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By *Elena Beccalli, Laura Chiaramonte and Ettore Croci*

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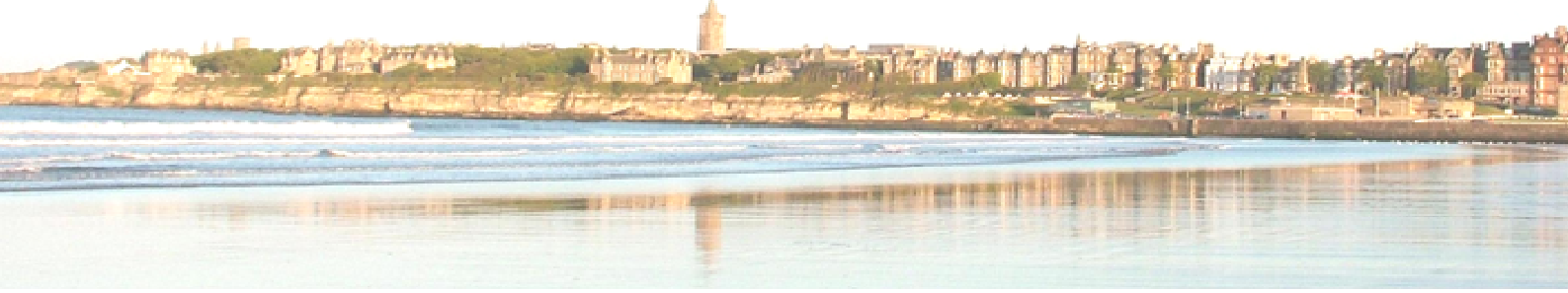

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Elena Beccalli[a], Laura Chiaramonte[b], and Ettore Croci[c+]

This Draft: June 14, 2016

Abstract

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JEL classification: G20, G21, G28, G32, G34

Keywords: Cash holdings, Excess cash, Liquidity, Listing Status, Investments, Lending.

[a]Università Cattolica del Sacro Cuore, Largo Gemelli 1, 20123 Milan, Italy. Phone +39-02-72342990. Email: elena.beccalli@unicatt.it

[b]Università Cattolica del Sacro Cuore, Largo Gemelli 1, 20123 Milan, Italy. Phone +39-02-72342749. Email: laura.chiaramonte@unicatt.it

[c]Università Cattolica del Sacro Cuore, Largo Gemelli 1, 20123 Milan, Italy. Phone +39-02-72343012. Email: ettore.croci@unicatt.it

+corresponding author

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1. Introduction

The lack of liquidity held at individual banks played a major role in triggering the great financial crisis of 2007-08 (Tirole, 2011). This has sparked a new interest in how banks manage their liquidity, leading both policymakers and academic to re-examine the measurement and importance of liquidity. Various policy initiatives were enacted to ensure that US banks hold sufficient liquidity both during the crisis (e.g., Capital Purchase Program; Term Action Facilities)[1] and in the following years (Basel III).[2] US banks responded increasing their cash reserves, the most liquid of the short term assets a bank can hold, from about 3% of their total assets at the onset of the crisis to more than 7% in 2011, as shown in Figure 1.[3] This sharp increase has not been reversed, with banks still holding almost 6% of their assets in cash at the end of 2014.[4]

[Please insert Figure 1 about here]

Precautionary reasons are often cited as the main motivations to stockpile liquid assets (Allen and Gale, 2004a; Acharya and Skeie, 2011; Diamond and Rajan, 2011; Gale and Yorulmazer, 2013). In these models, banks increase their liquid assets in anticipation of negative future events associated to liquidity shortages. Acharya *et al.* (2011), following Allen and Gale (2004b) and Gorton and Huang (2004), add a strategic dimension to the banks' choice on liquidity: banks hoard liquidity to prey on weaker competitors. Indeed, banks could accumulate liquidity to become buyers in fire asset sales of distressed financial institutions.

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[1] For example, the massive cash injections associated to the Capital Purchase Program (CPP) of the Treasury and the Federal Reserve's liquidity programs like the Term Action Facilities (TAF), and the payment of interest on all reserve balances held by depository institutions which started in October 2008.

[2] The Basel Committee on Banking Supervision (BCBS) introduced liquidity standards for banks in the December 2010 final document (the so-called Basel III accord). Following the Basel III accords, new regulation that imposes minimum liquidity coverage ratios have been introduced in the US for the first time. Quantitative U.S. regulatory standard for defining liquidity and establishing a minimum level of liquidity apply to large banks with more than $250 billion in total consolidated assets or $10 billion or more in on-balance-sheet foreign exposures. See: http://www.federalreserve.gov/newsevents/press/bcreg/20140903a.htm

[3] This increase cannot be explained by required reserves. In fact, reserve requirements barely moved between 2007 and 2009 (see https://www.federalreserve.gov/monetarypolicy/reservereq.htm#table1). Moreover, Ennis and Wolmann (2012) show that required reserves have a very small increment in the post crisis period.

[4] Ennis and Wolmann (2012), Berrospide (2013), and, for an international sample, Bonner et al. (2015) also provide evidence of a dramatic increase in banks' cash holdings.

While such holdings may be hoarded for precautionary or strategic reasons as part of a strategy to manage liquidity risk (Diamond and Dybvig, 1983; Gatev *et al.*, 2006; Gatev *et al.*, 2009), they are not free of potential costs. High levels of liquidity might induce managers to accept excessive risks, because high liquidity provides a kind of "insurance effect" for the managers, reducing the risk of a shortfall (Acharya and Navqi, 2012). In addition, excessive cash reserves may exacerbate conflicts between shareholders and the bank's managers. If not adequately monitored, managers have incentives to use cash to pursue investments that maximize their own utility often to the detriment of firm value (Jensen, 1986; Blanchard *et al.*, 1994; Harford, 1999). While a growing number of studies explore the importance of bank liquidity and liquidity creation (Berger and Bouwman, 2009), there is scarce evidence regarding the role of excess cash reserves for banks.

In this paper we address the paucity of evidence concerning how cash holdings, and in particular the fraction of these reserves of held in excess of the bank's needs (henceforth defined as excess cash), affect executives' behavior. To this end, we first derive the optimal level of cash reserves, [5] which allows us to compute the excess cash held by the bank.[6] The second part of the paper examines whether excess cash generates agency conflicts, is held for strategic motives, or is merely an additional buffer against negative events. We investigate several bank business policies: investments in terms of acquisitions (Harford, 1999; Harford *et al.*, 2008; Dittmar and Mahrt-Smith, 2007; Gao *et al.*, 2013), securities, and market power (Berger and Roman, 2016); lending in terms of loan growth (Acharya and Navqi, 2012), increases in credit risk (Berger and Bouwman, 2013), and securitization (Casu *et al.*, 2013).

In our analysis, we account for the different ability of banks to obtain funding from financial markets, which affects their optimal liquidity level. The listing status of the bank can serve as a

[5] We focus on a narrower definition of liquidity than usually used in the literature, because cash reserves are resources immediately at the disposal of the managers. For example, Cornett *et al.* (2011) define liquidity as cash plus non-asset-backed securities.

