# Market Discipline and Regulatory Arbitrage: Evidence from the Asset-backed Commercial Paper Exclusion

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**Abstract**

We investigate whether the U.S. stock market disciplines asset-backed commercial paper (ABCP) liquidity guarantor banks that exploit an arcane regulatory loophole in the "ABCP exclusion," which exempts the banks from raising risk capital for the guarantee obligation. We find that the market reduces the banks' franchise value under a shortened ABCP maturity, which obscurely raises the guarantee cost. The market drives the banks with franchise value more sensitive to the ABCP maturity to maintain a higher risk capital buffer. We interpret our findings as evidence that market discipline—complexity of the shadow banking system notwithstanding—alleviates the consequence of regulatory arbitrage.

*Keywords*: Capital Regulation; Market Discipline; Regulatory Arbitrage; Bank Risk Capital.

*JEL classification*: G01, G21, G28

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# 1 Introduction

The Basel Committee on Banking Supervision (BCBS) designates market discipline, together with the minimum capital requirements and supervisory review, as the "three pillars" of the Basel Accords. In nations such as the United States where the bank funding structure is complex, loopholes in the minimum capital requirement can be arcane enough to remain for an extended period. Loophole-exploiting banks took excessive risks beyond regulatory presumption and played a critical role in the recent financial crisis. How effective is the pillar of market discipline when the pillar of capital requirement is compromised? In particular, when banks are circumventing the minimum capital requirement under the nose of regulatory watchdogs, is the U.S. stock market efficient enough to spot them and lower their franchise value according to the excessive risk taken? Additionally, does the market pressure force loophole-exploiting banks to increase their risk capital without explicit regulatory intervention? Answering these questions will deepen our insights on the "three pillars" framework of Basel Accords.[1]

We develop a theoretical model to analyze whether the "Asset-backed commercial paper (ABCP) exclusion," a regulatory guideline introduced in Financial Accounting Standard (FAS) 140, demands adequate risk-capital for the guarantor banks of ABCP conduits.[2] Following the commercial paper market conditions, an ABCP conduit adjusts the newly issued commercial paper's maturity, which affects the guarantor bank's obligation in two opposing channels. First, a shorter maturity requires the guarantor bank to provide rollover support more frequently. Second, ABCPs with shorter maturity have less credit risk, which lowers the cost of rollover each time. Our model shows that the first channel dominates, that is, a drop in ABCP maturity always increases liquidity guarantee costs. Hence, the ABCP exclusion, which offers at least a 90% reduction in risk-capital requirement without considering the ABCP maturity, is a regulatory loophole. Subsequently, the variation in the ABCP maturity offers an opportunity to investigate market discipline on regulatory arbitrage.

[1] Many studies focus on how to refine capital requirements by focusing on macroprudential regulation and countercyclical capital buffer (Hanson, Kashyap, and Stein 2011; Repullo and Suarez 2012; Horváth and Wagner 2017; Jiménez, Ongena, Peydró, and Saurina 2017), bank liquidity management and regulation (Berger and Bouwman 2009; Cornett, McNutt, Strahan, and Tehranian 2011; Loutskina 2011; Acharya and Naqvi 2012), and stable funding measures (Brunnermeier and Pedersen 2008), among others. Nevertheless, the research on the effectiveness of market discipline under the presence of capital requirement loophole is limited.

[2] Please refer to Section 2 for a detailed introduction to the institutional details of ABCP, liquidity and credit guarantor banks, and "ABCP exclusion."

The model inspires empirical studies and develops testing hypotheses on both market *monitoring* and market *influence*, two distinct components of market discipline according to Bliss and Flannery (2002).[3] *If the market monitoring is effective*, the equity value of the liquidity guarantor bank will decline amid a drop in ABCP maturity even though the latter is not a concern in capital regulations. A shortened ABCP maturity raises the cost of the liquidity guarantee and lowers the bank franchise value and capital ratio, which alerts the regulator.[4] Hence, in equilibrium, a liquidity guarantor bank should maintain a higher capital ratio *ex ante*, *if the market influence is also effective.*

We find evidence of both market monitoring and influence using Moody's panel data on the universe of ABCP conduits from April 2001 to September 2009. The abnormal returns of the liquidity guarantor banks show that, when the quality of an *off-balance-sheet* ABCP conduit asset deteriorates, a shorter ABCP maturity still causes the bank to face higher guarantee costs consistent with the mechanism depicted in the theoretical model.

An important concern in interpreting our results is that the variation in ABCP maturity might not be exogenous: ABCP investors may run exactly because of the deteriorating condition of the guarantor bank. The endogeneity can amplify or attenuate our results. Although using average ABCP maturity instead of guarantor-specific maturities partially mitigates this problem, we use the maturity of non-financial commercial papers (NFCPs) as a plausible instrumental variable to further address the simultaneity concern. Given that the abnormal returns of the banking sector and non-financial sector are orthogonal over our sample period, and investors' idiosyncratic liquidity needs drive the maturities of both ABCP and NFCP (Bencivenga and Smith 1991; Allen and Gale 2004b; Allen and Gale 2004a), the NFCP maturity identifies the effect of investors' idiosyncratic maturity preference. The IV regression suggests that a single standard deviation increase (approximately 1.14%) in the percentage share of ABCP with overnight maturity (an increase from the average of 7.4% to 8.54%) leads to a 7.5 basis points negative return for a liquidity guarantor bank under average guarantee exposure (approximately 3.86% of total assets) and under average subprime 2/28 adjustable-rate mortgage delinquency rate buildup (0.416% per month). Our findings indicate that the stock market

[3]Market monitoring, based on the semi-strong form of the efficient market hypothesis (Ashcraft and Bleakley 2006), refers to market prices incorporate all relevant public information for a bank. Market influence means the market prices influence the bank's behavior.

[4]Ashcraft (2008) proves the market could provide information on default risk that helps regulators, who may offer aids to troubled banks or stop the forbearance against problem banks.

prices in the risks associated with the regulatory arbitrage activities, despite the complexity of shadow bank funding facilities.

We also find that loophole-exploiting banks maintain higher capital ratios (0.80% higher Tier-1 risk-capital ratio and a 0.74% higher total risk-capital ratio) than non-guarantor banks with similar characteristics. This effect is more pronounced among banks that are more sensitive to the ABCP maturity, suggesting that the stock market affects the loophole-exploiting banks' risk capital choice. We interpret our findings as evidence that the stock market can alleviate the impact of regulatory arbitrage on bank capital adequacy.

Our paper belongs to the literature on market discipline. Flannery and James (1984) show that the market notices the maturity mismatch between bank assets and liabilities; therefore, bank stock returns vary with interest rates.[5] Martinez Peria and Schmukler (2001) as well as Demirgüç-Kunt and Huizinga (2004) present market discipline by depositors as bank creditors. Subordinated notes and debentures can also serve as a market disciplinary tool (Avery, Belton, and Goldberg 1988; Gorton and Santomero 1990; Ashcraft 2008). This paper, to the best of our knowledge, is the first to show the effectiveness of market discipline against off-balance-sheet regulatory arbitrage.[6]

Our paper also contributes to two additional strands of literature. First, the empirical findings on the high capital ratio of the loophole-exploiting banks extend the literature on optimal bank capital structure. The optimal bank capital structure literature suggests that, contrary to conventional belief, banks do not simply leverage up to the minimum capital requirement but maintain an optimal capital buffer above the regulatory minimum (Flannery 1994; Myers and Rajan 1998; Diamond and Rajan 2000; Calomiris and Wilson 2004; Allen, Carletti, and Marquez 2011). Empirical studies (Berger, DeYoung, Flannery, Lee, and Öztekin 2008; Gropp and Heider 2010; Duchin and Sosyura 2014) confirm that banks maintain a capital buffer above the minimum requirement.[7] This article reveals that loophole-exploiting banks adjust their capital structure by holding additional risk capital.

[5]Other studies show the market prices bank stock using unexpected inflation shocks (Amihud 1996; Lajeri and Dermine 1999), exchange rate risks (Choi, Elyasiani, and Kopecky 1992), or changes in yield spreads and default spreads (Stiroh 2006).

[6]Our paper does not intend to argue whether the regulators are aware of the existence of ABCP regulatory loophole. Policy change and implementation in the United States must follow rules of procedure, which usually takes an extended period. Hence, a regulatory loophole may remain when the regulatory bodies are aware of its existence.

[7]Flannery and Rangan (2008) find that regulatory innovations in the early 1990s weakened conjectural government guarantees and enhanced bank counterparties' incentive to monitor and price default risk.

Second, this paper adds to the literature on the shadow banking system, rollover risk, and capital regulation (Brunnermeier 2008; Krishnamurthy 2009; Acharya, Gale, and Yorulmazer 2011; He and Xiong 2012b; Covitz, Liang, and Suarez 2013; Martin, Skeie, and von Thadden 2014; Kisin and Manela 2016) by focusing on the impact of rollover risk on the effectiveness of bank capital regulation. The model provides additional support to the belief that regulatory arbitrage is the primary driving force behind the growth of ABCP (Pozsar, Adrian, Ashcraft, and Boesky 2010, Adrian and Ashcraft 2012, and Ordonez 2013). The seminal paper by Acharya, Schnabl, and Suarez (2012) provides empirical evidence to support the hypothesis of regulatory arbitrage among ABCP guarantor banks, whereas our paper shows that the stock market disciplines the regulatory arbitraging banks. Our empirical specification identifies the effect of ABCP maturity corrected for the simultaneity between the bank return and ABCP maturity, and provides evidence that the bank returns are affected by the cost of liquidity guarantee in periods of both turmoil and the quiet years before the ABCP crisis.[8]

# 2 Institutional background

Before turning to our analysis, we present some necessary institutional details of ABCP conduits, particularly regarding the difference between liquidity and credit guarantees, which is at the core of our study.

## 2.1 ABCPs and guarantor banks

The total ABCP outstanding reached 1.21 trillion USD in 2007, approximately 12.3% the size of commercial bank liability in the United States, as Figure 1 shows. An ABCP conduit is a shadow banking funding facility that allows a bank to finance long-term assets off-balance-sheet, by rolling over short-term ABCP with the highest credit rating.[9] The value of the conduit's risky assets may fall below a pre-set threshold, upon when the conduit is deemed to be in default and forced into a costly liquidation. Nevertheless, the short maturity of ABCP allows investors to close their position

[8] Acharya et al. (2012) presents the evidence that regulatory arbitraging banks suffered a market value loss only during the ABCP run in August 2007 but not in months before the August.

[9] ABCP in the United States has maturity ranging from overnight to 270 days. In Europe, the maturity typically varies from overnight to 180 days.

before the deteriorating conduit has reached the default threshold. Hence, the institutional investors of ABCP, mostly money market funds (MMFs), demand *rollover support* to ensure they can unwind their positions swiftly.[10] Additionally, the investors also demand *wind-down support*; that is, getting paid when the defaulted ABCP conduit is liquidated.

Each ABCP conduit has a guarantor bank to provide the rollover and wind-down support. In many cases, the guarantor bank is the same bank that creates the ABCP conduit and moves its risky assets off-balance-sheet.[11] There are two distinct types of guarantees that banks can offer—credit guarantees and liquidity guarantees—with different levels of support to investors and distinct regulatory capital consequences.

## 2.2 Credit versus liquidity guarantor banks and capital requirements

Figure 2 illustrates the similarity and difference between the credit and liquidity guarantee.[12] Both guarantees feature *rollover support* when the conduit has not reached the default threshold: when the investors with maturing ABCP no longer want to reinvest or "rollover" the commercial paper, the sponsoring bank pays the ABCP's principal amount back to the investors. Usually, the bank then reissues ABCP, typically at a discounted price.

A credit guarantee offers better *wind-down support*. When the underlying conduit is deemed to be in default, ABCP investors with a credit guarantee receive the full principal from the guarantor bank. On the other hand, ABCP investors with a liquidity guarantee only recovers the remaining collateral value of the conduit's underlying assets.[13]

[10]Under SEC Rule 2a-7, MMFs may only hold the highest rated debt and must maintain an overall portfolio weighted average maturity of 60 days or less. According to the Federal Reserve Financial Accounts of the United States, MMFs had aggregate assets up to 2.69 trillion USD by the end of the year 2008. The large size of MMFs leads to lower transaction costs of ABCP in the secondary market.

[11]In other words, the bank transfers assets, such as mortgage-backed securities, from its balance sheet to the conduit.

[12]Our definitions of credit and liquidity guarantee are consistent with the definitions in Acharya et al. (2012), as well as in Kisin and Manela (2016). There are other alternative structures and supports in ABCP conduit, including but not limited to collateralized debt obligations, repurchase agreeements, and total return swaps. We do not include these alternative structures in our sample and analysis.

[13]Although the conduits typically have some credit enhancement measures, such as a subordinate or over-collateralization tranche as the first group to absorb the loss of the defaulted assets, ABCP investors are still subject to credit risk once the credit enhancement is depleted. The size of program credit enhancement is small,

Regulators require a credit-guarantor bank to prepare risk capital for the ABCP facility as if the long-term assets are financed on-balance-sheet, for the bank bears all the credit risks. On the other hand, valuing the obligation of a liquidity guarantor bank is not as easy because the guarantor is remote from the credit risk of the facility. Before 2010, regulators allowed qualified liquidity guarantors to enjoy an ABCP exclusion whereby the bank did not need to prepare risk capital at all, or only 10% of the risk capital required for comparable assets held on the balance sheet after a 2004 policy revision.[14] The ABCP exclusion *would* be a regulatory loophole *if* it underestimated the risk carried by liquidity guarantor banks. In this case, the ABCP exclusion provides an opportunity to test whether the stock market is aware of the risks associated with loophole-exploiting banks. The next section presents analytical results on how ABCP maturity affects the risk transfer from an ABCP conduit to its guarantor bank.

# 3 Theory

We start with a parsimonious model of an ABCP guarantor bank subject to a regulatory capital constraint. Consider a continuous time risk-neutral economy with time $t \in [0, +\infty)$ and riskless interest rate $r > 0$.[15] The economy contains a bank with initial equity capital $E$, deposit $D$, and balance sheet asset $B = D + E$. There is also one unit of risky long-term project which, after an initial investment, pays risky cash flow following a geometric Brownian motion $dy_t = \mu y_t dt + \sigma y_t dW_t$, where $W_t$ is a standard Brownian motion and $0 < \mu < r$. Hence, the project has an intrinsic value $V(y_t) = y_t / (r - \mu)$ as the risk-neutral expectation of cash flow. The initial investment to set up the project is $V(y_0) = y_0 / (r - \mu)$. At $t = 0$, the bank raises capital $V(y_0)$ for the risky project by setting up an off-balance-sheet ABCP conduit that issues and then rolls bank-guaranteed ABCP. The ABCP pays a fixed coupon $k$ such that the paper is originated at par. We focus on the analysis of the off-balance-sheet financing and let the value of balance sheet asset $B$ and of deposit $D$ remain constant over $t$.

often covering less than 15% of the conduit assets.

[14]Appendix A.2. offers more details about the regulations and codes.

[15]The dynamic capital structure model literature includes Leland (1994b), Leland and Toft (1996), Leland (1994a), and Decamps, Rochet, and Roger (2004). The fair value of deposit insurance is related to Merton (1977) and Merton (1978), which study the pricing of insurance under dynamic settings.

We let the ABCP guarantor bank issues commercial paper with a maturity that matches the investors' idiosyncratic shock of liquidity requirement.[16] In a similar vein as He and Xiong (2012a), we assume that the ABCP maturity $\tau \in (0, +\infty)$ follows an exponential distribution with probability density function $f(x) = me^{-mx}$ with parameter $m > 0$. Hence, $m$ fraction of the outstanding paper will mature within the next time unit, and the expected remaining time-to-maturity of ABCP is $1/m$.

The bank offers an ABCP guarantee $G(y_t, m)$, which refers to either a credit guarantee $G^C(y_t, m)$ or a liquidity guarantee $G^L(y_t, m)$. Under both types of guarantee, the guarantor bank offers *rollover support* that pays the investors the face value of their maturing ABCP if they choose not to roll over the paper. The bank then reissues the paper at the market price $A(y_t, m)$. The guarantee lasts until the ABCP conduit winds down, which is triggered by the conduit asset cash flow $y_t$ hitting the wind-down threshold $y_w$. Credit guarantor banks have to pay investors ABCP face value upon conduit wind-down, whereas liquidity guarantor banks only pay investors the market value of conduit assets. Panel (a) of Figure 3 demonstrates the timing of the events for a credit guarantor bank and how investors holding maturing ABCP are paid, whereas Panel (b) of Figure 3 illustrates a liquidity guarantor bank.

We assume that the initial bank capital $E$, being $E^C$ for a credit guarantor or $E^L$ for a liquidity guarantor, is large enough to cover the guarantee such that $E^C + G^C(y_t, m) \geq 0$ or $E^L + G^L(y_t, m) \geq 0$ for all $y_t > y_w$. The assumption is consistent with the fact that no ABCP conduit has ever experienced guarantor default even during the crisis period: ABCP is a vital funding facility for the sponsoring bank such that defaulting on the guarantee obligation leads to severe reputational damage.

