FinTech as a Financial Liberator *

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Abstract

Financial repression—regulating interest rates below the laissez-faire equilibrium—has historically impeded investment in developing economies. In China, bank deposits were long subject to binding interest rate caps. Using transaction and local penetration data from a leading FinTech payment company, we study the FinTech's introduction of a money market fund (MMF) with deposit-like withdrawal features but uncapped interest rates aids in interest rate liberalization. In aggregate, MMF assets grow rapidly, and banks whose deposit base was more exposed to the payment app see greater outflows. These outflows are concentrated in household demand deposits, for which the MMF is the closest substitute. Contrary to regulator concerns, exposed bank profitability does not decline. Rather, exposed banks invest more in financial innovation and are more likely to launch competing funds with similar features. Our results highlight how FinTech competition stimulates interest rate liberalization among traditional banks by introducing competition for funding.

Keywords: FinTech, mobile payment, 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 under-development (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: By lowering interest rates, financial repression may reduce the cost of capital for commercial banks and enhance the profitability of those banks with market power. A first-order concern for regulators is therefore whether increased funding costs will lead to lower bank profits and increase financial instability, or lead to greater innovation in the financial sector.

In this paper, we study the role that FinTech has played in reducing financial repression in China, the largest developing country. Like the United States' now-lifted Regulation Q, China imposes an often-binding interest rate cap on bank deposits. This cap applies to bank deposits, but not to money market mutual funds (MMFs), which, like bank deposits, are a liquid and low-risk savings product. 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 significant market power. Therefore, possibly owing to the close substitutability of MMFs and bank deposits and the potential for reducing their own profitability by competing with their own funding sources, traditional banks have been hesitant to do so. 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.

Our paper starts with the introduction of 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 mobile payment technology, introduced a MMF product, Yu'ebao, which offered above-deposit interest rates and T+0 liquidity. The T+0 redemption feature, coupled with Alipay's mobile 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. Other internet-based financial technology companies quickly followed suit

and introduced similar products.

With Yu'ebao's introduction and growth, the aggregate market share of bank deposits declined relative to MMFs. While bank deposits flowed into Yu'ebao in aggregate, there is significant cross-sectional heterogeneity among banks. In particular, banks' deposit bases have significant geographical heterogeneity, with some banks' deposit bases concentrated in cities that saw significant 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.

While the large aggregate outflows 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. The most exposed banks saw no differential impact on banks' performance measured as net interest margins (NIM). Moreover, the most exposed banks did not differentially increase the risk of their assets.

Rather than having no effect, however, we find striking evidence that greater exposure to Yu'ebao prompted banks to respond by investing in (defensive) innovation. Consistent with increased technological investment, we observe costs rising disproportionately at the most affected banks. This investment appears to be aimed, at least partially, at the introduction of MMFs designed to compete directly with Yu'ebao. 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 avoiding the interest rate caps. Thus, while the rise of Yu'ebao and similar products did in fact siphon deposits away from banks, 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 variables strategies. First, we utilize the pre-Yu'ebao penetration of the Alipay payment platform. Instrument relevance obtains 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 Alipay's headquarters in Hangzhou, 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 headquarters (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 customers' 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. The direct effect was the introduction of a product that offered similar transaction and liquidity services as bank deposits, but with uncapped rates. While this competing product siphoned deposits away from the banking system, these competitive pressures caused the most exposed banks to break the the cartel-like market structure that had been in place before Yu'ebao's introduction and introduced their own competing MMF products. 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.

While the potential impact of FinTech has been of intense academic interest, as in, e.g., Philippon (2016), Claessens et al. (2018), and Goldstein et al. (2019), many questions remain concerning the competitive impact of FinTechs competing with traditional bank lenders and the macroeconomic implications of that competition. Our paper speaks to many of these questions. An extensive literature has examined how banks and Fintech lenders compete, e.g., Navaretti et al. (2018), Thakor (2020). This literature examines competition across many product markets, e.g., lending (Buchak et al. (2018b), Tang (2019), and), 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.

While many papers have examined these competitive effects, few (e.g., Boot (2017) and Vallee and Zeng (2019)) have examined the bank response. Our paper contributes to the FinTech literature by examining how the arrival of FinTech induces banks themselves to catch up to their pure FinTech competitors

in terms of introducing competiting FinTech products. 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 (Zhang) 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). 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.

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. Indeed, we find that a strong predictor of Yu'ebao growth is pre-Yu'ebao exposure to the Alipay platform. Moreover, this pre-Yu'ebao exposure to Alipay becomes a good predictor of FinTech competitive pressures that traditional banks later faced in their traditional depository business.

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 the 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 proceeds as follows. Section 2 details the institutional background of FinTech and Banking in China. Section 3 details the data and introduces our empirical methodology. In Section 4 we examine the impact of Yu'ebao's introduction on bank deposit flows and balance sheet outcomes. In Section 5 we

examine banks' strategic response. Finally, in Section 6 we discuss our findings and conclude.

2 Institutional Background on FinTech and Banking in China

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

2.1 Ceiling Regulation and Dual-Track Interest Rates

Interest rates were once strictly regulated in China. The the central bank imposed a ceiling on the deposit interest rate and both a floor and a ceiling on the lending interest rate. The interest ceilings on bank deposits was the last to be lifted, eventually phasing out in October 2015 [1]. Figure 1 shows both the regulated deposit rates, as well as 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.

We emphasize three key features of the 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 around 0.35% and the 3-month time deposit ceiling ranges from 1.8% and 3%. During the same period, SHIBOR increases from 2% to over 6%, later hovering around 4%.

Second, the interest ceilings seldom change. The central bank controls the timing and magnitude of benchmark rates and ceiling requirements, and in history, the central bank has changed the ceiling fewer than ten times in more than twenty years, despite the central government's efforts to liberalize the interest rates[2]. Hence, despite daily fluctuations in the un-capped SHIBOR, deposit interest rates show essentially no sensitivity to market conditions.

Figure 1 also shows the yield of Yu'ebao, the FinTech MMF motivating this paper. The yield, shown in red, co-moves with SHIBOR, rather than with the deposit rate ceilings. Money-market funds are not

[1] There is still unofficial "self-disciplinary organization" which regulates the interest rates, but not mandatory.

[2] Interest rate liberalization has been on the central government's agenda on economic financial reforms since 1993. The interest rates in the inter-bank market was liberalized in 1996. There was regulation on loan interest rates as well, which was liberalized in July 2013.

subject to interest rate ceiling regulations as are commercial banks. In addition, the inter-bank market and money market in China has already been liberalized in the 1990s. Therefore MMF yields can freely reflect the changes in supply and demand in the loanable funds market. For retail investors, MMFs are able to provide yields much more competitive than traditional banks. For instance, during its first two years, Yu'ebao provides an average of 2% higher yield than 3-month time deposits, and a strikingly 5% higher yield than demand deposits. Hence, money market funds 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 Banking and the Money Market Fund Industry

The banking industry is highly concentrated in China. Traditional banks, especially the state-owned banks, play a dominant role in China's financial system. Figure 2 plots each bank's market share against its level of concentration of branch network. The largest 6 state-owned banks control 61.8% of the branches and have a nationwide branch network. The rest relies heavily on local and regional branches, with 95% of banks open at least 80% branches in a single city.

Other things equal, the 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 generates resistance to interest rate liberalization reforms by these banks. Additionally, given the significant concentration, banks historically had little incentive to introduce or innovate in unregulated products that could cannibalize their cheap deposit funding.

The money market fund industry has no such incentives. As demonstrated by the cases of the United States and other developed countries, the money market fund industry played a crucial role in the process of removing financial repression, passing through market interest rates to retail investors when the banking sector was under strict regulation. In China, however, the money market fund industry experienced very modest growth in size and remain almost invisible in terms of relative size to bank deposits since their inception in 2003. The upper panel of Figure 3 shows the absolute and relative size of the money-market fund (MMF) industry, compared to the size of household deposits in traditional banks. The MMF industry didn't grow much until ten years later in 2013.

We distinguish between money market fund products sold by their own companies (direct sales) and those distributed by a third party (distributed sales). For instance, a fund company can sell a money market fund on its own website, where clients can register their accounts and make investments directly. At the same time, it can also add securities companies, banks [3], and independent fund sale agencies[4] to its distribution network. Furthermore, it can also partner with Internet and tech companies, which usually don't have fund sales licenses but enjoy tremendous web traffic, to open a digital direct sales storefront and facilitate fund sales. From the appearance, however, investors may not be aware of the subtle difference between third-party distribution sales and Tech-enabled direct sales.

2.3 FinTech Products

FinTech changed the landscape in the wealth management industry, benefiting from the fast-developing mobile payment industry. China's Payment Market Report 2014, released by the People's Bank of China, showed that in 2014, the total transaction volume and value of non-cash business were 62.752 billion and RMB1,817.38 trillion (US$294.70 trillion) with year-on-year growth rate of 25.11% and 13.05% respectively.

Yu'ebao is the first of its kind combining FinTech payment and money market funds together. Launched in June 2013 [5], Yu'ebao is a money-market fund uniquely designed for and sold on Alipay, the largest digital payment tool in China [6]. Figure 4 shows a screenshot of a Yu'ebao balance in the Alipay app. Relative to existing savings products available from the 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 money market funds 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

[3] Banks serve as an important channel for MMF sales, accounting for one-third of the total sales.

[4] The government approved licenses for third-party independent fund sales agencies in February, 2012. The number of independent sales agencies increased from 3 to over a hundred since.

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

[6] Incorporated in 2004, Alipay has been leading the market share in third-party online digital payment market in China in the past sixteen years. As of 2013 year-end, "Alipay led the market with absolute dominance of 48.7%, Tencent Tenpay ranked the second with 19.4%, followed by Unionpay with 11.2%, according to iResearch.

liquidity of Yu'ebao the money market fund, enabling it to become a close substitute to bank demand deposits. Yu'ebao proved immensely popular almost immediately. The lower panel of Figure 4 shows the assets under management (blue dashed line) and the yield (red solid line). Yu'ebao surpassed one trillion yuan (roughly 150 billion USD) within roughly three years of its introduction.

We define "bao" products as money-market fund products with free T+0 unlimited fast redemption features often involving a third party, which is either a licensed distribution channel or a direct sales partner. Yu'ebao is the the first and the most conspicuous of the "bao" products. Users in China often refer to "bao-type products," named after Yu'ebao, loosely in daily lives and in fund sales. This definition not only captures the main features shared by various *bao* products, but also points a clear direction for data collection.

