The Risk of Implicit Guarantees: Evidence from Shadow Banks in China*

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Abstract

Although implicit guarantees are widely used in the shadow banking system, we know very little about its qualitative and quantitative properties. In this paper, we use a micro-level data set on China's shadow bank products to quantify the risk of implicit guarantees. We find a robust empirical fact that a bank extends stronger implicit guarantees to its shadow bank debt (i.e., wealth management products) when its reputation deteriorates. A simple model based on a stylized signaling game is proposed to rationalize the fact. The key mechanism of the model is that as a bank's reputation becomes worse, it has stronger incentives to send positive signals to the market, i.e., to boost the realized returns of its shadow bank debt, although it is not obliged to do so. Our findings imply that riskier banks should have higher risk-weight for their off-balance-sheet exposure because they are more tempted to offer implicit guarantees and take losses for its off-balance-sheet operations.

Keywords: Implicit Guarantee, Shadow Banking, Off-Balance-Sheet Financing, Wealth Management Product

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1 Introduction

Shadow banking has not yet stopped haunting economies in the world, a decade ago in the U.S. and now in China. The primary concern over shadow banking is that risks and potential losses that originate from the loosely regulated sector can spread to the traditional banking sector and jeopardize the growth of the entire economy. Implicit guarantees, a very common practice in the financial market, establish a crucial risk transmission channel from the shadow banking sector to its traditional counterpart. In the 2007-09 financial crisis, we have observed many examples of implicit guarantees.[1] Major banks such as Goldman Sachs, HSBC, and Citigroup volunteered to save their internal hedge funds and structured investment vehicles in trouble. 44 money market mutual funds received supports from their sponsors to avoid "breaking the buck". The most striking example is that Bear Stearns voluntarily bailed out two of its internal hedge funds 9 months before its own failure in 2008.

The risk associated with implicit guarantees is an important concern for bank regulators. The clear understanding of the risk transmission mechanism is critical for the design of the risk-weight that commercial banks are supposed to have for their shadow banking risk exposures. Given the importance of implicit guarantees, we are still lack of research that can quantify implicit guarantees and/or outline the underlying driving forces of the strength of implicit guarantees. Our paper intends to fill in this gap by analyzing a unique data set from a fast-growing shadow banking sector in China.

The Chinese shadow banking sector has been expanding aggressively for two reasons: *i*) a large scale of credit demand due to the enormous amount of public and private investments and *ii*) tight bank regulation that constrains the supply of bank credit. Wealth management products (WMPs) issued by commercial banks in China play a critical role in the shadow banking sector. By the end of 2017, the outstanding amount of all WMPs is 5 trillion USD, which is about 14 percent of the total liability of the entire banking sector and far exceeds the total outstanding of asset-backed commercial papers (ABCPs) in the U.S. at its peak around 2008.

WMPs are the off-balance-sheet counterparts of time deposits with two major differences. First, the issuance and pricing of WMPs are less regulated. The second difference is about timing and the type of guarantees. Deposit rates are fixed in the beginning, and the returns are explicitly guaranteed by banks on due dates. In the case of a WMP, however, its issuing bank only indicates a promised return on the issuance date. The return that investors actually earn is subject to the bank's discretion on the expiration date. It is the reputational concern that drives banks to pay high returns to their expiring WMPs' investors, who may actually leave. This is exactly the implicit guarantee in the context of WMPs. The feature of promised return being implicitly guaranteed makes the sample of WMPs ideal for the empirical study of the subject because the provision of implicit supports is more frequent for WMPs than for fixed income assets like securitized products.

The key empirical finding of this paper is that weaker banks extend stronger implicit guarantees. The alternative interpretation of this finding is that as the financial health or reputation of a bank deteriorates, it voluntarily chooses to load more risk from its off-balance-sheet operations. We have three pieces of evidence supporting this finding: two direct evidences that are based on the realized and promised returns of WMPs and indirect evidence that replies on the pricing of WMPs.

Our first empirical test employs the default of the trust product that a bank distributes as a pure reputational shock to the bank. We find that banks pay significantly higher returns to the investors of

[1] See Duffie (2010) and McCabe (2010) for further details of examples mentioned below.

WMPs that matures right after the default events. The trust default is a pure reputational shock to banks for the following reason. Trust products are arranged by trust companies, which often employ the branches of commercial banks as the distributing channels of the trust products. Hence, the failure of a trust product does not affect the distributing bank's fundamental. However, retail customers still blame the bank for advertising low quality investment products.

Our second test, which goes beyond the pure reputational shock, examines the effects of the variation in a bank's default risk on the strength of its implicit guarantees. The result shows that if a WMP matures at the moment when the issuing bank's default risk rises, the bank would volunteer to deliver a higher realized return. In other words, when the market believes that the bank is more likely to default, the bank becomes more inclined to pay the promised return of its expiring WMP although it has no legal obligation and it knows that the WMP investors may leave immediately. We measure a bank's default risk on its WMP's maturity date with the yield of the 3-month interbank certificate of deposit (CD) that it issues at the same time. The yield of the interbank CD can captures the market's belief of the bank's default risk in the near future. It is obvious that the interbank CD issuance and the payment of an expiring WMP are two decisions that a bank makes simultaneously. Due to the endogeneity concern, we instrument the yield of the interbank CD that is linked to a WMP with the yield of the interbank CD that the same bank issues on the issuance date of the WMP. The idea is that given the WMP's outstanding promised return, any innovation in the WMP's realized return should be unrelated to information available up to the issuance date.

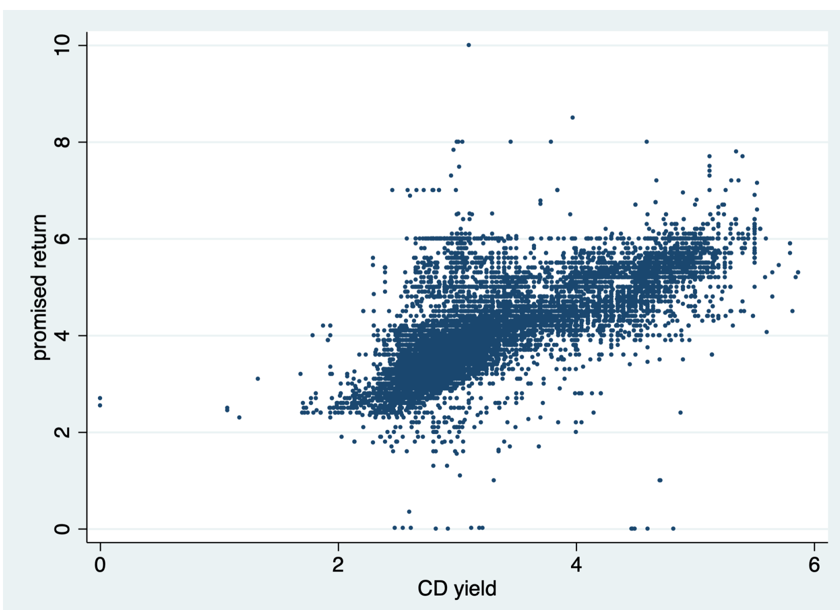
The indirect evidence is based on the interbank WMP-CD spread, which we interpret as the risk premium of implicit guarantee. Similar to the direct evidence, we find that if the interbank CD yield of a bank increases, the risk premium of implicit guarantee risk. The alternative interpretation is that as the default risk of a bank declines the risks of its on-balance-sheet and off-balance-sheet debt tend to converge. To calculate the premium, we construct a sample in which we pair each interbank WMP with an interbank CD issued by the same bank that has almost the same starting and maturity dates. There are four main reasons why our data set is ideal for the study the risk premium of implicit guarantees. First, the issuance, trading, and holding of interbank CDs face the lest regulatory restrictions among all on-balance-sheet items, which makes them similar to WMPs in the regard of regulation. Second, the pricing of interbank CDs is fully market-based. Hence, its pricing information is the most ideal proxy for the default risk of a bank. Third, interbank WMPs and CDs share the same group of investors, who are supposed to be the most sophisticated and rational in the market. Lastly, although WMPs are off-balance-sheet, their underlying assets are still difficult to identify even for bank regulators and not entirely bankruptcy remote. Therefore, investors must attach the risk of WMPs to the risk of their issuing banks. Overall, we think that the interbank WMP-CD spread (i.e., the difference between the return of WMP and the CD yield) is a good proxy of the risk of implicit guarantees because the major extra risk that WMP investors are exposed to is that banks may not pay the promised returns.

Since no existent theory can rationalize our empirical results well, this paper proposes a static pricing model in which we embed a standard signaling game. In the beginning of the model, a bank must raise liquidity from selling CDs and WMPs to risk-averse creditors. However, the type of the bank is unobservable. Given that a low type bank is more likely to fail than a high type, the CD yield will go up if the bank reputation becomes worse. A signaling game occurs in the end of the period, whose equilibrium outcome determines the payoff of WMPs. Both a high type bank and a low type bank can raise their WMP payoffs by liquidating their long-term assets. However, the liquidation cost is lower for a high type bank. Since a bank or a bank manager intends to maximize its market value, if a high bank's reputation deteriorates it would have strong incentives to pay high returns to its WMP investors so as to distinguish itself from low type banks. Therefore, the model replicates the fact that if the ex ante failure probability of a bank increases, it will extend more implicit guarantees to its WMP investors and thus its risk exposure to the off-balance-sheet operations increases.

Our simple model offers a new insight into our understanding of shadow banking: the decline in a bank's reputation has a nonlinear effect on its fundamental in the presence of shadow banking. If there is no shadow banking in our model, the decline in the bank reputation means nothing more than the decreased probability of the bank being of a high type. In the presence of shadow banking, however, the fundamental of the high type bank itself will also become worse due to the poor reputation. The reason is that when facing deteriorating reputation the high type bank is willing to liquidate its long-term assets and raise its payoff to shadow bank products. We believe this is what occurred to Bear Stearns and many other major players in the 2007-09 financial crisis. The benefit of bailing out off-balance-sheet products is to secure its reputation, while the cost is to hurt their own fundamentals.

Our findings have two relevant implications for shadow banking. First, implicit guarantees lead to additional funding costs for banks with high default risks. Notice that riskier banks already have to promise higher returns for attracting their shadow bank investors (see the relationship between WMPs' promised return and interbank CDs' yields shown in Figure 1). Moreover, riskier banks find it more "obligated" to pay high promised returns (i.e., stronger implicit guarantees). This ultimately causes additional funding costs, which do not apply to safe banks. Second, since riskier banks are more inclined to pay the promised returns of their WMPs, bank regulators should assign higher risk-weights to riskier banks for their off-balance-sheet exposures. Nevertheless, we have not observed any regulatory changes that take this fact into account.

Figure 1: Scatter Plot: WMP promised return against CD Yield



Literature. This paper speaks to the literature on implicit guarantees/recourses in shadow banking.

Higgins and Mason (2004) show that exercising implicit guarantees improve banks' performance in the future. Calomiris and Mason (2004) argue that although securitization with implicit guarantees is motivated by regulatory arbitrage, it indeed leads to a more efficient outcome given the overly tight capital requirement faced by banks. Acharya et al. (2012b) document that banks absorbed most of the losses on ABCP conduits via a different types of guarantees. Gorton and Souleles (2007) demonstrate that securitization arises as an implicit collusion between firms and investors to avoid bankruptcy cost. Ordoñez (2016) construct a model in which banks provide implicit guarantees because of their reputation concerns. In this paper, we contribute to this literature by connecting reputation models to data. We focus on the implicit guarantees that banks in China extend to their off-balance-sheet wealth management products and show that less healthy banks load more risk from shadow banking. Faltin-Traeger, Johnson and Mayer (2010) examine the securitization date in the U.S. and find a similar result that the spreads of Asset-Backed Securities are only on average higher when their sponsors are weaker.

Our paper also contributes to the burgeoning literature that studies China's rapid growing shadow banking sector, including wealth management products (WMPs), entrusted loans, and trusted loans as the three main components. Hachem and Song (2016) argue that tighter liquidity regulation and bank competition jointly induced the rapid growth of shadow banking. Chen, He and Liu (2017) attribute the growth of shadow banking to the stimulus packages and debt rollover through the lance of the Municipal Corporate Bonds. Acharya, Qian and Yang (2016) show that the boom of wealth management product is due to the four-trillion stimulus package and bank competition.

On the front of implicit guarantee, Chen, Ren and Zha (2017) exam the incentive of commercial banks to act as intermediaries to facilitate entrusted loans between firms by providing implicit and explicit guarantee. They also look into how monetary tightening magnify banks' risk taking behavior. Closest to our paper, Allen, Gu, Qian and Qian (2017) study implicit guarantee of trusted loans. They show that the expectation of implicit guarantees of central governments or banks flattens the spread-to-risk relationship. Complement to these work, our paper study the strategic provision of implicit guarantee on the wealth management products by banks. We show that banks choose to provide more guarantee exactly when it is costlier to do so, which creates additional fragility in the traditional banking sector.