Following the BCBS definition, a bank's capital ratio is the value of equity capital, including the credit guarantee obligation, over bank assets. As the credit guarantor bank must prepare risk capital as though they finance the ABCP conduit assets on-balance-sheet, its capital ratio $K^C(y_t)$ at $t \geq 0$ is

$$K^C(y_t) \equiv \frac{E^C + G^C(y_t, m)}{D + E^C + G^C(y_t, m) + V(y_t)}. \tag{1}$$

The risk capital reduction from the ABCP exclusion allows a liquidity guarantor bank to book

[16]We choose not to model the consumption problem specifically for it is not the focus of our paper. In the standard financial intermediary theory literature, investors face idiosyncratic uncertainty about her preference type as an early or late consumer (Bencivenga and Smith 1991; Allen and Gale 2004b; Allen and Gale 2004a). Investors facing such uncertainty will adjust the maturity of investment accordingly.

only $\beta V(y_t)$ in the calculation of the capital ratio $K^L(y_t)$.[17] We have $\beta = 0$ before December 2003, and $\beta = 0.1$ afterwards and until the ABCP exclusion was eliminated. In other words,

$$K^L(y_t) \equiv \frac{E^L + G^L(y_t, m)}{D + E^L + G^L(y_t, m) + \beta V(y_t)}. \tag{2}$$

We assume the liquidity guarantor has a significant involvement in off-balance-sheet financing such that $V(y_w) \geq \sqrt{\beta} D$. Finally, we let the bank maintain its capital ratio above a minimum requirement $\underline{K}$ or face a regulatory penalty.[18] Apparently, a credit guarantor would set $K^C(y_0) \geq \underline{K}$, and a liquidity guarantor would set $K^L(y_0) \geq \underline{K}$.

## 3.1 Market monitoring: ABCP maturity and cost of guarantee

ABCP maturity has two opposing effects on the cost of guarantees. First, as with many fixed-income security with credit risk, ABCPs with shorter maturity trade at a (weakly) higher price level since credit events are less likely to occur before the maturity date. Hence, when an investor no longer willing to roll over his ABCP, the guarantor—obligated to buy back the discounted paper at par—incurs a lower cost when the paper maturity is shorter. However, under an ABCP market exodus, a shorter ABCP maturity means the bank has to buy back discount papers at par more frequently. Does the high rollover frequency dominate the low cost of rollover—a lower ABCP maturity leads to a higher cost of liquidity guarantee—or not? To shed light on the comparative statics of guarantee cost, we first derive the value functions of credit and liquidity guaranteed ABCPs and study how they vary with ABCP maturities.

**Proposition 1.** *The value of ABCP under a credit guarantee does not vary with the maturity* $1/m$. *Specifically,* $A^C(y_t, m) = V(y_0)$.

**Proposition 2.** *The value function of ABCP with a liquidity guarantee* $A^L(y_t, m) = \mathbf{1}_{\{y_t \geq y_0\}} A_h^L(y_t, m) +$

[17] For simplicity, we assume all the assets, both on and off balance-sheet, have a risk weight of 100%.

[18] Once a bank fails to maintain the capital ratio above the minimum requirement, it can continue to operate under the regulatory forbearance, which leads to more stringent regulatory oversight and higher operating costs. The bank may also be forced to replenish capital through other means such as fire selling high quality assets or raising equity when the share price is subdued.

$\mathbf{1}_{\{y_t<y_0\}} A_l^L(y_t,m)$, *where*

$$
\begin{aligned}
A_h^L(y_t,m) &= \frac{k}{r}V(y_0) + C_h(m)\phi(y_t;y_w), \\
A_l^L(y_t,m) &= \frac{k+m}{m+r}V(y_0)(1-\psi(y_t;y_w)) + V(y_w)\psi(y_t;y_w) - C_l(m)\left(\psi(y_t;y_w) - \bar{\psi}(y_t;y_w)\right),
\end{aligned}
$$

*in which* $\phi(y_t;y_w) = \left(\frac{y_t}{y_w}\right)^H$, $\psi(y_t;y_w) = \left(\frac{y_t}{y_w}\right)^G$, *and* $\bar{\psi}(y_t;y_w) = \left(\frac{y_t}{y_w}\right)^{\bar{G}}$. *Further,* $H = \frac{1}{2} - \frac{\mu}{\sigma^2} - \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2}\right)^2 + \frac{2r}{\sigma^2}} < 0$, $G = \frac{1}{2} - \frac{\mu}{\sigma^2} - \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2}\right)^2 + \frac{2(r+m)}{\sigma^2}} < 0$ *and* $\bar{G} = \frac{1}{2} - \frac{\mu}{\sigma^2} + \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2}\right)^2 + \frac{2(r+m)}{\sigma^2}} > 0$. *Finally,* $C_h(m)$, $C_l(m)$, *and* $k$ *satisfy the smooth pasting conditions at* $A_h^L(y_t,m) = A_l^L(y_t,m) = V(y_0)$ *and* $\frac{\partial}{\partial y}A_h^L(y_t,m) = \frac{\partial}{\partial y}A_l^L(y_t,m)$ *at* $y_t = y_0$.

Despite the complicated value function of ABCP with liquidity guarantee, Proposition 1 and 2 show that the value of liquidity guaranteed ABCP varies with the ABCP maturity $1/m$, whereas the value of credit guaranteed ABCP does not. Panel (a) of Figure 4 shows that when the ABCP maturity gets shorter, i.e., from 6 month to 1 month, the value of a discounted ABCP (whose underlying asset value $y_t < y_0$) goes up. But this does not mean the liquidity guarantee of 1-month paper is cheaper to the bank: in fact, the opposite is true as the rollover frequency also determines the cost of the guarantee.

**Proposition 3.** *When the ABCP maturity decreases, the liquidity support value function converges to the credit support value function. When the maturity* $1/m$ *approaches* 0, $\lim_{m\to\infty} G^L(y_t,m) = G^C(y_t,m)$ *for* $\forall y_t > y_w$.

Proposition 3 indicates that a drop in the ABCP maturity leads to a higher liquidity guarantee cost. In other words, the effect of high rollover frequency dominate the low cost of rollover each time. Therefore, the ABCP exclusion, which reduces the risk capital requirement for a liquidity guarantor bank to 10% of the ABCP principal amount regardless of the ABCP maturity, is a regulatory loophole when the ABCP maturity is sufficiently short. Ignoring the effect of ABCP maturity gives the regulator a false sense that the liquidity guarantee is safer than the credit guarantee. Subsequently, the liquidity guarantor receives an opportunity for regulatory arbitrage to take excessive risks by moving risky assets to a liquidity-guaranteed ABCP conduit.

To further illustrate the intuition of Proposition 1, 2, and 3, Panel (a) of Figure 4 presents the value functions of credit and liquidity guaranteed ABCPs and the value of those guarantees under different maturities. Panel (b) of Figure 4 shows that the value function of the liquidity guarantee converges to the value function of the credit guarantee when the ABCP maturity shortens.

More importantly, Proposition 1, 2, and 3 suggest that the franchise value of a liquidity guarantor should vary with the ABCP maturity as well as the underlying asset value if the market is aware of the loophole, whereas the franchise value of a credit guarantor bank should not. We can then test whether the stock market is aware of the regulatory loophole in the ABCP exclusion.

*H1: The change in the maturity of the ABCP with a credit guarantee does not affect the risk transfer between the ABCP conduit and the guarantor bank. In other words, the interaction term between the maturity and underlying asset value should not significantly affect a credit guarantor bank's abnormal return.*

*H2: The drop in the maturity of the ABCP with a liquidity guarantee allows more risk transfer from the ABCP conduit to the guarantor bank. In other words, the interaction term between a shortened ABCP maturity and deteriorating underlying asset value lowers the liquidity guarantor bank's abnormal return.*

## 3.2 Market influence: equilibrium capital ratios

Would the loophole-exploiting banks prepare more risk capital, conditional on an efficient enough stock market that lowers the franchise value of those banks according to the excessive risk they have taken? In other words, under effective market monitoring, would the bank be concerned about whether the $K^C(y_t)$ or $K^L(y_t)$, which is driven by the market value of the equity capital and bank assets, can stay above the minimum requirement $\underline{K}$? How would such a concern affect the bank's choice of initial capital ratio $K^C(y_0)$ and $K^L(y_0)$? To address these questions, we first compare the dynamics of $K^L(y_t)$ and $K^C(y_t)$ under $y_t$.

**Proposition 4.** *When the ABCP maturity $1/m$ approaches zero, an ABCP liquidity guarantor—whose initial capital ratio is the same as a credit guarantor—has $K^L(y_t)$ that is more sensitive to the shock in the underlying asset value than the credit guarantor when $y_t < y_0$, or $\frac{dK^L(y_t)}{dy_t} > \frac{dK^C(y_t)}{dy_t}$. Subsequently, the liquidity guarantor is more likely to violate the minimum capital requirement under* *any realized path of $y_t$.*

Proposition 4 suggests that a liquidity guarantor with $K^L(y_0)$, *ceteris paribus*, finds itself violates the minimum requirement $\underline{\kappa}$ *earlier* than a credit guarantor with the same initial capital ratio $K^C(y_0) = K^L(y_0)$. In other words, the liquidity guarantor is more likely to breach the minimum capital requirement.

Banks actively manage their capital level by weighting the inefficiency of holding more capital in normal times and the cost of failing to meet the minimum capital requirement $\underline{K}$ during adverse times (Flannery 1994; Myers and Rajan 1998; Diamond and Rajan 2000; Allen et al. 2011). Hence, Proposition 4 establishes a connection between market discipline and guarantor banks' capital ratio: under effective market influence, liquidity guarantor banks should maintain a higher level of equilibrium *initial* capital ratio $K^L(y_0)$, or the book-value based capital ratio, than their otherwise equivalent credit guarantor counter-parties.[19] We present the following hypothesis to test the effectiveness of market influence.

*H3: Under an effective market influence, the ABCP liquidity guarantor banks keep a higher capital ratio than the credit guarantor banks.*

We test the empirical hypotheses in the following sections.

# 4 Data

We obtain the quarterly information on the outstanding amount of ABCP conduits, conduit guarantee types, and the guarantor institution from Moody's Investors Service, which publishes quarterly spreadsheets summarizing the basic information on most of the ABCP conduits. Our sample starts from April 2001, when FAS 140 became effective, to September 2009 when the ABCP exclusion ended.[20] We drop the data points of alternative conduits, including Collateralized Debt Obligations (CDO), Asset

[19]Standard results in stochastic optimization theory suggest that the bank should set the equilibrium initial capital ratio, be it $K^L(y_0)$ or $K^C(y_0)$, by keeping an optimal distance from the threshold level $\underline{K}$. This is also the intuition in the dynamic capital structure (Leland 1994a; He and Xiong 2012b)

[20]Although the ABCP exclusion was officially dropped in January 2010, the banks were aware of the coming policy change months before the final announcement. Therefore, we do not include 2009 Q4 in our sample.

Backed Securities (ABS), repurchase agreements, total return swaps, and mortgage warehouses.[21] We also remove the conduits with non-bank guarantors, such as asset management firms and automotive manufacturers. This leaves 18 publicly traded U.S. bank holding companies (BHCs) as ABCP guarantors in our sample. We then collapse the observations by aggregating the principal amount of outstanding ABCP across all the conduits supported by each bank in each quarter. The resulting dataset contains quarterly updates on each bank's liquidity guarantees and credit guarantees exposure. We then merge the bank conduit exposure information with bank financial statement information from the Federal Reserve Board's FR Y-9C forms for BHCs, by matching bank and quarter.

To compare the risk capital ratios between the guarantor and non-guarantor BHCs, we also include information of non-guarantor BHCs during the sample period. Following the common practices in Erel, Nadauld, and Stulz (2013), we drop all BHCs with missing data on total assets or with maximum total assets less than 1 billion USD during this period. This gives us 370 non-guarantor BHCs.

Table 1 summarizes the balance sheet information of U.S. bank holding companies, including both ABCP guarantor and non-guarantors. There are $7,996$ bank-quarter observations in total. Among them, 419 observations come from 18 ABCP guarantors. The remaining $7,577$ observations come from 370 BHCs that are non-guarantors and with maximum book assets larger than 1 billion.[22] The number of bank-quarter observations drops to $1,459$ and 376 when we keep only non-guarantors with more than 10 billion and 50 billion USD book assets, respectively, whereas the number of banks drops to 77 and 26. ABCP guarantors tend to be large banks. Guarantor and non-guarantor banks also differ in many other aspects including Tier 1 risk capital ratio and Total risk capital ratio. Nevertheless, the difference gets smaller when we compare ABCP guarantor banks with larger non-guarantor BHCs. In particular, the Total risk capital ratio of ABCP guarantors are lower than the average of non-guarantors with more than 1 billion USD assets but higher than that of large non-guarantor BHCs

[21] CDO and ABS are more complex structures in which some senior tranches are structured as ABCP. Some ABCP conduits have full credit guarantees as a repurchase agreement or a total return swap, which covers 100% of the ABCP balance with a counterparty other than the sponsoring bank. We drop these records because the repo and total return swap protection sellers, instead of banks, carry the credit risk. Some mortgage lenders use ABCP conduits as mortgage warehouses to provide the working capital and fund the newly originated mortgage loans that have not yet been moved into a mortgage pool for securitization. The mortgage lenders, as sponsors, are in many ways different from regular bank holding companies.

[22] Five banks started to sponsor ABCP conduits later than 2001Q2. They appear as non-guarantors in the earlier periods and as guarantors later. Hence, the sum of the number of guarantor and non-guarantor banks is greater than the total number of banks 381.

with 50 billion or more assets.

Table 2 provides summary statistics to reveal further details about the ABCP guarantor banks at the bank-quarter level. A guarantor bank may provide liquidity guarantee to one ABCP conduit and credit guarantee to another at the same time (129 bank-quarter observations in total). Therefore, the sum of observations of liquidity and credit guarantor bank-quarter observation is larger than the total number of bank-quarter of guarantor banks.

## 4.1 Measuring the conduits' credit risk and the CP maturity

Following the theoretical analysis, which suggests that a bank's cost of guarantee obligation depends on both the *conduit's credit risk* and the *commercial paper maturity*, we develop the corresponding empirical measures as follows.

To measure the *conduit's credit risk* by each guarantor bank, we first normalize the credit and liquidity guarantee exposure for each bank $i$ at period $t$ by the book value of the bank's balance sheet assets:

$$\text{LG Conduit Exposure}_{i,t} = \left[\frac{\text{Outstanding of ABCP with bank } i\text{'s liquidity guarantee}}{\text{Book value}}\right]_{i,t},$$
$$\text{CG Conduit Exposure}_{i,t} = \left[\frac{\text{Outstanding of ABCP with bank } i\text{'s credit guarantee}}{\text{Book value}}\right]_{i,t}.$$

We then obtain the credit risk information about the assets in the ABCP conduits. Moody's Investors Service releases, on an irregular basis, the mix of underlying assets for a few large ABCP conduits and shows that residential MBS is the primary type of the underlying assets. Therefore, we use the monthly subprime mortgage delinquency information from ABSNet, our third data source, as a proxy for the expected future credit loss in ABCP conduit assets.

Specifically, we focus on the delinquency status of subprime 2/28 adjustable-rate mortgage (ARM), a subprime mortgage product that first proliferated during the housing boom and later suffered massive credit loss.[23] Since the borrowers with low credit quality typically do not recover once they are over

[23]The term 2/28 means the borrower will enjoy a low fixed teaser mortgage rate for the first two years followed by a floating rate thereafter. The total term of the mortgage is 30 years. Adjustable-rate subprime mortgages allowed the borrowers with low income to enjoy a low initial teaser rate, which made the mortgage loan more

60 days delinquent, the 60-day delinquency rate was a closely watched indicator of the healthiness of ABCP collateral quality.[24] We aggregate the monthly balance of over 60-day delinquent subprime ARM 2/28 loans and normalize it with their monthly total current balance:

$$\text{Mortgage Delinquency}_t = \left[\frac{\text{Balance of over 60-day delinquent subprime ARM 2/28 loans}}{\text{Balance of subprime ARM 2/28 loans}}\right]_t .$$

Figure 5 shows the change in the subprime ARM 2/28 delinquency ratio during the study period.