It is the combination of payment technology and market interest rates that makes *bao* products both a close substitute for and a strong competitor against bank deposits. Administering a *bao* requires combining both payment technology with a wealth-management product. This combination is difficult for companies that are not either 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 emerge after the launch of Yu'ebao). FinTech companies and commercial banks, however, have very different inventives for launching *bao*. 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 money market funds by levering their natural advantage in processing payments.[7]

Yu'ebao's entry, however, spurred rapid growth and structural changes in the Chinese money market fund industry. 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

[7]It is worth noting that few banks had tried out T+0 fast redemption features through cooperation with fund companies. On January 5th, 2007, Industrial and Commercial Bank of China started cooperating with fund companies to offer T+0 redemption service for its clients. The main purpose, as quoted, was to "enable MMF to be as liquid as demand deposits." However, there are still 500-yuan investment minimum for retail investors with increments of 100 yuan, making it inconvenient for daily transactions. Moreover, ICBC charges fees for that fast redemption service. In July and August 2009, Jiaotong Bank also provided T+0 fast redemption service, and the redemption was made possible through the form of bank loans with an interest rate. More exceptions than common practice, these services got terminated only several days, ending within a week since their inception. In sum, although some commercial banks took steps in the direction of 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 another substitutes for bank deposits that pay market interest rates as Yu'ebao turned out to do.

started to offer MMFs with T+0 real-time redemption features 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. In terms of total number of Bank baos, their number follows a similar pattern at higher levels, meaning that individual banks were offering multiple bao products. Is this a coincidence in timing, or does Y'ebao cause the banks to offer their own bao-type products that pay market interest rates? These are the questions that we examine in detail in the subsequent sections.

3 Data Description and 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 level. Our empirical methodology then examines outcomes at cities and banks—principally deposit flows, bank profitability, and bank innovation, varies across cities and banks with their exposure to Yu'ebao.

3.1 Data sources

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 (3) city- and regional-level economic data, which serve as important control variables in our analyses.

3.1.1 Alipay data

Our data on Yu'ebao and Alipay comes 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 about 25 percent). Yu'ebao was launched in June 2013, as possesses many important features that distinguish it from existing MMF products, as discussed earlier.

Our unique data from Ant Group includes city-month level number of active Yu'ebao and Alipay

users. We can further decompose the users by their device type: web-end and mobile-end. With this data we are able to track the penetration ratios for 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 record starting from its launching date. Since Yu'ebao is embedded in Alipay, investors need to first register to become Alipay users if they have not done so. For the purpose of our research, we only use the following four characteristics of each anonymized transaction: the time stamp (to second-level accuracy), the amount of Yu'ebao purchase, the name of the associated bank (if it comes from a bank card), and the user's residence city, which enables us to match Yu'ebao purchases with cities and banks. Thus, we can track total flows from banks into Yu'ebao at a highly granular level. We aggregate transaction-level purchases to city-month level and bank-month level, respectively. Specifically, we focus on the cumulative fund flows into Yu'ebao as of May 2014, i.e., the first twelve months since its launch in June 2013.

Panel A of Table 1 shows the summary statistics for the city-level Alipay data.

3.1.2 Bank and other MMF data

Our data of commercial banks and their registered branches comes from China Banking and Insurance Regulatory Commission (CBIRC, formerly CBRC), the official regulatory authority over the banking industry in China. Banks are required by the law to get CBIRC's approval before opening a new branch. The registration form lists each branch's full name, full address, and approval date. We remove from our sample banks without any branches or not founded by May 2013. We focus on major cities operating in the urban area, keeping state-owned ("big"), joint-stock ("gufen"), and city commercial banks while excluding rural commercial banks, village banks ("cunzhen"), and foreign banks. The refinement leaves us 148 banks operating 193,289 branches, which represents over 80% 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, which represent the most comprehensive financial and economic datasets in China. The bank-level data compilation includes: (1) basic registration information,

such as the full name, inception date, headquarter city, registered capital, and the management: (2) bank-year level deposits data, including eight subcategories: 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, ratio of risky assets, non-performing loan (NPL) ratio, etc.

We hand-collect information on bank *bao* products, i.e., MMFs distributed by banks with $T + 0$ redemption, no minimum investment, zero fee, and unlimited times, similar to Yu'ebao. We collect detailed information on *bao* products by searching key words in all money market fund announcements compiled by WIND, the most comprehensive database on financial and economic information that is widely used by practitioners and researchers on Chinese financial market topics. 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. (If the money market fund is newly funded, it will also have a separate announcement for the T+0 feature.The key word search focuses on the period from 2003, the inception year of the first MMF in China, to 2017, four years since the launch of Yu'ebao.

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. We combine this hand-collected data with MMF-level data from WIND, which includes each MMF's full name, code, founding date, fund company, daily yield, and quarterly report data on share, purchase, redemption, investor composition, etc. Panel B of Table 1 shows the summary statistics.

3.1.3 City- and regional-level economic data

Our city-year-level macro data come from CSMAR and WIND, which includes panel data of GDP, population, industrial structure, unemployment, Internet subscribers, and mobile phone users. It is combined with the administrative data of city-level information, such as full name, province, longitude and latitude, available from Ministry of Civil Affairs and National Bureau for Geographics. Each city's distance to Hangzhou city is calculated using the geodist package in $Stata$. The datasets are merged using city

full names and bank full names.

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 China Interbank Market. 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.

Panel C of Table 1 shows the summary statistics for the city- and regional-level economic data.

3.2 Empirical design

We study the impact of Yu'ebao's introduction across a number of outcomes: deposit flows, bank profitability, and ultimately, banks' competitive response. The empirical design is similar in each case, and so we detail our strategy here.

3.3 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 Ali'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 their values

in January 2014 in Hangzhou as a benchmark (penetration = 100). Not surprisingly, E_{ct}^{YEB} and E_{ct}^{ALI} are 95% correlated, suggesting there is 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 6 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 8 shows the distribution of these variables.

The first outcome variable we consider is fund flows into Yu'ebao, which we track at the city level within the first 12 months of Yu'ebao's inception. In particular, we define for city c,

$$FundFlow_c = \text{Cumulative Yu'ebao flows, June 2013 – May 2014} \tag{4}$$

First, Yu'ebao user penetration predicts (per capita) fundflows into Yu'ebao, as shown in Figure 9. Second, past mobile payment penetration ratios predict future FinTech product sales. As shown in Figure 9, each city's penetration ratio of mobile payment (Alipay) positively predicts money market fund sales (fund flows into Yu'ebao) in that city in the 12 months following its introduction. Overall, FinTech penetration facilitates Yu'ebao sales. Third, distance to FinTech headquarter also matters for FinTech product sales. As shown in Panel C of Figure 9, the further away from Hangzhou, the smaller size of fund inflows.

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

$$\omega_{bct} = \frac{\#Branches_{bct}}{\sum_k \#Branches_{bkt}} \tag{5}$$

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. We then aggregate the Yu'ebao exposure, Alipay exposure, Hangzhou distance, and fund flows to the bank level as follows

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

$$E_{bt}^{ALI} = \sum_c \omega_{bct} E_{ct}^{ALI} \tag{7}$$

$$HZDistance_{bt} = \sum_c \omega_{bct} HZDistance_c \tag{8}$$

$$FundFlow_b = \sum_c \omega_{bct} FundFlow_c \tag{9}$$

As above, for the cross-sectional analysis, we fix E_b^{YEB} to December 2013, E_b^{ALI} to May 2013, and $HZDistance_{bt}$ to May 2013 (because while distances do not change, the bank branch network might change). Panel B of Figure 8 shows the distribution of these variables.

Beyond the city-to-bank aggregations, we examine a number of bank-specific variables, including financial performance: net interest margin, the cost-to-income ratio, the bank risky asset ratio, and the bad loan ratio. These indicators are year-end value taken from banks' annual reports, and we focus on the average change between 2012-2014 (i.e., 2014 year-end value minus 2012 year-end value).

3.4 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:

$$Y_c = \beta_0 + \beta_1 \log E_{c,2013}^{YEB} + X_c'\beta + \epsilon_c \tag{10}$$

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

For the bank-level analysis, we regress:

$$Y_b = \beta_0 + \beta_1 \log E^{YEB}_{b,2013} + X'_b\beta + \epsilon_b \tag{11}$$

Where Y_b are 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.

3.5 Instrumental variables 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 withdrawal funds from banks in order to open Yu'ebao accounts. To address this endogeneity concern, we adopt two instrumental variables strategies that utilize pre-Yu'ebao Alipay penetration as well as the city's distance (or bank's branch-weighted distance) from Ali's headquarters in Hangzhou. In particular, the first stage regressions for the city level are as follows:

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

$$\log E^{YEB}_{c,2013} = \beta_0 + \beta_1 \log HZDistance_{c,2013} + X'_c\beta + \epsilon_c \tag{13}$$

$$\log E^{YEB}_{c,2013} = \beta_0 + \beta_1 \log E^{ALI}_{c,2013} + \beta_2 \log HZDistance_{c,2013} + X'_c\beta + \epsilon_c \tag{14}$$

Similarly, the first stage regressions for the bank variables are as follows:

$$\log E^{YEB}_{b,2013} = \beta_0 + \beta_1 \log E^{ALI}_{b,2013} + X'_b\beta + \epsilon_b \tag{15}$$

$$\log E^{YEB}_{b,2013} = \beta_0 + \beta_1 \log HZDistance_{b,2013} + X'_b\beta + \epsilon_b \tag{16}$$

$$\log E^{YEB}_{b,2013} = \beta_0 + \beta_1 \log E^{ALI}_{b,2013} + \beta_2 \log HZDistance_{b,2013} + X'_b\beta + \epsilon_b \tag{17}$$

Panel A of Figure 7 plots city-level Yu'ebao penetration in December 2013 against Alipay penetration in May 2013. Past Alipay penetration ratios predict future Yu'ebao penetration: The higher Alipay

penetration prior to the introduction of Yu'ebao, the higher Yu'ebao penetration will be. In terms of the exclusion condition, payment technology per se does not compete with bank deposits: FinTech payment users still need to associated bank cards with their FinTech payment accounts in order to make payments, which should have no impact on (if any, it would be an increase) bank deposits.

Distance also matters for the diffusion of FinTech. Panel B of Figure 7 plots each city's FinTech payment penetration ratio against its geographical distance from Hangzhou city. The negative correlation between geographical distance and FinTech payment penetration points a clear direction for using the distance to Hangzhou as instrumental variable, since the location of FinTech company headquarter is relatively exogenous. The further away from the headquarter of the FinTech company, the lower the penetration ratio would be.

Table 2 shows the city level first stage regression results. Columns (1) and (2) show the first-stage regression results of using lagged Alipay penetration (May 2013 value) as an IV for Yu'ebao penetration (December 2013 value). We find that one unit increase in log Alipay penetration would lead to a significant 1.142 units 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-squareds from these regressions are 0.949 and 0.958, respectively. This shows that the initial expansion of Yu'ebao highly relies on the existing Alipay user base, rather than attracting non-users without Alipay accounts. It is the state-of-art FinTech payment technology that lays a solid foundation for the popularity of FinTech wealth management services.