More specifically on wealth management products, our paper is closely related to Acharya, Qian and Yang (2016), which show that the four-trillion stimulus package and bank competition lead to the boom of wealth management products. In contrast, we use data on the universe of interbank wealth management products to understand pricing and to what extent banks would guarantee this off-balance sheet product.

The rest of the paper is composed of five sections. Section 2 introduces the background information of China's banking system, wealth management products, and the interbank CD market. In Section 3, we illustrate how we construct different samples and also report summary statistics of main samples. Sections 4 and 5 focus on the empirical and theoretical results, respectively. Second 6 concludes and discuss the implication of the results.

2 Institutional Backgrounds

There are generally four types of domestic commercial banks in China: 5 state-owned banks ("big 5"), 12 national joint-equity banks ("joint"), urban banks, and rural banks. Big 5 banks have much larger sizes than all other banks. On the one hand, big 5 banks enjoy direct government support; on the other hand, their operations have to follow orders from the central government closely. Although joint-equity banks are smaller than big 5 banks, they are still much larger than urban and rural banks. In particular, the amount of deposits raised by an average joint-equity banks is around twenty-five times larger than that by an average urban or rural bank by the end of 2013.[2] Nevertheless, the total size of urban and rural banks is as large as the sum of total assets of the twelve joint-equity banks.

Joint-equity, urban, and rural banks are also less capable of absorbing deposits than big 5 banks. There are two main reasons. First, the big 5 banks are supported by the central government. Depositors generally think that the big 5 banks are much safer than all other commercial banks. Given deposit rates are capped by regulatory authorities, depositors definitely prefer safer banks.[3] Second, the big 5 banks have enormously wide branch networks over the entire country. Other banks, however, typically have their presence in a particular region of the nation. It is more convenient for both retail and institutional depositors to have bank accounts with them for the purpose of daily transactions. Given this situation, joint-equity, urban, and rural banks are major borrowers in the interbank market and the big 5 banks are major lenders. Other lenders in the interbank market include finance companies and mutual funds. Next, we will provide some detailed institutional backgrounds of wealth management products, trust products and the interbank CD market.

2.1 Wealth Management Products

There are a number of recent papers on China's wealth management products (WMPs). Acharya et al. (2016) and Hachem and Song (2016) contain detailed discussion of the history of this market, and particularly explain the important role of WMPs for small and medium-sized banks in China. In this section, we will focus on the background information that is critical for our empirical analyses.

WMPs are time deposit type investment products. The investors of a WMP are supposed to obtain returns and principals at the maturity date. We can categorize WMPs into three types according to different guarantees investors enjoy: 1) WMPs whose principals and returns are explicitly guaranteed, 2) WMPs whose principals are explicitly guaranteed but not their returns, and 3) WMPs whose neither principals nor returns are explicitly guaranteed. Regulatory authorities only treat the third type as issuing banks' off-balance-sheet liabilities. Hence, banks are inclined to issue WMPs with no guarantees for raising external funds. Hereafter, WMPs refer to those without any guarantees unless we specify in particular. Bank regulators require banks to fully inform investors that either returns or principals of WMPs are not guaranteed in any legally binding form. However, when a bank sells a WMP, it typically indicates a return that investors may probably enjoy, which we label as the promised return.

WMPs v.s. Time Deposits. There are two major *differences* between WMPs and time deposits. First, the investors of a WMP can take *no legal action* against its issuing bank if the realized return deviates from the promised one. The second difference is about *timing*. For time deposits, banks decide deposit rates only around the issuance dates. For a WMP, there are two critical dates for decision making: the issuance date when the issuing bank fixes the promised return, and the maturity date when the bank chooses the realized return.

Implicit Guarantee. The implicit guarantee of a WMP refers to the non-contractual guarantee of

[2] The median size of 12 joint-equity banks is around forty-five times larger than the median size of urban and rural banks.
[3] Readers can find more details about the regulatory frictions in China's banking system in (Acharya et al., 2016).

the promised return that the issuing bank signals in the marketing phase. The issuing bank will exercise the implicit guarantee only at the WMP's maturity date. Since no WMP is a one-shot game, a WMP issuing bank has incentives to offer implicit guarantees by paying the promised return as our summary statistics show later.

WMPs v.s. Securitization. Two major differences between WMPs and securitized products are worth discussion in detail. First, the information of assets that back WMPs is very opaque. When investors purchase WMPs, they only know the rough categories of underlying assets (e.g., fixed income, loans, equity, and so on) and the percentages of each category in the asset portfolio. In the case of securitization, however, the information of underlying assets is transparent. The second difference, which is more crucial, is whether the underlying assets are *bankruptcy remote*. In the case of securitization, its underlying assets are bankruptcy remote, i.e., if the asset originator defaults, its creditors cannot claim the assets that back the securitized products. The bankruptcy remote status is ensured by the trust law that governs the securitization.[4] The bankruptcy remote status is unclear for the underlying assets of WMPs as it is the banking supervision law and the commercial banking law in China that govern the operation of WMPs instead of the trust law. Therefore, the investors of a WMP are exposed to the default risk of the issuing bank because the bank's creditors may claim the underlying assets of the WMP.[5]

Realized Returns at Banks' Discretion. The realized return of a WMP is essentially at the discretion of the issuing bank around the moment when the WMP matures. Three major facts support this statement. First, since the identities of underlying assets are unclear to WMP investors, it is almost impossible for them to verify the actual returns of the portfolio. Second, there exists maturity mismatch between WMPs and their underlying assets. Moreover, a significant portion of the underlying assets are illiquid assets such as business loans. Hence, when a WMP matures, a significant proportion of its underlying illiquid assets have not generated returns yet, and there is no marketplace for the discovery of asset values. Third, one common practice of WMP issuing banks, which is officially prohibited by regulatory authorities but hard to eliminate completely, is that a bank uses a large pool of underlying assets to support multiple WMPs. In this case, issuing banks can decide which WMPs' investors obtain higher returns. Certainly, this decision process is not transparent at all.

The size of the WMP market grew rapidly over the last decade regardless of the frictions highlighted above. By the end of 2017, its size is around 5 trillion USD. More importantly, WMPs are very popular among Chinese households and firms as WMPs are considered as relatively "safe" investments that yield returns significantly higher than the regulated deposit rates. The reason why this market could survive and thrive is that issuing banks care about their long-run reputation. Even though they are not obligated to pay promised returns, issuing banks are afraid that they will lose their WMP investors if they pay rather low realized returns. We will show that such reputation concerns are especially critical for risky banks.

2.2 Trust Products

A pure reputational shock to banks is ideal for identification. We later will explore one reputational shock: the failure of trust products that banks sell on behalf of trust companies. There are around 68

[4]See Gorton and Souleles (2007) for the discussion of bankruptcy remote and securitization in the U.S. context. Readers can refer to Phua (2019) for detailed discussion of the securitization in China and the role of the trust law.

[5]See the Chinese article Lv and Li (2018) that offers a detailed legal analysis regarding the governance of WMPs.

trust companies in China.[6] Their main businesses are to extend trust loans to companies in the real sector such as real estate developers. To raise funds for trust loans, trust companies issue trust products to retail and institutional customers. Typically, both trust loans and trust products are off trust companies' balance sheets. Since commercial banks in China have very large clients bases, trust companies often delegate the sales of their trust products to banks. The trust products are almost identical to time deposits and they are backed by trust loans arranged by trust companies. The feature that is the critical for our identification is that a trust product or its default is irrelevant for the fundamental of the bank that offers its branches for the distribution of the product.

2.3 Interbank Certificate of Deposit

The interbank CD is an important form of interbank credit for no big 5 banks. According to our calculation, the ratio of outstanding interbank CD to asset is 6.8% on average with 8.4% standard deviation. The interbank CD market was launched in December 2013 by China's central bank, the People's Bank of China (PBoC). By issuing interbank CDs, a bank can take a deposit of 50 million RMB or more at a negotiated interest rate from other banks and other financial institutions such as insurance and security companies. Maturities of interbank CDs could be 1 month, 3 months, 6 months, 9 months, 12 months, and more than 1 year. There exists a fairly active secondary market for interbank CDs (see Amstad and He 2019 for the thorough review of the entire bond market in China). For instance, the trading volume of interbank CDs in the December of 2017 is 688 billion USD and that of money market in the same month is 1.08 trillion USD. Interbank CDs can also serve as collateral for the repurchase agreements. The issuance of interbank CDs and their secondary market tradings are conducted on the online electronic platform of a government agency, National Interbank Funding Center (NIFC).

Unlike other forms of on-balance-sheet debt, banks face much less regulatory restrictions for issuing interbank CDs. To control the systemic risk originated from the interbank market, regulatory agencies requires that interbank borrowing cannot exceed one third of a bank's total liabilities. However, funds raised through interbank CDs were not booked as interbank borrowing by regulatory authorities until the end of 2017. In addition, banks do not have to keep reserves for issuing interbank CDs. These properties make interbank CDs as the ideal counterpart of interbank WMPs.

The interbank CD yield of a bank is an ideal proxy its default risk for the following reasons. The issuance of interbank CDs face minimum regulatory restrictions, and the pricing of interbank CDs is market-based. Financial firms including deposit-taking banks trade interbank CDs on a centralized online trading form. Information on interbank CDs is very transparent. The bank name of each interbank CD, its terms such as the yield and volume, and its secondary market trading information are publicly available on the platform of NIFC. By the end of 2017, interbank CDs are the most actively traded security in the interbank market.

Given the all institutional background mentioned above, the difference between a bank's interbank WMP return and its interbank CD yield is a good proxy of the risk of implicit guarantees. First of all, interbank WMPs and interbank CDs are almost equally exposed to the default risks of their issuing banks. This is largely because assets that back WMP are neither fully transparent nor clearly bankruptcy remote. If a bank fails, the management of its WMPs would stall and the liquidation of assets underlying its WMPs would be very opaque and noisy. Second, investors of interbank WMPs largely overlap with

[6] See Allen, Gu, Qian and Qian (2017) for details of trust products in China.

investors of interbank CDs. Since interbank investors are most sophisticated in the market, mispricing is unlikely to occur for both financial instruments. Lastly, both types of assets are traded in free markets that are subject to minimal government interventions. One difference between the two types of assets may cause concerns over our measure of the risk premium of the implicit guarantee: interbank CDs can be traded in a secondary market and interbank WMPs cannot. However, since both types of assets have relatively short maturities, we think the liquidity premium that interbank CDs have is small.[7]

3 Data and Summary Statistics

Our empirical evidence consists of three main tests. The first test treats the default of a trust product as the reputational shock to the bank that distributes the product. In the second test, we measure the default risk of a bank by its interbank CD yield and relate a bank's default risk to the implicit guarantees of its WMPs' promised returns. In the third test, we focus on the interbank WMP-CD pairs and use their yield spreads to measure the risk premium of implicit guarantees.

We construct the main samples for the three tests based on three sources of raw data: wealth management products, default events of trust products, and interbank certificates of deposits that Chinese commercial banks issue. WMP data are derived from the website managed by a subsidiary of China's bank regulatory agency, China Banking and Insurance Regulatory Commission (CBIRC), https://www.chinawealth.com.cn; the source for the default cases of trust products is news media; and the website http://www.chinamoney.com.cn managed by the National Interbank Funding Center is the source of our interbank CD data.

3.1 Raw Data Sets

Wealth Management Products. Our raw WMP sample is the universe of all WMPs that domestic commercial banks in China issued from January 2012 to March 2017. In June 2013, to improve the transparency of wealth management products, CBIRC issued an order that all banks must submit information of all their WMPs issued since 2011. Banks that failed to do so would receive official warning or be even suspended its license of issuing new WMPs. Therefore, it is by far the most comprehensive data source of WMPs in China. All those WMP information must be registered in China Banking Wealth Management Registration System and posted on the website http://www.chinamoney.com.cn run by a subsidiary of CBIRC, China Central Depository and Clearing Co. The published product information includes: promised return, realized return, the identity of issuing bank, maturity, the starting and ending dates of sales, starting and expiration dates, types of guarantees (explicit guarantees of both principal and return, explicit guarantees of only principal, no explicit guarantees), the type of customers (retail, institutional, private-banking, and interbank), the risk ratings (5 categories), and the minimal purchase threshold. Promised returns, which are only suggestive, have no legal implications.[8] One drawback of our data set is that we do not observe the size of each WMP issuance.

[7] Chen, Cui, He and Milbradt (2017) quantify the interaction between default risk and liquidity risk of corporate bonds. They find the interaction accounts for around 10% of credit spread. Notice that the median maturity of corporate bonds in their sample is 5 years and the maturity of most interbank CDs and interbank WMPs is less than 1 year.

[8] In practice, banks sometimes offer two promised returns: high one and low one. However, the low promised return does not play any significant role. Hereafter, the promised return of a WMP only refers to the high one if two promised returns are offered.