We construct the measure for conduits' credit risk by guarantee type for each sponsoring bank $i$ at time $t$ as the product of relative conduit exposure and the percentage of over 60-day subprime ARM 2/28 delinquent ratios:

$$\text{LG Conduit Risk}_{i,t} = \text{LG Conduit Exposure}_{i,t} \times \text{Mortgage Delinquency}_t,$$
$$\text{CG Conduit Risk}_{i,t} = \text{CG Conduit Exposure}_{i,t} \times \text{Mortgage Delinquency}_t.$$

To measure the *commercial paper maturities*, we obtain the daily maturity distribution for all newly issued U.S. ABCP and NFCP with the highest credit rating from Federal Reserve. The NFCP maturity is an instrumental variable that solves the endogeneity between ABCP maturity and bank return, which we discuss shortly after. We calculate the daily distribution of maturity for the *outstanding* commercial papers by summing the issuance balance of the commercial paper with different maturities. We then use the ratio of the outstanding amount of ABCP maturing overnight to the total outstanding of ABCP with all maturities in the same period as a measurement of ABCP maturity, as well as a

affordable than fixed-rate subprime mortgages in the first few years. During the housing boom, it was widely believed that the borrowers could accumulate housing equity from the rising house prices while enjoying the first two years of teaser rate. The borrowers could then either sell the house for a profit or refinance into a mortgage with a lower rate. When the growth in home prices began to soften in 2007, the subprime ARM borrowers show an increasing level of delinquency.

[24]There are two standard approaches to calculate days in delinquency: the Office of Thrift Supervision (OTS) standard, and the Mortgage Banker's Association (MBA) standard. A mortgage loan that is 30 days delinquent in OTS standards is usually 60 days delinquent in MBA standards. Similarly, a 60 days delinquent loan in OTS standard is 90 days delinquent in MBA standards. The OTS standard has wider acceptance for subprime mortgage products. We follow the OTS standard in this paper.

similar measure for NFCP:

$$\%\text{OVN}_t = \left[\frac{\text{Outstanding of ABCPs that are maturing overnight}}{\text{Total ABCP outstanding}}\right]_t,$$
$$\%\text{OVN NFCP}_t = \left[\frac{\text{Outstanding of NFCPs that are maturing overnight}}{\text{Total NFCP outstanding}}\right]_t.$$

The $\%\text{OVN}_t$ corresponds to the parameter $m$ in Section 3. A higher overnight share at day $t$ implies that the bank must deliver more liquidity guarantee on that day. Panel (a) and (b) of Figure 6 show the daily fraction of ABCP and NFCP maturing overnight.

We also obtain the daily returns of the BHCs and the common market factors including daily riskless rate, Fama-French factors, Carhart momentum factor, by merging CRSP and Fama-French data. We merge the daily returns of banks with the daily commercial paper maturity and the level of mortgage delinquency. We then merge the resulting dataset with the quarterly ABCP conduit outstanding information and banks' call reports before the return date. Finally, we augment the dataset with macroeconomic data. The macroeconomic datasets include the monthly U.S. GDP and the magnitude of quantitative easing (QE); both can change the banks' returns as well as investor appetite to for ABCP. The GDP data are from Macroeconomic Advisers LLC, and the QE data are from the weekly MBS purchase amount published by the Federal Reserve.

Table 3 summarizes the guarantor banks' ABCP guarantee risk exposure, ABCP maturity, stock return, and other market and macroeconomic variables. The sample consists of $26,042$ observations of bank returns for 18 panel banks from 2001Q2 to 2009Q3. The ABCP maturity measure %OVN shows that on average, 7.4% of the outstanding ABCP matures overnight, whereas the ratio becomes 21.68% during the ABCP run. The average and maximum share of NFCP with overnight maturity are 10.26% and 41.60% respectively. Liquidity and credit guarantee conduit exposure show the outstanding ABCP that the bank guarantees relative to its book value. The size of liquidity guarantee facility is about 3.92% as large as the bank balance sheet on average, whereas the size of credit guarantee facility is about 0.86%.[25]

[25]The sum of the relative size of liquidity and credit guarantee facilities is about 4.8%, less than implied by Figure 1, since we drop the alternative conduits and non-bank guaranteed conduits.

# 5 Empirical analysis

## 5.1 Market monitoring: ABCP maturity and bank equity return

First, we investigate whether the market can effectively monitor the banks that exploit the ABCP exclusion. In particular, we test the hypotheses H1 and H2 by analyzing whether a reduction in the maturity of a bank-guaranteed ABCP lowers the bank's equity return.

One concern is that the change in ABCP maturity is not an exogenous variable that affects the sponsor bank's equity return. Although the investor's idiosyncratic maturity preference (Bencivenga and Smith 1991; Allen and Gale 2004b) affects the ABCP maturity, the preference is unlikely to be the only factor.[26] In particular, investors may demand short maturity ABCP exactly due to a deterioration in the creditworthiness of the sponsor bank which a lower stock price might indicate – a standard simultaneity issue.[27]

Using the overall maturity of the outstanding ABCP instead of the maturity of sponsor-bank-specific ABCP alleviates the simultaneity bias. A single bank's low equity return should have a lesser impact on the overall investors of ABCPs, most of whose papers are guaranteed by different banks. Further, banks' idiosyncratic risks, which drives ABCP maturities, may cancel out with each other. Therefore, using $\Delta\%\mathrm{OVN}_t$, the change in the ratio of ABCP outstanding maturing overnight from period $t-1$ to $t$, we test our hypotheses H1 and H2 using the unrestricted model

$$\begin{aligned}
r_{i,t}^{FF4} \quad = \quad & \alpha_i + \beta_0 \times \Delta\%\mathrm{OVN}_t \\
& + \beta_1 \times \Delta\text{LG Conduit Risk}_{i,t} + \beta_2 \times \Delta\%\mathrm{OVN}_t \times \Delta\text{LG Conduit Risk}_{i,t} \\
& + \beta_3 \times \Delta\text{CG Conduit Risk}_{i,t} + \beta_4 \times \Delta\%\mathrm{OVN}_t \times \Delta\text{CG Conduit Risk}_{i,t} \\
& + \beta_5 \times \mathbf{X}_{i,t} + \beta_6 \times \Delta\%\mathrm{OVN}_t \times \mathbf{X}_{i,t} + \beta_7 \times \mathbf{Y}_t + \varepsilon_{i,t}, \qquad (3)
\end{aligned}$$

[26]Both Bencivenga and Smith (1991) and Allen and Gale (2004b) assert the investors may face idiosyncratic shocks in their consumption needs, which affects their choice of investing in short-term or long-term assets.

[27]There is also a simultaneity concern between the mortgage delinquency and bank returns. An increase in mortgage delinquency lowers the value of banks with mortgage exposure. On the other hand, a poorly performing bank, typically associated with negative equity returns, may also adversely affect the credit access of households, leading to a higher mortgage delinquency rate. Nevertheless, it takes a much longer time for a distressed banking sector to increase mortgage delinquency rate. Therefore, the endogeneity between bank returns and mortgage delinquency is unlikely to affect our results.

and a group of restricted models in which regressors with insignificant regression coefficients are dropped. The dependent variable in equation (3), $r_{i,t}^{FF4}$ is the Fama-French-Carhart abnormal return of bank $i$ at holding period $t$. We drop the observations with excess return outside the $[-20\%, 20\%]$ range, and obtain $26,042$ observations. Among the explanatory variables other than $\Delta\%\mathrm{OVN}_t$, bank balance sheet variables $\mathbf{X}_{i,t}$ contain the book value per share, the earnings per share, and the deposit ratio. We also interact $\mathbf{X}_{i,t}$ with the ABCP maturity $\Delta\%\mathrm{OVN}_t$ to ensure we are controlling at the same level of variation used for coefficients of interest. The time-series control variables $\mathbf{Y}_t$ include controls for the macroeconomic and general market conditions include the magnitude of the Federal Reserve's quantitative easing during the financial crisis by using the weekly mortgage-backed security purchase amount, and the GDP growth as an indicator of the general economy. Finally, $\varepsilon_{i,t}$ is a bank-specific error term. Standard errors are clustered at the bank level and the year level to account for heteroscedasticity and serial correlation of errors as in Petersen (2009). We then identify the most appropriate regression specification using likelihood ratio tests.

Table 4 shows the OLS regression and LR test results. The OLS regression results for the unrestricted model (1) and the results of the restricted models (2) to (5) are shown in panel (a). The result presented in the model (1) shows that consistent with the model prediction and the hypothesis H1, neither $\Delta$CG Conduit Risk$_{i,t}$ nor $\Delta\%\mathrm{OVN}_t \times \Delta$CG Conduit Risk$_{i,t}$ have a significant effect on bank returns. More importantly, consistent with H2, the interaction between maturity and the riskiness of the conduit significantly affects the liquidity guarantor banks' abnormal returns. In other words, the stock market discovers the banks that practice regulatory arbitrage and varies their stock prices according to the risk exposure.

The LR test results in panel (b) of Table 4 suggest the best empirical specification for further empirical tests. The test results reject the hypothesis that model (4) is not nested in model (3). Thus, the interaction term between the ABCP maturity and liquidity guarantee exposure, $\Delta\%\mathrm{OVN}_t \times \Delta$LG Conduit Risk$_{i,t}$, must be included in the model. The LR test also rejects the hypothesis that model (5) is nested in the unrestricted model (1). The factors $\Delta\%\mathrm{OVN}_t \times \Delta$CG Conduit Risk$_{i,t}$ and $\Delta$CG Conduit Risk$_{i,t}$ do not have significant regression coefficients. We also observe that dropping these two terms leads to higher overall F-statistics in the regressions as in the panel (b) of Table 4, which suggests a better model fit. This confirms that the change in ABCP maturity is more relevant to the risk of a liquidity guarantee than that of a credit guarantee. Hence, we focus on the liquidity guarantee exposure and its interaction term with ABCP maturity in the following analysis.

## 5.2 IV regression using NFCP maturity

There might be remaining concerns as to the effectiveness of the average maturity of ABCP in alleviating the endogeneity problem: the total number of ABCP guarantor banks is limited (there are 18 of them in our sample), and the interconnection among banks can propagate a shock from one guarantor bank to another. To address these concerns, we use the maturity of NFCP as a plausible identification of the investors' idiosyncratic maturity preference $m_t$, which is hard to measure directly.

Many large non-financial firms issue NFCPs with similar credit and liquidity profiles as that of ABCP, and typically sell the papers to the same group of investors such as MMFs. Although NFCP may experience runs when the issuing firms are distressed and their stock prices drop, the ABCP and NFCP maturity are correlated since both are driven by the idiosyncratic maturity preferences of investors. Panel (c) of Figure 6 plots the change in ABCP maturity (y-axis) and NFCP maturity (x-axis) as well as the regression fitting line and the shaded region for the 95% confidence interval of regression coefficients. The significantly positive regression coefficient evinces the strong correlation.

To further illustrate how the maturity of NFCP helps to address the simultaneity, consider the maturities of ABCP and NFCP are affected by both the investors' idiosyncratic maturity preferences and issuer's equity return as

$$\begin{aligned}
\Delta\%\mathrm{OVN}_t &= \Delta m_t + \rho \times \mathbf{r}_t^a + \eta_t \\
\Delta\%\mathrm{OVN\ NFCP}_t &= \phi \times \Delta m_t + \bar{\rho} \times \bar{\mathbf{r}}_t^a + \bar{\eta}_t.
\end{aligned}$$

The vectors $\mathbf{r}_t^a = (\cdots, r_{i,t}^a, \cdots)$ and $\bar{\mathbf{r}}_t^a$ are the abnormal returns of the financial and non-financial sector, whereas the vector $\rho = (\cdots, \rho_i, \cdots)$ measures how abnormal returns affect investors' maturity choice. Similarly, the vector $\bar{\rho}$ measures how abnormal returns of non-financial firms affect the commercial paper investors' maturity choice. Additionally, the residuals $\eta_t$ and $\bar{\eta}_t$ are uncorrelated with other independent variables. The parameter $\phi$ captures the correlation between the ABCP and NFCP maturity due to the investors' maturity preference. Given that the financial sector and non-financial sector together represent the equity market, the market factors (Fama-french and Carhart factors) absorb the correlated components of the non-financial and financial sector returns and leave each element in the abnormal return of financial sectors $\mathbf{r}_t^a$ and non-financial firms $\bar{\mathbf{r}}_t^a$ almost orthogonal to each other.

Consider the simple regression specification $r_{i,t}^a = \beta_0^* + \beta_1^* \Delta m_t + \epsilon_{i,t}^*$ could we observe the $m_t$. The idiosyncratic shock of $\Delta m_t$ leads to an unbiased OLS estimator, that is, $\hat{\beta}_1^* = \frac{Cov(\Delta m_t, r_{i,t}^a)}{Var(\Delta m_t)}$. However, in reality we do not observe $m_t$, but $\%\text{OVN}_t$ instead. With the OLS regression specification $r_{i,t}^a = \beta_0 + \beta_1 \Delta\%\text{OVN}_t + \epsilon_{i,t}$, we obtain a biased OLS estimator $\hat{\beta}_1^{OLS} = \frac{Var(\Delta m_t)}{Var(\Delta\%\text{OVN}_t)}\hat{\beta}_1^* + \frac{Var(\epsilon_{i,t})}{Var(\Delta\%\text{OVN}_t)}\rho_i \neq \hat{\beta}_1^*$.[28] The endogeneity can lead to an either amplified or dampened coefficient $\hat{\beta}_1^{OLS}$.[29]

Using $\Delta\%\text{OVN NFCP}_t$ as the instrumental variable (IV), we have the IV estimator as $\hat{\beta}_1^{IV} = \frac{Cov(\Delta\%\text{OVN NFCP}_t, r_{i,t}^a)}{Cov(\Delta\%\text{OVN NFCP}_t, \Delta\%\text{OVN}_t)}$. With $Cov(\Delta\%\text{OVN NFCP}_t, r_{i,t}^a) = Cov(\phi \times \Delta m_t + \bar{\rho} \times \bar{\mathbf{r}}_t^a + \bar{\eta}_t, \beta_0 + \beta_1 \Delta\%\text{OVN}_t + \epsilon_{i,t}) = \hat{\beta}_1^* \phi Var(\Delta m_t)$, and $Cov(\Delta\%\text{OVN NFCP}_t, \Delta\%\text{OVN}_t) = Cov(\phi \times \Delta m_t + \bar{\rho} \times \bar{\mathbf{r}}_t^a + \bar{\eta}_t, \Delta m_t + \rho \times \mathbf{r}_t^a + \eta_t) = \phi Var(\Delta m_t)$, due to the orthogonality between $\mathbf{r}_t^a$ and $\bar{\mathbf{r}}_t^a$, the IV estimator $\hat{\beta}_1^{IV} = \frac{\hat{\beta}_1^* \phi Var(\Delta m_t)}{\phi Var(\Delta m_t)} = \hat{\beta}_1^*$ is unbiased. Similar arguments apply to the regressor $\Delta\%\text{OVN}_t \times \Delta\text{LG Conduit Risk}_{i,t}$.

Therefore, we implement the identification strategy by estimating the following IV regression:

$$\begin{aligned} r_{i,t}^{FF4} &= \alpha_i + \beta_0 \times \widehat{\Delta\%\text{OVN}_t} + \beta_1 \times \Delta\text{LG Conduit Risk}_{i,t} \\ &\quad + \beta_2 \times \widehat{\Delta\%\text{OVN}_t \times \Delta\text{LG Conduit Risk}_{i,t}} \\ &\quad + \beta_3 \times \mathbf{X}_{i,t} + \beta_4 \times \widehat{\Delta\%\text{OVN}_t \times \mathbf{X}_{i,t}} + \beta_5 \times \mathbf{Y}_t + \varepsilon_{i,t}, \end{aligned} \tag{4}$$

where $\widehat{\Delta\%\text{OVN}_t}$, $\widehat{\Delta\%\text{OVN}_t \times \Delta\text{LG Conduit Risk}_{i,t}}$, and $\widehat{\Delta\%\text{OVN}_t \times \mathbf{X}_{i,t}}$ are estimated from first-stage regressions using the NFCP maturity as IV.[30] We include similar controls, as in section 5.1, in both the first and second-stage regressions.

Table 5 reports the IV regression results: panel (a) shows the result of the second stage, and panel

[28]Specifically, $\hat{\beta}_1^{OLS} = \frac{Cov(\Delta m_t + \rho \times \mathbf{r}_t^a + \eta_t, r_{i,t}^a)}{Var(\Delta\%\text{OVN}_t)} = \frac{Var(\Delta m_t)}{Var(\Delta\%\text{OVN}_t)}\hat{\beta}_1^* + \frac{Cov(\Delta\%\text{OVN}_t, \epsilon_{i,t})}{Var(\Delta\%\text{OVN}_t)}$, in which the covariance $Cov(\Delta\%\text{OVN}_t, \epsilon_{i,t}) = Cov(\Delta m_t + \rho \times \mathbf{r}_t^a + \eta_t, \epsilon_{i,t}) = Cov(\rho_i r_{i,t}^a, \epsilon_{i,t}) = \rho_i Var(\epsilon_{i,t}) \neq 0$.