Distance-to-Hangzhou is another statistically significant instrumental variable, but is much weaker than the lagged Alipay penetration instrument. Columns (3) and (4) show the first-stage regression results of 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. This shows that each city's geographical distance to Hangzhou is also a highly relevant instrument, although is 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 remain the same signs.

It is worth noting that the coefficient before $ln(city\_branchshare)$, log value of each city's share in the

national bank branch network, is significantly negative. This implies a strong complementarity between FinTech and traditional banking: Yu'ebao gains more popularity in cities with fewer bank branches, other things equal. FinTech helps meet the demand for financial services underserved by traditional brick-and-mortar bank branches.

Since the FinTech exposure of banks is merely a linear combination of city-level FinTech penetration ratios, the relationship between the exposures and the synthetic geographical distance to Hangzhou, remain unchanged. Table 3 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, we find that banks with greater exposure to Alipay have significantly higher exposure to Yu'ebao as shown in Columns (1) and (2). Similarly, backs with a greater distance to 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 in Columns (5) and (6).

The IV analogs to the OLS specifications for the city-level regression, (10), and the bank-level regression, (11), are as follows:

$$Y_c = \beta_0 + \beta_1 \log \hat{E^{YEB}}_{c,2013} + X_c'\beta + \epsilon_c \tag{18}$$

$$Y_b = \beta_0 + \beta_1 \log \hat{E^{YEB}}_{b,2013} + X_b'\beta + \epsilon_b \tag{19}$$

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 The Impact of FinTech Entry: Complements or Competitors?

In this section, we analyze the impact of the entry of FinTech competition on traditional banking activities. We start by looking at the fund flows from bank depositors into FinTech products, and then examine average growth rate of bank deposits between 2012-2014, covering periods both before and after the launch of Yu'ebao.

4.1 City-level Evidence

4.1.1 Deposit Flows into Yu'ebao

We focus on the cumulative deposit flows into Yu'ebao from June 2013 to May 2014, i.e., the first twelve months following the birth of Yu'ebao. We first focus exclusively on fund flows from bank deposits directly into Yu'ebao. In subsequent analyses we examine bank deposits.

The main specification regresses the cumulative deposit outflows in a city or bank to Yu'ebao on log Yu'ebao penetration (city-level data) or log Yu'ebao exposure (bank-level data) in December 2013. 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 or bank's branch network's distance to Hangzhou. We expect to see a significantly positive coefficient before the FinTech indicators; i.e., if a city or a bank is more exposed to FinTech competition, it will see larger deposit flows into the newly-introduced FinTech wealth-management products Yu'ebao.

We begin by running specification (10), the city-level regression, using fund flows as the outcome variable. Table 4 presents city-level cross-sectional regressions results. Column (1) shows the univariate baseline OLS results using the log value of 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 lead to the log deposit flows into Yu'ebao in the future to increase by 1.55 units.

However, these results may be an over- or under-estimation due to omitted variables; i.e., cities with larger Yu'ebao penetration may have other characteristics in common, such as higher GDP, which result in higher deposits and deposit outflows. In Column (2), we include city characteristics into the regression to control for factors that affect both FinTech user penetration and future fund flows into FinTech products. These characteristics include whether the city is a provincial capital (the $provincial\_capital$ indicator), city-level GDP (gdp), population (pop), and the share of the city's bank branches in the national bank branch network ($city\_bankshare$). We fix these values to the year-end value of 2012 and take log of the latter three characteristics. As shown in Column (2), controlling for these city characteristics does not affect the sign nor the statistical significance of the coefficients but reducing the economic magnitudes: in the regressions with controls, the magnitude of the coefficient drops to 0.994.

These results do 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 insignificant. 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 a severer financial repression, since a larger fraction of funding would have been kept in regulated deposit accounts prior to Yu'ebao. This also shows that Yu'ebao emerges 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 the reverse causality problem: cities with larger deposit flows into Yu'ebao consequently have a higher Yu'ebao penetration. We address this concern by using pre-Yu'ebao Alipay penetration as an instrumental variable as described in specification (18), again using Fund flows as the outcome variable and instrumenting for Yu'ebao exposure. Specifically, we fix the city-level Alipay penetration ratios 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 Yu'ebao, as a second IV. We show 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 is true both in the OLS setting as well as in the quasi-experimental setting using pre-Yu'ebao Alipay penetration and distance from Hangzhou as instruments.

4.1.2 Deposit Growth

After examining factors driving deposit flows into FinTech products, we move on to test the impact of FinTech competition on overall deposit growth as opposed to specifically flows from banks into Yu'ebao. Given the strong effect of FinTech on city-level deposit outflows, one might expect a significant drop in city-level deposit growth after the introduction of Yu'ebao. While the outcome variable for the previous section was deposit fund flows into Yu'ebao, our outcome variable here is overall deposits in the city.

Interestingly, we find no significant impact of FinTech competition on city-level deposit growth, as

shown in Table 5, which summarizes city-level regression results. The univariate OLS result in Column (1) shows a negative coefficient on FinTech penetration, but adding additional controls in Column (2) eliminates the effect. The IV results in Columns (3)-(5), with Alipay penetration, Hangzhou distance, or both, as instrumental variables, respectively, show similar patterns. We find that deposit growth is mainly driven by the initial deposit level, which demonstrates a strong pattern of mean reversion. Additionally, we find cities which are provincial capitals, cities with more traditional bank branches, or cities with higher income growth (proxied by GDP per capita growth) would all experience a higher deposit growth, keeping other things equal.

Thus, although we see strong evidence for deposit flows *into Yu'ebao*, this does not appear to lead, at first blush, to cross-sectional city level differences in total deposits in the banking system. These seemingly contradictory results highlight the need for a more nuanced analysis of deposit flows. In particular, while city-level deposits include both household deposits and firm deposits, as well as demand deposits and time deposits, Yu'ebao is the best substitute particularly for retail demand deposits: That is, it offers immediate liquidity though a platform oriented towards retail users. Because the breakdown of household versus firm, and time versus demand deposits is not available at the city level, this motivates our bank-level analysis, that we examine in the next section.

4.2 Bank-level Evidence

We now turn to a bank level analysis. This approach allows for a more detailed decomposition into types of deposits—household versus firm; demand versus time—which enables us to examine which types are more affected by FinTech entry. Additionally, we examine the impact on bank balance sheet measures of profitability and costs.

4.2.1 Deposit outflows from banks to Yu'ebao

Given the strong effect of FinTech on city-level deposit outflows, one would expect a similar result in bank-level data as well. Using the bank-level OLS and IV specifications given in specifications (11) and (19), respectively, we repeat the previous analysis at the bank level. Table 6 present bank-level cross-sectional regressions results. Again, the first two columns present the baseline regression results

using Yu'ebao exposure in December 2013, while the rest columns demonstrate IV results using Alipay exposure and distance-to-Hangzhou fixed in May 2013. Similar to the city-level results, we find in the univariate regressions that there are more deposit outflows from banks that are more exposed to the Yu'ebao shock.

Interestingly, we find no such significant impact of FinTech competition on bank-level deposit outflows when we add bank level controls. As shown in Column (2), when controlling for bank size variables, the relationship disappears, showing that the size of the deposit outflows is mainly driven by the size of the banks. The IV regression results are consistent with the baseline regression results with controls, indicating that the bank-level deposit outflows are proportional to the bank sizes. Intuitively, banks with more deposits will face more deposit outflows, given the same exposure to FinTech competition (the baseline results); but the distribution of deposit outflows is not much different from that of bank sizes (the size control results). That is, the FinTech competition does not have a significant impact on bank deposits relative to their sizes. Adding other bank-level characteristics, such as banks' market share (defined as the fraction in bank branch numbers nationwide), deposit-to-interest-bearing-liabilities ratio ($depositIBL$), and branch-weighted GDP per capita, does not change the results. These controls take the year-end value of 2012 and are not statistically significant. Therefore, Yu'ebao competition may not have an impact on banks' overall business and performance and the stability of the banking industry at large.

4.2.2 Bank Deposit Growth

We next examine bank deposit growth more broadly, as opposed to only flows from the bank into Yu'ebao. Table 7 shows results regressing banks' deposit growth rate between 2012-2014 on their exposure to FinTech competition. Consistent with bank-level deposit outflow analysis, we do not find significant impact on overall bank deposit growth. The mean-reversion pattern dominates all other channels, and the FinTech exposure variables are statistically insignificant in both baseline and IV regressions.

However, much stronger results emerge when considering the subcategories of deposits for which Yu'ebao is the best substitute: Household, as opposed to firm, deposits, and demand, as opposed to

time, deposits. Recall that due to data restrictions, this analysis was not possible at the county level, but is possible at the bank level. The sub-category regression results are summarized in Table 8. Indeed, we find the effects are significantly negative for bank-level household deposit growth, but insignificant for bank-level firm deposit growth, after the initial level and mean reversion channel are controlled. These results are strong and robust for both OLS and IV approaches.

Breaking down the categories of deposits further, Table 9 shows that we also find significant results on household demand deposit growth but not household time deposit growth. The negative impact of FinTech competition on household demand deposit growth are statistically significant, while those on household time deposit growth are not. These results are strong and robust for both OLS and IV approaches. These results further supports the FinTech competition channel: (1) FinTech creates a close substitutes to bank demand deposits, since $T + 0$ fast redemption feature is a major selling point of the FinTech product; (2) The competition between Yu'ebao and bank deposits lies in the retail depositors, rather than the wholesale or institutional clientele, since the low investment threshold and no cash-out fee features of Yu'ebao mainly appeal to retail investors.

4.2.3 Bank Balance Sheet

The previous analysis suggests that banks and cities lose deposits to Yu'ebao—particularly 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.[8]. We also look at cost-income ratio, which indicates banks' operating cost relative to its revenue.

We find no significant impact on bank NIM, suggesting that the deposit outflows did not significantly hamper banks' ability to engage in traditional spread lending. Most of the variation in NIM is absorbed by the initial values, i.e., the starting value in 2012, suggesting there is 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 showing FinTech competition would reduce

[8]There was a regulatory change in the reporting standard of commercial bank balance sheet 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 the regulatory change.

bank profits or threaten financial stability.

Interestingly, however, we find strong evidence that bank cost-to-income ratios increase significantly. This 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 particularly in terms of launching new products that directly compete with Yu'ebao and Yu'ebao-like products, however the results here suggest that FinTech entry may be inducing efficiency improvement by banks along many dimensions.

