.051)	(0.034)	(0.016)	(0.017)
provincial_capital		0.006		0.718***		0.094**
		(0.038)		(0.088)		(0.039)
ln(city_branchshare)		-0.048		0.112		-0.073**
(December 2012 value)		(0.032)		(0.083)		(0.032)
lngdp		0.048		0.795***		0.079**
(December 2012 value)		(0.040)		(0.063)		(0.039)
lnpop		0.064*		-0.772***		0.030
(December 2012 value)		(0.037)		(0.066)		(0.035)
N	324	303	324	303	324	303
adj. R^2	0.949	0.957	0.256	0.783	0.955	0.960

(A) CITY-LEVEL FIRST-STAGE RESULTS

	Log of Bank Exposure to Yu'ebao (December 2013 value)					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(exposureAlipay)	1.162***	1.216***			1.095***	1.069***
(May 2013 value)	(0.034)	(0.035)			(0.038)	(0.046)
bank_lnHZdistance			-0.617***	-0.429***	-0.097***	-0.118***
(May 2013 value)			(0.057)	(0.039)	(0.023)	(0.024)
lnsize		0.029***		0.137***		0.037***
(December 2012 value)		(0.008)		(0.019)		(0.007)
bank_branchshare		-0.378		-1.849*		-0.390
(December 2012 value)		(0.337)		(1.081)		(0.306)
depositIBL		-0.000		-0.014***		-0.002*
(December 2012 value)		(0.001)		(0.003)		(0.001)
bank_lngdppc		-0.079		0.579***		-0.023
(December 2012 value)		(0.052)		(0.073)		(0.046)
N	148	133	148	133	148	133
R^2	0.946	0.957	0.387	0.800	0.953	0.966

(B) BANK-LEVEL FIRST-STAGE RESULTS

TABLE 3: CITY-LEVEL FUNDS INTO TIANHONG/YU'EBAO MMF, JUNE 2013 - MAY 2014

Note: Column 1-2 shows the results of the baseline regressions, while the rest columns demonstrate the IV regression results using three sets of IVs: Column 3 displays the IV regression results using Alipay exposure prior to Yu'ebao, column 4 shows the IV results of distance to Hangzhou city, and column 5 using both IVs. Standard errors are shown in parentheses. We use * for p<0.10, ** for p<0.05, and *** for p<0.010.

	City-level fund flows (June 2013-May 2014)				
	(1)	(2)	(3)	(4)	(5)
	Baseline	*Baseline*	*IV*	*IV*	*IV*
	w/o controls	*w/ controls*	*Alipay*	*HZdistance*	*Both*
ln(penetration_YEB)	1.550***	0.994***	0.975***	1.126***	0.985***
(December 2013 value)	(0.064)	(0.037)	(0.038)	(0.058)	(0.036)
provincial_capital		-0.010	-0.001	-0.073	-0.006
		(0.044)	(0.045)	(0.049)	(0.045)
ln(city_branchshare)		0.207***	0.212***	0.170***	0.209***
(December 2012 value)		(0.050)	(0.050)	(0.060)	(0.051)
lngdp		0.173***	0.189***	0.060	0.180***
(December 2012 value)		(0.058)	(0.056)	(0.071)	(0.055)
lnpop		0.772***	0.756***	0.882***	0.765***
(December 2012 value)		(0.050)	(0.055)	(0.083)	(0.055)
N	323	302	302	302	302
adj. R^2	0.681	0.980	0.980	0.979	0.980