[29]Usually, negative abnormal bank returns are linked to ABCP runs, so we expect $\rho_i < 0$. Together with the fact that $0 \leq \frac{Var(\Delta m_t)}{Var(\Delta\%\text{OVN}_t)} \leq 1$, $\frac{Var(\epsilon_{i,t})}{Var(\Delta\%\text{OVN}_t)} \geq 0$, and $\hat{\beta}_1^* < 0$, we cannot determine whether $\hat{\beta}_1^{OLS} < \hat{\beta}_1^*$ or not.

[30]Specifically, in the *first stage*, we estimate $\Delta\%\text{OVN}_t$, $\Delta\%\text{OVN}_t \times \Delta\text{LG Conduit Risk}_{i,t}$, and $\Delta\%\text{OVN}_t \times \mathbf{X}_{i,t}$

(b) shows the first stage regressions of $\Delta\%\text{OVN}_t$ and $\Delta\%\text{OVN}_t \times \Delta\text{LG Conduit Risk}_{i,t}$. Specifically, given the average exposure of liquidity guarantees (approximately 3.86% of total assets) for a sponsor bank under average speed of mortgage delinquency buildup (0.416% per month), a 1.14% absolute increase in the percentage share of ABCP with overnight maturity (such as an increase from the average 7.40% to 8.54%) leads to a 7.5 bps negative abnormal return for the sponsoring bank.[31] The magnitude of the effect in the IV regression (e.g., $-0.0408$ in the model (3) of Table 5) is larger than that of OLS regression (e.g., $-0.00855$ in the model (3) of panel (a) in Table 4). The result is robust with respect to the inclusion of bank fixed effect, bank balance sheet variables, and macroeconomic variables as discussed in Section 5.1.

We interpret the empirical estimates as evidence of the stock market's awareness of the excessive risk taken by the liquidity guarantor banks through ABCP exclusion. Hence, the market not only observes the on-balance-sheet activities such as maturity mismatch (Flannery and James 1984) or deposit credits (Demirgüç-Kunt and Huizinga 2004), but also the off-balance-sheet activities.

Our findings relate to Acharya et al. (2012), which provides empirical evidence of regulatory arbitrage among ABCP guarantor banks. Our paper shows that the stock market disciplines the loophole-exploiting guarantor banks. Acharya et al. (2012) found that banks which had built up a high conduit exposure—more regulatory arbitrage positions—turned out to be the riskier banks during the ABCP run in August 2007, or from August 8 to 10 in particular, but *not* in other months. Our paper explicitly recognizes the effect of ABCP maturity on the liquidity guarantee cost, and address the endogeneity issues in the empirical estimation. By including the ABCP maturity in the regression, our analysis reveals that the bank returns are affected by the cost of liquidity guarantee in periods of both turmoil and the quiet years before the ABCP crisis.

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using regression:

$$\begin{aligned} & \{\Delta\%\text{OVN}_t, \Delta\%\text{OVN}_t \times \Delta\text{LG Conduit Risk}_{i,t}, \Delta\%\text{OVN}_t \times \mathbf{X}_{i,t}\} \\ = \; & \alpha_i + \gamma_0 \times \Delta\%\text{OVN NFCP}_t + \gamma_1 \times \Delta\text{LG Conduit Risk}_{i,t} \\ & + \gamma_2 \times \Delta\%\text{OVN NFCP}_t \times \Delta\text{LG Conduit Risk}_{i,t} \\ & + \gamma_3 \times \mathbf{X}_{i,t} + \gamma_4 \times \Delta\%\text{OVN NFCP}_t \times \mathbf{X}_{i,t} + \gamma_5 \times \mathbf{Y}_t + v_t. \end{aligned}$$

[31] The F-statistics of the first stage regressions are much higher than 10, alleviating the concern of weak instruments. Figure 6 also shows the moment condition of the instrumental variable, the change in NFCP maturity $\%\text{OVN NFCP}_t$, is informative about the variable of interest, the change in ABCP maturity $\%\text{OVN}_t$.

#### 5.2.1 Robustness

In addition to the alternative regression specification, which has been addressed in the LR test, we note the following reservations concerning our empirical results in Table 5. The first concern is that the regression results are driven solely by the financial crisis period. To mitigate the concern, we first try to separate the regression in the periods before and after the beginning of 2007 when the ABCP market experienced an abrupt change. The first period observed a steady growth in the ABCP market while the second period witnessed the market's topping and decline. Panel (a) of Table 6 shows that the results are significant both before and after the ABCP market froze. Therefore, the empirical result presented using the whole sample data is not driven solely by the post-ABCP crisis period.

A similar concern is that the low-interest environment during 2002 and 2004 made the ABCP attractive to yield-seeking investors who were bound to hold only high-quality assets. The low-interest environment was also one of the primary reasons for the housing boom. Hence, we run separate regressions for the periods before and after the beginning of 2005 to capture the regression under different mortgage rate environments. Panel (b) of Table 6 shows the results are robust under both low and high mortgage rates.

The third potential concern is that the empirical result is driven by a small amount of extreme bank daily returns. Table 7 shows the robustness of the baseline results using alternative winsorizations and trimming schemes. In particular, we present the results from the observations in which bank returns within the $[-30\%, 30\%]$ range, as well as the the observations in which bank returns are winsorized at the $(1\%, 99\%)$ and the $(0.5\%, 99.5\%)$ level. Our results remain under all the alternative winsorization and trimming schemes.

The last concern is that the empirical results are driven by the particular choice of bank return. To check the robustness of our regression result, we use the Fama-French abnormal return as the alternative measure of the sponsoring bank's value. Table 8 confirms that the empirical findings remain under alternative return measures.

## 5.3 Market influence: bank risk capital buffer

We then examine the market influence by investigating whether loophole-exploiting banks maintain a higher risk capital buffer (H3). We start by comparing the risk capital ratios of ABCP guarantor banks with those of non-guarantors, including both credit guarantors and non-guarantor BHCs. Table 1 shows that the ABCP guarantor banks are quite different from their non-guarantor counterparts. Table 9 further compares the risk capital ratios, total assets, net income, and other bank characteristics among the ABCP guarantor banks and non-guarantor banks with asset book values above the 1 billion, 10 billion, and 50 billion USD threshold. Since the guarantors tend to be larger banks, the difference between guarantors and non-guarantors diminishes when we gradually eliminate the small non-guarantor banks from the comparison. Hence, we only include the non-guarantor BHCs with book assets less than 50 billion USD into our analysis.[32]

We then study the liquidity and credit guarantor risk capital ratios using the regression

$$\kappa_{i,q+1} = \alpha_i + \gamma_0 \times 1_{i,q}^{\{\text{Liquidity guarantor}\}} + \gamma_1 \times 1_{i,q}^{\{\text{Credit guarantor}\}} + \gamma_2 \times \mathbf{X}_{i,q} + \gamma_3 \times \mathbf{Y}_q + \varepsilon_{i,q}, \tag{5}$$

in which $\kappa_{i,q+1}$ is the bank $i$'s *book-value based* capital ratio—either the Tier-1 risk capital ratio or total capital ratio—at quarter $q+1$. In addition, $1_{i,q}^{\{\text{Liquidity guarantor}\}}$ is the indicator variable for the bank $i$ is a liquidity guarantor at quarter $q$, $\mathbf{Y}_q$ is the time fixed effect, and $\mathbf{X}_{i,q}$ is the vector of control variables for bank $i$ at quarter $q$. Following Gropp and Heider (2010), the control variables include each bank's market beta, market-to-book ratio, collateral-to-assets ratio, dividend payout ratio, EPS, ROA, and the logarithm of book assets (the square of logarithm book assets is also included to capture the nonlinear effect). We also run partial specifications without bank balance sheet controls.

Table 10 shows the regression result that a liquidity guarantor bank has higher capital ratios than a non-guarantor large BHC as evidenced by a 0.80% higher Tier-1 risk-capital ratio and a 0.74% total risk-capital ratio, demonstrates the association between a liquidity guarantor bank and higher risk capital ratio. On the other hand, credit guarantor banks keep lower capital ratios than non-guarantor large BHCs with similar primary characteristics.

[32] Banks with book assets above 50 billion USD are deemed to be "too-big-to-fail" (TBTF) banks, which are subject to more restrictive regulations.

### 5.3.1 Propensity score weighting

One may concern that a bank's decision to use ABCP funding facility is not exogenous: banks with certain characters, which correlate to a high capital ratio, may prefer to use and guarantee an ABCP facility. To address the concern, we estimate the propensity score $P_{i,q}$ for each bank $i$ to be an ABCP guarantor at time $q$ using

$$\Pr\{\text{ABCP guarantor}\}_{i,t} = \beta_0 + \beta_1 \times \mathbf{X}_{i,t} + \beta_2 \times \mathbf{Y}_t + \varepsilon_{i,t}, \tag{6}$$

with both logit and probit model. We then estimate the bank capital ratio using

$$\kappa_{i,q+1} = \alpha_i + \gamma_0 \times 1_{i,q}^{\{\text{Liquidity guarantor}\}} + \gamma_1 \times 1_{i,q}^{\{\text{ABCP guarantor}\}} + \gamma_2 \times \mathbf{X}_{i,q} + \gamma_3 \times \mathbf{Y}_q + \varepsilon_{i,q}, \tag{7}$$

The $\mathbf{Y}_t$ and $\mathbf{X}_{i,t}$ are the time fixed effects and control variables as in Equation 5. The columns (1) and (2) of Table 11 show the regression results where the $\Pr\{\text{ABCP guarantor}\}_{i,t}$ is estimated using Logit model, whereas the columns (3) and (4) are the results where $\Pr\{\text{ABCP guarantor}\}_{i,t}$ is estimated using Probit. The results are consistent with our previous findings. On average, a loophole exploiting guarantor has around 1.85% higher Tier-1 capital ratio and 1.28% higher total capital ratio than comparable banks, even though ABCP guarantor banks (both liquidity and *credit* guarantors) tend to have a lower capital ratio than non-guarantor banks with similar characteristics.

In summary, both the OLS regression results in Table 10 and propensity score weighted regression results in Table 11 point to a higher risk capital among the liquidity guarantor banks amid the negligence in capital regulation. The pattern is not evident among non-guarantor banks or credit guarantor banks which do not take advantage of the ABCP exclusion loophole.

### 5.3.2 Evidence of $\beta^{ABCP}$

It remains to confirm that the high regulatory capital among liquidity guarantors is due to the pressure of negative stock return. Hence, we investigate how the stock prices sensitivity to ABCP conduit risk affects the risk capital buffer of the guarantors. Specifically, we first estimate the connection between an ABCP guarantor bank's stock return with its ABCP obligation exposure within each quarter $q$ for each bank $i$ by regressing the bank's daily Fama-French-Carhart abnormal return with the interaction of bank's guarantee exposure and ABCP maturity change:

$$\begin{aligned} r_{i,q,t}^{FF4} &= \alpha_{i,q} + \beta_0 \times \Delta\%\text{OVN}_{q,t} + \beta_1 \times \Delta\text{LG Conduit Risk}_{i,q,t} \\ &\quad + \beta_{i,q}^{ABCP} \times \Delta\%\text{OVN}_{q,t} \times \Delta\text{LG Conduit Risk}_{i,q,t} + \varepsilon_{i,q,t}. \end{aligned} \tag{8}$$

We focus on the coefficient $\beta_{i,q}^{ABCP}$, which represents each ABCP guarantor bank $i$'s average stock price sensitivity to the risk from the ABCP guarantee obligation in quarter $q$. We then run a panel regression

$$\kappa_{i,q+1} = \alpha_i + \gamma_0 \times \beta_{i,q}^{ABCP} + \gamma_1 \times \mathbf{X}_{i,q} + \gamma_2 \times \mathbf{Y}_q + \varepsilon_{i,q}, \tag{9}$$

to evaluate the relationship between a guarantor's choice of capital ratio and the sensitivity of stock price to ABCP guarantee risk.[33]

Panel (a) of Table 12 presents the summary statistics of $\beta_{i,q}^{ABCP}$ estimated from Equation (8). A more negative $\beta_{i,q}^{ABCP}$ means the return of bank $i$ in quarter $q$ is more sensitive to the guarantee risk exposure, measured an increased share of ABCP with overnight maturity and an increased conduit asset delinquency. Panel (b) of Table 12 shows the regression result of Equation (9). A guarantor bank that is one standard deviation more sensitive to the ABCP risk—a bank with a 2.258 more negative $\beta^{ABCP}$—maintains a 27 basis points higher Tier-1 and a 19 basis point higher total capital ratio.

Beyond the association between liquidity guarantor bank and high capital ratio presented in Table 10 and 11, Table 12 provides additional evidence that the loophole-exploiting guarantor banks increase their risk capital in response to the pressure of franchise value emanating from the ABCP guarantee obligation. The finding provides new evidence on how the market changes bank behavior (Ashcraft 2008) and extends the existing body of literature on optimal bank capital structure (Berger et al. 2008; Gropp and Heider 2010).

[33] Alternatively, one can use an event study base on the ABCP market freeze in August 2007 to evaluate the change in bank capital ratio. However, this method has the following limitations. First, the ABCP market freeze had a profound impact on the banking system. Therefore, the change in bank capital ratio may not be a response to the ABCP market condition only. Second, the limited number of ABCP guarantor leads to a sample size that is too small to yield a robust statistical inference.

# 6 Conclusion

Does the stock market recognize banks exploiting regulatory loophole using shadow banking financing facilities? We first prove that the ABCP exclusion is a regulatory loophole that permits investigation as to whether the stock market is aware of the regulatory arbitrage opportunity. The empirical test confirms our assertion by showing that the interaction between the change in ABCP maturity and conduit asset credit loss affects the abnormal returns of the ABCP liquidity guarantor banks, but not the returns of the credit guarantors.

Subsequently, does the pressure emanating from the stock market influence the capital structure of the banks? Our model shows that, compared to the credit guarantors or non-guarantors, liquidity guarantor banks are more likely to violate the minimum risk capital requirement, *ceteris paribus*. Hence, under market influence, a liquidity guarantor bank will hold higher risk capital *ex ante*. Empirical evidence shows that the liquidity guarantor banks have a Tier-1 risk capital ratio that is 80 basis points higher than that of non-guarantor banks. Additionally, a guarantor whose franchise value is more sensitive to the risk from the ABCP guarantee obligation maintains a higher risk capital buffer.

In summary, our paper presents both active market monitor and influence on the ABCP guarantor banks and notes the effectiveness of market discipline when the minimum capital requirements are compromised.

# A Appendix

## A.1 Proof of Propositions

The non-arbitrage condition suggests that the ABCP value function $A\left(y_t, m\right)$ satisfies the differential equation

$$rA\left(y_t, m\right) = kV(y_0) + m\left(V(y_0) - A\left(y_t, m\right)\right)\mathbf{1}_{\{A(y_t,m)<V(y_0)\}} + \mu y_t \frac{\partial A\left(y_t, m\right)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 A\left(y_t, m\right)}{\partial y_t^2}, \tag{A.1}$$

in which $A\left(y_t, m\right)$ may refer to both ABCP with a credit guarantee $A^C\left(y_t, m\right)$ and a liquidity guarantee $A^L\left(y_t, m\right)$.[34] Nevertheless, $A^C\left(y_t, m\right)$ and $A^L\left(y_t, m\right)$ do not share the same boundary conditions due to their different obligations at $y_t = y_w$. Specifically, $A^C\left(y_w, m\right) = V(y_0)$ whereas $A^L\left(y_w, m\right) = V\left(y_w\right)$.[35]

**Proposition 1.** *The value of ABCP under a credit guarantee does not vary with the maturity* $1/m$. *Specifically,* $A^C\left(y_t, m\right) = V(y_0)$.

*Proof.* Since the maturity of ABCP is finite with probability 1, together with limited liability, we also have the boundary condition for $A^L\left(y_t\right)$ at singular point $y_t \to \infty$ as $\lim_{y_t\to\infty}\left|A^C\left(y_t\right)\right| < +\infty$.

The credit guarantee ensures that the ABCP investor will always be able to collect the coupon payment, and have no credit risk even if the conduit defaulted. Since the ABCP with a credit guarantee is a riskless investment, the par coupon, by non-arbitrage, has to be $r$. Therefore, the ODE in Equation (A.1) becomes

$$\left(r - m\mathbf{1}_{\{A^C(y_t,m)<V(y_0)\}}\right)\left(V(y_0) - A^C\left(y_t, m\right)\right) = \mu y_t \frac{\partial A^C\left(y_t, m\right)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 A^C\left(y_t, m\right)}{\partial y_t^2}.$$

Together with boundary conditions at wind-down trigger $A^C\left(y_w\right) = V(y_0)$, it is easy to see this

[34] Specifically, the required return of ABCP equals the sum of the ABCP coupon payment $kV(y_0)$, the change of market value $A\left(y_t, m\right)$ with the fluctuation of underlying assets, and the value of rollover support. Incentive compatibility implies that the ABCP investor only chooses to rollover his paper when its market price $A\left(y_t, m\right)$ is no less than the face value. Hence, the value of rollover support is the difference between face value $V(y_0)$ and ABCP value $A\left(y_t, m\right)$ multiplies the maturity intensity $m$, controlled by the rollover condition $A\left(y_t, m\right) < V(y_0)$.