5 Banks' Response to FinTech Competition

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

5.1 Bank-distributed T+0 MMFs

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 money market funds with T+0 real-time redemption features offered by banks to their deposit customers, together with the identity of the offering banks and the dates at which 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 summarized in Table 11. Column (1) shows the baseline OLS result with control variables. We find that a one-standard-deviation increase in Yu'ebao exposure is associated with roughly a 10% greater likelihood of the bank introducing a *bao* product within the timeframe. Column (2) shows the first stage of the Alipay instrument on Yu'ebao exposure, finding, as before, a strong, positive relationship. Column (3) shows the reduced form result of regressing *bao* introduction on Alipay exposure, and finds a similarly large and statistically significant effect. Column (4) shows the full IV estimate, again 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, shown in columns (5)-(7). 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 equal, we find that those banks with a larger size or a greater reliance on deposits as funding source are also more likely to launch *bao*-type products. Interestingly, banks with more branches are less likely to keep up with the FinTech competition. There could be several explanations. One is the replacement cost: banks with more brick-and-mortar bank branches may find it more costly to introduce innovations that would attract fund flows away from bank deposits. The other is the clientele differentiation: banks with more brick-and-mortar branches may appeal to a clientele different 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

$$\lambda(t;X) = \lambda_0(t)\exp(\beta_0 + \beta_1 \log E^{YEB}_{b,2013} + X'_b\beta) \tag{20}$$

Where $\log E^{YEB}_{b,2013}$ is the bank's direct or instrumented exposure to Yu'ebao, and X'_b are bank level controls. As shown in column (1), (3) and (5) in Table 12, the coefficients derived from the hazard model is even larger than those in the OLS analysis, and the IV results are consistent with the baseline. In addition, we find supporting evidence that banks with larger size and fewer brick-and-mortar branches would be more likely to launch *bao* products.

Finally, as a placebo test, we examine interest rates on wealth-management products (WMPs) issued by banks. These products serve as a useful placebo because they often require minimum investments in excess of 50,000 yuan. For this reason, WMPs and FinTech products such as Yu'ebao target different clientele from one another; thus, if the channel for our findings comes through the competitive pressures that banks face from Yu'ebao competing with its household demand deposits business, we should find little effect on WMPs. As shown in Table 13, banks do not seem to change WMP yields according to their exposure to FinTech. 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 the interest rate liberalization reform in China.

6 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, the Alipay's money market fund that offered T+0 liquidity and transaction services, while not being subject to interest rate caps, had the effect of siphoning deposits out of the traditional banking system. In the cross-section, cities and banks with the greatest exposure to Yu'ebao faced significant deposit outflows. These findings are robust to several instrumental variables approaches that

address potential endogeneity concerns.

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 see 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 efficiency, for example, by pursuing their own financial innovation. Indeed, we find that the most exposed banks launched their own competing T+0 money market fund products, further undermining financial repression. At the same time, 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 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, as well as the indirect effect of banks introducing their own competing products due to competitive pressures. 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 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 several FinTech innovation, and 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.

Data Source and Variable Construction

FIGURE 1: USER AGREEMENT AND ANNOUNCEMENT DETAILS OF YU'EBAO

FIGURE 2: DEFINING BAO PRODUCTS THROUGH MMF ANNOUNCEMENTS

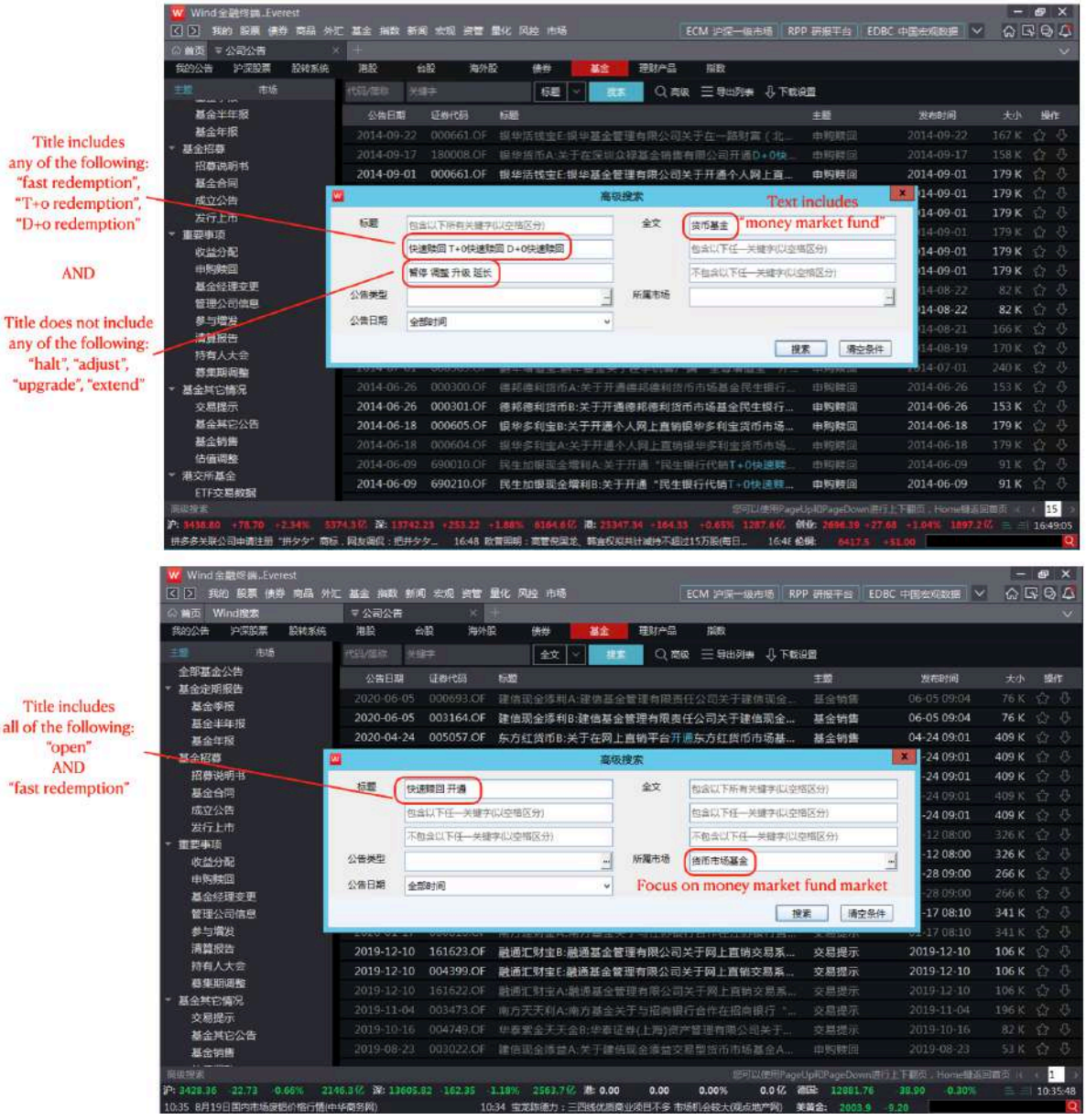


TABLE 1: VARIABLE DEFINITION AND DATA SOURCE

	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	
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 year-end value. RESSET.*
bank_lngdppc	*A bank's branch-weighted sum of lngdppc, 2012 year-end value. WIND, authors' calculation.*
bank_grgdppc	*A bank's branch-weighted sum of gr_gdppc_1214. WIND, authors' calculation.*
NIM	*Net interest margin, 2012 year-end value. A delta before it means the change between 2012-2014. RESSET.*
CostIncomeRatio	*Operating cost-to-income ratio, 2012 year-end value. RESSET.*
ratio_badloans	*Bad loan ratio, 2012 year-end value. RESSET.*
ratio_riskyassets	*Risky assets divided by total assets, 2012 year-end value. RESSET.*

References

Boot, A. W. (2017). The future of banking: From scale & scope economies to fintech 29. *European Economy* (2), 77–95.

Buchak, G., G. Matvos, T. Piskorski, and A. Seru (2018a). Beyond the balance sheet model of banking: Implications for bank regulation and monetary policy. Technical report, National Bureau of Economic Research.

Buchak, G., G. Matvos, T. Piskorski, and A. Seru (2018b). Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics 130*(3), 453–483.

Claessens, S., J. Frost, G. Turner, and F. Zhu (2018). Fintech credit markets around the world: size, drivers and policy issues. *BIS Quarterly Review September*.

Gennaioli, N., A. Shleifer, and R. W. Vishny (2013). A model of shadow banking. *The Journal of Finance 68*(4), 1331–1363.

Goldstein, I., W. Jiang, and G. A. Karolyi (2019). To fintech and beyond. *The Review of Financial Studies 32*(5), 1647–1661.

Jack, W. and T. Suri (2014). Risk sharing and transactions costs: Evidence from kenya's mobile money revolution. *American Economic Review 104*(1), 183–223.

Jiang, E., G. Matvos, T. Piskorski, and A. Seru (2020). Banking without deposits: Evidence from shadow bank call reports. Technical report, National Bureau of Economic Research.

Ma, Y., K. Xiao, and Y. Zeng (2020). Mutual fund liquidity transformation and reverse flight to liquidity. *Available at SSRN 3640861*.

McKinnon, R. et al. (1973). Money and capital in economic development.

Moreira, A. and A. Savov (2017). The macroeconomics of shadow banking. *The Journal of Finance 72*(6), 2381–2432.

Navaretti, G. B., G. Calzolari, J. M. Mansilla-Fernandez, and A. F. Pozzolo (2018). Fintech and banking. friends or foes? *Friends or Foes*.

Parlour, C. A., U. Rajan, and H. Zhu (2020). When fintech competes for payment flows. *Available at SSRN*.

Philippon, T. (2016). The fintech opportunity. Technical report, National Bureau of Economic Research.

Shaw, E. S. (1973). Financial deepening in economic development.

Tang, H. (2019). Peer-to-peer lenders versus banks: substitutes or complements? *The Review of Financial Studies 32*(5), 1900–1938.

Thakor, A. V. (2020). Fintech and banking: What do we know? *Journal of Financial Intermediation 41*, 100833.

Vallee, B. and Y. Zeng (2019). Marketplace lending: A new banking paradigm? *The Review of Financial Studies 32*(5), 1939–1982.

Xiao, K. (2020). Monetary transmission through shadow banks. *The Review of Financial Studies 33*(6), 2379–2420.

Zhang, A. T. Estimation of high-dimensional dynamic games: Fintech lenders and bank branch closures.

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).