TABLE 4: BANK LEVEL DEPOSIT GROWTH BY CATEGORY: HOUSEHOLD VS. FIRM DEPOSITS

Note: This table shows the results for deposit growth separated by deposit segment: Households and Firms. Columns (1)-(4) show the results for households; Columns (5)-(8) show the results for firms. As before, Columns (1) and (5) are the baseline OLS regressions with controls; (2) and (6) are the IV regressions using Alipay exposure as an instrument for Ye'ebao exposure; (3) and (7) are the IV regressions using Hangzhou distance as an instrument for Yu'ebao exposure; (4) and (8) are the IV regressions using both instruments in the fist stage. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	Household deposit growth				Firm deposit growth			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	*IV*	*IV*	*IV*	*Baseline*	*IV*	*IV*	*IV*
	w/ controls	*Alipay*	*HZdistance*	*Both*	*w/ controls*	*Alipay*	*HZdistance*	*Both*
ln(exposureYEB)	-8.190	-9.361**	-9.158*	-9.331**	1.358	1.330	3.754	1.697
	(4.867)	(4.590)	(5.560)	(4.541)	(2.366)	(2.356)	(2.544)	(2.251)
ln(deposit_hh)	-2.124**	-2.019**	-2.038**	-2.022**				
	(0.996)	(0.917)	(0.911)	(0.907)				
ln(deposit_firm)					-1.251*	-1.248**	-1.513**	-1.288**
					(0.709)	(0.634)	(0.672)	(0.634)
ln(bank_branchshare)	9.423	7.833	8.109	7.874	-27.047	-27.126	-20.420	-26.111
	(52.767)	(48.812)	(48.842)	(48.771)	(47.241)	(42.070)	(43.803)	(42.281)
depositIBL	-0.189	-0.194	-0.193	-0.194	-0.210**	-0.210**	-0.201**	-0.209**
	(0.158)	(0.139)	(0.141)	(0.139)	(0.100)	(0.090)	(0.091)	(0.090)
ratio_hhdeposit	0.192	0.196	0.195	0.196	0.058	0.058	0.036	0.055
	(0.169)	(0.154)	(0.157)	(0.155)	(0.103)	(0.092)	(0.104)	(0.093)
bank_lngdppc	14.824	16.643*	16.327	16.596*	1.223	1.266	-2.384	0.714
	(9.170)	(8.557)	(10.054)	(8.530)	(5.499)	(5.178)	(5.149)	(5.029)
bank_grgdppc	117.501*	129.802**	127.668*	129.483**	66.671**	66.968**	41.754	63.153**
	(59.563)	(55.781)	(69.235)	(56.102)	(29.771)	(28.782)	(33.692)	(28.435)
N	40	40	40	40	40	40	40	40
adj. R^2	0.329	0.326	0.327	0.326	0.333	0.333	0.310	0.333

TABLE 5: BANK LEVEL DEPOSIT GROWTH BY CATEGORY: HOUSEHOLD DEMAND VS. TIME DEPOSITS

Note: This table shows the results for household deposit growth separated by deposit type: Demand and Time. Columns (1)-(4) show the results for household demand deposits; Columns (5)-(8) show the results for household time deposits. As before, Columns (1) and (5) are the baseline OLS regressions with controls; (2) and (6) are the IV regressions using Alipay exposure as an instrument for Yu'ebao exposure; (3) and (7) are the IV regressions using Hangzhou distance as an instrument for Yu'ebao exposure; (4) and (8) are the IV regressions using both instruments in the fist stage. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	HH Demand deposit growth				HH Time deposit growth			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline w/ controls	*IV Alipay*	*IV HZdistance*	*IV Both*	*Baseline w/ controls*	*IV Alipay*	*IV HZdistance*	*IV Both*
ln(exposureYEB)	-15.207**	-16.985***	-12.223	-15.973**	-4.604	-5.205	-10.251*	-6.021
	(7.385)	(6.122)	(7.948)	(6.381)	(6.479)	(6.045)	(6.193)	(5.728)
ln(deposit_hhdemand)	-5.412	-5.062	-5.999	-5.261				
	(5.625)	(4.980)	(4.787)	(4.910)				
ln(deposit_hhtime)					-8.964	-9.315	-12.264	-9.792
					(9.493)	(8.111)	(9.120)	(8.146)
lnsize	5.642	5.465	5.938	5.565	5.618	6.046	9.639	6.627
	(5.553)	(4.908)	(4.729)	(4.848)	(10.221)	(8.733)	(9.589)	(8.705)
ln(bank_branchshare)	-36.378	-38.617	-32.620	-37.343	7.699	4.770	-19.848	0.787
	(72.144)	(63.176)	(63.620)	(63.020)	(86.502)	(77.062)	(84.071)	(77.813)
depositIBL	-0.090	-0.102	-0.070	-0.095	-0.105	-0.102	-0.073	-0.097
	(0.262)	(0.229)	(0.226)	(0.227)	(0.241)	(0.208)	(0.204)	(0.206)
ratio_hhdeposit	0.433	0.429	0.440*	0.432	0.360	0.377	0.523	0.400
	(0.298)	(0.269)	(0.247)	(0.263)	(0.399)	(0.346)	(0.399)	(0.350)
bank_lngdppc	26.636*	29.485**	21.853	27.864**	5.980	6.937	14.979	8.238
	(15.552)	(13.071)	(14.847)	(13.204)	(12.147)	(11.029)	(11.565)	(10.607)
bank_grgdppc	219.688**	236.101***	192.135**	226.762***	74.450	80.134	127.915	87.865
	(90.199)	(77.994)	(84.378)	(78.341)	(91.738)	(82.979)	(85.598)	(81.650)
N	37	37	37	37	38	38	38	38
adj. R^2	0.141	0.137	0.130	0.140	0.275	0.275	0.235	0.273