[35] There are secondary boundary conditions for $A^C\left(y_t, m\right)$ and $A^L\left(y_t, m\right)$, at $y_t \to \infty$ based on the regularity condition. We relegate the discussion of both secondary boundary conditions to the Appendix.

ODE has a unique solution $A^{C}(y_t) = V(y_0)$. $\square$

**Proposition 2.** *The value function of ABCP with a liquidity guarantee* $A^{L}(y_t, m) = \mathbf{1}_{\{y_t \geq y_0\}} A_h^{L}(y_t, m) + \mathbf{1}_{\{y_t < y_0\}} A_l^{L}(y_t, m)$, *where*

$$\begin{aligned} A_h^{L}(y_t, m) &= \frac{k}{r} V(y_0) + C_h(m) \phi(y_t; y_w), \\ A_l^{L}(y_t, m) &= \frac{k+m}{m+r} V(y_0)(1 - \psi(y_t; y_w)) + V(y_w)\psi(y_t; y_w) - C_l(m)\left(\psi(y_t; y_w) - \bar{\psi}(y_t; y_w)\right), \end{aligned}$$

*in which* $\phi(y_t; y_w) = \left(\frac{y_t}{y_w}\right)^{H}$, $\psi(y_t; y_w) = \left(\frac{y_t}{y_w}\right)^{G}$, *and* $\bar{\psi}(y_t; y_w) = \left(\frac{y_t}{y_w}\right)^{\bar{G}}$. *Further,* $H = \frac{1}{2} - \frac{\mu}{\sigma^2} - \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2}\right)^2 + \frac{2r}{\sigma^2}} < 0$, $G = \frac{1}{2} - \frac{\mu}{\sigma^2} - \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2}\right)^2 + \frac{2(r+m)}{\sigma^2}} < 0$ *and* $\bar{G} = \frac{1}{2} - \frac{\mu}{\sigma^2} + \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2}\right)^2 + \frac{2(r+m)}{\sigma^2}} > 0$. *Finally,* $C_h(m)$, $C_l(m)$, *and* $k$ *satisfy the smooth pasting conditions at* $A_h^{L}(y_t, m) = A_l^{L}(y_t, m) = V(y_0)$ *and* $\frac{\partial}{\partial y} A_h^{L}(y_t, m) = \frac{\partial}{\partial y} A_l^{L}(y_t, m)$ *at* $y_t = y_0$.

*Proof.* As in Section 3, the ABCP creditor's value function $A^{L}(y_t, m)$ satisfies the ODE

$$rA^{L}(y_t, m) = kV(y_0) + m\left(V(y_0) - A^{L}(y_t, m)\right)\mathbf{1}_{\{A^{L}(y_t, m) < V(y_0)\}} + \mu y_t \frac{\partial A^{L}(y_t, m)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 A^{L}(y_t, m)}{\partial y_t^2},$$

with boundary condition $A^{L}(y_w, m) = V_m(y_w)$.

The regularity condition under $y_t \to \infty$, when the probability of having $y_t$ hits $y_w$ converges to zero, gives out the second boundary condition. Since the maturity of ABCP is finite with probability 1, together with limited liability which leads to positive ABCP value, we have the boundary condition for $A^{L}(y_t, m)$ at singular point $y_t \to \infty$ as $\lim_{y_t \to \infty} \left|A^{L}(y_t, m)\right| < +\infty$.

We can write the differential equation into region $l$ in which $y < y_0$ and region $h$ in which $y > y_0$ as:

$$\begin{aligned} rA_h^{L}(y_t, m) &= kV(y_0) + \mu y_t \frac{\partial A_h^{L}(y_t, m)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 A_h^{L}(y_t, m)}{\partial y_t^2} \\ rA_l^{L}(y_t, m) &= kV(y_0) + m\left(V(y_0) - A_l^{L}(y_t, m)\right) + \mu y_t \frac{\partial A_l^{L}(y_t, m)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 A_l^{L}(y_t, m)}{\partial y_t^2}, \end{aligned}$$

in which the boundary conditions become $A_l^{L}(y_w, m) = V_m(y_w)$ and $\lim_{y_t \to \infty} \left|A_h^{L}(y_t, m)\right| < +\infty$. Standard theorems about stochastic differential equation suggest the smooth pasting condition (see Karatzas 1991) at $y_t = y_0$ as $A_h^{L}(y_t, m) = A_l^{L}(y_t, m)$ and $\frac{\partial}{\partial y_t} A_h^{L}(y_t, m) = \frac{\partial}{\partial y_t} A_l^{L}(y_t, m)$. We then obtain the value functions of $A_h^L$, $A_l^L$, and $A^L$ following the standard technique for second order ODE. $\square$

With the value function of the ABCP, we are ready to model the value function of the ABCP guarantee $G$, being credit guarantee $G^C$ or liquidity guarantee $G^L$, which satisfies

$$rG\left(y_t, m\right) = m\left(A\left(y_t, m\right) - V(y_0)\right)\mathbf{1}_{\{A(y_t,m)<V(y_0)\}} + \mu y_t \frac{\partial G\left(y_t, m\right)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 G\left(y_t, m\right)}{\partial y_t^2}, \qquad \text{(A.2)}$$

in which $A(y_t, m) = A^C(y_t, m)$ for the credit guarantee case and $A(y_t, m) = A^L(y_t, m)$ otherwise.[36] Only under credit guarantee $G^C$ does the guarantor bank need to provide credit protection upon the conduit wind-down. Hence, the credit guarantee has a boundary condition $G^C\left(y_w, m\right) = -V(y_0) + V\left(y_w\right) < 0$ whereas the liquidity guarantee has $G^L\left(y_w, m\right) = 0$.[37]

To prove Proposition 3, we first prove the following Lemma:

**Lemma A.1.** *When the ABCP maturity $1/m$ approaches zero, the liquidity guarantee ABCP value $\lim_{m\to\infty} A^L\left(y_t, m\right) = V(y_0)$ for $\forall y_t > y_w$. In other words, the value of liquidity guaranteed ABCP converges to that of credit guaranteed ABCP when the maturity $1/m$ drops.*

*Proof.* Following the value function of ABCP with liquidity guarantee given in Proposition 2, it is easy to see when $m \to \infty$, we have $G = \frac{1}{2} - \frac{\mu}{\sigma^2} - \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2}\right)^2 + \frac{2(r+m)}{\sigma^2}} \to -\infty$, and $\bar{G} = \frac{1}{2} - \frac{\mu}{\sigma^2} + \sqrt{\left(\frac{1}{2} - \frac{\mu}{\sigma^2}\right)^2 + \frac{2(r+m)}{\sigma^2}} \to \infty$. Therefore, $\psi\left(y_t; y_w\right) = \left(\frac{y}{y_w}\right)^G \to 0$, and $\bar{\psi}\left(y_t; y_w\right) = \left(\frac{y}{y_w}\right)^{\bar{G}} \to \infty$. So the value function of ABCP, under a finite coupon $k$, becomes

$$\begin{aligned}
\lim_{m\to\infty} A_h^L\left(y_t, m\right) &= \frac{k}{r}V(y_0) + \lim_{m\to\infty} C_h(m)\phi\left(y_t; y_w\right), \\
\lim_{m\to\infty} A_l^L\left(y_t, m\right) &= \lim_{m\to\infty} \frac{k+m}{m+r}V(y_0) + C_l(m)\bar{\psi}\left(y_t; y_w\right) \\
&= V(y_0) + \lim_{m\to\infty} C_l(m)\bar{\psi}\left(y_t; y_w\right).
\end{aligned}$$

The smooth pasting conditions, $A_h^L\left(y_t, m\right) = A_l^L\left(y_t, m\right) = V(y_0)$ and $\frac{\partial}{\partial y}A_h^L\left(y_t, m\right) = \frac{\partial}{\partial y}A_l^L\left(y_t, m\right)$

[36] The differential equation follows the similar non-arbitrage argument used in the ABCP value functions.

[37] There are secondary boundary conditions for $G^C\left(y_t, m\right)$ and $G^L\left(y_t, m\right)$, at $y_t \to \infty$ based on the regularity condition. We relegate the discussion of the secondary boundary conditions to the Appendix.

at $y_t = y_0$, suggest that

$$\begin{aligned}\frac{k}{r}V(y_0) + \lim_{m\to\infty} C_h(m)\phi\left(y_t; y_w\right) &= V(y_0) + \lim_{m\to\infty} C_l(m)\bar{\psi}\left(y_t; y_w\right) = V(y_0), && \text{(A.3)}\\ \lim_{m\to\infty} C_h(m)\frac{\partial}{\partial y}\phi\left(y_t; y_w\right) &= \lim_{m\to\infty} C_l(m)\frac{\partial}{\partial y}\bar{\psi}\left(y_t; y_w\right). && \text{(A.4)}\end{aligned}$$

It is then easy to see Equation (A.3) suggests that $\lim_{m\to\infty} C_l(m)\bar{\psi}\left(y_t; y_w\right) = 0$. Hence, $\lim_{m\to\infty} C_l(m) = 0$. With $\frac{\partial}{\partial y_t}\phi\left(y_t; y_w\right) = \frac{\partial}{\partial y_t}\left(\frac{y_t}{y_w}\right)^G = G\left(\frac{y_t}{y_w}\right)^{G-1} < 0$, Equation (A.4) suggests $\lim_{m\to\infty} C_h(m) = 0$ as well. Use Equation (A.3) again, with $\frac{k}{r}V(y_0) + \lim_{m\to\infty} C_h(m)\phi\left(y_t; y_w\right) = V(y_0)$ together with $\lim_{m\to\infty} C_h(m) = 0$ and $\lim_{m\to\infty}\phi\left(y_t; y_w\right) = 0$, we have $k = r$. Summarize the value of $C_l$, $C_h$, $G$ and $\bar{G}$ under $m \to \infty$, we get $\lim_{m\to\infty} A^L\left(y_t, m\right) = V(y_0)$ for $\forall y_t \in (y_w, \infty)$. □

**Proposition 3.** *When the ABCP maturity decreases, the liquidity support value function converges to the credit support value function. When the maturity $1/m$ approaches 0, $\lim_{m\to\infty} G^L\left(y_t, m\right) = G^C\left(y_t, m\right)$ for $\forall y_t > y_w$.*

*Proof.* By Equation (A.2), together with the value function of ABCP with credit guarantee $A^C = V(y_0)$, we can obtain that the value ABCP with credit guarantee, as well as the value of credit guarantee, does not vary with maturity $1/m$. Hence, we can drop the $m$ in $G^C(y_t, m)$, and the differential equation for credit guarantee $G^C$ is

$$rG^C\left(y_t\right) = \mu y_t \frac{\partial G^C\left(y_t\right)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 G^C\left(y_t\right)}{\partial y_t^2}, \tag{A.5}$$

with boundary condition $G^C\left(y_w\right) = -V(y_0) + V\left(y_w\right) < 0$. On the other hand, when $y_t \to \infty$, the stopping time $\tau = \inf\{t : y_t < y_w\} \to \infty$. Hence, $\lim_{y_t\to\infty} G^C(y_t) = 0$.

Let $\bar{G}^L\left(y_t\right) = \lim_{m\to\infty} G^L\left(y_t, m\right)$. Starting from the differential equation for liquidity guarantee $G^L$

$$rG^L\left(y_t, m\right) = m\left(A^L\left(y_t, m\right) - V(y_0)\right)\mathbf{1}_{\{A^L(y_t,m)<V(y_0)\}} + \mu y_t \frac{\partial G^L\left(y_t, m\right)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 G^L\left(y_t, m\right)}{\partial y_t^2},$$

and using Lemma A.1, we have $\lim_{m\to\infty} A^L\left(y_t, m\right) = V(y_0)$ for $\forall y_t \in (y_w, \infty)$, and $A^L\left(y_w, m\right) =$

$V(y_w)$. Therefore, with $G^C(y_w) = -V(y_0) + V(y_w)$

$$r\bar{G}^L(y_t) = mG^C(y_w)\mathbf{1}_{\{y_t=y_w\}} + \mu y_t \frac{\partial \bar{G}^L(y_t)}{\partial y_t} + \frac{1}{2}\sigma^2 y_t^2 \frac{\partial^2 \bar{G}^L(y_t)}{\partial y_t^2}, \tag{A.6}$$

with boundary condition $\bar{G}^L(y_w) = 0$. Similar to the credit guarantee case, $\lim_{m\to\infty} \bar{G}^L(y_t) = 0$.

Clearly, the differential equations (A.5) and (A.6) share the same general solution, and the inhomogeneous term $mG^C(y_w)\mathbf{1}_{\{y_t=y_w\}}$ in differential equation (A.6) is a delta function on $y_t = y_w$. Following the standard Green function method, we have $G^C(y_t) = \bar{G}^L(y_t)$ for $\forall y_t \in (y_w, \infty)$. □

**Proposition 4.** *When the ABCP maturity $1/m$ approaches zero, an ABCP liquidity guarantor—whose initial capital ratio is the same as a credit guarantor—has $K^L(y_t)$ that is more sensitive to the shock in the underlying asset value than the credit guarantor when $y_t < y_0$, or $\frac{dK^L(y_t)}{dy_t} > \frac{dK^C(y_t)}{dy_t}$. Subsequently, the liquidity guarantor is more likely to violate the minimum capital requirement under any realized path of $y_t$.*

*Proof.* First, it is easy to see that

$$K^C(y_t) \equiv \frac{E^C + G^C(y_t, m)}{D + E^C + G^C(y_t, m) + V(y_t)} = \frac{\kappa^C(y_t)}{1 + \kappa^C(y_t)}.$$

Notice that $K^C(y_t)$ is strictly increasing in $\kappa^C(y_t)$. Hence, using $\kappa^C(y_t) > 0$ instead of $K^C(y_t)$ does not change the behavior of a bank that is trying to maintain a capital ratio above the minimum requirement. Similar arrangement applies to $\kappa^L(y_t)$. We also let $\underline{K} \equiv \frac{\underline{\kappa}}{1+\underline{\kappa}}$.

The initial capital ratio of a credit guarantor with balance sheet equity capital $E^C$ is $\kappa^C(y_0) = \frac{E^C+G^C(y_0)}{D+V(y_0)}$ and the initial capital ratio of a liquidity guarantor, who only needs to recognize a $\beta$ fraction of ABCP exposure, to be $\kappa^L(y_0) = \frac{E^L+G^L(y_0)}{D+\beta V(y_0)}$. Hence, $\kappa^C(y_0) = \kappa^L(y_0)$ suggests that

$$\frac{E^L + G^L(y_0)}{D + \beta V(y_0)} = \frac{E^C + G^C(y_0)}{D + V(y_0)}. \tag{A.7}$$

With $\hat{G}^C(y_t) = G^C(y_t) - G^C(y_0)$ and similarly for liquidity guarantee as $\hat{G}^L(y_t) = G^L(y_t) -$

$G^L(y_0)$, we can write $\kappa^C(y_t) = \frac{E^C+G^C(y_0)+\hat{G}^C(y_t)}{D+V(y_t)}$ and $\kappa^L(y_t) = \frac{E^L+G^L(y_0)+\hat{G}^L(y_t)}{D+\beta V(y_t)}$. Subsequently,

$$\begin{aligned} \frac{d\kappa^L(y_t)}{dy_t} - \frac{d\kappa^C(y_t)}{dy_t} &= \frac{d}{dy_t}\frac{E^L+G^L(y_0)}{D+\beta V(y_t)} - \frac{d}{dy_t}\frac{E^C+G^C(y_0)}{D+V(y_t)} \\ &\quad + \frac{d}{dy_t}\frac{\hat{G}^L(y_t)}{D+\beta V(y_t)} - \frac{d}{dy_t}\frac{\hat{G}^C(y_t)}{D+V(y_t)}, \end{aligned}$$

whereas

$$\begin{aligned} \frac{d}{dy_t}\frac{E^L+G^L(y_0)}{D+\beta V(y_t)} - \frac{d}{dy_t}\frac{E^C+G^C(y_0)}{D+V(y_t)} &= \left[-\beta\frac{E^L+G^L(y_0)}{[D+\beta V(y_t)]^2} + \frac{E^C+G^C(y_0)}{[D+V(y_t)]^2}\right]\frac{dV(y_t)}{dy_t} \\ &= [f(1)-f(\beta)]\frac{\kappa^C(y_0)}{r-\mu}, \end{aligned}$$

where the second equality follows Equation (A.7) and $f(\beta) = \beta\frac{D+\beta V(y_0)}{[D+\beta V(y_t)]^2}$. Following $r > \mu$, it is easy to see $\frac{df(\beta)}{d\beta} > 0$ when $y_t \in (y_w, y_0)$. Therefore, $f(1) - f(\beta) > 0$ so

$$\frac{d}{dy_t}\frac{E^L+G^L(y_0)}{D+\beta V(y_t)} - \frac{d}{dy_t}\frac{E^C+G^C(y_0)}{D+V(y_t)} > 0. \tag{A.8}$$