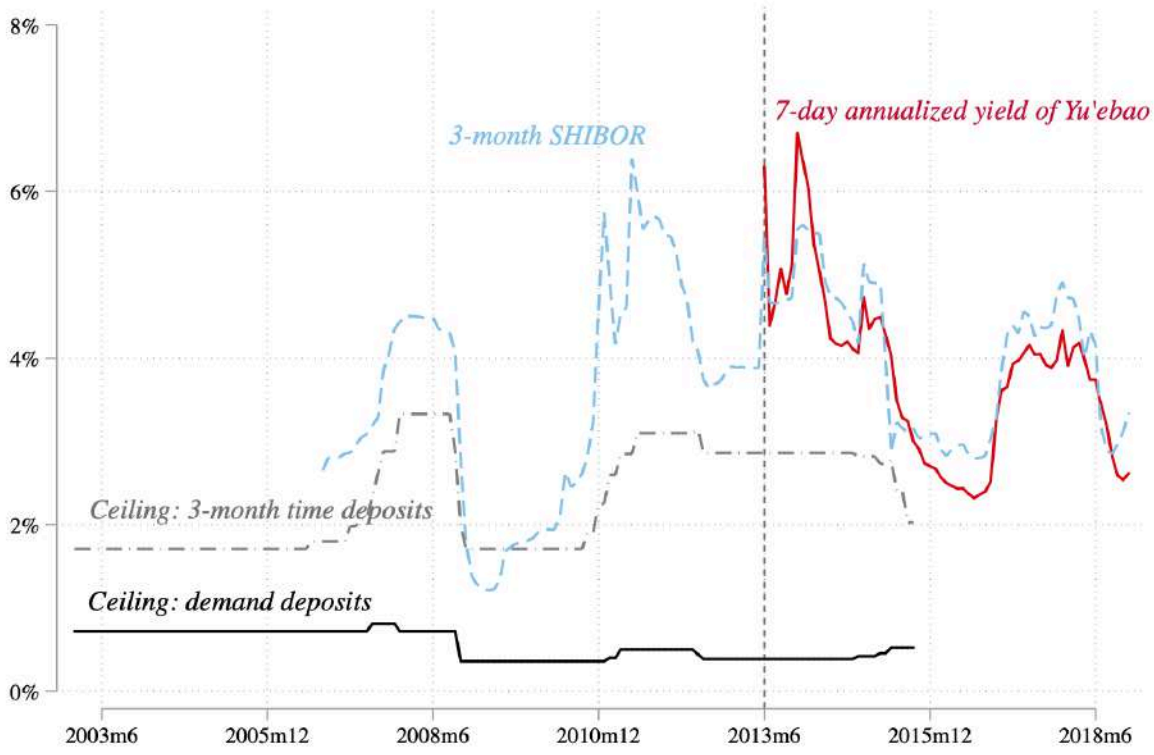


FIGURE 2: BANK BRANCH CONCENTRATION

Note: This figure shows the concentration of bank branches versus bank market share as of May 2013. 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. The figure shows that the banks with the greatest market share have the most diverse branch network, meaning that are not dominated by only a few branches.

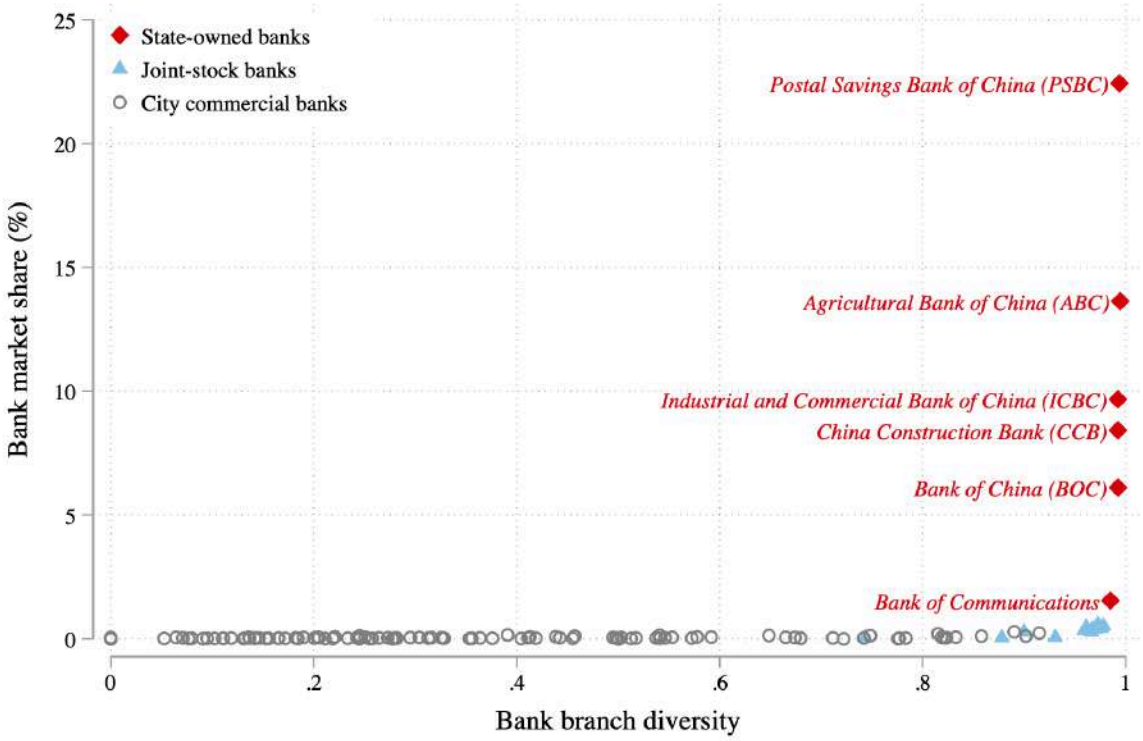


FIGURE 3: MONEY MARKET FUND INDUSTRY IN CHINA

Note: This figure shows the absolute and relative size (compared to bank deposits) of the money-market fund (MMF) industry. The red bars show the absolute size (right 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).

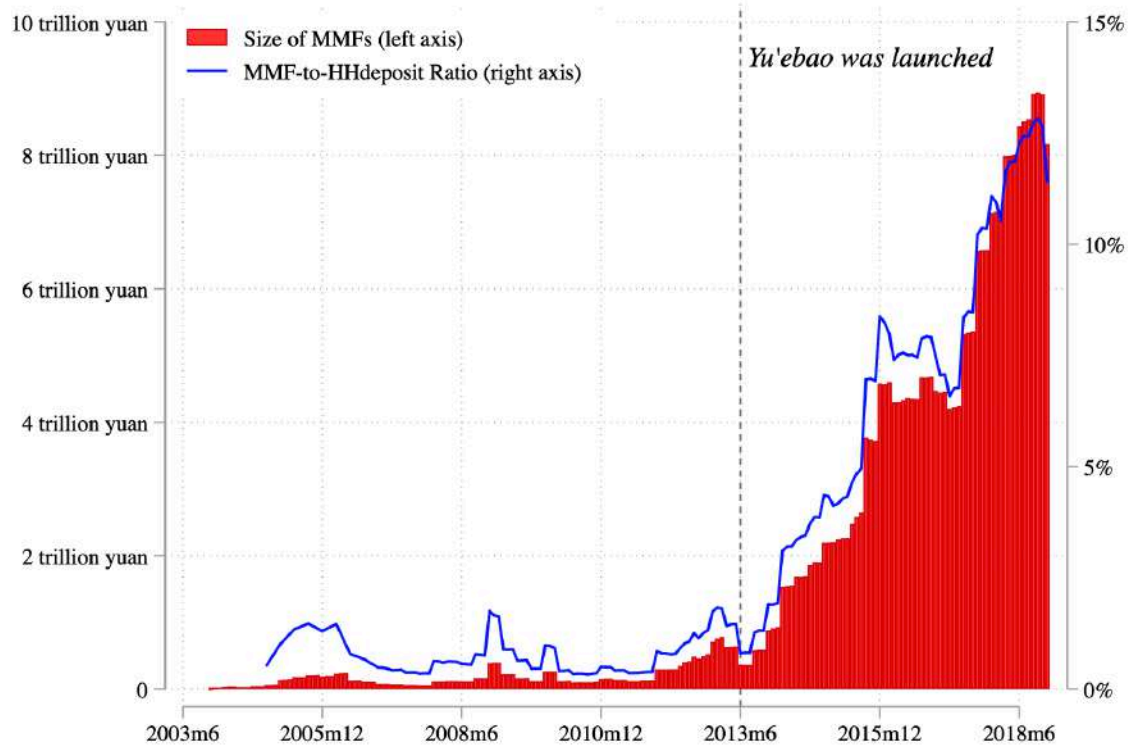
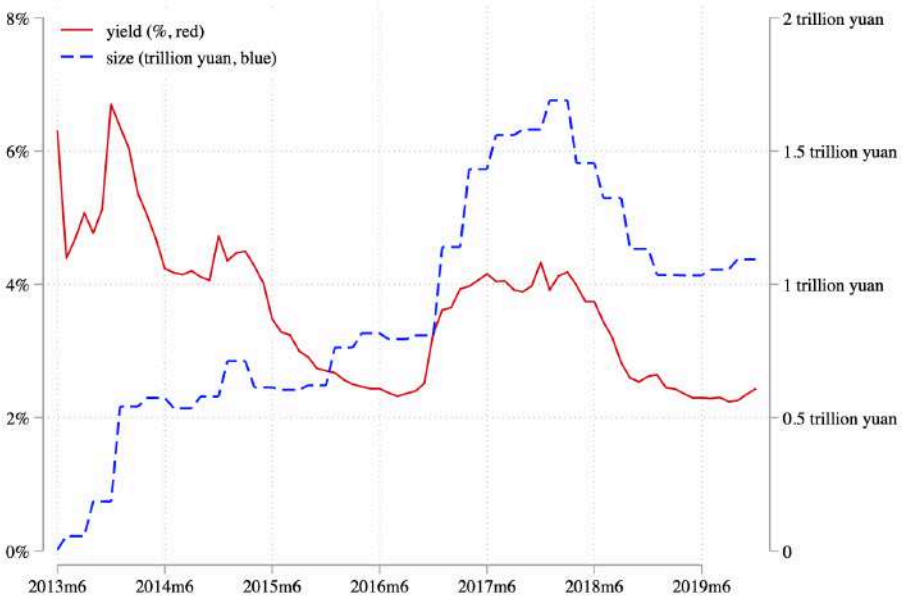


FIGURE 4: YU'EBAO AS FINTECH INNOVATION

Note: The top panel shows a screenshot of a Yu'ebao balance in the Alipay app. The bottom panel shows the average yield on Yu'ebao (red, left axis) and the assets under management, (blue, right axis).