Although our main empirical tests of implicit guarantees focus on the relationship between the realized return of WMPs and their issuing banks' default risks, it is helpful to look at a descriptive measure of implicit guarantees of our raw sample. We measure the degree of implicit guarantee that bank i extends to its WMP j as

$$degree\ of\ implicit\ guarantee_{i,j} = \frac{realized\ return_{i,j} - promised\ return_{i,j}}{promised\ return_{i,j}}. \tag{1}$$

This measure takes the difference between the realized return of a WMP and its promised return and normalizes the difference by the promised return, which is a proxy of the risk of the WMP. The higher the measure is, more guarantees that a bank extends to a WMP. We understand that many other noises such as the risk of the underlying assets contaminate the measure at the individual WMP level. Nevertheless, we believe that such noises will be canceled at the bank and population level. Around 70% WMPs in the raw sample have their realized returns exactly equal promised ones. Panel A in Table 1 presents the main summary statistics of all WMPs that joint-equity, urban and rural banks issue.[9] First of all, Panel A presents that most WMP investors obtain the promised returns that banks advertise. Second, we observe that banks guarantee returns of their institutional WMPs more aggressively than those of retail WMPs. Panels B-D in Table 1 show more detailed information on the distribution of implicit guarantee measure cross different types of banks for a given client type. If we focus on institutional WMPs, urban and rural banks appear to offer stronger implicit guarantees than their competitors joint-equity banks who are substantially larger. Similar evidence can be found for the fifth and tenth percentile of the retail WMPs' implicit guarantee measure (see Panel B in Table 1).

Default of Trust Product. We collect default events of trust product that news media in China reported from 2011 to 2016. There are three sources that we search for the news reports: WiseNews, which contains the largest amount of digital content of Chinese newspapers and widely used in Chinese media research (Qin, Strömberg and Wu, 2018); Baidu, the largest Chinese search engine in China; and Google.

The keywords that we use for searching the new reports include Chinese character combinations: "trust products" + "default", "trust product" + "credit event", and "trust product" + "repayment". We admit that with all these efforts some default events may still uncovered. For such cases, the general public did not know of such low profile default events, and there is no significant reputational problem. In total, we find six default events of trust products and link the six default events to banks that sell the relevant products.

Interbank Certificate of Deposit. The basic information on interbank CDs includes yield at the issuance, maturity, identity of issuing bank, size, and starting date. Summary statistics are collected in Table 2. There are 22,438 interbank CDs issued from 2014 to 2016. In our sample, big 5 banks only issued 194 interbank CDs. This fact indicates that big 5 banks are not the major borrowers in the interbank market as they can enjoy a large amount of stable deposits from their enormous webs of branches in China. Major issuers of interbank CDs are joint-equity, urban, and rural banks. The average yields of interbank CDs issued by different types of banks tend to be close. The sizes of interbank CDs issued by different types of banks are consistent with their relative size. In addition, the median maturity

[9] Our later analysis will focus on the three types of banks. We group normal retail WMPs and private banking WMPs together as retail WMPs

Table 1: Summary Statistics: Implicit Guarantees of WMPs

This table reports summary statistics of the degree of implicit guarantees (defined in Equation 1) of our raw sample (Panel A) and its three client-type sub-groups: retail customers (Panel B), institutional investors (Panel C), and interbank investors (Panel D).

Panel A: *types of clients*					
client types	mean (std)	5th percentile	10th percentile	25th percentile	N
retail	-0.037 (0.104)	-0.233	-0.160	-0.018	224,138
institutional	-0.016 (0.081)	-0.088	-0.023	0	143,499
interbank	-0.011 (0.076)	-0.029	0	0	33,887
all WMPs	-0.027 (0.095)	-0.207	-0.104	0	401,524
Panel B: *retail WMPs across different types of banks*					
bank types	mean (std)	5th percentile	10th percentile	25th percentile	N
joint-equity	-0.044 (0.132)	-0.257	-0.182	-0.009	65,370
urban	-0.030 (0.086)	-0.208	-0.131	-0.018	93,975
rural	-0.040 (0.095)	-0.243	-0.177	-0.032	64,793
Panel C: *institutional WMPs across different types of banks*					
bank types	mean (std)	1st percentile	5th percentile	10th percentile	N
joint-equity	-0.022 (0.087)	-0.420	-0.167	-0.032	81,108
urban	-0.008 (0.075)	-0.271	-0.044	0	49,421
rural	-0.008 (0.056)	-0.278	-0.022	0	12,970
Panel D: *interbank WMPs across different types of banks*					
bank types	mean (std)	1st percentile	5th percentile	10th percentile	N
joint-equity	-0.010 (0.080)	-0.350	0	0	14,081
urban	-0.009 (0.079)	-0.364	-0.026	0	8,655
rural	-0.014 (0.068)	-0.357	-0.029	0	11,151

of interbank CDs issued by rural banks is three months, which is one half of the median maturity of interbank CDs issued by joint-equity and urban banks. Thus, the rollover risk faced by rural banks is much higher than other banks.

Table 2: Summary Statistics of Interbank CDs

This table reports the summary statistics of the yield of interbank CDs of our raw sample and its bank-type sub-groups.

	yield				*size (100 million RMB)*				*maturity (month)*				*N*
	mean (std)	Q_1	Q_2	Q_3	mean (std)	Q_1	Q_2	Q_3	mean (std)	Q_1	Q_2	Q_3	
big5	3.38 (0.83)	2.75	3.00	4.16	13.4 (13.0)	5	10	20	4.47 (3.41)	3	3	6	194
joint-equity	3.34 (0.72)	2.87	3.03	3.50	14.4 (16.5)	5	10	18	6.29 (4.64)	3	6	9	6051
urban	3.39 (0.65)	2.99	3.15	3.55	6.80 (6.77)	2.8	5	10	5.87 (4.43)	3	6	9	10120
rural	3.28 (0.59)	2.93	3.10	3.36	3.80 (4.14)	1.3	3	5	3.93 (3.40)	1	3	6	6073
full sample	3.35 (0.66)	2.93	3.10	3.50	8.08 (10.8)	2	5	10	5.44 (4.34)	3	3	6	22438

3.2 Three Main Samples

We drop all WMPs issued by big 5 banks while constructing the main samples. The reason is that the big 5 banks enjoy strong implicit guarantees from the central government. We do not think there are meaningful variations in their default risk at least in our sample period.

Sample for Trust Shock Test. We restrict our sample to retail WMPs because institutional and interbank WMP investors are more sophisticated and they understand clearly that default events of the trust products that banks sell have minimum effects on banks' fundamentals. Panels A and B in Table 1 display some basic summary statistics of retail WMPs.

To consider the reputational effect of trust products' default, we think a bank's retail WMP is hit by the shock if it matures within a certain window of days after the default event. If we use 60, 30, 15, and 7 days window, 9,999, 4,965, 3,077, and 1,552 retail WMPs are hit by trust shocks, respectively.

Sample for Default Risk Test. To take into account a bank's default risk, we link its WMP with its 3-month interbank CD that is issued on or less than seven days before the WMP's maturity date. The yield of the interbank CD proxies the default risk of the bank. The common endogeneity problem arises because the return payment of the WMP and the issuance of the interbank CD are decisions made by the bank almost simultaneously. To address the endogeneity problem, we match the WMP with the 3-month interbank CD that the bank issues on or within seven days **before** the issuance date of the WMP. Our main sample, in total, is composed of the 41,122 WMPs that pair with the two types of interbank CDs.

Table 3 displays the summary statistics of five key variables: a WMP's realized and promised returns, the WMP maturity, the yield of the interbank CD issued around the maturity date of the WMP ($CD\ yield_{end}$), the yield of the interbank CD issued around the issuance date of the WMP ($CD\ yield_{start}$), and the overnight Shanghai Interbank Offered Rates (Shibor) at the maturity date of the WMP ($overnight\ shibor_{end}$). Table 3 shows that the returns of WMPs for institutional clients are generally higher than that of WMPs for retail investors. Institutional investors in this case include both interbank investors and non-financial firms. In terms of maturity, WMPs tend to be short-term. The median maturity of WMPs in our sample is about 3 months.

Table 3: Summary Statistics

This table reports the summary statistics of six key variables of our main sample: a WMP's realized return, (high) promised return, maturity (days), the yield of CD issued at the maturity of the WMP ($CD\ yield_{end}$), the yield of CD issued at the issuance date of the WMP ($CD\ yield_{start}$), and the overnight Shibor at the maturity of the WMP ($overnight\ shibor_{end}$).

	mean	std	p25	p50	p75	mean	std	p25	p50	p75
	all client types (41122 observations)					institutional clients (27054 observations)				
realized return	3.82	(0.95)	3.10	3.75	4.40	3.55	(0.78)	3.00	3.40	4.00
promised return	3.94	(1.04)	3.20	3.80	4.50	3.62	(0.80)	3.05	3.45	4.10
maturity (days)	105.78	(86.40)	36.00	90.00	175.00	101.00	(87.56)	34.00	86.00	165.00
$CD\ yield_{end}$	3.42	(0.75)	2.85	3.04	4.14	3.39	(0.74)	2.83	3.03	4.10
$CD\ yield_{start}$	3.39	(0.79)	2.84	3.02	3.95	3.37	(0.78)	2.82	3.00	3.90
$overnight\ shibor_{end}$	2.13	(0.41)	2.00	2.04	2.28	2.12	(0.41)	2.00	2.04	2.28

For a given WMP, if no 3-month interbank CDs are issued around either its issuance or maturity dates, we could still use the yield information of the issuing bank's outstanding interbank CDs to proxy the default risk of the bank. To control the maturity term premium, we request that such outstanding interbank CDs will matures in around three months. One caveat of using outstanding interbank CDs' yield information is that the yield information itself sometimes is an estimate provided by the trading platform as the transaction of an interbank CD does not occur everyday. After we extend our main sample, we find 72,145 WMPs and the summary statistics of the extended sample are reported in Table 10 in Appendix D.

Sample of Interbank WMP-CD Pairs. Suppose there is heterogeneity regarding the risks of implicit guarantees cross different banks, then we should also find some heterogeneity regarding the premium

Table 4: **Summary Statistics: Interbank WMP-CD Spreads**

This table reports the summary statistics of interbank WMP-CD spreads that we calculate based on either WMPs' promised returns or realized returns.

Panel A: *WMP return* − *CD yield*

	promised return					*realized return*				
bank types	mean (std)	Q1	median	Q3	N	mean (std)	Q1	median	Q3	N
joint-equity	0.778 (0.527)	0.550	0.700	0.900	4957	0.797 (0.578)	0.600	0.750	0.950	3716
urban	0.749 (0.529)	0.500	0.700	0.870	2211	0.793 (0.415)	0.600	0.750	0.920	1395
rural	0.567 (0.424)	0.300	0.530	0.750	1550	0.583 (0.391)	0.320	0.550	0.780	1162
all banks	0.733 (0.517)	0.500	0.680	0.890	8718	0.757 (0.521)	0.550	0.720	0.900	6273

Panel B: $\ln(1+\textit{WMP return}) - \ln(1+\textit{CD yield})$

	promised return					*realized return*				
bank types	mean (std)	Q1	median	Q3	N	mean (std)	Q1	median	Q3	N
joint-equity	0.0075(0.0051)	0.0054	0.0068	0.0087	4957	0.0077(0.0056)	0.0058	0.0073	0.0092	3716
urban	0.0072(0.0051)	0.0048	0.0067	0.0084	2211	0.0076(0.0040)	0.0058	0.0072	0.0088	1392
rural	0.0055(0.0041)	0.0029	0.0051	0.0073	1550	0.0056(0.0038)	0.0031	0.0053	0.0076	1162
all banks	0.0071(0.0050)	0.0048	0.0066	0.0085	8716	0.0073(0.0050)	0.0053	0.0070	0.0087	6258

Panel C: (*WMP return* − *CD yield*)/ *CD yield*

	promised return					*realized return*				
bank types	mean (std)	Q1	median	Q3	N	mean (std)	Q1	median	Q3	N
joint-equity	0.218 (0.145)	0.167	0.209	0.261	3701	0.251 (0.193)	0.180	0.232	0.298	3716
urban	0.232 (0.169)	0.146	0.217	0.279	2211	0.249 (0.126)	0.182	0.241	0.293	1395
rural	0.174 (0.132)	0.086	0.164	0.241	1550	0.181 (0.116)	0.097	0.174	0.242	1162
all banks	0.228 (0.168)	0.151	0.213	0.275	8718	0.237 (0.170)	0.168	0.226	0.288	6273

of the risks. To address this issue, we construct a sample of interbank WMP-CD pairs. In particular, we pair each interbank WMP with an interbank CD issued by the same bank if the differences between their issuance dates and their maturity dates are within 6 days. If there are multiple interbank CDs satisfy the criterion, we select the one with the smallest distance with respect to their issuance dates. The advantage of this sample is that the two instruments of each pair share the same issuer and, more importantly, the same group of potential investors. As we have discussed, the CD yield of a bank is an ideal proxy for its default risk since the interbank CD is its on-balance-sheet liability. Given the general condition that interbank WMPs and CDs are backed by the same asset pools of their issuing banks, the difference between the returns of the two is almost purely about the risk of implicit guarantees.