In addition, we have $\frac{d}{dy_t}\frac{\hat{G}^L(y_t)}{D+\beta V(y_t)} = \frac{1}{D+\beta V(y_t)}\frac{d\hat{G}^L(y_t)}{dy_t} - \frac{\beta\hat{G}^L(y_t)}{[D+\beta V(y_t)]^2}\frac{dV(y_t)}{dy_t}$ and $\frac{d}{dy_t}\frac{\hat{G}^C(y_t)}{V(y_t)} = \frac{1}{D+V(y_t)}\frac{d\hat{G}^C(y_t)}{dy_t} - \frac{\hat{G}^C(y_t)}{[D+V(y_t)]^2}\frac{dV(y_t)}{dy_t}$. Notice Proposition 3 suggests that $\lim_{m\to\infty} G^L(y_t) \to G^C(y_t)$ for all $y_t > y_w$. Hence, when the ABCP maturity $1/m$ is small enough, we have $\lim_{m\to\infty}\frac{d\hat{G}^L(y_t)}{dy_t} \to \frac{d\hat{G}^C(y_t)}{dy_t} > 0$. With a small enough $\beta$

$$\frac{1}{D+\beta V(y_t)}\frac{d\hat{G}^L(y_t)}{dy_t} > \frac{1}{D+V(y_t)}\frac{d\hat{G}^C(y_t)}{dy_t}. \tag{A.9}$$

Finally, $V(y_t) > V(y_w) > \sqrt{\beta}D$ gives $\frac{\beta}{[D+\beta V(y_t)]^2} > \frac{1}{[D+V(y_t)]^2}$. From Proposition 3, we have $\frac{\beta\hat{G}^L(y_t)}{[D+\beta V(y_t)]^2} < \frac{\hat{G}^C(y_t)}{[D+V(y_t)]^2}$ when $m \to \infty$. Combine this with Equation (A.8) and (A.9), we have $\frac{d\kappa^L(y_t)}{dy_t} > \frac{d\kappa^C(y_t)}{dy_t}$ and therefore $\frac{dK^L(y_t)}{dy_t} > \frac{dK^C(y_t)}{dy_t}$ for $y_t \in (y_w, y_0)$. □

## A.2 Details of ABCP conduit regulations

Both the Financial Accounting Standards Board (FASB) and financial regulators such as the Federal Reserve, FDIC, and Department of the Treasury shape regulatory guidelines as to how much risk capital banks need to hold against the risky assets moved to the conduit. In September 2000, the

Financial Accounting Standards Board (FASB) introduced Financial Accounting Standards (FAS) 140, which allowed a bank to transfer its assets to a "qualified SPE" and book the transaction as a "true sale."[38] This means that an ABCP liquidity guarantor bank can enjoy the "ABCP exclusion" and avoid the costly risk capital requirement completely. In 2004, regulators increased the capital standard and required the banks to hold risk capital against 10% of the size of ABCP liquidity facilities.[39] Unlike the liquidity guarantee, the credit guarantee consistently has a 100% risk-capital requirements similar to on-balance sheet loans because it violates the "true sales" condition.

In mid-2007, the deterioration of the underlying risky assets, such as mortgage-backed securities (MBS), caused the ABCP market to freeze abruptly. The collapse of the ABCP market as a major funding source limited the capability of the U.S. banking sector to raise capital and became an important reason for the subsequent crisis. Finally, on January 28, 2010, the financial regulators collectively decided to eliminate the ABCP exclusion on March 29, 2010.

[38]An ABCP conduit achieves a "qualifying SPE" status if the bank moves its assets to the conduit and satisfies the following four conditions. First, the financial assets are isolated from the bank after the transfer and, second, the limited activities of the conduit are entirely specified in the legal documents. Third, the conduit holds only passive financial assets that were transferred in, guarantees, and servicing rights. Finally, sale or disposal of the conduit assets must be specified in the legal documents and exercised by a party that puts the holders' beneficial interest back to the SPE.

[39]In December 2003, the Office of the Comptroller of the Currency (OCC), Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation (FDIC), and Office of Thrift Supervision (OTS) collectively permitted the sponsoring banks to exclude those assets in ABCP programs that were consolidated as a result of FASB Interpretation 46(R) from their risk-weight asset base. For more details, please refer to Risk-based capital gudelines; capital adequacy guidelines; capital maintenance: consolidation of asset-backed commercial paper programs and other issues, 69 Fed. Reg. 44,908 (July 28, 2004), (to be codified at 12 C.F.R. pt. 3; 12 C.F.R. pts. 208, 225; 12 C.F.R. pt. 325; 12 C.F.R. pt. 567). Effective since September 30, 2004. These guidelines are responses to FASB Interpretation 46(R), which required banks to consolidate SPE assets to its balance sheet.

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Figure 1: **Total ABCP outstanding vs commercial bank liability**
The left y-axis is for total ABCP outstanding, and the right y-axis (scaled ten times) is for commercial bank liabilities. In the early 2000s, the total ABCP outstanding is about 10% the size of total commercial bank liability in the United States. The ABCP market size picked up rapidly then, reaching 1.21 Trillion USD in July 2007. The ABCP market experienced a rapid drop in size in the summer of 2007, and never recovered since. The ABCP exclusion was dropped in March 2010, as the dashed line marks. Source: FRED Economic Data from the Federal Reserve Bank of St. Louis.

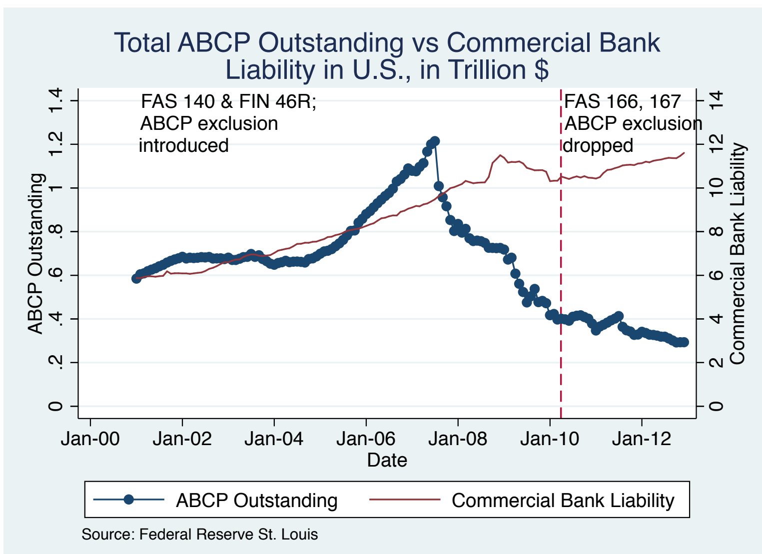
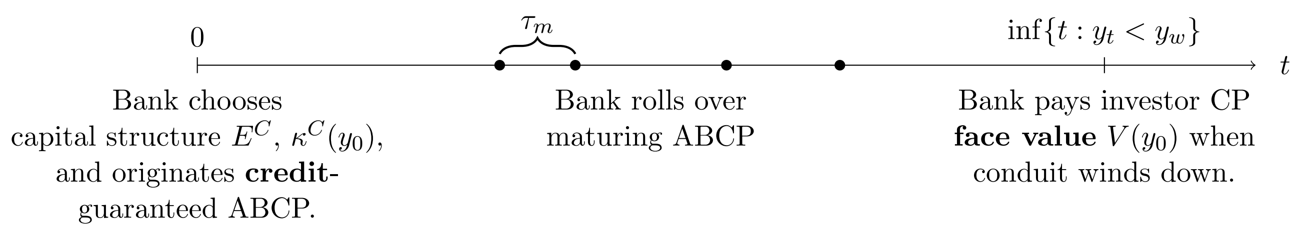


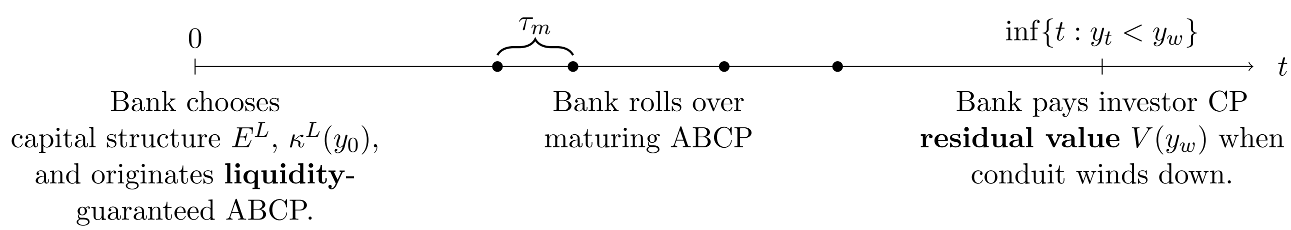
Figure 2: **Credit vs. liquidity guarantee**
The table illustrates the similarity and difference between a credit guarantor bank and a liquidity guarantor bank. When the investors with maturing ABCP no longer want to reinvest or "rollover" the commercial paper, the sponsoring bank pays the commercial paper's principal amount back to the ABCP investors. When the investor's ABCP is deemed default, that is, under the wind-down trigger, only the investors of credit-guaranteed ABCP can receive their principal from the guarantor bank. The investors of liquidity-guaranteed ABCP incur losses since they can only obtain the market value (sales proceedings) of the conduit assets. Finally, before 2010 when ABCP exclusion was effective, liquidity-guarantor banks were not required to prepare risk-capital according to the full-size of the conduit as credit-guarantors do, but only 0% to 10% instead.

<table>
<tr><th></th><th>Credit guarantor bank</th><th>Liquidity guarantor bank</th></tr>
<tr><td>When ABCP matures:</td><td colspan="2">- Bank does nothing if the investors rollover.<br>- Bank pays the investors ABCP face value, then re-issues ABCP, if the investors leave.</td></tr>
<tr><td>When ABCP conduit winds-down:</td><td>Bank pays the investors the ABCP face value.</td><td>Bank pays the investors the fair market value of underlying assets.</td></tr>
<tr><td>Capital requirement under ABCP exclusion:</td><td>Bank needs to prepare risk-capital for 100% of the ABCP conduit assets.</td><td>Bank only needs to prepare risk-capital for 0% to 10% of the ABCP conduit assets.</td></tr>
</table>

Figure 3: **Model timeline.**
Panel (a) and (b) presents the timelines for credit and liquidity guarantor banks in the model respectively. There are multiple events of rolling over maturing ABCP, marked by the black dots. The ABCP maturity follows an exponential distribution with parameter $m$, so $\tau_m \sim Exp(m)$. When incumbent ABCP matures, the bank needs to rollover the commercial paper under the cash flow $y_t$. Since the cash flow $y_t$ may not be as high as $y_0$, the new commercial paper may be issued at a discount since the investor may demand a higher return. In this case, the bank equity holder has to post the margin and will suffer a loss. Once the ABCP conduit wind-down gets triggered, the credit guarantor bank needs to pay the face value of the commercial paper to the investors, whereas the liquidity guarantor bank pays the residual value of underlying assets to the investors.

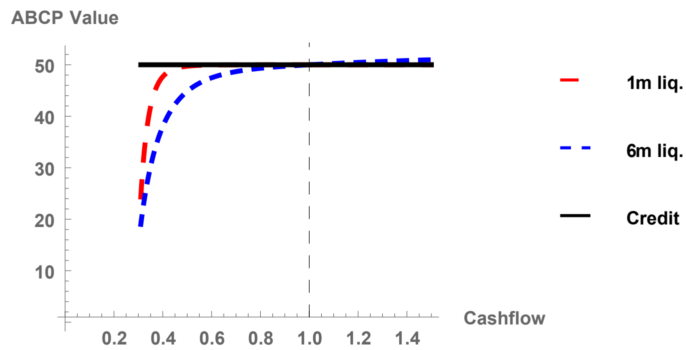



(a) **Credit guaranteed ABCP**

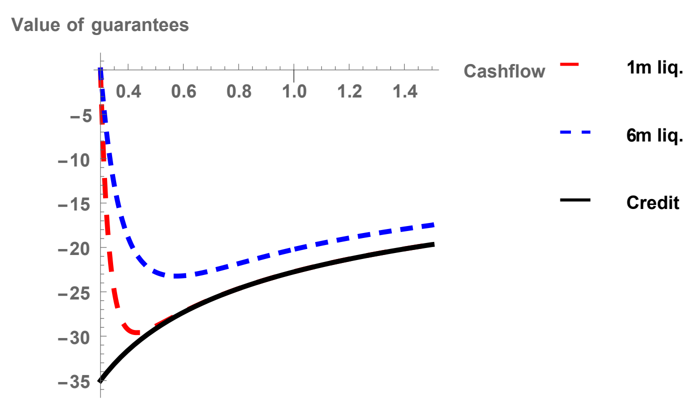



(b) **Liquidity guaranteed ABCP**

Figure 4: **Value functions by ABCP maturity and guarantee type**
Panel (a) shows the value functions of credit guaranteed ABCP (solid line), liquidity guaranteed ABCP with one month maturity (long dashed line), and liquidity guaranteed ABCP with six months maturity (short dashed line). Panel (b) shows the value functions of credit guarantee (solid line), liquidity guarantee for one month ABCP (long dashed line), and liquidity guarantee for three month ABCP (short dashed line). Parameters are $r = 0.05$, $\mu = 0.03$, $\sigma = 0.5$, $y_w = 0.3$, and $y_0 = 1$.




(a) **Value functions of ABCP**




(b) **Value functions of credit vs. liquidity guarantee**

Figure 5: **Subprime ARM 2/28 60+ day delinquency ratio**
The delinquency status of 30-year adjustable-rate subprime mortgages with a fixed rate for the first two years. We aggregate the monthly balance of over 60-day delinquent subprime ARM 2/28 loans and normalize it with the monthly total current balance of subprime ARM 2/28 loans. The delinquency rate was stable before mid-2006, then started to pick up as the U.S. housing market softened. By the end of 2009, about 50% of the subprime ARM 2/28 borrowers are over 60 days delinquent.

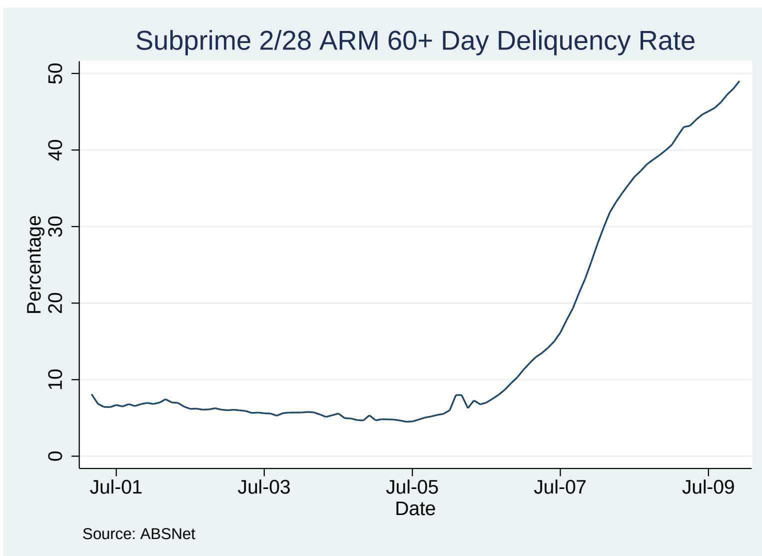
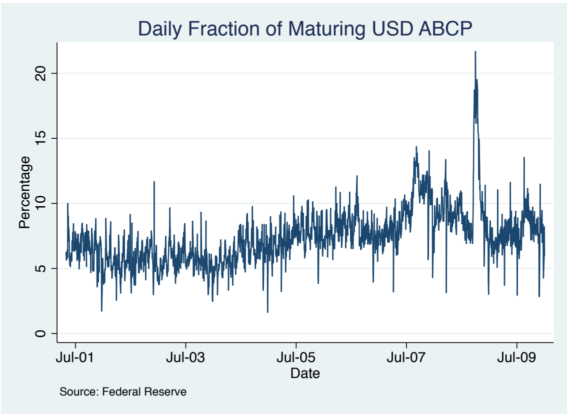
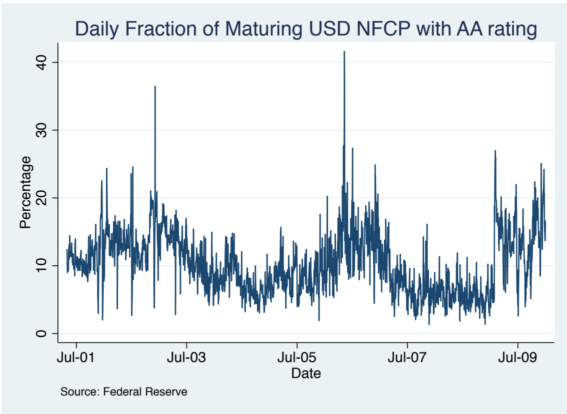


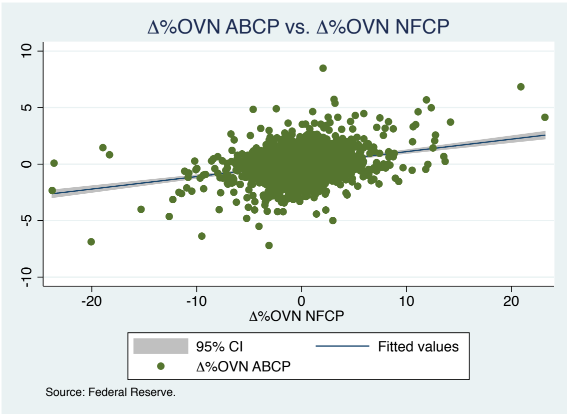
Figure 6: **USD ABCP and NFCP maturing overnight**
Panel (a) presents the share of outstanding ABCP with overnight maturity. Panel (b) presents the share of NFCP with overnight maturity. Both time series are on a daily basis. The maturity of ABCP shortened during the 2007 ABCP market freeze, while the maturity of NFCP shortened during the 2006 downgrade of General Motors. Panel (c) shows the regression between the change in ABCP maturity (y-axis) versus the change in NFCP maturity (x-axis) on the same day, with the shaded region represents the 95% confidence interval of regression coefficient.