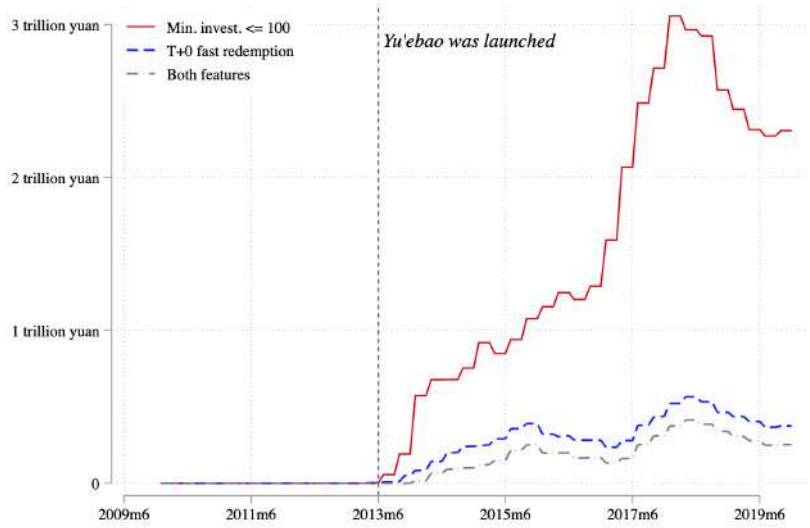
(A) USER INTERFACE OF YU'EBAO (EXAMPLE)



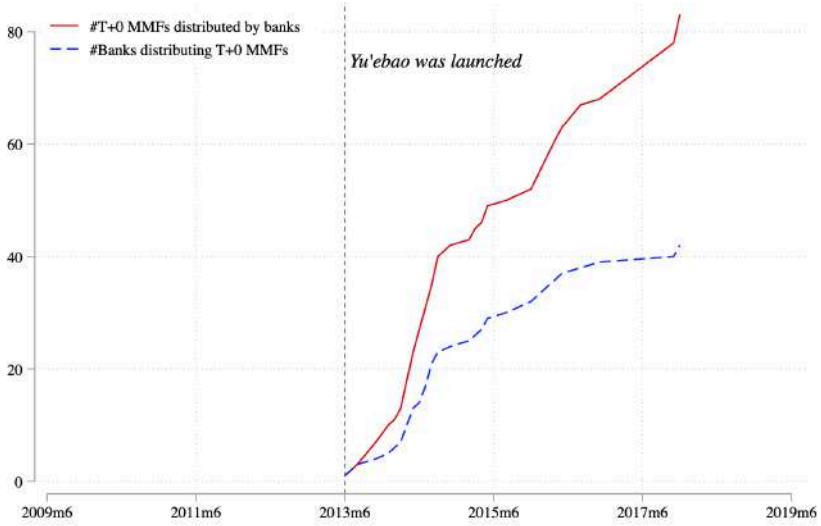
(B) YIELD AND SIZE OF YU'EBAO, 2013-2019

FIGURE 5: STRUCTURAL CHANGE IN THE MMF INDUSTRY

Note: This figure shows the structural change in the Chinese MMF industry around the time of Yu'ebao's introduction, indicated by the dashed verticle gray line. The upper panel shows the size of bank-distributed MMFs with a minimum investment no more than 100 yuan, those with $T + 0$ fast redemption, and those with both features.The lower panel 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) SIZE OF BANK-DISTRIBUTED MMFS



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

FIGURE 6: 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.

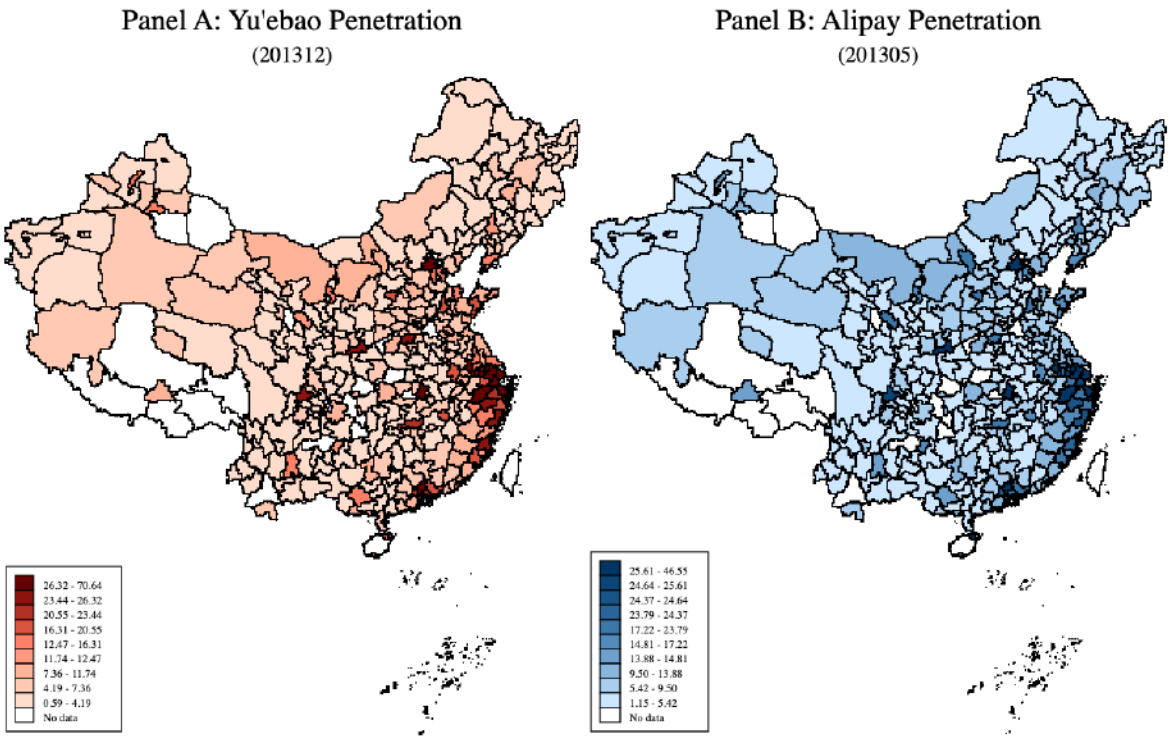


FIGURE 7: CITY-LEVEL FIRST STAGE

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.

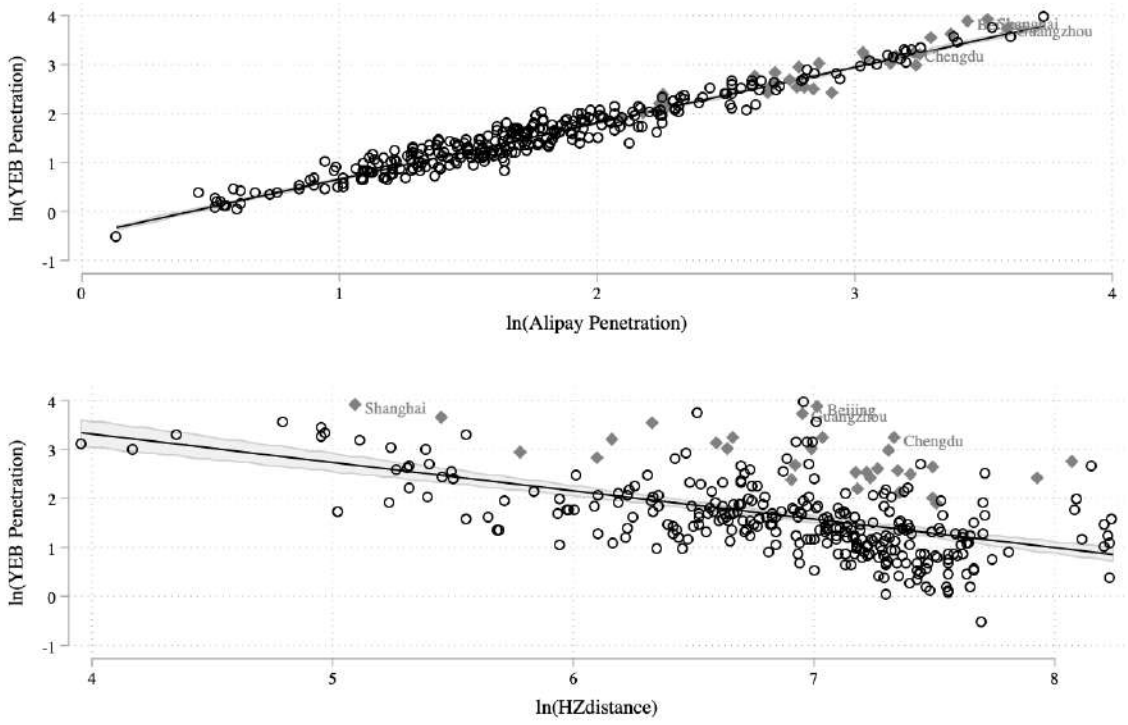
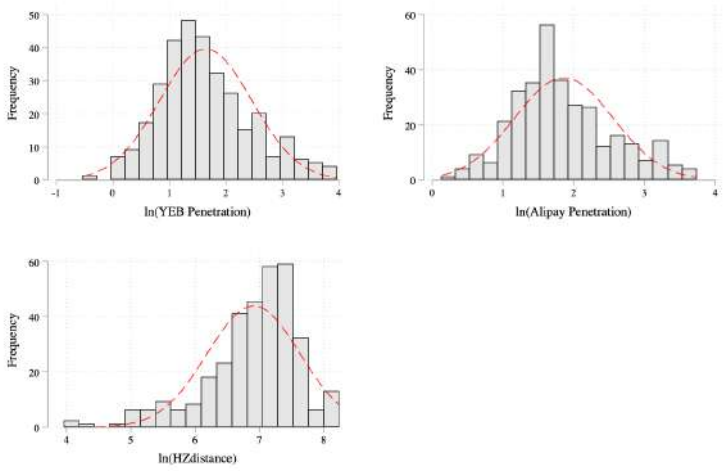


FIGURE 8: DISTRIBUTION OF KEY FINTECH VARIABLES

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, repsectively. A bank's weighted distance to Hangzhou, $Bank\_lnHZdistance$ (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