[6] See Harford, 1999; and Opler *et al.*, 1999, for models for non-financial institutions and Cornett *et al.*, 2011 for optimal liquidity in banks.

proxy for the availability of external capital for a bank. We posit that, everything else equal, unlisted banks are more financially constrained than listed banks, because they have a more limited supply of capital available. Thus, unlisted banks can rely less than listed banks on the strategy "finance as you go" (Tirole, 2011). Since we expect unlisted banks to be more financially constrained than listed banks, they should hold more cash and engage in a less aggressive behavior. For these reasons, the precautionary motive to hold cash is expected to be more relevant for unlisted banks than for listed banks. Listed firms, usually with a more diffuse ownership than unlisted firms, also suffers from more severe agency problems between shareholders and managers (Gao *et al.*, 2013).

Our sample is composed of all US bank holding companies (henceforth BHCs) having consolidated data available from the Federal Reserve Bank of Chicago (FR Y-9C) with total assets larger than $500 million over the period 2002-2014.[7] Using quarterly data, we find evidence of a noteworthy increase in cash and due from other institutions starting around the financial crisis (see Figure 1). We also find that unlisted bank holding companies respond to the crisis by increasing their liquidity buffers more sharply than listed banks (7.9% vs. 6% at the end of 2011), which supports our view that unlisted banks expect to face tougher conditions in raising external capital.

The main results of the empirical analysis can be summarized as follows. As for the determinants of cash reserves held by banks, which complements the findings on bank liquidity of Cornett *et al.* (2011), we show that larger, more profitable, and more capitalized banks hold less cash. Similarly to what found for non-financial corporations by Duchin (2010), more diversified banks hold less cash as well.[8] We also observe that cash injections during the crisis and the subsequent repayments impact the bank cash holdings with the expected sign (positive and negative, respectively).

[7] The asset-size threshold for filing the FR YR-9C form was increased from $150 million to $500 million in March 2006 ($1 billion from March 2015). To maintain a balanced sample throughout our sample period, we opt to include only bank holding companies with asset size above $500 million.

[8] Duchin (2010) documents that diversification reduces the amount of cash held by non-financial corporations.

We do not find evidence supporting the view that excess cash exacerbates agency costs, in particular when we look at listed BHCs. Indeed we find that listed cash-rich banks refrain from making acquisition investments and, when they do, their acquisitions do not exhibit abnormally low returns. Banks do not use excess cash to increase their market power, which actually decreases. Excess cash is not positively associated with an increase in risk-weighted assets, a proxy for bank credit risk-taking (Berger and Udell, 1994, Berger, 1995, Berger and Bouwman, 2009). We also find that investment in securities decreases when listed banks hoard more cash than the amount expected by our model. Overall, these results indicate that managers of listed firms build up large liquidity buffers mainly for precautionary reasons, and not for taking on more risks. On the other hand, unlisted banks exhibit a trade-off between excess cash and investment. Managers of unlisted banks increase acquisition spending and take on more credit risk when cash is plentiful, which is consistent with a credit supply explanation. Having less funding opportunities, excess cash is indeed one of the few options that unlisted bank managers have to fund investment projects.

We also offer evidence suggesting that the great financial crisis of 2007-08 represents a significant break with the past. Indeed, the correlation between excess cash and investments, both in terms of acquisitions and securities, increases in the post-crisis period. Again this result is in line with a supply shock argument, according to which the sensitivity of investment to the existing cash resources increases when the liquidity in credit and equity markets decreases. We provide several robustness analyses to show that excess cash is not merely a negative proxy of liquidity creation (Berger and Bouwman, 2009). Finally, we document that our findings are robust when instead of excess cash we use the actual cash held by a bank, mitigating concerns that an error-in-variable problem may drive our results.

Our paper provides several contributions to the literature. First, we offer new evidence that excess cash does not create severe agency conflicts between managers and shareholders in the banking industry. Understanding the incentives of cash on bank managers is of paramount

importance in the light of the introduction of minimum liquidity ratios, and the substantial increase of cash holdings in the aftermath of the financial crisis. While regulation may have opened the door for managers to increase their power in the bank they manage, our evidence suggests that this concern appears of second-order importance. Second, we provide compelling evidence about the importance of the listing status for bank holding companies, highlighting that liquidity risk could be more severe for unlisted banks. This is also important at policy level, often too focused on systemic risks and too-big-too-fail banks, and adds to the literature about the cost of ignoring small banks (Croci *et al.*, 2016). Third, our results indicate that cash reserves are an important tool in managing liquidity risk, especially after the financial crisis of 2007-2008. Finally, our findings leads to important policy implications: cash affects bank's behavior, so policies aimed at creating liquidity buffers should also focus directly on cash. More importantly, excess cash impacts listed and unlisted firms differently, suggesting that a one-size-fits-all type of liquidity coverage ratios may not be the optimal choice.

The remainder of the paper is organized as follows. We review the literature and develop our hypotheses in the Section 2. We describe our sample and present summary statistics in Section 3. We examine the determinants of cash levels in Section 4. The effects of excess cash on bank's policies are presented in Section 5. Additional analyses are presented in Section 6. We conclude in Section 7.

2. Literature review

The disruptions caused by the financial crisis of 2007-08 have highlighted the importance of bank liquidity. Liquidity problems generated a downward spiral, which led to fire sales that in turn further intensified the crisis (Brunnermeier and Pedersen, 2009; Adrian and Shin, 2010). As shown in Kashyap and Rajan (2008), bank liquidity difficulties spilled over to bank borrowers (as banks reduced loans to preserve liquidity), thereby slowing the whole economy. Despite the large body of

theoretical works that examine the incentives to hoard liquidity,[9] fewer studies conduct empirical analyses. Recent empirical papers have especially analyzed bank liquidity, finding that liquidity indeed increases following the crisis and that liquidity hoarding is common to banks of all sizes (Ennis and Wolman, 2012; Berrospide, 2013).[10]

An increase in cash reserves, like the one observed after the crisis, may be driven by precautionary motives and strategic reasons, but it has also the potential to generate new agency conflicts.[11] Managers have incentives to take more risks, for example engaging in aggressive lending, if bank liquidity is sufficiently high (Acharya and Navqi, 2012). Moreover, if not adequately monitored, excess cash allows managers to pursue their own agenda, which could even lead to a destruction of firm value (Jensen, 1986).[12] However, excess cash does not necessarily generate agency costs. Indeed, Bates *et al.* (2009) show that the increase in cash holdings over time for US industrial companies cannot be systematically ascribed to agency problems in firms. Due to the importance of liquidity management and the higher costs of mismanaging cash reserves in the banking industry, managers could be very reluctant to use the accumulated cash to finance their own pet projects if this could lead to negative career and compensation changes (Eckbo *et al.*, 2016). For these reasons, the precautionary motive, which allows banks to protect themselves against their depositors' uncertain liquidity needs, may also explain why banks hoard cash (Acharya and Skeie, 2011; Diamond and Rajan, 2011; Gale and Yorulmazer, 2013; Heider *et al.*, 2015). Finally, managers could also increase cash reserves to build up financial slack to position themselves as buyers in fire asset-sales (Allen and Gale, 2004b; Gorton and Huang, 2004; Acharya *et al.*, 2011). Under this scenario, cash is used strategically to exploit competitors' weaknesses.