(a) **ABCP**




(b) **NFCP**




(c) **Relationship between ABCP and NFCP maturity**

Table 1: **Summary statistics: ABCP guarantors vs. other bank holding companies**
This table summarizes the balance sheet information, at the bank-quarter level, about the U.S. bank holding companies from 2001Q2 to 2009Q3. Column "All BHCs" shows the means and standard deviations of variables for all bank holding companies (BHC). Column "Guarantors" shows the means and deviations for all banks that provided a guarantee to ABCP conduits. Column "Non-guarantors 1B+ assets," "Non-guarantors 10B+ assets," and "Non-guarantors 50B+ assets" show the statistics for all the non-guarantor banks with maximum book assets larger than 1 billion, 10 billion, and 50 billion USD respectively.

| | (1) All BHCs mean/sd | (2) Guarantors mean/sd | (3) Other 1B+ mean/sd | (4) Other 10B+ mean/sd | (5) Other 50B+ mean/sd |
|---|---|---|---|---|---|
| Total Assets (Bil.) | 35.609 | 360.528 | 17.641 | 79.363 | 251.738 |
| | (172.445) | (522.477) | (100.790) | (219.194) | (382.539) |
| Market-to-book | 1.816 | 2.102 | 1.800 | 1.891 | 1.698 |
| | (0.836) | (0.882) | (0.831) | (0.897) | (0.770) |
| Collateral to assets (%) | 26.676 | 28.460 | 26.577 | 27.353 | 22.202 |
| | (12.505) | (15.968) | (12.278) | (13.278) | (13.843) |
| Beta | 0.957 | 1.107 | 0.949 | 1.068 | 1.182 |
| | (0.555) | (0.376) | (0.562) | (0.420) | (0.447) |
| Asset risk | 0.049 | 0.047 | 0.049 | 0.045 | 0.045 |
| | (0.035) | (0.026) | (0.035) | (0.028) | (0.034) |
| EPS | 0.344 | 0.664 | 0.326 | 0.526 | 0.714 |
| | (0.843) | (0.906) | (0.836) | (0.983) | (1.217) |
| Payout ratio (%) | 37.404 | 44.280 | 37.024 | 41.626 | 40.967 |
| | (53.911) | (64.586) | (53.237) | (57.564) | (57.872) |
| ROA (%) | 0.199 | 0.284 | 0.194 | 0.234 | 0.237 |
| | (0.554) | (0.307) | (0.564) | (0.412) | (0.502) |
| log(Total assets) | 15.351 | 18.915 | 15.154 | 17.185 | 18.691 |
| | (1.499) | (1.207) | (1.245) | (1.107) | (1.021) |
| $\log^2$(Total assets) | 237.910 | 359.231 | 231.201 | 296.557 | 350.411 |
| | (49.589) | (46.464) | (40.211) | (39.943) | (39.210) |
| Total cap. ratio (%) | 13.244 | 12.882 | 13.264 | 13.159 | 12.741 |
| | (3.188) | (1.976) | (3.241) | (2.360) | (2.525) |
| T1 cap. ratio (%) | 11.501 | 9.374 | 11.619 | 10.732 | 9.586 |
| | (3.429) | (2.251) | (3.444) | (2.622) | (2.433) |
| Observations | 7996 | 419 | 7577 | 1459 | 376 |
| N. of banks | 381 | 18 | 370 | 77 | 26 |

Table 2: **Summary statistics: ABCP guarantors**
This table summarizes the balance sheet information, at the bank-quarter level, about the ABCP guarantor banks from 2001Q2 to 2009Q3. Column "Guarantor" shows the means and the standard deviation of variables for all ABCP guarantors (hence it is same as the column "Guarantor" in Table 1). Column "Liquidity guarantor" and "Credit guarantor" are for liquidity and credit guarantor banks respectively. Column "Dual guarantor" is for banks that provided both liquidity and credit guarantee to ABCP conduits in the quarter.

| | (1)<br>Guarantors (Any)<br>mean/sd | (2)<br>Guarantors (Liq.)<br>mean/sd | (3)<br>Guarantors (Cred.)<br>mean/sd | (4)<br>Guarantors (Both)<br>mean/sd |
|---|---|---|---|---|
| Total Assets (Bil.) | 360.528 | 367.379 | 768.557 | 887.216 |
| | (522.477) | (537.039) | (662.157) | (673.690) |
| Market-to-book | 2.102 | 2.078 | 2.002 | 1.906 |
| | (0.882) | (0.868) | (0.793) | (0.702) |
| Collateral to assets (%) | 28.460 | 28.363 | 30.785 | 31.050 |
| | (15.968) | (16.433) | (19.147) | (20.958) |
| Beta | 1.107 | 1.103 | 1.227 | 1.243 |
| | (0.376) | (0.386) | (0.409) | (0.442) |
| Asset risk | 0.047 | 0.046 | 0.045 | 0.042 |
| | (0.026) | (0.026) | (0.031) | (0.031) |
| EPS | 0.664 | 0.684 | 0.623 | 0.672 |
| | (0.906) | (0.904) | (0.939) | (0.942) |
| Payout ratio (%) | 44.280 | 42.382 | 47.803 | 42.939 |
| | (64.586) | (63.800) | (71.799) | (71.506) |
| ROA (%) | 0.284 | 0.285 | 0.228 | 0.217 |
| | (0.307) | (0.310) | (0.297) | (0.302) |
| log(Total assets) | 18.915 | 18.910 | 19.960 | 20.195 |
| | (1.207) | (1.228) | (1.106) | (1.017) |
| $\log^2$(Total assets) | 359.231 | 359.073 | 399.630 | 408.864 |
| | (46.464) | (47.259) | (43.856) | (40.607) |
| Total cap. ratio (%) | 12.882 | 12.953 | 12.668 | 12.832 |
| | (1.976) | (2.027) | (1.864) | (2.015) |
| T1 cap. ratio (%) | 9.374 | 9.492 | 9.341 | 9.688 |
| | (2.251) | (2.289) | (2.392) | (2.520) |
| Observations | 419 | 388 | 160 | 129 |

Table 3: **Summary statistics: ABCP guarantor bank return and ABCP market**
This table summarizes the ABCP guarantor bank return, the ABCP market condition, as well as related macroeconomic conditions used in the empirical analysis. The sample consists of 18 U.S. bank equity returns starting from 2001Q2 to 2009Q3, as well as the market return in the same period. Both returns are holding period returns from CRSP: the market return is the value-weighted return including the dividend. Maturities of both ABCP and NFCP are from the Federal Reserve – %OVN and %OVN NFCP measure the percentages of the outstanding ABCP and NFCP with overnight maturity on a daily basis. Liquidity (credit) guarantee exposure shows the outstanding ABCP that the bank guarantees relative to its book value. ΔMortgage Delq. shows the change in the fraction of Subprime 2/28 loans that are 60+ day delinquent. Bank balance sheet data are from call reports. Monthly GDP growth is from Macroeconomic Advisers LLC. Fed QE is the weekly mortgage-backed security purchase amount published by the Federal Reserve.

| | mean | sd | min | max | count |
|---|---|---|---|---|---|
| **Daily returns** | | | | | |
| $r_{i,t} - r_f$ (%) | 0.002 | 2.638 | -19.959 | 19.996 | 26042 |
| **Maturity of ABCP** | | | | | |
| %OVN | 7.405 | 2.162 | 1.632 | 21.681 | 2138 |
| Δ%OVN | -0.001 | 1.140 | -7.200 | 8.484 | 2138 |
| **Maturity of NFCP** | | | | | |
| %OVN NFCP | 10.259 | 4.464 | 1.330 | 41.604 | 2138 |
| Δ%OVN NFCP | 0.003 | 2.837 | -23.594 | 20.901 | 2138 |
| **Exposure to ABCP conduit** | | | | | |
| Exposure (%) | 3.921 | 3.801 | 0.000 | 20.100 | 419 |
| Credit Guarantee Exposure (%) | 0.864 | 1.954 | 0.000 | 11.804 | 419 |
| **Mortgage delinquency** | | | | | |
| Δ Mortgage Delq. (%) | 0.416 | 0.686 | -1.709 | 2.376 | 2138 |
| **Macro** | | | | | |
| Monthly GDP Growth% | 0.131 | 0.597 | -1.688 | 1.580 | 105 |
| Fed QE (USD Bil.) | 2.044 | 12.901 | -4.782 | 167.531 | 2138 |

Table 4: **Model selection**

Panel (a) reports the OLS regressions as in section 5.1 with combinations of regressors. The model (1) is the unrestricted model as the equation (3), whereas the model (2), (3), (4) and (5) are the restricted models. As shown in the coefficient table, the model (2) drops the $\Delta$%OVN $\times$ $\Delta$CG Conduit Risk, the model (3) further drops $\Delta$CG Conduit Risk, and the model (4) further drops $\Delta$%OVN$\times\Delta$LG Conduit Risk. The model (5) drops $\Delta$%OVN$\times\Delta$LG Conduit Risk from the unrestricted model. The dependent variable, $r_{i,t}^{FF4}$, is the holding period equity abnormal return of bank $i$ at period $t$, after controlling for the Fama-French and Carhart factors. For the explanatory variables, $\Delta\%\text{OVN}_t$ measures the change in the ratio of ABCP outstanding matures overnight from period $t-1$ to $t$. $\Delta\text{Conduit Risk}_{i,t}$ is the product of subprime mortgage delinquency rate change between period $t-1$ and $t$, multiplies the bank's exposure to ABCP liquidity guarantee aforementioned, which is the principal of ABCP relative to the bank's book value. The regression controls for bank fixed effect, bank balance sheet variables, and macroeconomic variables. Model (3), which the interaction term $\Delta$%OVN $\times$ $\Delta$LG Conduit Risk drives down the bank returns, shows the highest overall F-statistics. Panel (b) reports the Likelihood ratio (LR) test to test the hypothesis of nested models. The LR $\chi^2$ show that removing $\Delta$%OVN $\times$ $\Delta$LG Conduit Risk rejects the nested model hypothesis, whereas removing $\Delta$%OVN $\times$ $\Delta$LG Conduit Risk and $\Delta$LG Conduit Risk, which does not reject the nested model hypothesis, leads to higher $F$-statistics.

(a) **OLS regressions**

| | (1)<br>$r_{i,t}^{FF4}$ (%) | (2)<br>$r_{i,t}^{FF4}$ (%) | (3)<br>$r_{i,t}^{FF4}$ (%) | (4)<br>$r_{i,t}^{FF4}$ (%) | (5)<br>$r_{i,t}^{FF4}$ (%) |
|---|---|---|---|---|---|
| $\Delta$%OVN | -0.0448 | -0.0494 | -0.0493 | -0.0428 | -0.0354 |
| | (0.0366) | (0.0362) | (0.0362) | (0.0361) | (0.0363) |
| $\Delta$ LG Conduit Risk | 0.00309 | 0.00306 | 0.00446 | 0.00452 | 0.00317 |
| | (0.00453) | (0.00453) | (0.00374) | (0.00375) | (0.00453) |
| $\Delta$%OVN $\times$ $\Delta$ LG Conduit Risk | -0.00670$^{*}$ | -0.00856$^{***}$ | -0.00855$^{***}$ | | |
| | (0.00372) | (0.00292) | (0.00292) | | |
| $\Delta$ CG Conduit Risk | 0.00445 | 0.00448 | | | 0.00434 |
| | (0.00820) | (0.00820) | | | (0.00820) |
| $\Delta$%OVN $\times$ $\Delta$ CG Conduit Risk | -0.00510 | | | | -0.0121$^{**}$ |
| | (0.00630) | | | | (0.00495) |
| Bank Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Balance Sheet Controls | Yes | Yes | Yes | Yes | Yes |
| Macro Controls | Yes | Yes | Yes | Yes | Yes |
| Observations | 26042 | 26042 | 26042 | 26042 | 26042 |
| Overall F-Statistics | 2.476 | 2.932 | 3.810 | 1.432 | 2.284 |

Standard errors in parentheses. $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

(b) **LR test results**

| Likelihood-ratio test assumption | LR $\chi^2$ |
|---|---|
| Model (2) nested in model (1) | 0.33 |
| Model (3) nested in model (2) | 0.17 |
| Model (4) nested in model (3) | 11.20$^{***}$ |
| Model (5) nested in model (1) | 5.17$^{**}$ |

$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Table 5: **Effect of ABCP maturity on bank abnormal returns (IV)**
Panel (a) reports the IV betas of the model presented in equation (4) in section 5.2. The dependent variable, $r_{i,t}^{FF4}$, is the holding period equity abnormal return of bank $i$ at period $t$, after controlling for the Fama-French and Carhart factors. For the explanatory variables, $\Delta\%\text{OVN}_t$ measures the change in the ratio of ABCP outstanding matures overnight from period $t-1$ to $t$. $\Delta\text{Conduit Risk}_{i,t}$ is the product of subprime mortgage delinquency rate change between period $t-1$ and $t$, multiplies the bank's exposure to ABCP liquidity guarantee aforementioned, which is the principal of ABCP relative to the bank's book value. Standard errors are clustered at the bank and year level. Panel (b) presents the corresponding first-stage regressions for the regressors of the model (3) presented in panel (a).

(a) **IV Regression: Second stage**

| | (1)<br>$r_{i,t}^{FF4}$ (%) | (2)<br>$r_{i,t}^{FF4}$ (%) | (3)<br>$r_{i,t}^{FF4}$ (%) |
|---|---|---|---|
| $\Delta$%OVN × $\Delta$ LG Conduit Risk | -0.0408*** | -0.0408*** | -0.0408*** |
| | (0.0156) | (0.0156) | (0.0156) |
| $\Delta$%OVN | -0.128 | -0.126 | -0.127 |
| | (0.119) | (0.117) | (0.117) |
| $\Delta$ LG Conduit Risk | 0.00435 | 0.00437 | 0.00411 |
| | (0.00515) | (0.00407) | (0.00392) |
| Bank Fixed Effects | Yes | Yes | Yes |
| Balance Sheet Controls | No | Yes | Yes |
| Macro Controls | No | No | Yes |
| Observations | 26042 | 26042 | 26042 |
| N. of Bank Clusters | 18 | 18 | 18 |
| N. of Time Clusters | 9 | 9 | 9 |
| Overall F-Statistics | 4.942 | 55.18 | 27.06 |

Standard errors in parentheses. $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

(b) **IV Regression: First stage**

| | (1)<br>$\Delta$%OVN | (2)<br>$\Delta$%OVN × $\Delta$ LG Conduit Risk |
|---|---|---|
| $\Delta$%OVN NFCP | 0.122*** | -0.102*** |
| | (0.00226) | (0.00827) |
| $\Delta$%OVN NFCP × $\Delta$ LG Conduit Risk | -0.00736*** | 0.0719*** |
| | (0.000608) | (0.00223) |
| $\Delta$ LG Conduit Risk | 0.00285 | -0.0105 |
| | (0.00219) | (0.00803) |
| Bank Fixed Effects | Yes | Yes |
| Balance Sheet Controls | Yes | Yes |
| Macro Controls | Yes | Yes |
| Observations | 26042 | 26042 |
| Overall F-Statistics | 386.8 | 149.7 |

Standard errors in parentheses. $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

Table 6: **Robustness: IV regression by periods**

This table presents two sets of robustness checks of the IV betas, as in section 5.2.1, for the model presented in equation (4). The model (1) in panel (a) presents the regression results using data before the end of 2006 when the U.S. ABCP market enjoyed rapid growth, whereas the model (2) uses data afterward. The model (1) in panel (b) presents the result using data before the end of 2004, when mortgage borrower enjoyed low mortgage rates, whereas the model (2) presents the result using rest of the data. The dependent variable, $r_{i,t}^{FF4}$, is the holding period equity abnormal return of bank $i$ at period $t$, after controlling for the Fama-French and Carhart factors. For the explanatory variables, $\Delta\%\text{OVN}_t$ measures the change in the ratio of ABCP outstanding matures overnight from period $t-1$ to $t$. $\Delta\text{Conduit Risk}_{i,t}$ is the product of subprime mortgage delinquency rate change between period $t-1$ and $t$, multiplies the bank's exposure to ABCP liquidity guarantee aforementioned, which is the principal of ABCP relative to the bank's book value. Standard errors are clustered at the bank and year level.