In the sample, we find 8718 interbank WMP-CD pairs. We calculate the spread of the interbank WMP-CD pairs in three different manners: *WMP return* − *CD yield*, $\ln(\textit{WMP return}) - \ln(\textit{CD yield})$, and (*WMP return* − *CD yield*)/ *CD yield*. Table 4 presents the summary statistics of the spreads. Panel A shows that the average spread of all interbank WMP-CD pairs is slightly above 70 basis points, which is 20 percent of the average interbank CD yield and marginally larger than the one standard deviation of interbank CD yields. At the time we collected data there are outstanding WMPs without realized return information. Hence, the number of interbank WMP-CD pairs with WMPs' realized returns is 6273, which is significantly less than the size of the core sample.

4 Implicit Guarantees and Bank Risk: Empirical Evidence

In this section, we present three sets of empirical results, which shows that weaker banks are more inclined to offer implicit guarantees. First, we investigate the impact of a pure reputational shock that is orthogonal to a bank's fundamental, and find that banks hit by the shock pay realized returns closer to promised ones. Next, we move beyond the pure reputation shock and consider the default risk of a bank that is measured by the yield of its interbank CD. Our tests show that as a bank's default risk increases, its willingness to pay the promised return rises as well. Lastly, we consider the interbank WMP-CD pairs and find that the risk premium of implicit guarantees measured by the interbank WMP-CD yield spreads indeed decline if banks' default risks rise.

As we have discussed in Section 2.1, the realized return of a WMP is subject to the issuing bank's discretion at the moment when the WMP matures. Nevertheless, the issuing bank cannot pay any arbitrary return to its investors given the outstanding promised return it has indicated at the selling stage. Therefore, the realized return of a WMP exactly informs to what extent the bank is willing to guarantee the promised return of the WMP implicitly. The main task of this section is to uncover main determinants of implicit guarantees.

4.1 Implicit Guarantees and Trust Shock

Our first test is the regression of the realized return of a WMP ($\ln(1 + \textit{realized } R)$) against the dummy of the trust shock, the promised return ($\ln(1 + \textit{promised } R)$), return guarantee types, risk rating, and the over-night SHIBOR rate at the WMP's maturity date with bank and WMP maturity date quarterly fixed effects (see equation 2). We expect the coefficient of the trust shock to be positive for the following intuition. Although the failure of a trust product does not affect the balance sheet of the bank that provides the selling channel, it influences the bank's reputation among its retail customers because they blame the bank for distributing and endorsing low quality products. In reality, retail customers indeed protested in front of the branches where they purchased the trust products that default. Given that its reputation deteriorates due to the trust default, the bank would be more cautious when deciding the realized returns of its maturing WMPs. Therefore, we expect that the bank volunteers to pay higher (realized) returns to the investors of WMPs that are due right after the default.

$$\begin{aligned}\ln(1 + \textit{realized } R_{i,b}) = {} & \beta_1 \textit{trust shock}_{i,b} + \beta_2 \ln(1 + \textit{promised } R_{i,b}) + \textit{bank fixed effect}_b \\ & + \textit{quarterly fixed effect}(\textit{maturity date}_{i,b}) + \textit{other controls}_{i,b} + e_{i,b}\end{aligned} \tag{2}$$

Our identification assumption is simple. The default of a trust product is orthogonal to the selling bank's fundamental. Nevertheless, the default event hurts the bank's reputation among its retail customers. Therefore, the coefficient of the trust shock informs the effect of the reputational shock. We assume a WMP is hit by the trust shock ($\textit{shock} = 1$) if it matures within 60 days after the default of a trust product that the WMP's issuing bank sells. Our tests also consider shorter windows from 30 days to 7 days.

Results presented in Table 5 show that banks hit by trust shocks extend stronger implicit guarantees, that is, they pay higher realized returns given the outstanding promised returns banks advertise at the selling stages. Given its outstanding promised return, if a WMP happens to mature in the aftermath of a trust shock, its issuing bank will significantly raises the realized return. The coefficients of the trust shock indicate that such a negative reputation event would cause at least 10 basis points more interest expenses.

Table 5: Implicit Guarantees: Trust Shock

This table reports regressions of the realized return of a bank's WMP ($\ln(1+\textit{realized return})$) against the trust shock, the WMP's promised return ($\ln(1+\textit{promised return})$), guarantee types, risk rating, and the overnight Shibor at the WMP's maturity date ($\textit{overnight shibor}_{end}$) with bank and WMP maturity date time fixed effects for the sample of retail WMPs.

	(1)	(2)	(3)	(4)
trust shock	0.00154***	0.00129*	0.00140**	0.00095**
	(0.00059)	(0.00068)	(0.00068)	(0.00038)
$\ln(1+\textit{promised } R)$	0.45160***	0.45138***	0.45128***	0.45122***
	(0.07765)	(0.07776)	(0.07783)	(0.07790)
principal guaranteed	-0.00495***	-0.00496***	-0.00496***	-0.00496***
	(0.00082)	(0.00082)	(0.00082)	(0.00082)
principal & return	-0.00525***	-0.00525***	-0.00525***	-0.00525***
guaranteed	(0.00082)	(0.00082)	(0.00082)	(0.00082)
$\textit{rating} = 2$	0.00015	0.00015	0.00015	0.00015
	(0.00085)	(0.00085)	(0.00085)	(0.00085)
$\textit{rating} = 3$	0.00094	0.00094	0.00094	0.00094
	(0.00096)	(0.00096)	(0.00096)	(0.00096)
$\textit{rating} = 4$	0.00476***	0.00476***	0.00475***	0.00475***
	(0.00124)	(0.00124)	(0.00124)	(0.00124)
$\textit{rating} = 5$	0.00508**	0.00509**	0.00509**	0.00509**
	(0.00258)	(0.00258)	(0.00258)	(0.00258)
$\textit{overnight shibor}_{end}$	0.00176***	0.00176***	0.00176***	0.00177***
	(0.00027)	(0.00027)	(0.00028)	(0.00028)
Windows (days)	60	30	15	7
Observations	198,748	198,748	198,748	198,748
Adjusted R^2	0.767	0.767	0.767	0.767

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We next interpret the coefficient estimates of other variables. The coefficient of the promised return is positive naturally since banks are supposed to pay higher actual returns if their promised returns are higher in the beginning. Given the same return promised at the sale stage, banks pay significantly lower returns to WMPs with explicit guarantees. Notice that WMPs with explicit guarantees are banks' on-balance-sheet liabilities, which offers less regulatory arbitrage opportunities than WMPs with no guarantees. Therefore, the customers who prefer WMPs with no guarantees are more important. In addition, investors of WMPs with no guarantees choose to take on more risks by self-selection. In principal, they are more sensitive to WMPs' realized returns than investors of WMP with explicit guarantees. The same logic also explains that WMPs with higher ratings (i.e., riskier) yield higher realized returns.

The test we have presented so far clearly identifies the effects of a pure reputational shock on the fulfillment of implicit guarantees. Nevertheless, what we observe more often in reality is the deterioration in the market belief of a bank's fundamental, which could be driven by a fundamental shock or a reputational shock or both. Next, we will move beyond the pure reputational shock and attempt to identify the connection between the market belief of a bank's default risk and the strength of implicit guarantees it offers.

4.2 Implicit Guarantees and Default Risk

In this section, we particularly focus on the default risk of a bank as the main determinant of implicit guarantees it extends to its WMPs. Since it is almost impossible to measure the objective default risk, we focus on the capital market's belief regarding the default risk of a bank in the near future. The particular measure we use is the yield of the 3-month interbank CD that the bank issues around the time its WMP matures.

4.2.1 Empirical Challenge and Strategy

Our basic test is the regression of the realized return of a WMP ($\ln(1 + \textit{realized } R)$) against the yield of the interbank CD issued at the maturity date of the WMP ($\ln(1 + \textit{CD yield}_{end})$), the promised return ($\ln(1+\textit{promised } R)$), return guarantee types, risk rating, and the over-night SHIBOR rate at the WMP's maturity date.

$$\begin{aligned} \ln(1 + \textit{realized } R_{i,b}) = \beta_1 \ln(1 + \textit{CD yield}_{end,i,b}) + \beta_2 \ln(1 + \textit{promised } R_{i,b}) + \textit{bank fixed effect}_b \\ + \textit{quarterly fixed effect}(\textit{maturity date}_{i,b}) + \textit{other controls}_{i,b} + e_{i,b} \end{aligned} \tag{3}$$

This simple regression is subject to the endogeneity problem for the following reasons. The first issue is sample selection. We only select cases that banks are able to issue interbank CDs when they have WMPs maturing. Hence, our test cannot address the behavior of banks who cannot raise credit from the interbank market due to their intermediate default risks. Second, the issuance of an interbank CD itself can alleviate the issuing bank's liquidity problem and this, in turn, can help the bank pay a relatively high realized return. Third, a maturing WMP itself depletes the issuing bank's liquidity, which could raise the bank's default risk in 3 months and thus raises the CD yield.

To address the above endogeneity problem, we instrument the yield of the interbank CD issued at a WMP's maturity date with the yield of the interbank CD that the bank issues at the WMP's issuance date ($\ln(1+\textit{CD yield}_{start})$). The instrument variable is valid for the following reasons. First, the realized return decision is made only at the maturity date of the WMP. Conditional on the promised return all other information available up to the issuance date, the random error in the realized return should be the result of the innovation that occurs after the issuance date. Therefore, this random error cannot be predicted by the CD yield at the issuance date of the WMP. Second, the default risk of a bank is persistent to some degree. Hence, the yields of the two interbank CDs at two dates are correlated as Column 2 in Table 6 displays.

4.2.2 Empirical Results

Table 6 collects the results of the main regression of the second test. Column 1 shows the result of the OLS regression. It provides the suggestive evidence that the high CD yield at the maturity date is associated with the high realized return of the WMP even when we control its promised return. Column 2 in Table 6 displays the result of the first stage regression, which shows that the yields of a bank's interbank CDs tend to be persistent over time. In the third column of Table 6, we show the result of 2SLS, in which the CD yield at a WMP's maturity date is instrumented by the CD yield at the WMP's

Table 6: Implicit Guarantees

This table reports results of regressions of the realized return of a bank's WMP ($\ln(1+\textit{realized return})$) against the yield of the bank's interbank CD issued at the WMP's maturity date ($\ln(1+\textit{CD yield}_{end})$), the WMP's promised return ($\ln(1+\textit{promised return})$), guarantee types, risk rating,and the overnight Shibor at the WMP's maturity date ($\textit{overnight shibor}_{end}$). Column 1 reports the result of OLS, Column 2 the first stage regression of $\ln(1+\textit{CD yield}_{end})$ against the yield of the bank's interbank CD issued at the issuance date of the WMP ($\ln(1+\textit{CD yield}_{start})$), Column 3 the 2SLS of the main sample, Column 4 the 2SLS of the extended sample that use the secondary market yield information to proxy the default risk of a bank.

	(1)	(2)	(3)	(4)
dependent variable	$\ln(1+\textit{realized R})$	$\ln(1+\textit{CD yield}_{end})$	$\ln(1+\textit{realized R})$	$\ln(1+\textit{realized R})$
$\ln(1+\textit{CD yield}_{end})$	0.15131***		0.68443***	0.62574***
	(0.05423)		(0.15391)	(0.13971)
$\ln(1+\textit{promised R})$	0.65336***	-0.01979	0.55500***	0.59129***
	(0.04329)	(0.01473)	(0.06130)	(0.05608)
principal guaranteed	-0.00502***	-0.00075***	-0.00552***	-0.00493***
	(0.00159)	(0.00020)	(0.00137)	(0.00139)
principal & return	-0.00575***	-0.00187***	-0.00536***	-0.00494***
guaranteed	(0.00168)	(0.00042)	(0.00137)	(0.00157)
$\textit{rating} = 2$	-0.00207	-0.00103***	-0.00120	-0.00113
	(0.00163)	(0.00034)	(0.00133)	(0.00142)
$\textit{rating} = 3$	-0.00189	-0.00150***	-0.00060	-0.00065
	(0.00176)	(0.00044)	(0.00125)	(0.00142)
$\textit{rating} = 4$	-0.00878	-0.00088*	-0.00689*	-0.00531**
	(0.00542)	(0.00048)	(0.00352)	(0.00238)
$\textit{rating} = 5$	0.00007	-0.00136***	0.00247*	0.00107
	(0.00141)	(0.00041)	(0.00137)	(0.00200)
$\textit{overnight shibor}_{end}$	-0.00200***	0.00993***	-0.00786***	-0.00705***
	(0.00046)	(0.00056)	(0.00157)	(0.00142)
$\ln(1+\textit{CD yield}_{start})$		0.41863***		
		(0.01945)		
regression type	*OLS*	*1st stage*	*2SLS*	*2SLS*
observations	41105	41105	41105	72145
CD yield info	*primary*	*primary*	*primary*	*primary + secondary*
adjusted R^2	0.725	0.624	0.600	0.653

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

issuance date. In addition, we run the same 2SLS regression with the extended sample in which we use the secondary market yield information of outstanding interbank CDs when no interbank CDs are issued around WMPs' either maturity or issuance dates. The result of this regression is reported in the fourth column of Table 6.