[9] See, for example, Allen and Gale, 2004a; Allen and Gale, 2004b; Gorton and Huang, 2004; Acharya and Skeie, 2011; Diamond and Rajan, 2011; Tirole, 2011; Gale and Yorulmazer, 2013; Heider et *al.*, 2015.

[10] Studying US commercial banks, Ennis and Wolman (2012) observe that, especially in the immediate aftermath of the crisis, the largest commercial banks held a disproportionate amount of reserves at the peak of the crisis.

[11] Another motivation, transaction reasons (Bates et *al.* 2009), is ignored in this paper because scarcely relevant in our analysis. We also ignore tax considerations (Foley et *al.* 2007) because the great majority of the banks considered does not have foreign operations.

[12] Whilst the effects of high cash reserves as amplifier of agency costs between managers and shareholders have been thoroughly investigated for industrial companies (see, for example, Blanchard *et al.*, 1994; Harford, 1999; Duchin *et al.*, 2010; Pinkowitz *et al.*, 2013), they have not received much attention in the banking literature.

The level of cash a bank holds may depend on its ability to obtain funding from financial markets, with privately owned companies usually facing higher costs of external capital (Brav, 2009, Saunders and Steffen, 2011). Listed banks, which can more easily sell equity and debt to the public, have a larger supply of capital available than unlisted banks, everything else equal. Thus, the listing status of the bank can serve as a proxy for the availability of external capital for a bank. Since unlisted banks are more financially constrained, we expect that the precautionary motive to hold cash is more important for unlisted banks than for listed banks. Lacking easy access to financial markets, unlisted banks may be also prone to build large liquidity buffers for strategic reasons. On the other hand, public ownership of listed firms usually implies a diffuse ownership, increasing agency problems between managers and shareholders. As a consequence of the severity of these agency conflicts, listed firms retain more cash (Gao *et al.*, 2013; Farre-Mensa, 2015). Because of these considerations, listed banks should retain more cash than privately owned ones if agency problems are relevant.

The investigation of the fundamental determinants of banks' incentives to hold liquid assets, in particular at empirical level, is the focus of relatively few studies as observed by Bonner *et al.* (2015). Cornett *et al.* (2011) show that commercial banks more exposed to liquidity risk from loan commitment increased cash reserves, negatively affecting the ability to issue new loans around the crisis. Berrospide (2013) uses unrealized losses in securities holdings, i.e. the write-downs of securities that result from mark-to-market accounting of investment portfolios, as a source of liquidity risk and finds that it is positively correlated with cash reserves. The first aim of our paper is thus to shed some light on the determinants of the optimal level of bank cash holdings, by differentiating between listed and unlisted banks, and to compute whether banks holds cash in excess of this optimal level.

The presence of cash above the optimal level might have implications on bank business policies. Therefore, the second aim of our paper is to investigate these policies to understand and

disentangle the reasons behind the decision to hold cash (namely, agency conflicts, precautionary motives and strategic reasons). To achieve this goal, we analyze several bank business policies: investment policies (acquisitions, and security investments); competitive effects (market power); and lending policies (growth increases in credit risk; securitization activity). Table 1 provides the list of bank business policies and the expected signs according to the three different motivations. The rational is to test whether this excess cash held by banks exacerbate agency conflicts or is the result of precautionary and strategic reasons that go above and beyond what captured by the determinants of the optimal cash holding model.

[Please insert Table 1 about here]

We consider two types of investments: acquisitions and security investments. Acquisitions are a textbook example of investments where agency conflicts may arise. While the banking literature has examined the potential divergence of interests between managers and shareholders (see, for example, DeYoung *et al.*, 2009),[13] these studies do not investigate whether cash holdings affect acquisition choices and the associated wealth effect.[14] Under the agency problem hypothesis, we expect cash rich banks to be more acquisitive than other banks, but we expect these acquisitions to generate lower abnormal returns because of their poor average quality. If precautionary motives drive the surge in cash reserves beyond the optimal level, we expect that fewer acquisitions will be carried out. Strategic motives imply that banks are increasing cash reserves to be in a position to make acquisitions during fire sales, which usually are associated with crisis periods. Thus, if strategic motives drive the increase in cash reserves, we expect that the relation between excess cash and acquisitions will be stronger in crisis times and will not generate a negative market reaction.

[13] There is ample evidence on agency conflicts between managers and shareholders in acquisitions for non-financial companies (for example, Harford, 1999; Dittmar and Mahrt-Smith, 2007; Harford *et al*, 2008; Gao *et al.*, 2013).

[14] Studies on acquisitions mostly focus on size (Berger and Hannan, 1988); CEO ownership (Hadlock *et al.*, 1999; Hughes *et al.*, 2003); CEO compensation (Bliss and Rosen, 2001; Rosen, 2004); and CEO incentives (Chen *et al.*, 2006; Gupta and Misra, 2007; Hagendorff and Vallascas, 2011; Minnick *et al.*, 2011; DeYoung *et al.*, 2013).

Another type of investment we consider is financial securities.[15] Since larger liquidity buffers increase risk-taking incentives (Acharya and Navqi, 2012), we expect a positive relation between excess cash and investments in securities under the agency-based explanation. On the other hand, the precautionary motive argument leads to the opposite conclusion: an increase in excess cash is associated with a decrease. As in the case of acquisition investments, if the cash build-up is driven by strategic motives, then we expect that the relationship will be more accentuated in the post-crisis period when prices are lower, and opportunities to obtain high returns on risky securities larger.

Banks may exploit excess cash to improve their competitive position. As Berger and Roman (2016) argue, additional liquidity buffers can increase a bank's market power. This increase can be associated with channels associated to precautionary, strategic, and agency cost motivations. Customers may be willing to pay more for credit from banks with large liquidity buffers and creditors may demand lower interest rates, because of the lower default risk of these banks (safety channel). Excess cash can be a manifestation of a desire for a "quiet-life" (Hicks, 1935, Keeley, 1990; and Cordella and Yeyati, 2003). In this scenario, banks have a decreasing incentives for aggressive behavior, leading to higher market power (high fees and rates for credit; low rates for deposits). However, excess liquidity also creates the incentives to take additional risks (Acharya and Navqi, 2012). This could increase market power because riskier customers pay higher interest rates (increased moral-hazard channel) (Berger and Roman, 2016). Liquidity may also affect negatively market power. Excess cash may be used to for strategic purposes like competing more aggressively in the product market (Funderberg and Tirole, 1986; Bolton and Scharfstein, 1990). For example, cash-rich banks may offer customers lower rates and fees on loans and loan commitments and higher rates on deposits and other funds to drive weaker competitors out of their

[15] Ennis and Wolman (2012) observe that banks did not substitute reserves for other securities.

markets (predation channel). Excess liquidity may signal a willingness to take less risk, shifting to safer portfolios, and therefore to lower market power, for precautionary reasons.[16]

We analyze several features of the bank's lending policy. Abundant cash reserves may also induce managers to take excessive risk. Indeed, excess cash can reduce the risk of failure in case of a negative outcome. Liquidity buffers above the optimal level could lead managers to pay less attention to the quality of the loans, resulting in a deterioration of their loan portfolio. More generally, they will increase bank risk-taking (Acharya and Navqi, 2012). However, the scarce empirical evidence on this relationship has not provided support for this prediction (Ennis and Wolman, 2012). If excess cash increases agency costs between managers and shareholders as argued in Acharya and Navqi (2012), then, lending and bank risk-taking will increase. Strategic considerations may also drive a positive association between excess cash and lending, in particular when the increase in lending is aimed at weakening competitors. If instead precautionary motives cause banks to increase their cash reserves, then lending and risk-taking will decrease as documented in Cornett *et al.* (2011).