(a) **IV regression by periods: 2001-2006 vs. 2007 - 2009**

| | (1)<br>$r_{i,t}^{FF4}$ (%) | (2)<br>$r_{i,t}^{FF4}$ (%) |
|---|---|---|
| $\Delta$%OVN × $\Delta$ LG Conduit Risk | -0.0342*** | -0.0262** |
| | (0.0107) | (0.0105) |
| $\Delta$%OVN | -0.0142 | -0.694 |
| | (0.0492) | (0.493) |
| $\Delta$ LG Conduit Risk | -0.00428 | 0.00977* |
| | (0.0119) | (0.00545) |
| Bank Fixed Effects | Yes | Yes |
| Balance Sheet Controls | Yes | Yes |
| Macro Controls | Yes | Yes |
| Observations | 16762 | 9280 |
| N. of Bank Clusters | 18 | 14 |
| N. of Time Clusters | 5 | 4 |
| Overall F-Statistics | 7.069 | 1.176 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

(b) **IV regression by periods: 2001-2004 vs. 2005 - 2009**

| | (1)<br>$r_{i,t}^{FF4}$ (%) | (2)<br>$r_{i,t}^{FF4}$ (%) |
|---|---|---|
| $\Delta$%OVN × $\Delta$ LG Conduit Risk | -0.0275* | -0.0327** |
| | (0.0150) | (0.0156) |
| $\Delta$%OVN | -0.00515 | -0.387 |
| | (0.0581) | (0.329) |
| $\Delta$ LG Conduit Risk | -0.0274* | 0.00743** |
| | (0.0158) | (0.00370) |
| Bank Fixed Effects | Yes | Yes |
| Balance Sheet Controls | Yes | Yes |
| Macro Controls | Yes | Yes |
| Observations | 10323 | 15719 |
| N. of Bank Clusters | 17 | 14 |
| N. of Time Clusters | 3 | 6 |
| Overall F-Statistics | 2.320 | 2.449 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: **Robustness: IV regression using alternative winsorizing and trimming schemes**
This table presents the robustness of the IV betas, as in section 5.2.1, for the model presented in equation (4). The model (1) shows the regression results when we trim the observations with daily excess return beyond ±30% range. The model (2) and (3) shows the regression results under $(1\%, 99\%)$ level and $(0.5\%, 99.5\%)$ level respectively. The dependent variable, $r_{i,t}^{FF4}$, is the holding period equity abnormal return of bank $i$ at period $t$, after controlling for the Fama-French and Carhart factors. For the explanatory variables, $\Delta\%\text{OVN}_t$ measures the change in the ratio of ABCP outstanding matures overnight from period $t-1$ to $t$. $\Delta\text{Conduit Risk}_{i,t}$ is the product of subprime mortgage delinquency rate change between period $t-1$ and $t$, multiplies the bank's exposure to ABCP liquidity guarantee aforementioned, which is the principal of ABCP relative to the bank's book value. Standard errors are clustered at the bank and year level.

| | (1) | (2) | (3) |
|---|---|---|---|
| | $r_{i,t}^{FF4}$ (%) | $r_{i,t}^{FF4}$ (%) | $r_{i,t}^{FF4}$ (%) |
| Δ%OVN × Δ LG Conduit Risk | -0.0408*** | -0.0459** | -0.0451** |
| | (0.0155) | (0.0194) | (0.0191) |
| Δ%OVN | -0.136 | -0.236 | -0.173 |
| | (0.174) | (0.241) | (0.196) |
| Δ LG Conduit Risk | 0.00342 | 0.00476 | 0.00462 |
| | (0.00428) | (0.00394) | (0.00394) |
| Bank Fixed Effects | Yes | Yes | Yes |
| Balance Sheet Controls | Yes | Yes | Yes |
| Macro Controls | Yes | Yes | Yes |
| Observations | 26117 | 26139 | 26139 |
| N. of Bank Clusters | 18 | 18 | 18 |
| N. of Time Clusters | 9 | 9 | 9 |
| Overall F-Statistics | 28.01 | 3.603 | 0.984 |

Standard errors in parentheses. $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

Table 8: **Robustness: IV regression using Fama French 3-factor residual return**
This table presents the robustness of the IV betas, as in section 5.2.1. The dependent variable, $r_{i,t}^{FF}$, is the holding period equity residual return of the Fama-French 3-factor model for bank $i$ at period $t$. For the explanatory variables, $\%\text{OVN}_t$ measures outstanding ABCP during period $t$, so $\Delta\%\text{OVN}_t$ measures the change in the ratio of ABCP outstanding matures overnight from period $t-1$ to $t$. $\Delta\text{Conduit Risk}_{i,t}$ is the product of subprime mortgage delinquency rate change between period $t-1$ and $t$, multiplies the bank's exposure to ABCP liquidity guarantee aforementioned, which is the principal of ABCP relative to the bank's book value. Standard errors are clustered at the bank and year level.

| | (1)<br>$r_{i,t}^{FF}$ (%) | (2)<br>$r_{i,t}^{FF}$ (%) | (3)<br>$r_{i,t}^{FF}$ (%) |
|---|---|---|---|
| $\Delta\%$OVN $\times$ $\Delta$ LG Conduit Risk | -0.0399*** | -0.0398*** | -0.0400*** |
| | (0.0150) | (0.0149) | (0.0148) |
| $\Delta\%$OVN | -0.122 | -0.120 | -0.120 |
| | (0.108) | (0.106) | (0.105) |
| $\Delta$ LG Conduit Risk | 0.00383 | 0.00251 | 0.00251 |
| | (0.00310) | (0.00219) | (0.00250) |
| Bank Fixed Effects | Yes | Yes | Yes |
| Balance Sheet Controls | No | Yes | Yes |
| Macro Controls | No | No | Yes |
| Observations | 26042 | 26042 | 26042 |
| N. of Bank Clusters | 18 | 18 | 18 |
| N. of Time Clusters | 9 | 9 | 9 |
| Overall F-Statistics | 0.727 | 1.335 | 0.965 |

Standard errors in parentheses. $^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Table 9: **Descriptive statistics and Student $t$-test: ABCP guarantors vs. non-guarantors**
This table lists the $t$-test result to compare ABCP guarantor banks and non-guarantor banks in the sample period 2001Q2 - 2009Q3. Column "Guarantors vs. 1B+ Non-guarantors," "Guarantors vs. 10B+ Non-guarantors," and "Guarantors vs. 50B+ Non-guarantors" show the difference in means as well as the corresponding standard errors between the ABCP guarantor banks and non-guarantor BHCs with maximum assets larger than 1 billion, 10 billion, and 50 billion USD respectively during the sample period. Guarantor and non-guarantor banks also differ in many aspects from total assets to risk capital ratios. Nevertheless, the difference gets smaller or insignificant when we compare ABCP guarantor banks with larger non-guarantor BHCs. Indeed, the Tier-1 risk capital ratio and Total risk capital ratio of ABCP guarantors are significantly lower than the average of non-guarantors with more than 1 billion USD assets, but not so when compared with that of large non-guarantor BHCs with 50 billion or more assets.

| | (1)<br>Guarantors vs Other 1B+<br>b/se | (2)<br>Guarantors vs Other 10B+<br>b/se | (3)<br>Guarantors vs Other 50B+<br>b/se |
|---|---|---|---|
| Total Assets (Bil.) | 342.887*** | 281.165*** | 108.790*** |
| | (25.551) | (26.162) | (32.260) |
| Market-to-book | 0.301*** | 0.210*** | 0.404*** |
| | (0.044) | (0.049) | (0.059) |
| Collateral to assets (%) | 1.883** | 1.108 | 6.258*** |
| | (0.793) | (0.854) | (1.057) |
| Beta | 0.158*** | 0.039* | -0.074** |
| | (0.019) | (0.021) | (0.029) |
| Asset risk | -0.002* | 0.001 | 0.001 |
| | (0.001) | (0.001) | (0.002) |
| EPS | 0.338*** | 0.138*** | -0.050 |
| | (0.045) | (0.051) | (0.077) |
| Payout ratio (%) | 7.256** | 2.654 | 3.313 |
| | (3.214) | (3.497) | (4.343) |
| ROA (%) | 0.090*** | 0.050*** | 0.047 |
| | (0.016) | (0.018) | (0.030) |
| log(Total assets) | 3.761*** | 1.730*** | 0.224*** |
| | (0.061) | (0.066) | (0.079) |
| $\log^2$(Total assets) | 128.029*** | 62.673*** | 8.820*** |
| | (2.316) | (2.499) | (3.040) |
| T1 lev. ratio (%) | -1.275*** | -0.681*** | -0.503*** |
| | (0.089) | (0.098) | (0.147) |
| Total cap. ratio (%) | -0.382*** | -0.278** | 0.140 |
| | (0.103) | (0.115) | (0.162) |
| T1 cap. ratio (%) | -2.245*** | -1.358*** | -0.212 |
| | (0.117) | (0.130) | (0.167) |
| Observations | 7996 | 1878 | 795 |

Table 10: **Capital ratios of ABCP liquidity & credit guarantors vs. all TBTF BHCs**
Panel (a) presents the higher risk capital buffer of liquidity guarantor BHCs compared to all ABCP guarantor banks. Panel (b) presents the higher risk capital buffer of liquidity guarantor BHCs compared to TBTF banks. The dependent variables are the Tier 1 capital ratio, presented in columns (1) and (2), and Total capital ratio, presented in columns (3) and (4). Estimation results with or without bank balance sheet control variables are presented. Reported in the parenthesis, Newey-west standard errors are used to adjust for the autocorrelation in the bank risk capital ratios.

| | (1)<br>T1 cap. ratio (%) | (2)<br>T1 cap. ratio (%) | (3)<br>Total cap. ratio (%) | (4)<br>Total cap. ratio (%) |
|---|---|---|---|---|
| Liquidity guarantor | 0.856*** | 0.804*** | 0.805*** | 0.740*** |
| | (0.237) | (0.225) | (0.249) | (0.236) |
| Credit guarantor | -0.950*** | -0.960*** | -0.852*** | -0.880*** |
| | (0.281) | (0.265) | (0.296) | (0.277) |
| Market-to-book | | 0.248* | | 0.0457 |
| | | (0.141) | | (0.148) |
| Collateral to assets (%) | | 0.0554*** | | 0.0571*** |
| | | (0.0121) | | (0.0126) |
| Beta | | -0.0691 | | 0.255 |
| | | (0.273) | | (0.286) |
| Asset risk | | -3.694 | | -7.384* |
| | | (3.749) | | (3.914) |
| EPS | | 0.217** | | 0.240** |
| | | (0.0952) | | (0.0993) |
| Payout ratio (%) | | -0.000656 | | -0.000451 |
| | | (0.000671) | | (0.000699) |
| ROA (%) | | -0.125 | | -0.186 |
| | | (0.231) | | (0.241) |
| log(Total assets) | | -5.547* | | -8.633*** |
| | | (2.931) | | (3.065) |
| $\log^2$(Total assets) | | 0.111 | | 0.184** |
| | | (0.0757) | | (0.0791) |
| N | 795 | 795 | 795 | 795 |
| Adj. $R^2$ | 0.378 | 0.451 | 0.363 | 0.445 |
| Overall F-Statistics | 10.06 | 10.82 | 9.326 | 10.39 |

Table 11: **Propensity score weighted regression**
This table presents the higher risk capital buffer of liquidity guarantor BHCs compared to all BHCs with 1B+ total assets. The columns (1) and (2) show the regression results where the $\Pr\{\text{ABCP guarantor}\}_{i,t}$ is estimated using Logit model, whereas the columns (3) and (4) are the results where $\Pr\{\text{ABCP guarantor}\}_{i,t}$ is estimated using Probit. The weight for each ABCP guarantor bank is $\frac{1}{\Pr\{\text{ABCP guarantor}\}_{i,t}}$ whereas the weight for a non-guarantor is $\frac{1}{1-\Pr\{\text{ABCP guarantor}\}_{i,t}}$. The dependent variables are the Tier 1 capital ratio, presented in columns (1) and (3), and Total (Tier 1 and Tier 2) capital ratio, presented in columns (2) and (4). Bank balance sheet control variables are described in Appendix. Reported in the parenthesis, Newey-west standard errors are used to adjust for the autocorrelation in the bank risk capital ratios.

| | Logit | | Probit | |
|---|---|---|---|---|
| | (1) T1 cap. ratio(%) | (2) Total cap. ratio(%) | (3) T1 cap. ratio(%) | (4) Total cap. ratio(%) |
| Liquidity guarantor | 1.855*** | 1.280*** | 1.854*** | 1.280*** |
| | (0.249) | (0.252) | (0.249) | (0.252) |
| ABCP guarantor | -1.897*** | -0.862*** | -1.898*** | -0.863*** |
| | (0.249) | (0.256) | (0.249) | (0.256) |
| Market-to-book | -0.416** | -0.213 | -0.420** | -0.219 |
| | (0.167) | (0.152) | (0.166) | (0.151) |
| Collateral to assets (%) | 0.0327*** | -0.00599 | 0.0326*** | -0.00602 |
| | (0.00503) | (0.00491) | (0.00503) | (0.00492) |
| Beta | 1.956*** | 1.922*** | 1.972*** | 1.931*** |
| | (0.421) | (0.378) | (0.422) | (0.379) |
| Asset risk | 39.08*** | 39.00*** | 39.20*** | 39.09*** |
| | (6.618) | (6.181) | (6.562) | (6.149) |
| EPS | 0.0250 | -0.262 | 0.0159 | -0.270 |
| | (0.183) | (0.193) | (0.184) | (0.194) |
| Payout ratio (%) | -0.00347*** | -0.00138 | -0.00347*** | -0.00139 |
| | (0.00106) | (0.000928) | (0.00106) | (0.000929) |
| ROA (%) | 0.969 | 1.603** | 0.997 | 1.631** |
| | (0.636) | (0.687) | (0.641) | (0.691) |
| log(Total assets) | -2.290 | -4.941*** | -2.311* | -4.958*** |
| | (1.398) | (1.388) | (1.393) | (1.385) |
| $\log^2$(Total assets) | 0.0557 | 0.121*** | 0.0562 | 0.122*** |
| | (0.0364) | (0.0362) | (0.0363) | (0.0361) |
| N | 795 | 795 | 795 | 795 |
| Adj. $R^2$ | 0.460 | 0.465 | 0.463 | 0.468 |
| Overall F-Statistics | 26.07 | 24.25 | 26.46 | 24.69 |

Table 12: **Capital ratios and $\beta^{ABCP}$**

This table presents the ABCP beta and capital ratio. Panel (a) presents the summary statistics of ABCP beta, estimated from Equation (8). Panel (b) presents the regression result of result of Equation (9). Estimation results with or without bank balance sheet control variables are presented. The dependent variables are the Tier 1 capital ratio, presented in columns (1) and (2), and Total capital ratio, presented in columns (3) and (4). Reported in the parenthesis, Newey-west standard errors are used to adjust for the autocorrelation in the bank risk capital ratios.

(a) **Summary statistics of $\beta^{ABCP}$**

| | mean | sd | min | max | count |
|---|---|---|---|---|---|
| $\beta^{ABCP}$ | -0.398 | 2.258 | -18.154 | 2.189 | 419 |

(b) **Capital ratios and $\beta^{ABCP}$**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | T1 cap. ratio (%) | T1 cap. ratio (%) | Total cap. ratio (%) | Total cap. ratio (%) |
| $\beta^{ABCP}$ | -0.154*** | -0.119*** | -0.121*** | -0.0851*** |
| | (0.0341) | (0.0312) | (0.0355) | (0.0329) |
| Balance Sheet Controls | No | Yes | No | Yes |
| Observations | 419 | 419 | 419 | 419 |
| Adj. $R^2$ | 0.00935 | 0.159 | -0.0142 | 0.114 |
| Overall F-Statistics | 20.40 | 9.092 | 11.67 | 6.716 |