The key result of Table 6 is that riskier banks are more inclined to pay relatively high realized returns (i.e., closer to promised returns). In other words, if a bank becomes riskier at the moment when its outstanding WMP is due, we find that the bank will be less likely to default. The results of Columns 3 and 4 in Table 6 show that if the CD yield of a bank increases by 100 basis points, realized returns that its WMP investors obtain would on average increase by above 60 basis points. As a caveat, we need to emphasis that this empirical finding cannot address how an insolvent bank would prioritize the payment of its outstanding WMPs. This is because by selection our sample only contains banks that are able to tap the interbank credit market upon the maturity dates of their outstanding WMPs.

Strong Implicit Guarantee (i.e., High Realized Return) $\neq$ High Credit Spread. The typical

Table 7: Implicit Guarantees: time fixed effect and WMP maturity

This table reports results of regressions of the realized return of a bank's WMP ($\ln(1+$ *realized return*$)$) against the yield of the bank's interbank CD issued at the WMP's maturity date ($\ln(1+$ *CD yield*$_{end})$), the WMP's promised return ($\ln(1+$ *promised return*$)$) , guarantee types, risk rating, and the overnight Shibor at the WMP's maturity date (*overnight shibor*$_{end}$) with quarterly fixed effects at the maturity dates of WMPs. Column 1 reports the result of the regression without quarterly fixed effects as a benchmark, Column 2 the regression with the fixed effects, Column 3 the fixed-effect regression of the sub-sample of WMPs with 20-to-40 day maturity, Column 4 the fixed-effect regression of the sub-sample of WMPs with 80-to-100 day maturity, and Column 5 the fixed-effect regression of the sub-sample of WMPs with 170-to-190 day maturity.

	(1)	(2)	(3)	(4)	(5)
$\ln(1+$ *CD yield*$_{end})$	0.68443***	3.35121***	0.52011***	0.54322***	3.74704
	(0.15391)	(1.09515)	(0.13156)	(0.14776)	(2.94695)
$\ln(1+$ *promised R*$)$	0.55500***	0.52670***	0.49711***	0.49003***	0.58975***
	(0.06130)	(0.05506)	(0.10873)	(0.04834)	(0.13574)
principal guaranteed	-0.00552***	-0.00662***	-0.00755***	-0.00536***	-0.00461
	(0.00137)	(0.00129)	(0.00144)	(0.00101)	(0.00303)
principal & return guaranteed	-0.00536***	-0.00660***	-0.00715***	-0.00532***	-0.00545
	(0.00137)	(0.00122)	(0.00131)	(0.00094)	(0.00335)
rating = 2	-0.00120	-0.00176	-0.00289***	-0.00069	-0.00091
	(0.00133)	(0.00113)	(0.00072)	(0.00119)	(0.00279)
rating = 3	-0.00060	-0.00144	-0.00309***	-0.00033	0.00063
	(0.00125)	(0.00108)	(0.00088)	(0.00102)	(0.00286)
rating = 4	-0.00689*	-0.00767***	-0.00796***	0.01147	-0.00406*
	(0.00352)	(0.00287)	(0.00074)	(0.00878)	(0.00240)
rating = 5	0.00247*	0.00204		0.00303***	0.00333
	(0.00137)	(0.00124)		(0.00104)	(0.00304)
overnight shibor$_{end}$	-0.00786***	-0.02651***	-0.00407***	-0.00547***	-0.02737
	(0.00157)	(0.00941)	(0.00130)	(0.00138)	(0.02069)
sub-sample by maturity (days)	full sample	full sample	[20,40]	[80,100]	[170,190]
quarterly FE at maturity	No	Yes	Yes	Yes	Yes
observations	41105	41105	10566	9580	7156
adjusted R^2	0.600	-0.704	0.618	0.634	-1.684

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

credit spread insight cannot explain our empirical finding. When a firm issues a bond, creditors demand higher spread at the issuance stage if their estimates of default probability are high. WMPs also have the similar feature, that is, riskier banks offer higher promised returns to their WMP investors (see Figure 1). However, what we intend to highlight is different. It is when a WMP is about to mature that its issuing bank decides to pay higher returns if its default becomes more likely at the same time. Notice that the issuing bank is not obligated to pay any return to its WMP investors. To sum up, in the case of a typical corporate bond, it is bond investors that demand high risk premium on the bond *issuance* date for the future risk exposure; in the case of a WMP, it is the issuing bank that volunteers to offer a high return on the WMP *maturity* date to its investors, who will in principal walk away immediately.

Other factors also affect the strength of implicit guarantees that banks provide for their WMP investors. For instance, if a bank raises the promised return of a WMP by 100 basis points, the realized return that the WMP's investors obtain would decline by around 60 basis points on average (Columns 3 and 4 in Table 6). WMPs with explicit principal and return guarantees tend to pay lower realized

Table 8: Implicit Guarantees: Clients

This table reports results of regressions of the realized return of a bank's WMP ($\ln(1+\textit{realized return})$) against the yield of the bank's interbank CD issued at the WMP's maturity date ($\ln(1+\textit{CD yield}_{end})$), the WMP's promised return ($\ln(1+\textit{promised return})$), guarantee types, risk rating, and the overnight Shibor at the WMP's maturity date ($\textit{overnight shibor}_{end}$) for sub-samples of WMPs of different client types. Columns 1 and 2 report results of OLS and 2SLS regressions of the full sample as benchmarks, Columns 3 and 4 OLS and 2SLS regressions of the sub-sample of WMPs for institutional and interbank clients, Columns 5 and 6 the OLS and 2SLS regressions of the sub-sample of WMPs for retail and private banking clients.

	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(1+\textit{CD yield}_{end})$	0.15131***	0.68443***	0.07545***	0.38979***	0.17469*	0.78680***
	(0.05423)	(0.15391)	(0.02006)	(0.12583)	(0.08988)	(0.14411)
$\ln(1+\textit{promised R})$	0.65336***	0.55500***	0.84285***	0.75203***	0.48877***	0.41728***
	(0.04329)	(0.06130)	(0.04543)	(0.06802)	(0.06259)	(0.06910)
principal guaranteed	-0.00502***	-0.00552***	-0.00249**	-0.00300***	-0.00889***	-0.00802***
	(0.00159)	(0.00137)	(0.00095)	(0.00098)	(0.00212)	(0.00165)
principal & return	-0.00575***	-0.00536***	-0.00232**	-0.00215**	-0.01029***	-0.00909***
guaranteed	(0.00168)	(0.00137)	(0.00100)	(0.00092)	(0.00176)	(0.00130)
$\textit{rating}=2$	-0.00207	-0.00120	-0.00109	-0.00060	-0.00423**	-0.00246*
	(0.00163)	(0.00133)	(0.00114)	(0.00101)	(0.00179)	(0.00137)
$\textit{rating}=3$	-0.00189	-0.00060	-0.00132	-0.00048	-0.00278	-0.00088
	(0.00176)	(0.00125)	(0.00112)	(0.00089)	(0.00175)	(0.00145)
$\textit{rating}=4$	-0.00878	-0.00689*	-0.00417***	-0.00384***	-0.01417***	-0.00767*
	(0.00542)	(0.00352)	(0.00099)	(0.00087)	(0.00385)	(0.00405)
$\textit{rating}=5$	0.00007	0.00247*	-0.00221**	-0.00363***	-0.00383***	0.00065
	(0.00141)	(0.00137)	(0.00100)	(0.00124)	(0.00058)	(0.00106)
$\textit{overnight shibor}_{end}$	-0.00200***	-0.00786***	-0.00087***	-0.00434***	-0.00261***	-0.00935***
	(0.00046)	(0.00157)	(0.00030)	(0.00159)	(0.00065)	(0.00106)
sub-sample by client type	*full sample*	*full sample*	*institutions*	*institutions*	*retail*	*retail*
regression type	*OLS*	*2SLS*	*OLS*	*2SLS*	*OLS*	*2SLS*
observations	41105	41105	27036	27036	14048	14048
adjusted R^2	0.725	0.600	0.851	0.787	0.558	0.419

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

returns.[10] The tightness of the interbank liquidity measured by the overnight SHIBOR negatively affects the realized returns paid by banks. Banks are less inclined to pay out cash if they have options of not doing so when liquidity becomes more valuable.

We have conducted additional tests of certain sub-samples to check the robustness of the our main result. In particular, we add the quarterly time fixed effect to the baseline regression (Column 2 in Table 7) and run the same regression for sub-samples of WMPs with different types of maturities. In particular, Columns 3, 4, and 5 in Table 7 collect results of the regression of WMPs of one-month, three-month, and six-month. The results displayed in Table 7 show that riskier banks tend to provide more implicit guarantees even if we take into account the time fixed and maturity effects. To further control bank-level characteristics, we run tests that incorporate the bank cross quarter fixed effects (see Table 11 in Appendix D for results).

There are generally two types of WMP clients: institutional and retail. Institutional investors include non-financial firms and more specialized interbank investors. Retail investors also include those with high-level net worth. Banks may extend different degrees of implicit guarantees towards different types of clients. To address this concern, we split the main sample into two groups and run the same set of

[10]The return guarantee refers to the guarantee of the "low promised" one.

regressions, whose results are collected in Table 8. Columns 3-6 show that banks tend to pay relatively high realized returns regardless of the client types when the market believe they become riskier. The comparison of results reported in Columns 4 and 6 indicates that the promised return of institutional WMPs have higher predicting power and that the realized return of retail WMPs are more sensitive to the market's attitude regarding the default risk of the issuing bank.

Remark. Our empirical results show that when banks face a higher marginal funding cost they volunteer to pay out cash that is more than what they are not obligated. As profit-maximizing agents in the economy, the cost of sacrificing liquidity in hard times must be compensated by certain profits in the future. Recall that the yield of a bank's interbank CD largely captures the risk assessment of financial firms regarding the default probability of the CD issuing bank. The rise in the CD yield indicates the deterioration of such risk assessment, i.e., the market belief of the CD issuing bank's default risk. Our theoretical discussed later will show that the marginal effect of raising realized return on boosting a bank's reputation is particularly higher when the bank's reputation deteriorates.

4.3 Risk Premium of Implicit Guarantee

WMP investors are exposed to the risk that returns that they actually obtain could be less than the promised ones even when WMP issuing banks are still solvent. On the contrary, interbank CD investors always receive the face value unless the bank files bankruptcy. Hence, WMP investors must demand the premium for compensating the risk of implicit guarantees.

In this section, we focus on results of regression of interbank WMP-CD spread against the type of bank, maturity, the type of explicit guarantee, expected and unexpected market liquidity, and risk ratings (see Table 9). First of all, we find a supporting fact that complements the key result of the previous sections, that is, as the default risk of a bank increases, the premium risk of its implicit guarantee declines. Given the two connected results being presented, it is important to provide a coherent interpretation. Suppose the CD yield of a bank increases by 1 percent because the interbank market questions its default risk. The promised return of the bank's interbank WMP would only increase by 43 basis points on average. In other words, the interbank WMP-CD spread declines by 57 basis points. The underlying reason is that the market anticipates (correctly) that while the bank raises the promised return of its WMP, its propensity to pay the promised return also rises. Hence, the risk of implicit guarantees declines and the bank does not have to raise the promised return by exactly what the interbank market requests for its CD.

The interbank WMP-CD spread also depends on other control variables. For instance, the spread is smaller for WMPs whose principals are explicitly guaranteed by issuing banks. The spread is also higher for WMP-CD pairs issued by rural and urban banks. We also run the same sets of regressions for the extended sample, in which we pair interbank WMPs with outstanding interbank CDs that mature around the same date. The results are collected in Table 12 in Appendix.

5 Implicit Guarantees and Bank Risk: Signaling Game

In this section, we present a simple model that can rationalize our empirical results that if banks become riskier they extend more implicit guarantees to their off-balance-sheet obligations. Basically, we embed

Table 9: Risk Premium of Implicit Guarantee

This table displays the results of regressions of the interbank WMP-CD spread against the yield of the bank's interbank CD issued around the same time (*CD yield*), the maturity of the WMP, the size of the interbank CD, guarantee types, risk rating, and the overnight Shibor at the WMP's maturity date (*overnight shibor*$_{end}$). In the regressions whose results shown in Columns 1, 3, and 5, we WMPs' promised return to calculate the spread of the interbank WMP-CD pair; in those of Columns 2, 4, and 6, we use the realized returns.