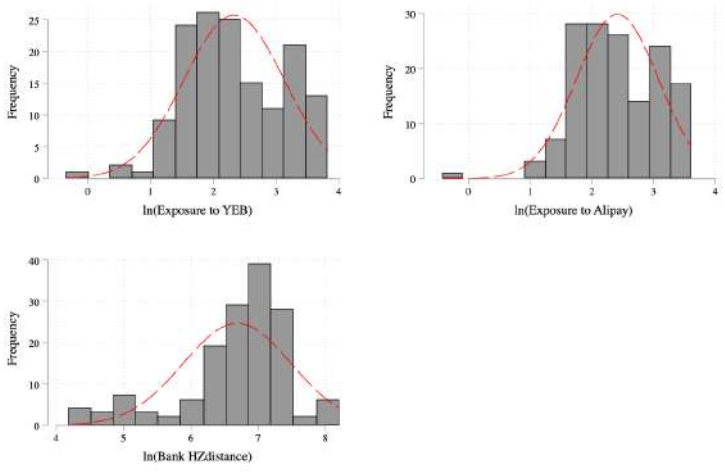
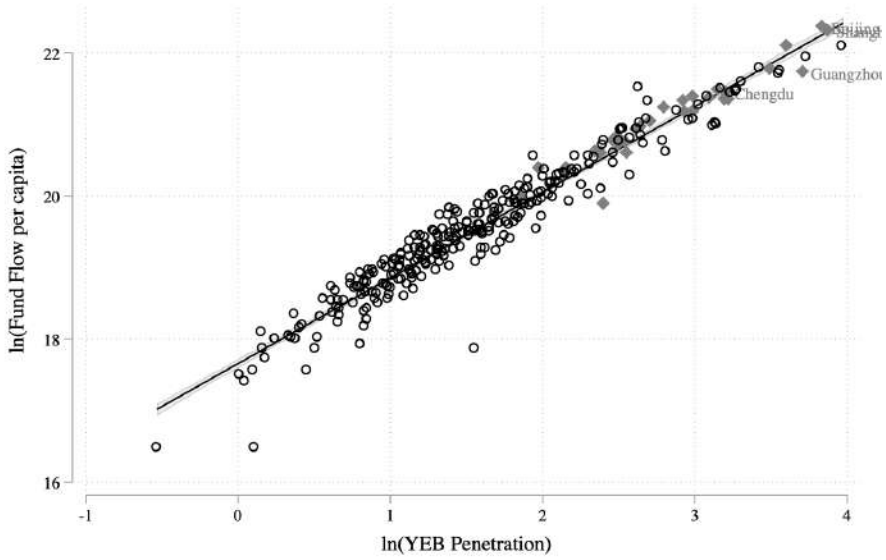
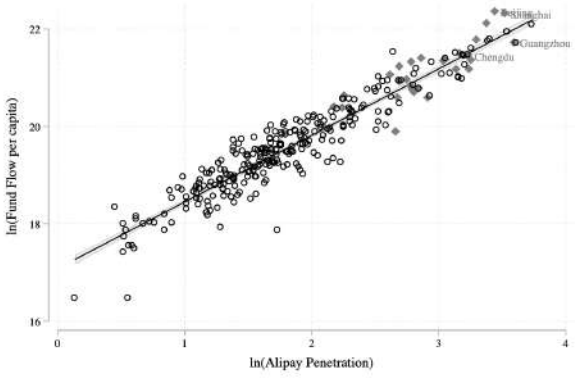


FIGURE 9: CITY-LEVEL FINTECH PENETRATION AND DEPOSIT OUTFLOWS PER CAPITA

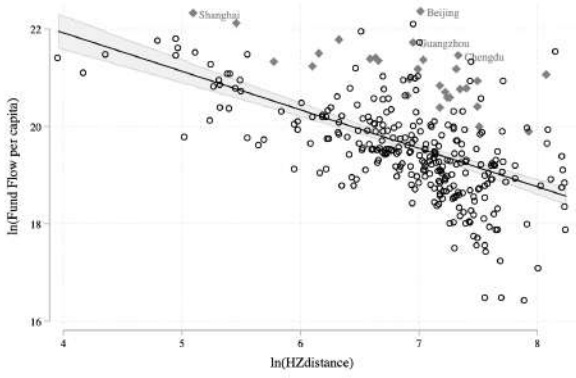
Note: This figure shows the relationship between Yu'ebao fund flows and Ye'ebao penetration. Panel (A) shows the direct relationship between log fund flows per capita and Ye'ebao adoption. Panel (B) shows the relationship between log fund flows per capita and the first instrument, pre-Yu'ebao Alipay 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

FIGURE 10: PROBABILITY OF BANK OFFERING *bao* PRODUCTS

Note: This figure demonstrate the predicted probability of whether a bank would start distributing T+0 MMFs similar to Yu'ebao (*bao* products) using a probit model.

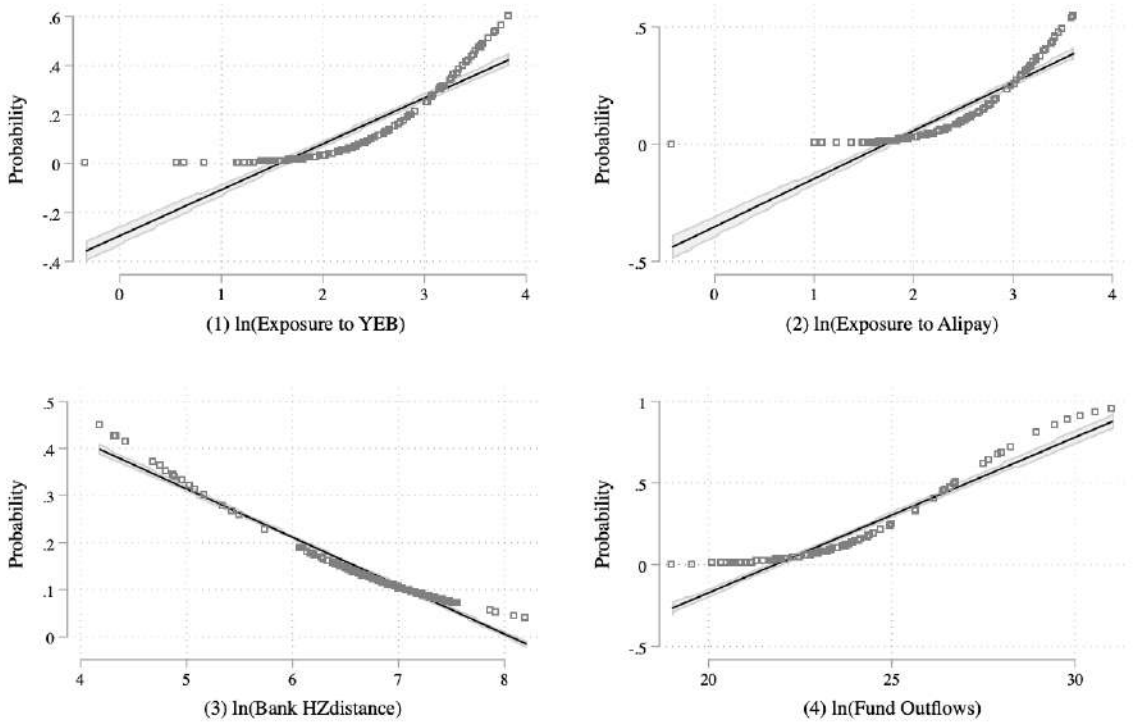


TABLE 1: SUMMARY STATISTICS

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: CITY-LEVEL FIRST-STAGE REGRESSIONS

Note: Column 1-2 show the first-stage regression results of using lagged Alipay penetration (May 2013 value) as IV for Yu'ebao penetration (December 2013 value), Column 3-4 show the first-stage regression results of using distance-to-Hangzhou as IV for Yu'ebao penetration (December 2013 value), and column 5-6 use both IVs. Results without and with controls are shown in odd and even columns, respectively. City-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.

	ln(penetration_YEB) *(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)
_cons	-0.483***	-1.183***	5.629***	3.065***	0.275**	-0.506*
	(0.028)	(0.258)	(0.347)	(0.707)	(0.126)	(0.277)
N	324	303	324	303	324	303
R^2	0.949	0.958	0.259	0.786	0.955	0.961
adj. R^2	0.949	0.957	0.256	0.783	0.955	0.960
F	6860.106	1626.136	128.343	288.395	3319.598	1300.489

TABLE 3: BANK-LEVEL FIRST-STAGE REGRESSIONS

Note: Column 1-2 show the first-stage regression results of using lagged Alipay exposure (May 2013 value) as IV for Yu'ebao exposure (December 2013 value), Column 3-4 show the first-stage regression results of using lagged synthetic distance-to-Hangzhou (May 2013 value) as IV for Yu'ebao exposure (December 2013 value), and column 5-6 use both IVs. Results without and with controls are shown in odd and even columns, respectively. 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.

	ln(exposureYEB) *(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)
_cons	-0.475***	-0.947***	6.454***	3.246***	0.332	0.147
	(0.090)	(0.178)	(0.374)	(0.594)	(0.222)	(0.292)
N	148	133	148	133	148	133
R^2	0.946	0.957	0.387	0.800	0.953	0.966
F	1164.072	674.289	116.433	154.981	743.370	716.771

TABLE 4: CITY-LEVEL FUNDS INTO YUEBAO, 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_fundflow *(June 2013-May 2014)*				
	(1) *Baseline w/o controls*	(2) *Baseline w/ controls*	(3) *IV Alipay*	(4) *IV HZdistance*	(5) *IV 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)
_cons	22.813***	18.419***	18.436***	18.299***	18.427***
	(0.123)	(0.499)	(0.496)	(0.554)	(0.499)
N	323	302	302	302	302
R^2	0.682	0.980	0.980	0.979	0.980
adj. R^2	0.681	0.980	0.980	0.979	0.980
F	581.869	2111.139			

TABLE 5: GROWTH IN OVERALL DEPOSITS BY CITY

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_grdepositpc *(December 2012 - December 2014)*				
	(1) *Baseline w/o controls*	(2) *Baseline w/ controls*	(3) *IV Alipay*	(4) *IV HZdistance*	(5) *IV Both*
ln(penetration_YEB)	-1.335***	0.227	-0.740	-1.005	-0.773
(December 2013 value)	(0.251)	(0.586)	(0.681)	(0.994)	(0.651)
ln(depositpc)		-3.801***	-2.958***	-2.727**	-2.929***
(December 2012 value)		(0.817)	(0.833)	(1.077)	(0.819)
provincial_capital		2.829***	2.621***	2.564***	2.614***
		(0.861)	(0.830)	(0.844)	(0.829)
ln(city_branchshare)		2.548***	2.523***	2.516***	2.522***
(December 2012 value)		(0.642)	(0.637)	(0.642)	(0.638)
lngdp		0.016	0.334	0.421	0.345
(December 2012 value)		(0.792)	(0.815)	(0.850)	(0.813)
lnpop		-2.200**	-2.241**	-2.252**	-2.243**
(December 2012 value)		(0.922)	(0.908)	(0.911)	(0.908)
grgdppc		0.226***	0.262***	0.272***	0.263***
(December 2012 - December 2014)		(0.059)	(0.061)	(0.067)	(0.060)
_cons	16.503***	32.893***	31.190***	30.723***	31.131***
	(0.495)	(5.009)	(5.060)	(5.212)	(5.047)
N	252	252	252	252	252
R^2	0.094	0.353	0.344	0.339	0.344
adj. R^2	0.091	0.335	0.325	0.320	0.325
F	28.330	17.587			