Finally, ecent literature has also shown that securitization is associated with a decline of lending standards (Mian and Sufi 2009; Keys *et al*., 2010; Dell'Ariccia *et al*., 2012). Banks can intensify this aggressive policy when they have excess cash under the agency costs hypothesis, but they will reduce it if they hold cash for precautionary reasons. Strategic motives could induce cash rich banks to engage in less securitization, because excess cash could allow firms to bear more risks. Indeed, Casu *et al.* (2013) find that securitizing banks are less liquid than non-securitizing ones, suggesting that firms that hoard liquidity are more reluctant to use credit risk transfer technique.

[16] We do not consider the stigma channel mentioned by Berger and Roman (2016) here because our cash surplus is not associated to a signal of financial distress like it could be for TARP cash injections.

3. Dataset and sample

Our sample is composed of all US bank holding companies (henceforth BHCs) with consolidated data available from the Federal Reserve Bank of Chicago (FR Y-9C) with total assets larger than $500 million over the period 2002-2014. Since the asset-size threshold for filing the FR YR-9C form was increased from $150 million to $500 million in March 2006, our sample includes only bank holding companies exceeding the $500 million threshold to avoid the inclusion of small BHCs in the early part of our sample period that do not to have to file the FR Y-9C report after 2005.[17] The final sample comprises 46,629 bank-quarter observations.

We also employ data from several other sources. Merger data are from the Federal Reserve Bank of Chicago BHC Merger data file.[18] Data on participation to the Capital Purchase Program (CPP), as well as the amounts received and reimbursed under such program, are obtained from the US Treasury's Troubled Asset Relief Program (TARP) Investment Program Transaction Reports.[19] Data on Federal liquidity injections during the financial crisis are from the Board of Governors of the Federal Reserve System. The term facilities used by the Federal Reserve to provide liquidity to the banking system we consider include the Term Auction Facility (TAF)[20], the Term Securities Lending Facility (TSLF), the Primary Dealer Credit Facility (PDCF), the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF), and the Term Asset-Backed Securities Loan Facility (TALF). Fleming (2012) provides in-depth descriptions of these facilities. We also obtain from the Board of Governors of the Federal Reserve System data used to compute the TED spread (Cornett *et al.*, 2011), the credit spread and the Treasury rates.[21]

[17] The asset-size threshold for filing the FR YR-9C form was increased to $1 billion starting from March 2015.
[18] https://www.chicagofed.org/banking/financial-institution-reports/merger-data
[19] https://www.treasury.gov/initiatives/financial-stability/reports/Pages/TARP-Investment-Program-Transaction-Reports.aspx
[20] http://www.federalreserve.gov/newsevents/reform_taf.htm
[21] http://www.federalreserve.gov/releases/h15/data.htm#fn11

Data on institutional investors' holdings in listed BHCs are from ThomsonReuters 13F Holdings database. Finally, we also use CRSP for stock market data and Compustat for additional data.

4. Cash Holdings & Excess Cash

4.1 Determinants of Cash Holdings

We measure cash holdings as cash and due from depository institutions scaled by total assets (CASH). Table 2 reports summary statistics of CASH for the full sample of all BHCs (Panel A) and the sub-samples of listed and unlisted BHCs (Panel B). We find evidence of a noteworthy increase in cash and due from other institutions starting around the financial crisis (see also Figure 1). The average bank more than doubles its cash reserves from about 3% of its total assets at the onset of the crisis to more than 7% in 2011. This sharp increase has not been reversed, with banks still holding almost 6% of their assets in cash at the end of 2014. Differently from Gao *et al.* (2013) that show that private non-financial firms hold on average about half as much cash as publicly listed corporations, we find that unlisted bank holding companies responded to the crisis by increasing their liquidity buffers more sharply than listed banks (7.9% vs. 6% at the end of 2011). This larger increase for unlisted banks is consistent with unlisted banks being more financially constrained than listed banks, and therefore more prone to managing liquidity risk.

[Please insert Table 2 about here]

To empirically investigate the determinants of cash reserves held by banks, we use the following bank fixed-effect (FE) regression model over the period 2002Q1-2014Q4:

$$CASH_{it} = \beta_1 LN\_SIZE_{it} + \beta_2 ROAA_{it} + \beta_3 CIR_{it} + \beta_4 ETA_{it} + \beta_5 REVENUE\_HHI_{it} + \beta_6 NPL_{it} + \beta_7 STD\ DEV\ ROA_{it} + \beta_8 CORE\_DEP_{it} + \beta_9 UNREALIZED\_LOSSES_{it} + \beta_{10} UNUSED\_COMMITMENTS_{it} + \beta_{11} D\ FED\ LIQ\ INJ_{it} + \beta_{12} TARP\ INJ_{it} + \beta_{13} TARP\ REIMB_{it} + \beta_{14} D\_LISTED_{it} + \delta_i + \gamma_t + \varepsilon_{it} \quad (1)$$

where the subscript *i* denotes the bank and *t* indicates the quarter. In this model, δ_i is the bank fixed-effects, γ_t is the time fixed-effects at quarterly level, and ε_{it} is the error term.

Following the related literature (see Cornett *et al.*, 2011), we include both bank-specific factors and variables relating to the liquidity injections occurred during the credit financial crisis as explanatory variables of CASH in regression (1). We present definition and construction of all variables used in the paper in Table A.1 in the Appendix. Among bank-specific variables, we use the natural logarithm of bank's total assets (LN_SIZE) to proxy for bank size. Foley *et al.* (2007), Bates *et al.* (2009), and Duchin (2010) document a negative association between size and cash holdings for non-financial companies. Based on this evidence, a negative sign is expected for the relation between LN_SIZE and CASH. Large banks could also retain less cash reserves for precautionary reasons due to the expectation of a government bailout in case of distress. Indeed, Bayazitova and Shivdasani (2011) and Duchin and Sosyura (2012) find that larger banks were more likely to have their application to participate in the CPP program accepted by the US Treasury. We employ the return on average assets (ROAA) as proxy for bank profitability. The sign of the relation between ROAA to CASH is *a priori* uncertain. On the one hand, cash increases as consequence of a higher profitability (Bourke, 1989). On the other hand, the relationship may turn negative if banks, in light of their positive ROAA, reduce cash holdings (Molyneux and Thornton, 1992). Operational inefficiency, proxied by the cost-to-income-ratio (CIR), should increase the cash held by the banks because less efficient banks tend to have higher costs to face (Altunbas *et al.*,