Dependent Variable	*WMP return* $-$ *CD yield*		ln(*WMP return*) $-$ ln(*CD yield*)		$\frac{WMP\ return - CD\ yield}{CD\ yield}$	
	promised	*realized*	*promised*	*realized*	*promised*	*realized*
	(1)	(2)	(3)	(4)	(5)	(6)
CD yield	-0.256***	-0.365***	-0.251***	-0.355***	-0.125***	-0.163***
	(0.027)	(0.029)	(0.026)	(0.027)	(0.009)	(0.009)
maturity	0.039***	0.058***	0.038***	0.056***	0.010***	0.017***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)
CD size	-0.002***	-0.002*	-0.002***	-0.002*	-0.001***	-0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
principal guaranteed	-0.456***	-0.529***	-0.439***	-0.508***	-0.139***	-0.155***
	(0.079)	(0.083)	(0.076)	(0.080)	(0.023)	(0.018)
principal & return	-0.391***	-0.455***	-0.376***	-0.437***	-0.119***	-0.128***
guaranteed	(0.099)	(0.094)	(0.095)	(0.091)	(0.031)	(0.028)
rating $= 2$	-0.039	-0.039	-0.038	-0.038	-0.012	-0.006
	(0.067)	(0.046)	(0.064)	(0.044)	(0.020)	(0.009)
rating $= 3$	0.110*	0.140**	0.105*	0.134**	0.032	0.046**
	(0.063)	(0.069)	(0.061)	(0.066)	(0.020)	(0.019)
rating $= 4$	0.090*	0.125**	0.087*	0.119**	0.028*	0.040***
	(0.049)	(0.057)	(0.047)	(0.055)	(0.015)	(0.015)
overnight shibor$_{end}$		-0.078*		-0.074*		-0.022
		(0.040)		(0.039)		(0.019)
observations	8718	6127	8716	6112	8718	6127
adjusted R^2	0.402	0.441	0.401	0.438	0.443	0.448

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

a stylized signaling game into a 2-period partial equilibrium model.

5.1 Model

We consider a bank or a bank manager that lives in 2 periods, $t = 1, 2$. The bank has X units of long-term assets in period 1. The bank could be either high type with probability α or low type. The value of one unit of asset owned by a high type bank is $k > 1$ at the end of period 2, and the value of one unit of asset managed by a low type bank is normalized to be 1. The type of a bank is unobservable. Only the bank itself knows of its type.

In period 1, there is a fixed liquidity shortfall for the bank, $f > 0$. We assume that the bank has to raise f in total from the interbank market to finance this liquidity shortfall. If the liquidity shortfall is not covered, we assume that the liquidation cost of long-term assets is extremely large. In addition, we assume that there is a regulatory constraint that a bank can only obtain γf from issuing interbank CDs. The remaining $(1 - \gamma) f$ has to be financed by issuing off-balance-sheet WMPs. This regulatory setting is consistent with the institutional details regarding interbank borrowing in China (see Section 2.3). Both CDs and WMPs mature in period 2. Let R denote the face value of CDs, which is endogenous in equilibrium. We will discuss the payoffs of WMPs later.

Assume that the risk-free rate is zero and there is a continuum of creditors who are risk-averse with an increasing concave function $u(\cdot)$. Assuming risk-averse creditors allows the model to capture risk premium. For simplicity, we assume that each creditor can only invest in either one unit of CD, WMP, or risk-free bond in period 0.

5.1.1 Period 2

We will first introduce the objective function of the bank and then discuss liquidity shocks that the bank is subject to in period 2. Let μ denote the market's belief that a bank is of high type in the end of period 2, which is an endogenous object. We assume that the objective of the bank is to maximize its market value, i.e., $(k\mu + 1 - \mu)X_2$, where X_2 denotes the units of assets that the bank still manages in period 2. Although the current setting is static, we can recast our model in an infinite horizon environment. Suppose that the bank lives for infinite periods and the tenure of its manager only lasts for two periods. We also assume, as in Ross (1977), that the compensation of the manager is an increasingly monotonic function of the bank's market value in period 2. Hence, the objective function of the bank manager is what we have assumed.

In period 2, the bank receives random liquidity shocks to both its an on-balance-sheet account and an off-balance-sheet account. For simplicity, we assume that it is prohibited to transfer funds between the two accounts.[11] In fact, total long-term assets managed by the bank are also allocated between the two accounts. But, we do not specify the allocation as it would not matter for the key mechanism. When the bank liquidates its long-term assets, it can freely allocate the funds to any of the two accounts.

Liquidity shocks to the on-balance-sheet and off-balance-sheet accounts of the banks are correlated. There are three possible observable states for the liquidity shocks: up, med, and down.

The *up* state occurs with a positive probability β to both high type and low type banks. In the *up* state, we assume that the bank has sufficiently large liquidity in both of its accounts so that both high type and low type banks can pay R to their CD investors and more importantly, for WMPs, a low type bank finds it optimal to mimic whatever a high type bank intends to pay. Let R^u denote the payoff of WMPs in the *up* state.

The probability that the *med* state occurs to a high type bank is β_h and to a low type bank is β_l, where $\beta_h > \beta_l > 0$. In the *med* state, we assume that the realized liquidity on the on-balance-sheet account is large enough to pay R. However, the liquidity on the off-balance-sheet account is $\underline{r}$, where $\underline{r} < (1-\gamma)f$. If the bank decides to pay its WMP investors more than $\underline{r}$, it has to liquidate a fraction of its long-term assets X. We assume that a high type bank is more efficient in terms of liquidating their assets, that is, a high bank will obtain θ_h if it liquidates one unit of its long-term asset; and if it is a low type bank, it will only obtain θ_l for liquidating one unit, where $\theta_l < \theta_h$. If a bank decides not to liquidate any of its long-term assets, it just pays what it has on its off-balance-sheet account. In summary, if a high type bank decides to pay its WMP investors $R^h + \underline{r}$ where $R^h \geq 0$, then its holding of long-term assets in the end of period 2 is $X - \frac{R^h}{\theta_h}$; and if a low type bank pays $R^l + \underline{r}$ where $R^l \geq 0$, then it has $X - \frac{R^l}{\theta_l}$ units of long-term assets.

In the *down* state, we assume that there is a huge liquidity shortfall and the bank fails. Creditors of both CDs and WMPs obtain the minimum recovery return $\underline{r}$, where $\underline{r} < \gamma f$. The *down* state occurs to a

[11] We can relax this assumption such that it is costly to transfer funds between the two funds. Nevertheless, transferring funds between a bank's on-balance-sheet account and its off-balance-sheet account is indeed not allowed by bank regulators in China, although it is hard to eliminate this practically.

high type bank with probability $1-\beta-\beta_h$ and to a low type bank with probability $1-\beta-\beta_l$. Naturally, we assume that the values of β_h and β_l are such that $\min\{1-\beta-\beta_h, 1-\beta-\beta_l\} > 0$. Since $\beta_h > \beta_l$, the low type bank is more likely to fail. In period 0, if the prior of a bank being a high type α declines, then the market would think the bank is more likely to be insolvent in period 2.

5.1.2 Remarks on the Model Setting

A high type bank is superior to a low type one in three aspects. First, the value of long-term assets held by a high type bank is higher. Second, it is less costly to liquidate long-term assets held by a high type bank. Third, a high type bank is less likely to fail. We interpret the three differences in a coherent fashion that assets held by a high type bank have higher quality. Next, we briefly discuss the roles of the three assumptions. The first assumption ensures that the bank or its manager cares about its reputation, that is, the market's belief over its type. The second assumption is standard for a signaling game where the signaling cost is lower for a good type. The role of the third assumption is to relate the reputation of the bank in period 1 to its default risk in period 2 as well as the risk premium of its CDs.

We interpret the liquidity shortfall to the bank in period 1 as that occurs in the intermediate period in Holmström and Tirole (1998). The bank needs to raise a mount of cash in order to maintain its operation or meet the liquidity withdrawal of its clients.

The *med* state in period 2 is the core of the model, which gives rise to a classic signaling game in the WMP market. In *med* state, a high type bank can raise the return of its WMP to distinguish itself from a low type bank. This is feasible because the signaling cost (i.e., the liquidation cost) for the high type bank is lower. We will analyze the signaling game in detail later.

Although both *up* and *down* states are necessary, their roles are auxiliary. The *down* state captures the default risk of CDs. The *up* state offers the freedom to the payoff of WMPs in the med state. If there are only *down* and *med* states, the payoff of WMP in the *med* state is entirely fixed by risk-averse creditors' indifference condition with respect to the choice between a risk-free bond and one unit of WMP.

5.2 Analysis

In this section, we first briefly characterize the payoff of CDs and then analyze the return of the WMP. The payoff of the WMP depends on both the pricing equation of risk-averse creditors and the equilibrium of the signaling game in the *med* state.

5.2.1 The Payoff of CDs

Given the model setup, the face value of all CDs is denoted by R. In both *up* and *med* states, the bank is always able to pay the face value regardless of its type. In the *down* state, a CD investor can only obtain the recovery return $\underline{r}$. For a risk-averse creditor to be indifferent between a risk-free bond and CDs, the face value has to satisfy

$$u\left(\gamma f\right) = \Pi u(R) + (1-\Pi)u(\underline{r}), \text{ where } \Pi = \alpha\beta_h + (1-\alpha)\beta_l + \beta.$$

Given the two assumptions $\underline{r} < \gamma f$ and $\beta_h > \beta_l$, it is straightforward to observe that if the bank's reputation in period 1 (i.e., α) declines, the face value of CDs must increase. Since creditors are risk-averse, we have the following proposition with respect to the risk premium of CDs

$$r_{\text{cd}} \equiv \frac{\Pi R + (1-\Pi)\underline{r}}{\gamma f} - 1.$$

Proposition 1 (The Risk Premium of CDs) *If the reputation of the bank in period 1 declines, the risk premium of CDs r_{CD} rises.*

5.2.2 The Payoff of WMPs

Recall payoffs of WMPs in different states $\{R^u, R^h, R^l, \underline{r}\}$, the indifference condition of a risk-averse creditor implies that

$$u\left((1-\gamma)f\right) = \beta u\left(R^u\right) + \alpha\beta_h u\left(R^h\right) + (1-\alpha)\beta_l u\left(R^l\right) + (1-\beta-\alpha\beta_h-(1-\alpha)\beta_l)u\left(\underline{r}\right). \tag{4}$$

Up State. Given our assumption that both types of banks have sufficiently high liquidity on both of their on-balance-sheet and off-balance-sheet accounts, it is practically unfeasible for a high type bank to distinguish it from a low type one since there is no meaningful signals that it can send to the market. For simplicity, we assume that a pooling equilibrium will occur in the *up* state with both types of bank paying R^u and that R^u is such that equation (4) holds given the equilibrium outcome of the signaling game in the *med* state, that is, $\{R^h, R^l\}$. Basically, we assume that there exists an credible commitment device which ensures that the bank will pay R^u in the *up* state.

Med State. Suppose that the med state occurs, Bayes' rule implies that the likelihood that a bank is of high type in the beginning of period 2 is

$$\alpha_2 = \frac{\alpha\beta_h}{\alpha\beta_h + (1-\alpha)\beta_l}.$$

In the beginning of the *med state*, the bank of type i chooses the payoff of its WMPs R^i to affect the market belief of it being high type μ^i and maximizes its market value in the end of period 2

$$\left(k\mu^i + 1 - \mu^i\right)\left(X - \frac{R^i}{\theta_i}\right), \text{ where } i = h, l.$$

Given that the signaling game allows for multiple equilibria, we make the following equilibrium selection assumption.

Assumption 1

i A Pareto dominated equilibrium never occurs;

ii we use intuitive criterion to select equilibrium if there exist two equilibria such that one does not Pareto dominates the other.

We next consider two classes of equilibria separately: pooling equilibria and separating equilibria.

Pooling Equilibrium. In a pooling equilibrium, both high type and low type banks send the same signal to the market, that is, $R^h = R^l$. Hence, the market does not update its belief and $\mu = \alpha_2$. The objective function of a type i bank is given by

$$(k\alpha_2 + 1 - \alpha_2)\left(X - \frac{R^i}{\theta_i}\right), \text{ where } i = h, l.$$

Since signaling is costly, it is straightforward to observe that $R^h = R^l = 0$ in the Pareto efficient pooling equilibrium. Hence, the market value of both high type and low type banks in the end of period 2 in the *med* state is $(k\alpha_2 + 1 - \alpha_2)\,X$.

Separating Equilibrium. In a separating equilibrium, the payoffs of WMPs issued by high type and low type banks $\{R^h, R^l\}$ satisfy the incentive compatible constraints

$$X - \frac{R^l}{\theta_l} \geq k\left(X - \frac{R^h}{\theta_l}\right) \text{ for a low type bank and}$$
$$k\left(X - \frac{R^h}{\theta_h}\right) \geq X - \frac{R^l}{\theta_h} \text{ for a high type bank.}$$

The market value of a high type bank is $k\big(X - \frac{R^h}{\theta_h}\big)$ and that of a low type bank is $X - \frac{R^l}{\theta_l}$. Since the marginal cost of liquidating long-term assets is lower for a high type bank, in the Parent efficient separating equilibrium a low type bank only pays $\underline{r}$ to its WMP investors (i.e., $R^l = 0$) and the return of WMPs issued by a high type bank is such that the low type bank is indifferent between mimicking a high type bank and revealing its own type, that is,

$$X = k\left(X - \frac{R^h}{\theta_l}\right). \tag{5}$$

In the Pareto efficient equilibrium, the market value of a high type bank is $k\big(X - \frac{R^h}{\theta_h}\big)$ where R^h satisfies equation (5) and that of a low type bank is X.