TABLE 6: BANK LEVEL FUNDS INTO YUEBAO, JUNE 2013 - MAY 2014

Note: Column 1-2 show 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 regression results using synthetic 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.

	bank_fundflow *(June 2013-May 2014)*				
	(1) *Baseline w/o controls*	(2) *Baseline w/ controls*	(3) *IV Alipay*	(4) *IV HZdistance*	(5) *IV Both*
ln(exposureYEB)	1.457***	0.131	0.061	0.147	0.073
(December 2013 value)	(0.229)	(0.177)	(0.176)	(0.290)	(0.176)
lnsize		1.272***	1.285***	1.269***	1.282***
(December 2012 value)		(0.070)	(0.066)	(0.081)	(0.067)
bank_branchshare		4.869	4.615	4.926	4.658
(December 2012 value)		(3.461)	(3.296)	(3.522)	(3.313)
depositIBL		0.013	0.013	0.013*	0.013
(December 2012 value)		(0.009)	(0.008)	(0.008)	(0.008)
bank_lngdppc		0.090	0.137	0.080	0.129
(December 2012 value)		(0.280)	(0.277)	(0.316)	(0.277)
_cons	20.045***	1.352	1.304	1.362	1.312
	(0.499)	(1.443)	(1.398)	(1.443)	(1.403)
N	117	110	110	110	110
R^2	0.197	0.857	0.857	0.857	0.857
adj. R^2	0.190	0.850	0.850	0.850	0.850

TABLE 7: BANK LEVEL GROWTH IN OVERALL DEPOSITS

Note: This table shows the results for deposit growth versus Yu'ebao exposure. Column (1) shows the results of the baseline regressions with controls; Columns (2), (3), and (4) show the IV regressions with Alipay exposure, Hangzhou distance, and both Alipay and Hangzhou distance as instruments, respectively. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	bank_grdeposit *(December 2012 - December 2014)*				
	(1) *Baseline w/o controls*	(2) *Baseline w/ controls*	(3) *IV Alipay*	(4) *IV HZdistance*	(5) *IV Both*
ln(exposureYEB)	-1.721	0.208	-0.536	2.673	-0.019
(December 2013 value)	(1.522)	(1.797)	(1.847)	(2.754)	(1.877)
ln(bank_deposit)		-3.580***	-3.456***	-3.991***	-3.542***
(December 2012 value)		(1.060)	(1.052)	(1.075)	(1.048)
ln(bank_branchshare)		69.218*	66.919*	76.830**	68.517*
(December 2012 value)		(39.727)	(39.153)	(39.109)	(39.056)
depositIBL		-0.272**	-0.282**	-0.240**	-0.275**
(December 2012 value)		(0.113)	(0.112)	(0.112)	(0.112)
bank_lngdppc		-2.457	-1.919	-4.237	-2.292
(December 2012 value)		(2.665)	(2.430)	(2.618)	(2.396)
bank_grgdppc		25.591	28.516	15.904	26.483
(December 2012 value)		(28.316)	(26.352)	(29.076)	(26.621)
_cons	21.914***	97.852***	97.437***	99.228***	97.725***
	(3.738)	(23.940)	(23.548)	(22.314)	(23.341)
N	135	132	132	132	132
R^2	0.014	0.237	0.237	0.228	0.237
adj. R^2	0.007	0.201	0.200	0.191	0.201
F	1.279	8.979			

TABLE 8: 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

	Bank Deposit Growth 2012-2014							
	Household deposit growth				Firm deposit growth			
	(1) *Baseline w/ controls*	(2) *IV Alipay*	(3) *IV HZdistance*	(4) *IV Both*	(5) *Baseline w/ controls*	(6) *IV Alipay*	(7) *IV HZdistance*	(8) *IV 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)
_cons	66.077**	62.884***	63.438***	62.967***	50.535**	50.439***	58.587***	51.672***
	(25.079)	(23.510)	(23.954)	(23.265)	(20.413)	(18.357)	(19.211)	(18.299)
N	40	40	40	40	40	40	40	40
R^2	0.449	0.447	0.448	0.447	0.453	0.453	0.433	0.453
adj. R^2	0.329	0.326	0.327	0.326	0.333	0.333	0.310	0.333
F	16.514				15.527			

TABLE 9: 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 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

	Bank Deposit Growth 2012-2014							
	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)
_cons	16.147	10.669	25.343	13.786	134.961***	134.943***	134.793***	134.919***
	(43.790)	(38.145)	(39.389)	(38.160)	(48.962)	(43.392)	(48.873)	(44.226)
N	37	37	37	37	38	38	38	38
R^2	0.332	0.329	0.324	0.331	0.432	0.432	0.401	0.430
adj. R^2	0.141	0.137	0.130	0.140	0.275	0.275	0.235	0.273
F	2.121				8.476			

TABLE 10: FINTECH EXPOSURE AND BANK BALANCE SHEET

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. 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 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)
_cons	1.729**	1.698**	1.737**	1.704**	18.291***	18.726***	17.681***	18.569***
	(0.738)	(0.723)	(0.721)	(0.723)	(4.820)	(4.644)	(4.420)	(4.594)
N	125	125	125	125	131	131	131	131
R^2	0.279	0.277	0.279	0.278	0.731	0.730	0.730	0.731
adj. R^2	0.236	0.234	0.236	0.235	0.716	0.715	0.715	0.715

TABLE 11: PROBABILITY OF BANKS DISTRIBUTING *bao* PRODUCTS: LINEAR MODELS

Note: This table shows the results for banks' probabilities of distributing bao products (Yu'ebao-like MMFs) versus their exposure to Yu'ebao. *Bao* is an indicator variable for whether the bank introduces the product. Column (1) shows the OLS analysis. Column (2) shows the first stage regression of bank Yu'ebao exposure on Bank Alipay exposure. Column (3) shows the reduced form regression of product introduction on Alipay exposure. Column (4) shows the IV result. Columns (5)-(7) show the analogous reduced first stage, reduced form, and IV results using Hangzhou distance as the instrument. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	Dependent variable:						
	observed	exposureYEB	Bao		exposureYEB	Bao	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
exposureYEB	0.011***						
	(0.004)						
exposureAlipay		1.242***	0.012**				
		(0.034)	(0.005)				
bank_lnHZdistance					−6.770***	−0.067*	
					(0.618)	(0.037)	
exposureYEB (IV)				0.010**			0.010*
				(0.004)			(0.005)
lnsize	0.166***	0.333**	0.172***	0.169***	1.453***	0.182***	0.168***
	(0.024)	(0.164)	(0.024)	(0.024)	(0.392)	(0.023)	(0.025)
ln(bank_branchshare)	−2.845**	−8.648	−2.984**	−2.901**	−34.944	−3.235**	−2.890**
	(1.405)	(9.756)	(1.414)	(1.407)	(23.867)	(1.422)	(1.420)
depositIBL	0.005**	0.002	0.005*	0.005*	−0.224***	0.003	0.005*
	(0.003)	(0.018)	(0.003)	(0.003)	(0.041)	(0.002)	(0.003)
bank_lngdppc	−0.052	−1.121**	−0.052	−0.041	6.907***	0.025	−0.043
	(0.071)	(0.515)	(0.075)	(0.072)	(1.080)	(0.064)	(0.079)
Constant	−2.914***	−6.986**	−2.999***	−2.932***	43.615***	−2.498***	−2.928***
	(0.485)	(3.358)	(0.487)	(0.486)	(9.881)	(0.589)	(0.489)
Observations	133	133	133	133	133	133	133
R^2	0.471	0.960	0.462	0.470	0.761	0.450	0.470
Adjusted R^2	0.450	0.959	0.440	0.449	0.752	0.429	0.450
Residual SE (df = 127)	0.315	2.190	0.317	0.315	5.386	0.321	0.315

TABLE 12: PROBABILITY OF DISTRIBUTING *bao* PRODUCTS: HAZARD MODEL

Note: This table shows the results for banks' probabilities of distributing bao products (Yu'ebao-like MMFs) versus their exposure to Yu'ebao using a hazard model on the time interval from Yu'ebao's introduction to Banks' (possible) launch of bao products. Column (1) uses exposure to Yu'ebao directly; (2) is the "reduced form" using exposure to Alipay; (3) uses predicted Yu'ebao exposure based on Alipay exposure. Columns (4)-(5) are the analogous "reduced form" and "instrumnted" results using Hangzhou distance to predict Yu'ebao exposure. We use * for p<0.10, ** for p<0.05, and *** for p<0.010

	Dependent variable:				
	Time to introduce *bao*				
	(1)	(2)	(3)	(4)	(5)
ln(exposureYEB)	0.058**				
	(0.025)				
ln(exposureAlipay)		0.083**			
		(0.037)			
ln($\hat{exposureYEB_1}$)			0.068**		
			(0.031)		
ln(HZdistance)				−0.479*	
				(0.260)	
ln($\hat{exposureYEB_2}$)					0.055*
					(0.030)
lnsize	0.908***	0.936***	0.936***	0.968***	0.968***
	(0.147)	(0.144)	(0.144)	(0.145)	(0.145)
ln(bank_branchshare)	−17.944**	−18.725**	−18.725**	−19.418**	−19.418**
	(8.315)	(8.301)	(8.301)	(8.599)	(8.599)
depositIBL	0.012	0.013	0.013	−0.005	−0.005
	(0.021)	(0.021)	(0.021)	(0.019)	(0.019)
bank_lngdppc	−0.352	−0.466	−0.466	0.267	0.267
	(0.690)	(0.725)	(0.725)	(0.619)	(0.619)
Observations	133	133	133	133	133
R^2	0.430	0.429	0.429	0.420	0.420
Max. Possible R^2	0.892	0.892	0.892	0.892	0.892
Log Likelihood	−110.477	−110.489	−110.489	−111.569	−111.569
Wald Test (df = 5)	63.970***	61.720***	61.720***	60.900***	60.900***
LR Test (df = 5)	74.649***	74.626***	74.626***	72.465***	72.465***
Score (Logrank) Test (df = 5)	98.234***	95.608***	95.608***	93.491***	93.491***

TABLE 13: PLACEBO - 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	*Baseline*	*Baseline*	*IV*	*IV*	*IV*
	w/o controls	*w/ controls*	*w/ controls*	*Alipay*	*HZdistance*	*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
R^2	0.001	0.515	0.542	0.540	0.541	0.540
adj. R^2	-0.013	0.501	0.490	0.488	0.489	0.488