2007). We use the ratio of equity to total assets (ETA) to proxy for bank capital[22]. There could be a trade-off between equity and liquidity: highly capitalized banks have an easier access to the capital market and may decide to keep less cash for precautionary reasons - banks facing higher undiversifiable liquidity risk hold more capital (Castiglionesi *et al.*, 2014). Hence, we expect a negative sign for the relation between ETA and CASH. Following Duchin (2010), we expect a negative sign between diversification and cash reserves, given that diversification attenuates liquidity risks. We measure the lack of bank diversification as the sum of the squared of the ratio of non-interest income to the sum of non-interest income and total non-interest income and the squared of the ratio of total non-interest income to the sum of non-interest income and total non-interest income (REVENUE_HHI). We also expect that banks will increase their liquidity buffers for precautionary reasons when credit risk and operating profit volatility are substantial (see Altunbas *et al.*, 2007 for credit risk). We employ the ratio of non-performing loans to total assets (NPL) as a proxy for credit risk, and the standard deviation of ROAA (STD_DEV_ROAA) to proxy for operating profit volatility. Core deposits, defined as the sum of deposits under $100,000 plus all transactions deposits scaled by total assets (CORE_DEP), are a stable source of funding for the bank (Cornett *et al.*, 2011). We, therefore, expect that banks that rely more on core deposits retain less cash. Following Berrospide (2013) and Cornett *et al.* (2011), we also include in the model UNREALIZED_LOSSES and UNUSED_COMMITMENTS, which proxy for additional sources of liquidity risks due to losses in securities holdings and exposure to undrawn commitments.[23] Both variables are expected to increase the level of cash holdings.

Liquidity injections programs carried out by the Fed (Fleming, 2012) and the CPP of the US Treasury (see, for example, Bayazitova and Shivdasani, 2012; Duchin and Sosyura, 2012) have the potential to positively affect the level of cash reserves held by banks. To control for the effects

[22] In an unreported analysis, we also use alternative capital measures, such as the tier 1 risk-based capital ratio (T1R), the tier 1 leverage ratio (T1R_LEV), and the total risk-based capital ratio (TRCR). We obtain qualitatively similar results.

[23] Our definition of UNREALIZED_LOSSES includes cash-flow hedges (BHCK4336). Our results do not change if we remove this component from the variable definition.

associated with the Fed programs, we include a binary variable, D_FED_LIQ_INJ, taking value 1 in the quarters in which the bank received liquidity under one or more Fed programs.[24] Regarding the CPP, part of the larger TARP, we add variables capturing both the liquidity injections (positive effect on cash reserves) and the capital repayments (negative effect). Differently from Fed programs, which were usually short-term, repayments to the Treasury did not start before June 2009, well after the start of the program (October 2008), and sometimes took place years after the liquidity injection. We control for cash injections and capital repayments using either binary variables (D_TARP_INJ and D_TARP_REIMB, respectively) or the amount of the original investment/capital repayment scaled by total assets (OR_INV_AMOUNT and CAP_REIMB_AMOUNT, respectively).

Finally, a binary variable for the listing status is included (D_LISTED) to account for the different opportunities of funding of listed and unlisted banks.[25] D_LISTED is expected to have a negative coefficient.

In an alternative model,[26] following Cornett *et al.* (2011), we include the TED spread (TED_SPREAD),[27] computed as the difference between the three-month London Interbank Offered Rate (LIBOR) and the three-month Treasury rate. An increase in the TED spread implies that the risk of default on interbank loans (i.e. counterparty risk) is increasing.

Table 3 reports summary statistics of the determinants of cash holding for the BHCs in our sample (Panel A) and the sub-sample of listed and unlisted BHCs (Panel B) as well as summary statistics all other variables used in empirical analysis.[28] Pairwise correlations between variables are presented in Appendix A.2. Listed banks are larger, more efficient, characterized by a higher quality

[24] We consider the following FED programs: Term Auction Facility (TAF), Term Securities Lending Facility (TSLF), Primary Dealer Credit Facility (PDCF), Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF), and Term Asset-Backed Securities Loan Facility (TALF).
[25] It is possible to include D_LISTED even when bank fixed effects are there because of banks that changed listing status during the sample period.
[26] In this model that include market-specific factors (i.e. the TED spread), we use the fixed-effects at yearly level.
[27] We also use credit spread (the difference between the BBB and AAA yields) or Treasury rate (the three-month Treasury rate), in place of the TED spread. We obtain qualitatively similar results.
[28] These variables will be discussed in later sections.

loan portfolio, and more likely to be included in the Fed and Treasury liquidity programs than unlisted banks. On the other hand, unlisted banks are more diversified[29] and rely more on core deposits than their listed counterparts. Finally, even if the differences are statistically significant, profitability and operating profit volatility are economically similar between the two subsamples.

[Please insert Table 3 about here]

4.2 Regression Results

The first step of our analysis is to provide evidence about the determinants of cash reserves held by bank. Results of panel regressions with bank and quarter fixed effects are shown in columns I to III of Table 4 (Panel A), which complement the findings on bank liquidity of Cornett *et al.* (2011). We estimate the model with and without variables related to Treasury's and Fed's programs. Overall, we find that larger, more profitable, and more capitalized banks retain less cash. Similarly to what found for non-financial corporations by Duchin (2010), more diversified banks hold less cash as well.[30] Managerial inefficiencies, proxied by the cost-income ratio, have a positive coefficient, indicating that managers increase liquidity buffers because of these costs. Banks more exposed to operating profit volatility show an increase of their cash reserves. All these results are in line with the precautionary motive to retain cash. However, differently from Cornet *et al.* (2011), we find that core deposits are positively correlated with cash holdings: this source of stable funding does not reduce the cash held by a bank. We also observe that cash injections during the crisis and the subsequent repayments impact the bank cash holdings with the expected sign (positive and negative, respectively). Unrealized losses on security holdings affects positively the amount of cash held by banks, similarly to what observed by Berrospide (2013), with banks building up liquidity buffers to face the liquidity risk. On the other hand, unused commitments have a negative effect on

[29] A possible explanation for this unexpected result is that the average listed bank is also relatively small and undiversified.

[30] Duchin (2010) documents that diversification reduces the amount of cash held by non-financial corporations.

the cash holdings of the bank, which is line with the evidence provided by Cornett *et al.* (2011) for large commercial banks. Treasury's interventions impact cash holdings more than Fed's, which could be explained with the longer maturity of the Treasury's injections. Finally, the binary variable for listed banks has the expected negative sign, suggesting that listed banks retain less cash than unlisted banks. In Columns IV to VI of Panel A, we replicate the model including the TED spread. In these models, we include year dummies to control for the time trend.[31] Results are similar to those without TED spread, and the TED spread is not significant. The only differences concern UNREALIZED_LOSSES and the liquidity injections from and repayments to the Treasury. While the coefficients maintain the expected sign, their statistical significance is now weaker.

Panel B of Table 4 estimates the same model for the subsamples of listed and unlisted BHCs. Splitting the sample highlights important differences between the two groups that are not captured in Panel A. ROA affects negatively cash reserves of unlisted banks, but not those of listed BHCs. Cash reserves of publicly listed bank holding companies are insensitive to their profitability, which is likely to be related to a supply of capital that relies less on internal funds than unlisted banks. Capital ratios and diversification affect only cash reserves of listed firms. We do not observe the same trade-off between capital and liquidity for unlisted banks. Highly capitalized listed banks may issue equity as well as debt to the public more easily and at a lower cost than unlisted banks (Saunders and Steffen, 2011). Finally, cash reserves of unlisted banks increases with UNREALIZED_LOSSES, but the same does not happen for listed banks. Overall, the evidence suggests that profitability (proxied by the ROA and UNREALIZED_LOSSES) and its riskiness (STD_DEV_ROAA) are the key determinants, together with managerial inefficiencies (CIR) and demand deposits (CORE_DEPOSITS), of the cash reserves of unlisted banks. Lacking an easy access to external capital markets, these banks manage their liquidity as a function of their internal

[31] Since data for the TED spread are on quarterly basis, we cannot include quarterly variables.

cash flows and retail deposits. Listed banks present a different picture, exploiting diversification to reduce their liquidity needs and trading off liquidity for capital.