Equilibrium Selection. The only equilibrium that survives the intuitive criterion is the Pareto efficient separating equilibrium. Therefore, if the outcome of the pooling equilibrium discussed above does not Pareto dominate that of the separating one, we will pick the separating equilibrium; otherwise, we pick the pooling equilibrium. Since the welfare of a low type bank is strictly better off in the pooling equilibrium, we always select the pooling equilibrium where the welfare of a high type bank is weakly better off, that is,

$$(\alpha_2 k + 1 - \alpha_2)\,X \geq k\left(X - \frac{R^h}{\theta_h}\right) = k\left(X - \frac{k-1}{k}\frac{\theta_l}{\theta_h}X\right),$$

where the equality comes from the condition that R^h satisfies equation (5). We simplify the above inequality and derive the following proposition.

Proposition 2 *In the signaling game that starts in the beginning of the med state,*

i. if $\alpha_2 > 1 - \frac{\theta_l}{\theta_h}$, the pooling equilibrium emerges where $R^h = R^l = 0$ and the market value of both types of banks is $(k\alpha_2 + 1 - \alpha_2)\,X$

ii. if $\alpha_2 \leq 1 - \frac{\theta_l}{\theta_h}$, the separating equilibrium occurs in which R^h satisfies condition (5), $R^l = 0$, and the market values of high type and low type banks are $k\left(X - \frac{R^h}{\theta_h}\right)$ and X respectively.

The intuition of the proposition is straightforward. If the market belief is not to the advantage of a high type bank, the bank must have a strong incentive to the market by paying high return to its WMP investors. In this way, the high type bank can distinguish itself from a low type bank who finds it too costly to mimic. In contrast, when the market belief is in favor of a high type bank, the cross-substitution between a high type bank and a low type bank is minimal. Since it is costly to liquidate long-term assets so as to pay high returns to WMP investors, it is optimal for the high type bank to stay in the pooling equilibrium. In summary, we show that if the reputation of a bank deteriorates the payoff of its WMP could rise.

The Risk Premium of WMPs. The payoff of WMPs in the *up* state and the risk premium of WMPs depend on the equilibrium outcome of the signaling game and thus the market belief in the beginning of the *med* state. If $\alpha_2 > 1 - \frac{\theta_l}{\theta_h}$, that is, the market belief is in favor of a high type bank, then the WMP pricing equation (4) becomes

$$u\left((1-\gamma)f\right) = \beta u\left(R_p^u\right) + (1-\beta)u\left(\underline{r}\right);$$

if $\alpha_2 \leq 1 - \frac{\theta_l}{\theta_h}$, then

$$u\left((1-\gamma)f\right) = \beta u\left(R_s^u\right) + \alpha\beta_h u\left(R^h\right) + (1-\beta-\alpha\beta_h)u\left(\underline{r}\right).$$

Without the loss of generality, we focus on the case that $R_p^u > R_s^u \geq R^h$ around the threshold $\alpha_2 = 1 - \frac{\theta_l}{\theta_h}$. In this case, if the equilibrium switches from the pooling one to the separating one, the payoff of WMPs becomes less risky for WMP investors. Since creditors are risk-averse, the risk premium of WMPs declines from

$$\begin{aligned} r_{\text{wmp}}^p &\equiv \frac{\beta R_p^u + (1-\beta)\underline{r}}{(1-\gamma)f} - 1 \text{ to} \\ r_{\text{wmp}}^s &\equiv \frac{\beta R_s^u + \alpha\beta_h R^h + (1-\beta-\alpha\beta_h)\underline{r}}{(1-\gamma)f} - 1. \end{aligned}$$

Remarks. Our theoretical model replicates two key empirical findings that we discuss in Section 4. Firstly, the model shows that if the reputation of a bank α_2 crosses the threshold $1 - \frac{\theta_l}{\theta_h}$ from above, the expected return of CDs increases[12] and, more importantly, the bank extends stronger implicit guarantees, that is, the degree of implicit guarantees defined in Section 3 increases from

$$\begin{aligned} &\frac{\beta R_p^u + (1-\beta)\underline{r} - R_p^u}{R_p^u} \text{ to} \\ &\frac{\beta R_s^u + \alpha\beta_h R^h + (1-\beta-\alpha\beta_h)\underline{r} - R_s^u}{R_s^u}. \end{aligned}$$

Hence, our model produces the result that as the yield of CDs issued by a bank increases, the bank extends more implicit guarantees. Secondly, notice that as the bank reputation α_2 just crosses the threshold, the CD yield only increases slightly but the risk premium of WMPs sharply increases due to the equilibrium switch. Therefore, we reproduce the second empirical result that as the CD yield of a bank increases, its interbank WMP-CD spread declines.

[12] Recall Proposition 1 and note that α is strictly increasing in α_2.

The decline in a bank's reputation has a real negative consequence on its fundamental. In our model, if the reputation of the bank is sufficiently good, the market value of the bank is $(\alpha k + 1 - \alpha)X$ in the beginning of period 1. If its reputation declines and passes the threshold, its market value becomes

$$\left(\alpha k \left(1 - \frac{k-1}{k}\frac{\theta_l}{\theta_h}\right) + 1 - \alpha\right) X.$$

We can observe that the market value of the bank declines with its reputation not just because the chance of being a low type bank increases but also due to the fact that the fundamental of a high type bank decreases by a factor of $\frac{k-1}{k}\frac{\theta_l}{\theta_h}$.

Equilibrium selection is crucial for the sharp prediction of our model. However, it is not necessary. In the appendix, we consider an extension which replicates the same set of results without resorting to equilibrium switch. The main purpose of having the equilibrium selection assumption in our model is to deliver the key mechanism of the model in a simple and intuitive fashion. Nevertheless, our assumption is not entirely counter-intuitive. Although the equilibrium refinement device such as intuitive criterion always selects the separating equilibrium, it is hard to imagine that a high type bank would still prefer to signal its type in a costly fashion even when the market almost believe it is a high type bank.

The theoretical model predicts that if banks' reputation at the issuance of WMPs (i.e., α) declines, they are also more inclined to extend more implicit guarantees. With the interbank WMP-CD pair sample, we find the evidence that is consistent with the theoretical result. In particular, we run regression of WMPs' realized returns against WMPs' promised returns, CD yields, bank types, maturity, types of explicit guarantees, and SHIBOR. The results of these regressions are reported in Table 13 in Appendix.

6 Conclusion

In this paper, we show that a bank is more inclined to extend implicit guarantees when the market expectation of its default increases. This result is supported by both a couple of empirical evidences and the signaling-game based theoretical model. Our result has two insights regarding risks of shadow banking. First, when high-risk banks raise credit via shadow banking, our result shows that they face additional funding costs as the consequences of stronger implicit guarantees that investors expect. Second, our finding implies that a bank's risk-weight of its off-balance-sheet exposure ought to depend on its own default risk.

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Appendix

In the appendix, we present a variant of the main model and show that equilibrium switching is not necessary for replicating the key results of the paper. The model variant differs from the main model in three aspects: (i) the liquidity that a high type bank has on its off-balance-sheet account in the *med* state is $\underline{r}$; (ii) the liquidity that a low type bank has on its off-balance-sheet account in the *med* state is $\underline{r} + r$, where r follow a distribution $F(\cdot)$, with mean m; (iii) a low type bank cannot liquidate its long-term assets. Without the loss of generality, we assume that if a high type bank decides not to liquidate any of its long-term assets, it just pays what it has on its off-balance-sheet account to its WMP investors, and if a low type bank is unable to mimic a high type bank, it pays what it has on its off-balance-sheet account to its WMP investors. In our sample, we never observe a case that the payoff of a WMP is below its principal even when the issuing bank fails to deliver what it promises.

A High Type Bank's Optimization Problem in the *Med* State

Given that the med state occurs, suppose a high type bank chooses the payoff of its WMPs as $R^h + \underline{r}$. From the perspective of a low type banks, if it is able to pay $R^h + \underline{r}$, it will definitely do so due to the substantial high market value of mimicking a high type bank. The Bayes' updating implies that the market belief in the end of the *med* state satisfies

$$\mu = \frac{\alpha_2}{\alpha_2 + (1-\alpha_2)(1-F(R^h))}.$$

It is easy to see that μ is increasing in R^h with the interpretation that the higher the WMP payoff is, the less likely that a low type bank can mimic. The marginal effect of raising R^h varies with the prior α_2

$$\frac{\partial \mu}{\partial R^h} = \mu(1-\mu)\frac{f(R^h)}{1-F(R^h)}$$

Note that μ is increasing in α_2 and that $\mu(1-\mu)$ is increasing in μ if $\mu < 0.5$ and decreasing in μ otherwise. Hence, in the special case where r follows an exponential distribution, that is, $F(R^h) = 1 - \exp(-\lambda R^h)$ and

$$\frac{\partial \mu}{\partial R^h} = \lambda\mu(1-\mu),$$

$\frac{\partial \mu}{\partial R^h}$ is increasing in α_2 if $\mu < 0.5$ and decreasing in α_2 otherwise. In the range where $\mu > 0.5$, the marginal effect of raising R^h increases if the bank's reputation deteriorates.

Given the strategy portfolio, a high bank's market value in the end of period 2 in the *med* state is

$$(\mu k + 1 - \mu)\left(X - \frac{R^h}{\theta}\right).$$

The first order condition is

$$\mu(1-\mu)\frac{f(R^h)}{1-F(R^h)}(k-1)\left(X-\frac{R^h}{\theta}\right)=\frac{1}{\theta}(\mu(k-1)+1)$$

The right hand side term of the above equation is the marginal cost of raising the WMP payoff, which is increasing in the liquidation cost $1-\theta$, in the value of long-term assets k, and also in the reputation of the bank (α_2 or μ). The left hand side term is the marginal benefit whose property is less straightforward. However, in the special case where the liquidity shock to a low type bank follows an exponential distribution, we know that the marginal benefit is decreasing in the bank's reputation in a range where $\mu > 0.5$. To sum up, the first order condition has a clear prediction that given that $\mu > 0.5$, if the bank reputation declines the marginal cost of raising the WMP payoff also declines and the market benefit rises. Hence, the high type bank finds it optimal to pay higher WMP returns when its initial reputation declines on the maturity date.

B The Risk Premium of WMPs

In the variant of the main model, the return of WMPs in the *up* state R^u is determined by a risk-averse creditor's indifference condition, that is,

$$\begin{aligned}u((1-\gamma)f) &= \beta u(R^u)+(\alpha\beta_h+(1-\alpha)\beta_l(1-F(R^h)))u(R^h+\underline{r})\\&+(1-\alpha)\beta_l\left(\int_{\underline{R}}^{R^h}u(r+\underline{r})dF(r)\right)+(1-\beta-\alpha\beta_h-(1-\alpha)\beta_l)u(\underline{r}),\end{aligned}$$

where $\underline{R}$ is the lower bound of the liquidity shock to a low type bank's off-balance-sheet account r. With probability $1-F(R^h)$, a low type bank also pays R^h to its WMP investors so that it could enjoy the same high market value that a high type bank can. Alternatively, the low type bank just pays what it has on its off-balance-sheet account $r+\underline{r}$ ($< R^h+\underline{r}$).

Given the payoff of WMPs in the *up* state, the measure of implicit guarantees can be expressed as

$$\frac{1}{R^u}\left(\beta R^u+\alpha\beta_h R^h+(1-\alpha)\beta_l E\left[\min\{r,R^h\}\right]+\underline{r}\right)-1.$$

The WMP-CD spread is

$$\frac{1}{(1-\gamma)f}\left(\beta R^u+\alpha\beta_h R^h+(1-\alpha)\beta_l E\left[\min\{r,R^h\}\right]+\underline{r}\right)-\frac{1}{\gamma f}\left(\Pi R+(1-\Pi)\underline{r}\right), \tag{6}$$

where $\Pi=\beta+\alpha\beta_h+(1-\alpha)\beta_l$. Given that $R^u > R^h$ and the difference between R^h and $E\left[\min\{r,R^h\}\right]$ is sufficiently small, as the bank reputation α declines the WMP payoff in the *med* state R^h rises. So does the payoff of WMPs issued by a low type bank $E\left[\min\{r,R^h\}\right]$. Since creditors are risk-averse, the WMP payoff in the *up* state R^u declines. Hence, it is easy to see that if the bank reputation declines the measure of implicit guarantees decreases and the WMP-CD spread declines. In the following section, we will use a specific example to illustrate this case.