TABLE 6: PROBABILITY OF BANKS DISTRIBUTING *bao* PRODUCTS

Note: The panel A and B of this table summarize the results for banks' probabilities of distributing bao products (Yu'ebao-like MMFs) versus their exposure to Yu'ebao using a linear model and using a hazard model on the time interval from Yu'ebao's introduction to Banks' (possible) launch of bao products, respectively. *Bao* is an indicator variable for whether the bank introduces the product before December 2017, the observation window. In Panel A, Column (1) shows the baseline OLS analysis, and Column (2) through (3) show the IV result. In Panel B, Column (1) uses exposure to Yu'ebao directly; Columns (2)-(3) are the "instrumented" results using predicted Yu'ebao exposure based on Alipay exposure and Hangzhou distance, respectively. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	(1) *Baseline*	(2) *IV exposureAlipay*	(3) *IV HZdistance*
exposureYEB	0.011***	0.010**	0.010*
	(0.004)	(0.004)	(0.005)
lnsize	0.166***	0.169***	0.168***
	(0.024)	(0.024)	(0.025)
bank_branchshare	−2.845**	−2.901**	−2.890**
	(1.405)	(1.407)	(1.420)
depositIBL	0.005**	0.005*	0.005*
	(0.003)	(0.003)	(0.003)
bank_lngdppc	−0.052	−0.041	−0.043
	(0.071)	(0.072)	(0.079)
Observations	133	133	133
Adjusted R^2	0.450	0.449	0.450

(A) LINEAR MODEL

	(1) *Baseline*	(2) *IV exposureAlipay*	(3) *IV HZdistance*
exposureYEB	0.058**	0.068**	0.055*
	(0.025)	(0.031)	(0.030)
lnsize	0.908***	0.936***	0.968***
	(0.147)	(0.144)	(0.145)
bank_branchshare	−17.944**	−18.725**	−19.418**
	(8.315)	(8.301)	(8.599)
depositIBL	0.012	0.013	−0.005
	(0.021)	(0.021)	(0.019)
bank_lngdppc	−0.352	−0.466	0.267
	(0.690)	(0.725)	(0.619)
Observations	133	133	133
Wald Test (df = 5)	63.970***	61.720***	60.900***

(B) HAZARD MODEL

TABLE 7: CHANGE IN YIELDS ON WMPS WITH HIGH MINIMUM INVESTMENT REQUIREMENT AND NO T+0 FAST REDEMPTION

Note: This table shows the results for changes in bank WMP yields versus Yu'ebao exposure. Column (1) uses only Yu'ebao exposure. Column (2) adds the level of WMP yields as a control. Column (3) adds additional controls. Columns (4)-(6) are IV specifications using Alipay exposure, Hangzhou distance, and both as instruments, respectively. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	Change in bank WMP yield, 2012-2014					
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline w/o controls	*Baseline w/ controls*	*Baseline w/ controls*	*IV Alipay*	*IV HZdistance*	*IV Both*
ln(exposureYEB)	0.010	-0.025	-0.035	-0.055	-0.053	-0.055
	(0.048)	(0.032)	(0.058)	(0.057)	(0.062)	(0.054)
wmpyield		-0.308***	-0.306***	-0.308***	-0.308***	-0.308***
		(0.039)	(0.051)	(0.048)	(0.049)	(0.048)
lnsize			0.010	0.011	0.011	0.011
			(0.017)	(0.016)	(0.016)	(0.016)
ln(bank_branchshare)			-1.051	-1.099	-1.093	-1.098
			(0.852)	(0.808)	(0.817)	(0.808)
depositIBL			0.002	0.002	0.002	0.002
			(0.002)	(0.002)	(0.002)	(0.002)
bank_lngdppc			0.050	0.064	0.062	0.064
			(0.055)	(0.054)	(0.061)	(0.053)
bank_grgdppc			-0.628	-0.517	-0.532	-0.519
			(1.160)	(1.074)	(1.103)	(1.072)
_cons	0.266*	1.852***	1.478**	1.501***	1.498***	1.501***
	(0.148)	(0.212)	(0.569)	(0.535)	(0.535)	(0.535)
N	72	72	70	70	70	70
adj. R^2	-0.013	0.501	0.490	0.488	0.489	0.488