[Please insert Table 4 about here]

4.3 The Estimation of Excess Cash

To compute the excess cash held by the bank (EX_CASH), we estimate the model shown in Equation (1) on quarterly basis from 2002Q1 to 2014Q4. The residuals of the cross-sectional regressions are our measure of excess cash, i.e. the deviation from the target level of cash for that particular quarter obtained from the model.

Panel C of Table 4 reports summary statistics of the target cash level for the full sample of all BHCs and the sub-samples of listed and unlisted BHCs. Overall, we find that the average values of target cash level increase over the period 2002 – 2014. Hence, the values of cash predicted by the model show a similar trend of CASH observed in Table 2. Moreover, despite the growing trend of CASH, the number of banks with cash levels lower than the optimal level (see the number of observations with negative EX_CASH) is substantially stable compared to the beginning of the period.

5. Bank Business Policies

To examine whether excess cash generates agency conflicts or it has a precautionary or strategic nature, we identify the following business policy choices: acquisition and security investments; competition; lending policies, and increases in credit risk (see Table A.1 in the Appendix for details on these dependent variables).[32] While the list is certainly not exhaustive, choices concerning these policies could help us to distinguish and disentangle the different reasons

[32] To mitigate concerns that errors-in-variable biases drive our results, we present the results using CASH in Section 6.2.

to build a liquidity buffer. We lag all the independent variables by one quarter with respect to the dependent variable.

5.1 Investment Policies

5.1.1 Acquisitions

We analyze acquisitions in terms of both of acquisitiveness and abnormal returns around their announcements. More specifically, to assess the propensity to acquire, we employ a binary variable that takes the value of 1 if the bank completes at least an acquisition in the following quarter, and 0 otherwise (D_ACQ). We use the sum of total assets of the target banks acquired in the following quarter, scaled by the total assets of the acquiring bank (TA_ACQ), to examine whether excess cash affects acquisition volume. Cumulative abnormal returns (CAR) in the event window (-2, 2 and -1, 1) centered on the acquisition date are our proxy of the quality of acquisitions. As determinants of acquisitions, besides EX_CASH, we use the bank-specific factors (LN_SIZE, ROAA, CIR, ETA, REVENUE_HHI, NPL, and STD_DEV_ROAA) already employed in Equation (1), plus other control variables that vary depending on the analysis. More specifically, when we estimate the propensity to acquire, D_ACQ or TA_ACQ, we also include the dummy listed (D_listed). Following the literature (see, for example, Hagendorff and Vallascas, 2011), in the abnormal return regressions, we also consider the ratio of the target bank's total assets to the bidding bank's total assets (REL_SIZE), a dummy variable that takes the value of 1 if target and bidder are from the same state, and 0 otherwise (D_SAME_STATE), a binary variable that takes the value of 1 if the target bank is listed, and 0 otherwise (D_PUBLIC_TARGET), and CEO's delta and vega (LN_DELTA and LN_VEGA).

Panel A of Table 5 provides the results for the acquisitiveness of bank holding companies. We estimate models using the full sample, and subsamples for listed and unlisted banks. We employ both a logit model, when the dependent variable is a binary variable for acquisitions in the next quarter, and a Tobit model for the volume of acquisitions. Consistently with Beccalli and

Frantz (2013), results show that in the full sample, excess cash does not affect the bank's acquisition investment decisions. However, we observe substantial differences when we analyze the subsamples based on the bank listing status. Excess cash has a negative effect on acquisitions when the BHC is listed. This negative coefficient does not support the agency view that excess cash exacerbates agency conflicts and leads to empire building (Jensen, 1986). On the other hand, the finding is consistent with banks hoarding cash in excess of their needs for precautionary motives. Unlisted banks, especially when we focus on the volume of acquisitions, exhibit a tendency to acquire more after accumulating excess cash. This pattern appears to be consistent with both an agency-driven story and the strategic motive for acquisitions. However, following Gao *et al.* (2013), unlisted banks are the least likely to suffer severe agency conflicts because ownership is usually more concentrated and managers do not have the same freedom they have in a listed bank with diffuse ownership. So, agency problems should be more pronounced in listed banks, not unlisted ones. Because of this consideration, together with the results of Table 4 where we show that unlisted banks manage their liquidity as function of their internal cash flows because of their financial constraints, strategic motivations drive the results.

Concerning the control variables, we find, as expected, that size increases the likelihood of acquisitions as well as being listed. Profitability and capital ratios are positive and significant, but only for listed firms. Diversification reduces the incentives to carry out acquisitions, but only for unlisted firms. Risk of operating profits, measured by the standard deviation of ROAA, decreases the propensity to acquire of listed BHCs, but it does not affect the one of unlisted banks.

[Please insert Table 5 about here]

Regarding the quality of the acquisitions carried out in our sample period, we run an event study analysis around the announcement of acquisitions. Because the analysis needs stock returns, only listed banks are considered in the analysis. Panel B of Table 5 presents univariate statistics for the abnormal returns of the 609 acquisitions carried out by listed banks with stock prices available

on CRSP.[33] Abnormal returns in the two event windows examined are indistinguishable from 0 at conventional levels. The multivariate analysis in Panel C surprisingly shows a positive coefficient for acquisitions of publicly listed banks. In line with Hagendorff and Vallascas (2011) and Croci and Petmezas (2015), CEO risk-taking incentives measured by vega positively impacts acquisition propensity.

Overall, results from acquisition investment policies do not support the agency view as a driver of hoarding cash in excess of the banks' needs. However, excess cash seems to be hoarded for precautionary reasons by listed banks and for strategic considerations by unlisted banks. So, supply of funding contributes to determine the effects of excess cash.

5.1.3 Security Investments

Agency costs, strategic considerations, and precautionary reasons could also affect the relationship between excess cash and investment securities. Managers of banks with excess cash may take risks investing in securities. We investigate whether excess cash induces such a behavior. While under agency considerations, we expect an increase in securities held by banks, the precautionary motives suggest the opposite: risk averse banks will avoid these investments. Strategic considerations may impact the relationship between excess cash and investments in securities if banks hoard cash to invest in high-return securities. We use total investment in securities (TOT_SEC) to examine the impact of excess cash on security investment. Since TOT_SEC includes investments in both riskless and risky securities, we decompose it in (ii) investment in riskless securities RISKLESS_SEC (investment in riskless securities) and RISKY_SEC (investment in risky

[33] Abnormal returns are computed using a market model. Market returns are proxied by the returns of the CRSP value weighted portfolio. We employ the period [-240, -41] as estimation period and we require a minimum of 20 returns in this period.

securities).[34] We expect relationships to be stronger for investments in risky securities. Other than EX_CASH, the models include the same control variables of the acquisition regressions. We also include in the model the interaction between excess cash and the dummy listed (INT_EX_CASH_D_LISTED) to detect different behavior according to the listing status.