C A Numerical Example

In this section, we consider an example where $u(x) = -\exp(-\rho x)$ and the liquidity shock to a low type bank's off-balance-sheet account r follows an exponential distribution, that is, $F(r) = 1 - \exp(-\lambda r)$. Next, we will use a numerical example to discuss the main mechanism of the model. Figure 2 shows the comparative statics of the model.

As the reputation of the bank deteriorates (i.e., α declines), a high type bank raises its WMP payoff in the *med* state (dashed line in the upper right panel) because the marginal benefit of doing so increases and its marginal cost declines. Accordingly, it becomes more likely that a low type bank pays all its liquidity on the off-balance-sheet account to the WMP investors (solid line in the upper right panel). The two effects work together and push up the average payoff of WMPs in the *med* state (dashed line in the upper left panel). Since creditors are risk-averse, when the average payoff of WMPs in the *med* state rises the bank is able to promise much less return to WMP investors in the *up* state (dashed in the upper left panel). Therefore, the example shows that as the bank reputation goes down its propensity to pay promised returns to its WMP investors increases.

As the bank reputation declines, the chance that it enters the *down* state increases and thus its CD yield has to increase to compensate the high failure risk for its CD investors (the lower left panel). Overall, the lower right panel shows that the WMP-CD spread (6) declines as the bank reputation becomes worse. The key mechanism is the following. As the reputation deteriorates, the marginal effect of sending positive signals to the market rises in the *med* state. Due to the reputation effect, the payoff of WMPs becomes less risky and behave closer to that of on-balance-sheet CDs. Therefore, the spread of the two financial instruments narrows.

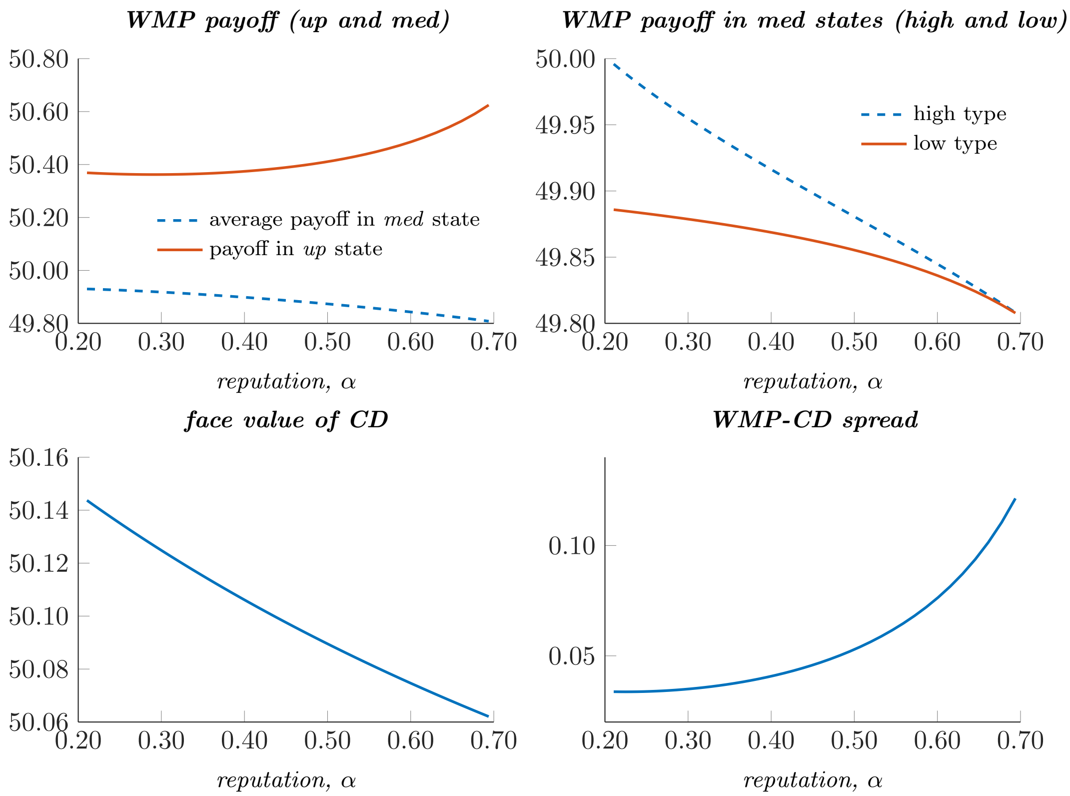

Figure 2: WMP-CD Spread

D Tables

Table 10: Summary Statistics

This table reports the summary statistics of six key variables of the extended sample: a WMP's realized return, (high) promised return, maturity (days), the yield of CD issued at the maturity of the WMP ($CD\ yield_{end}$), the yield of CD issued at the issuance date of the WMP ($CD\ yield_{start}$), and the overnight Shibor at the maturity of the WMP ($overnight\ shibor_{end}$).

	mean	std	p25	p50	p75	mean	std	p25	p50	p75
	all client types (72164 observations)					institutional clients (44770 observations)				
realized return	3.95	(0.97)	3.20	3.90	4.60	3.66	(0.84)	3.05	3.50	4.20
promised return	4.07	(1.06)	3.25	4.00	4.65	3.73	(0.86)	3.10	3.55	4.20
maturity (days)	112.94	(89.97)	40.00	91.00	180.00	110.28	(93.48)	35.00	90.00	180.00
$CD\ yield_{end}$	3.35	(0.70)	2.86	3.05	3.65	3.33	(0.69)	2.85	3.04	3.52
$CD\ yield_{start}$	3.40	(0.76)	2.87	3.05	3.81	3.38	(0.76)	2.85	3.04	3.79
$overnight\ shibor_{end}$	2.09	(0.40)	1.95	2.02	2.26	2.09	(0.40)	1.95	2.02	2.26

Table 11: Implicit Guarantees: bank across quarter fixed effect

This table reports results of regressions of the realized return of a bank's WMP ($\ln(1+$ *realized return*$)$) against the yield of the bank's interbank CD issued at the WMP's maturity date ($\ln(1+CD\ yield_{end})$), the WMP's promised return ($\ln(1+$ *promised return*$)$) , guarantee types, risk rating, and the overnight Shibor at the WMP's maturity date ($overnight\ shibor_{end}$) with bank cross quarter fixed effects at the maturity dates of WMPs. Column 1 reports the first stage regression, Column 3 the fixed-effect regression of the sub-sample of WMPs with 20-to-40 day maturity, Column 4 the fixed-effect regression of the sub-sample of WMPs with 80-to-100 day maturity, and Column 5 the fixed-effect regression of the sub-sample of WMPs with 170-to-190 day maturity.

	(1)	(2)	(3)	(4)	(5)
dependent variable	$\ln(1+CD\ yield_{end})$	$\ln(1+realized\ R)$	$\ln(1+realized\ R)$	$\ln(1+realized\ R)$	$\ln(1+realized\ R)$
$\ln(1+CD\ yield_{end})$		3.53678***	0.52907***	0.51921***	1.10543
		(1.09108)	(0.16077)	(0.15913)	(1.00448)
$\ln(1+promised\ R)$	-0.00767**	-0.45185***	-0.46383***	-0.50928***	-0.48777***
	(0.00348)	(0.06215)	(0.12689)	(0.04673)	(0.14366)
principal guaranteed	0.00011	-0.00675***	-0.00813***	-0.00555***	-0.00631**
	(0.00007)	(0.00142)	(0.00163)	(0.00100)	(0.00248)
principal & return guaranteed	-0.00000	-0.00697***	-0.00765***	-0.00557***	-0.00817***
	(0.00008)	(0.00154)	(0.00138)	(0.00110)	(0.00270)
$rating = 2$	0.00001	-0.00206*	-0.00347***	-0.00075	-0.00253
	(0.00009)	(0.00118)	(0.00086)	(0.00115)	(0.00212)
$rating = 3$	-0.00007	-0.00107	-0.00357***	-0.00023	-0.00070
	(0.00009)	(0.00109)	(0.00101)	(0.00087)	(0.00228)
$rating = 4$	0.00038***	-0.00834***	-0.00876***	0.01118	-0.00546***
	(0.00009)	(0.00297)	(0.00086)	(0.00869)	(0.00187)
$rating = 5$	0.00009	0.00130		0.00239**	0.00107
	(0.00008)	(0.00119)		(0.00118)	(0.00232)
$overnight\ shibor_{end}$	0.00789***	-0.02829***	-0.00411***	-0.00461***	-0.00796
	(0.00057)	(0.00973)	(0.00149)	(0.00151)	(0.00626)
$\ln(1+CD\ yield_{start})$	0.05883***				
	(0.00832)				
regression type	*1st stage*	*2SLS*	*2SLS*	*2SLS*	*2SLS*
sub-sample by maturity (days)	full sample	full sample	[20,40]	[80,100]	[170,190]
observations	41019	41019	10518	9515	7103
adjusted R^2	0.899	-1.909	0.294	0.360	0.043

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Risk Premium of Implicit Guarantee (extended)

This table displays the results of regressions of the interbank WMP-CD spread against the yield of the bank's interbank CD issued around the same time (*CD yield*), the maturity of the WMP, the size of the interbank CD, guarantee types, risk rating, and the overnight Shibor at the WMP's maturity date ($overnight\ shibor_{end}$). In the regressions whose results shown in Columns 1, 3, and 5, we WMPs' promised return to calculate the spread of the interbank WMP-CD pair; in those of Columns 2, 4, and 6, we use the realized returns.

Dependent Variable	*WMP return* $-$*CD yield*		$\ln(1 + WMP\ return)$ $- \ln(1 + CD\ yield)$		$\frac{WMP\ return - CD\ yield}{CD\ yield}$	
	promised	*realized*	*promised*	*realized*	*promised*	*realized*
	(1)	(2)	(3)	(4)	(5)	(6)
CD yield	-0.187***	-0.156***	-0.185***	-0.155***	-0.111***	-0.104***
	(0.042)	(0.028)	(0.040)	(0.027)	(0.011)	(0.008)
maturity	0.001***	0.001***	0.001***	0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CD size	-0.002***	-0.002**	-0.002***	-0.002**	-0.001***	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
principal guaranteed	-0.612***	-0.625***	-0.589***	-0.601***	-0.189***	-0.191***
	(0.063)	(0.061)	(0.060)	(0.059)	(0.018)	(0.018)
principal & return guaranteed	-0.477***	-0.520***	-0.458***	-0.499***	-0.149***	-0.154***
	(0.081)	(0.070)	(0.077)	(0.067)	(0.024)	(0.019)
$rating = 2$	-0.066	-0.064	-0.063	-0.061	-0.022	-0.016
	(0.057)	(0.041)	(0.055)	(0.039)	(0.019)	(0.013)
$rating = 3$	0.067	0.087**	0.065	0.083**	0.017	0.027**
	(0.042)	(0.040)	(0.041)	(0.039)	(0.012)	(0.012)
$rating = 4$	0.109**	0.097**	0.106**	0.093**	0.027***	0.026***
	(0.049)	(0.038)	(0.048)	(0.037)	(0.010)	(0.010)
$overnight\ shibor_{end}$		-0.174		-0.165		-0.059
		(0.108)		(0.104)		(0.037)
observations	18188	15750	18188	15750	18186	15748
adjusted R^2	0.326	0.312	0.325	0.310	0.376	0.339

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Implicit Guarantees: Interbank WMP-CD Pairs

This table reports results of regressions of the realized return of a bank's WMP ($\ln(1+$ *realized return*)) against the yield of the bank's interbank CD issued at the WMP's issuance date ($\ln(1+$ *CD* $yield_{start}$)), the WMP's promised return ($\ln(1+$ *promised return*)) , guarantee types, risk rating, and the overnight Shibor at the WMP's maturity date (*overnight* $shibor_{end}$) with monthly fixed effects at the issuance and maturity dates of WMPs. Column 1 shows the regression result of the full sample, Column 2 the sub-sample of joint-equity banks' WMPs, Column 3 the sub-sample of urban banks' WMPs, Column 4 the sub-sample of rural banks' WMPs.

	(1) full sample	(2) joint-equity	(3) urban	(4) rural
$\ln(1+CD\ yield_{start})$	0.179***	0.218***	0.187**	0.035
	(0.052)	(0.068)	(0.073)	(0.022)
$\ln(1+promised\ R)$	0.767***	0.766***	0.585***	0.933***
	(0.095)	(0.114)	(0.189)	(0.041)
maturity	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
principal guaranteed	-0.002*	-0.004***	-0.001*	-0.000
	(0.001)	(0.001)	(0.001)	(0.000)
principal & return	-0.001***	-0.002***	-0.002*	-0.000
guaranteed	(0.000)	(0.001)	(0.001)	(0.000)
$rating = 2$	-0.000	-0.000	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)
$rating = 3$	0.000	0.000	0.001*	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)
$rating = 4$	-0.000	-0.000		0.000
	(0.001)	(0.001)		(0.000)
$overnight\ shibor_{end}$	0.001	0.001	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.000)
observations	14113	8332	3317	2460
adjusted R^2	0.883	0.869	0.913	0.981

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$