TABLE 8: FINTECH EXPOSURE AND BANK BALANCE SHEET: PROFITS

Note: This table shows the results for bank profitability and exposure to Yu'ebao. Columns (1)-(4) consider banks' change in net interest margin; Columns (5)-(8) consider banks' change in cost-to-income ratio. The regression is cross-sectional at the bank level. As before, Columns (1) and (5) are the baseline OLS regressions with controls; (2) and (6) are the IV regressions using Alipay exposure as an instrument for Ye'ebao exposure; (3) and (7) are the IV regressions using Hangzhou distance as an instrument for Yu'ebao exposure; (4) and (8) are the IV regressions using both instruments in the fist stage. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	Change in net interest margin, 2012-2014				*Change in cost/income ratio, 2012-2014*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	*IV*	*IV*	*IV*	*Baseline*	*IV*	*IV*	*IV*
	w/ controls	*Alipay*	*HZdistance*	*Both*	*w/ controls*	*Alipay*	*HZdistance*	*Both*
ln(exposureYEB)	0.063	0.020	0.074	0.028	1.126**	1.368**	0.786	1.281**
	(0.092)	(0.084)	(0.116)	(0.086)	(0.564)	(0.545)	(0.739)	(0.524)
NIM	-0.246***	-0.247***	-0.246***	-0.247***				
	(0.077)	(0.076)	(0.074)	(0.075)				
CostIncomeRatio					-0.361***	-0.363***	-0.358***	-0.362***
					(0.071)	(0.069)	(0.069)	(0.069)
lnsize	-0.052	-0.045	-0.054	-0.047	-0.550***	-0.598***	-0.483**	-0.581***
	(0.034)	(0.034)	(0.037)	(0.034)	(0.206)	(0.200)	(0.202)	(0.194)
ln(bank_branchshare)	1.181	1.046	1.217	1.073	23.691***	24.818***	22.111***	24.412***
	(1.112)	(1.092)	(1.119)	(1.093)	(8.490)	(8.095)	(8.009)	(8.005)
depositIBL	-0.001	-0.001	-0.001	-0.001	0.010	0.011	0.007	0.011
	(0.005)	(0.005)	(0.005)	(0.005)	(0.027)	(0.026)	(0.028)	(0.026)
bank_lngdppc	-0.189	-0.158	-0.197	-0.164	-0.379	-0.546	-0.146	-0.486
	(0.151)	(0.142)	(0.154)	(0.143)	(0.622)	(0.588)	(0.736)	(0.590)
bank_grgdppc	1.049	1.229	1.002	1.195	-13.948	-14.951*	-12.542	-14.590*
	(1.334)	(1.304)	(1.294)	(1.298)	(8.900)	(8.630)	(8.155)	(8.496)
N	125	125	125	125	131	131	131	131
adj. R^2	0.236	0.234	0.236	0.235	0.716	0.715	0.715	0.715

TABLE 9: FINTECH EXPOSURE AND BANK BALANCE SHEET: RISKS

Note: This table shows the results for bank risk-taking measures and exposure to Yu'ebao. Columns (1)-(4) consider banks' change in bad loan ratios; Columns (5)-(8) consider banks' change in risky asset ratios. The regression is cross-sectional at the bank level. As before, Columns (1) and (5) are the baseline OLS regressions with controls; (2) and (6) are the IV regressions using Alipay exposure as an instrument for Ye'ebao exposure; (3) and (7) are the IV regressions using Hangzhou distance as an instrument for Yu'ebao exposure; (4) and (8) are the IV regressions using both instruments in the fist stage. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	Change in bad loan ratio, 2012-2014				*Change in risky asset ratio, 2012-2014*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	*IV*	*IV*	*IV*	*Baseline*	*IV*	*IV*	*IV*
	w/ controls	*Alipay*	*HZdistance*	*Both*	*w/ controls*	*Alipay*	*HZdistance*	*Both*
ln(exposureYEB)	-0.025	-0.045	0.026	-0.034	-1.491*	-1.626**	-1.703	-1.636**
	(0.052)	(0.057)	(0.078)	(0.058)	(0.781)	(0.785)	(1.133)	(0.792)
ratio_badloan	-0.164***	-0.160***	-0.175***	-0.162***				
	(0.061)	(0.061)	(0.060)	(0.061)				
ratio_riskyassets					-0.101**	-0.101***	-0.101**	-0.101***
					(0.041)	(0.039)	(0.040)	(0.039)
lnsize	0.000	0.004	-0.009	0.002	-0.896**	-0.878**	-0.868*	-0.877**
	(0.015)	(0.014)	(0.018)	(0.015)	(0.405)	(0.383)	(0.445)	(0.390)
ln(bank_branchshare)	-0.408	-0.485	-0.216	-0.444	51.968**	51.539***	51.293**	51.508***
	(0.506)	(0.492)	(0.539)	(0.491)	(20.758)	(19.804)	(21.159)	(19.962)
depositIBL	0.001	0.000	0.001	0.000	-0.167***	-0.169***	-0.170***	-0.169***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.042)	(0.041)	(0.039)	(0.040)
bank_lngdppc	0.082	0.095	0.049	0.088	-0.202	-0.092	-0.029	-0.084
	(0.084)	(0.083)	(0.093)	(0.084)	(1.153)	(1.139)	(1.197)	(1.125)
bank_grgdppc	-0.476	-0.391	-0.687	-0.437	3.120	4.091	4.646	4.162
	(0.739)	(0.717)	(0.709)	(0.711)	(13.820)	(13.500)	(14.544)	(13.495)
N	120	120	120	120	89	89	89	89
adj. R^2	0.004	0.003	-0.002	0.004	0.368	0.368	0.367	0.368