Table 6 shows the results of the estimation of panel models with bank and quarter fixed effects regressions for total investment in securities (Columns I to III); riskless securities (Columns IV to VI); and risky securities (Columns VII to IX). We find that excess cash is negatively related to investment in securities, a relationship that holds also for the subsamples of listed and unlisted banks. When we investigate risky securities, we still observe a negative relationship between excess cash and risky securities, but this trade-off is more accentuated for listed banks (the interaction coefficient between excess cash and the listed dummy is significant at 10% level). This result signals once again that agency motives are not the reason behind the decision to hoard cash by listed banks. Unlisted banks also reduce the investment in riskless securities when they hold excess cash, suggesting that unlisted banks do not consider cash and Treasuries as perfect substitutes.

Large banks tend to invest more in securities, but this is limited to riskless securities. We also find evidence of a trade-off between capital and investment in risky securities. Inefficient and more profitable listed banks invest more in securities. Non-performing loans negatively affect security investment. Overall, these findings suggest that managers build up large liquidity buffers for precautionary reasons more than for taking on more risks.

[Please insert Table 6 about here]

5.1.3 Competitive Effects

[34] Cornett *et al.* (2011) includes investments in US Treasuries in their definition of liquidity. However, our definition of liquidity is narrower, i.e. only cash and due from other institutions. Moreover, especially during the financial crisis, precautionary motives could have led managers to sell government securities.

Berger and Roman (2016) provide evidence that liquidity injection under the TARP gave recipients competitive advantages with respect to non-recipient, in particular because this liquidity contributed to make these banks safer in the eyes of the investors. In this section, we analyze whether over a longer time period, which includes also expansionary years, excess cash has the same effect on market power. Market power is measured by the Lerner index (LERNER), i.e. price minus marginal cost divided by price, similarly to Berger and Roman (2016).[35] As for the other control variables, we include bank-specific factors (LN_SIZE, ROAA, CIR, ETA, NPL, NII_NOR, D_LISTED, INT_EX_CASH_D_LISTED) as well as variables to control for the TARP and FED cash injections and repayments.[36]

We find that EX_CASH has a negative and significant coefficient, suggesting that excess cash is not used to increase market power. This results contrasts with Berger and Roman (2016). This negative coefficient is in line with the predation channel and the decreased-moral-hazard channel (increase in cash signals the willingness to move into safer portfolios). While the predation channel is associated with a strategic use of excess cash, the decreased-moral-hazard channel has clearly a more precautionary nature and is in contrast to an agency story. While the coefficient for listed banks is more negative, there is no statistically significant difference between listed and unlisted firms.

The joint reading of the results for acquisitions and market competition suggest that predation (and so strategic motives) is a better explanation for unlisted banks, which also increase their acquisitiveness when are cash rich. On the other hand, precautionary explanations are more suitable for listed banks given the negative relationship between excess cash and acquisitions shown in Table 5.

[Please insert Table 7 about here]

[35] We describe the construction of the variable in Table A.1 of the Appendix. For a more detailed explanation of the Lerner Index, see Berger and Roman (2016).

[36] Differently from Berger and Roman (2016), we do not include age in our regression model because age is available only for a limited number of observations.

5.2 Lending Policies

The second business policy we investigate is lending. We test if excess cash helps predict lending growth in the following quarter. Acharya and Navqi (2012) predicts that higher liquidity buffers should induce managers to take excessive risks by increasing lending because of the higher security that liquidity provides. We present the results of panel regression estimations with bank and quarter fixed effects in Table 8.[37]

To estimate the growth in volume of bank lending, we compute the growth rate of gross loans (LN_LGR). We assess the propensity to increase credit risk-taking using the difference between risk-weighted assets (RWA) in two consecutive quarters, scaled by lagged total assets (DELTA_RWA) (Shrieves and Dahl, 1992; Berger and Udell, 1994; Berger, 1995; and Aggarwal and Jacques, 2001). As determinants of LN_LGR and DELTA_RWA, in addition to EX_CASH, we use the bank-specific factors already employed in Equation (1) and the interaction between excess cash and the listed bank dummy.

We find that listed banks extend fewer loans when excess cash is high (Columns I to III). Again this result corroborates the view that cash hoarding is mostly for precautionary reasons in listed banks. Concerning control variables, size affects negatively the growth rate of lending while profitable banks extend more credit. Inefficient unlisted banks increase lending, probably to make up for the additional costs. Consistently with Gambacorta and Mistrulli (2004), Cornett *et al.* (2011), and Carlson *et al.* (2013), we find that better capitalized banks have higher growth rates. Diversification negatively affects lending growth, but only for unlisted banks. Banks with lot of nonperforming loans on their balance sheet restrain their lending (Carlson *et al.*, 2013) as well as banks with high operating profit volatility do. Differently from Ivashina and Sharfstein (2010) and Cornett *et al.* (2011), stable funding in the form of core deposits does not facilitate lending.

[37] We also test the contemporaneous relation between excess cash and lending growth. We find a negative relationship, suggesting that cash rich firms do not engage in excessive lending as suggested by Acharaya and Navqi (2012). Results are similar for both listed and unlisted banks.

[Please insert Table 8 about here]

Results for credit risk-taking are presented in Columns IV to VI of Table 8. Excess cash is positively associated with the change in risk-weighted assets.[38] However, we find again a different behavior between listed and unlisted BHCs. While excess cash induces unlisted banks to take more risks, this does not happen for listed banks. Again, these results are inconsistent with the agency view, especially those of listed banks. The results for unlisted banks are consistent with the view of Acharya and Navqi (2012), which posits that banks take excessive risk-taking when liquidity is high, but they could also be associated with strategic motives.

Size affects the change in RWA negatively, a sign that contrasts with the view that large banks have a higher propensity to increase risks because their better access to external funds and the credit risk transfer market (Casu *et al.*, 2011). Consistent with Anderson and Fraser (2000), we find that ETA affects positively credit risk-taking. ROAA increases risk-taking, consistent with the view that profitable banks are in a position to take more risks. As for lending growth, diversification hinders risk-taking for unlisted firms, which do not have resources to pursue credit risk-increasing strategies if they are diversified. Similarly to what Casu *et al.* (2011) find, banks that are already facing high risks, both operating profit and credit risks, tend to avoid adding further risk.

We present the results for securitization in Columns VII to IX of Table 8. We do not find evidence of a relationship between excess cash and securitization. This lack of a significant relationship is also confirmed when we look at the subsamples of listed and unlisted banks.

Overall, the evidence from decisions related to the lending policies of the banks do not lend support to the view that excess cash increase bank managers' incentives to take risks.

[38] In an unreported analysis, we also examine the contemporaneous relationship between the change in risk-weighted assets and excess cash. We find a negative and significant coefficient for excess cash.

6. Additional analysis and robustness checks

6.1 Instrumental Variable Approach

While the use of lagged variables and bank-fixed effects alleviate some endogeneity concerns, the relationships we uncover can be affected by reverse causality. To mitigate this concern, we use an instrument variable approach where we instrument excess cash using a house price index and the business bankruptcy cases in the bank state. We follow Chu (2016) and Granja *et al.* (2014) to create the house price index. The house price index is the weighted house price index in the MSAs in which the bank operates. We use the percentage of deposits of the bank holding company in the MSA as weight, and we exclude the MSA in which the bank has the largest amount of deposits from the index to reduce the effect of bank on the local house market. We rescale all house price index to assume value 100 at the end of 2001, the beginning of our sample period. As Chu (2016) observes, house price changes are likely to be out of the control of individual banks, which makes it a suitable instrument to satisfy the exclusion condition. House price indexes data are from the Federal Housing Finance Agency.[39] The second instrument is the log of 1 plus the number of business bankruptcy cases in the bank state, which are obtained from the F-2 U.S. Bankruptcy courts – Business and Non- Business cases filed, by Chapter of the Bankruptcy code. We use all business-related bankruptcies for every quarter in our sample. We use the two instruments together.[40] Unreported, we find that the instruments pass the relevance condition, and they are statistically significant in the first stage regression.

Results are presented in Table 9. In the sake of brevity, we only present the coefficients of the instrumented variable (excess cash). Acquisition and competition results are similar to what we show in Table 5, but with a weaker statistical significance level for the first ones (Panels A and B). Panel C documents a different pattern for investment in security. Once instrumented, excess cash impacts positively on investments in risky securities, supporting a strategic argument. Finally, in

[39] http://www.fhfa.gov/DataTools/Downloads/pages/house-price-index.aspx

[40] In unreported analysis, we obtain similar results (with a slightly weaker statistical significance) using the log of 1 plus the number of business bankruptcy in the state.

Panel D, we show that excess cash affects negatively lending and securitization, but the securitization result is mostly due to listed companies.

[Please insert Table 9 about here]

6.2 Financial Crisis

Figure 1 shows that the great financial crisis of 2007-08 represents a break point in the time series of cash holdings. While our excess cash measure accounts for this trend (see Table 4, Panel C), we take a closer look at whether the crisis affected how banks manage liquidity. Table 10 provides the results of our analysis.

The crisis has indeed an effect on how banks use excess cash for their acquisition policies. In Panel A, excess cash has the same negative coefficient we obtain in Table 4. However the interaction between excess cash and the crisis period dummy has a positive coefficient, mitigating the relationship. This result is driven by listed banks, which rely on their cash reserves for their acquisition investments in the after crisis period more than in the pre-crisis period. This behavior is consistent with a strategic use of excess cash: cash rich banks have an incentive to employ their reserve to prey on weaker competitors (Bolton and Scharfstein, 1990). While the analysis for competitive effects do not produce any significant result (Panel B), we find that the trade-off between excess cash and risky security investments is mitigated in the after crisis period (Panel C).

We do not find evidence that the crisis has altered the relationship between excess cash and lending growth in the overall sample (Panel D), but excess cash is no longer significant for listed banks. Including the interaction between excess cash and crisis weakens the results for risk-weighted assets, where the excess cash coefficient remains positive but it is no longer significant. Excess cash continues to remain insignificant in the securitization regressions. However, the interaction between excess cash and crisis is negative and weakly significant, suggesting that banks with excess cash engage less in securitization.

Overall the evidence is again not consistent with excess cash exacerbating agency conflicts even after the financial crisis. In the aftermath of the crisis, precautionary and strategic considerations dominate. These results are in line with a supply shock argument, according to which the sensitivity of investment to the existing cash resources increases when other funding opportunities dry up.

[Please insert Table 10 about here]

6.3 Cash levels

The existence of potential errors-in-variable bias in the estimation of the excess cash, which is our variable of interest, could affect our results. Observed excess cash is derived from a first-stage statistical procedure. Estimation errors at the first stage might have an impact on the validity of inferences drawn in the second stage. To alleviate this concern, we use cash reserves instead of excess cash, also adding the control variables of Equation 1 to the models of Tables 4 to 8. In unreported analysis,[41] we find qualitatively similar to those obtained with excess cash, alleviating the concern that our findings are driven by an errors-in-variable bias.

6.4 Liquidity Creation

A final robustness check is related to liquidity creation. The liquidity creation measure proposed by Berger and Bouwman (2009) has received considerable attention in the banking literature (see Berger *et al*., 2016 for a recent application). Cash enters the liquidity creation function with a negative coefficient. In an unreported table, we find that excess cash is not another (negative) proxy for liquidity creation. In fact, using the CAT_FAT version of liquidity creation in lieu of excess cash, we cannot replicate the results obtained in Tables 4 to 8. In particular, liquidity

[41] Results are available from the authors.

creation affects positively acquisition investments for both listed and unlisted banks, increases the Lerner index, credit risk-taking and reduces security investments.

7. Conclusions

In light of the recent regulatory changes, we aim to investigate the role of cash in banking. For all US bank holding companies with total assets larger than $500 million over the period 2002-2014, we examine the determinants of cash levels and the effects of excess cash on bank's policies. We observe that cash hoarding increased after the great financial crisis of 2007-08 and it never reverted back to the pre-crisis level. This increase is more accentuated for non-listed banks. We find that larger, more profitable, more capitalized, and more diversified banks hold less cash. As for bank's policies, our evidence does not support the hypothesis that excess cash exacerbates agency costs between managers and shareholders. Precautionary and strategic motives are more suitable explanations for the excess cash reserves that banks decided to hoard.

We also provide evidence that the listing status affect bank's behavior in managing liquidity. Our results support the view. Listed banks do not exhibit any behavior consistent with the hypothesis that excess cash increases agency problems. On the other hand, managers of unlisted banks, the least likely to suffer from agency problems (Gao *et al.*, 2013) increase acquisition spending and take on more credit risk when cash is plentiful. This finding is consistent also with a credit supply explanation. Using the listing status as a proxy for the funding supply available to a bank, our results support the view that non-listed banks are more financially-constrained than their listed counter-parts and they hoard more cash for precautionary and strategic. While listed banks have more funding opportunities available, cash is one of the few options that unlisted bank managers have to fund their activities.

We offer new evidence that mitigates the concern that imposing liquidity ratios (as done in Basel III) could leave too much cash in the hands of managers, who could adopt policies that destroy firm value. Understanding the incentives of cash on bank managers is of paramount importance in the light of the introduction of minimum liquidity ratios, and the substantial increase of cash holdings in the aftermath of the financial crisis. While regulation may have opened the door for managers to increase their power in the bank they manage, our evidence suggests that this concern is of second-order importance. Second, we provide compelling evidence about the importance of the listing status for bank holding companies, highlighting that liquidity risk could be a much severe problem for unlisted banks. This is also important at policy level, often too focused on systemic risks and too-big-too-fail banks, and adds to the literature about the cost of ignoring small banks (Croci *et al.*, 2016). Finally, we present several results that highlight important differences between banks and non-financial institutions, paving the way for future analysis.

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Tables and Figures

Figure 1. Trend of cash and due from depository institutions

The figure shows the trend of cash and due from depository institutions to total assets (CASH) for all bank holding companies (BHCs), i.e. the full sample, and for listed and unlisted BHCs over the period 2002 – 2014. To compute CASH, we use US Bank Holding Company (BHC) quarterly data from FRY-9C forms. CASH is winsored at the 1 per cent of each tail.

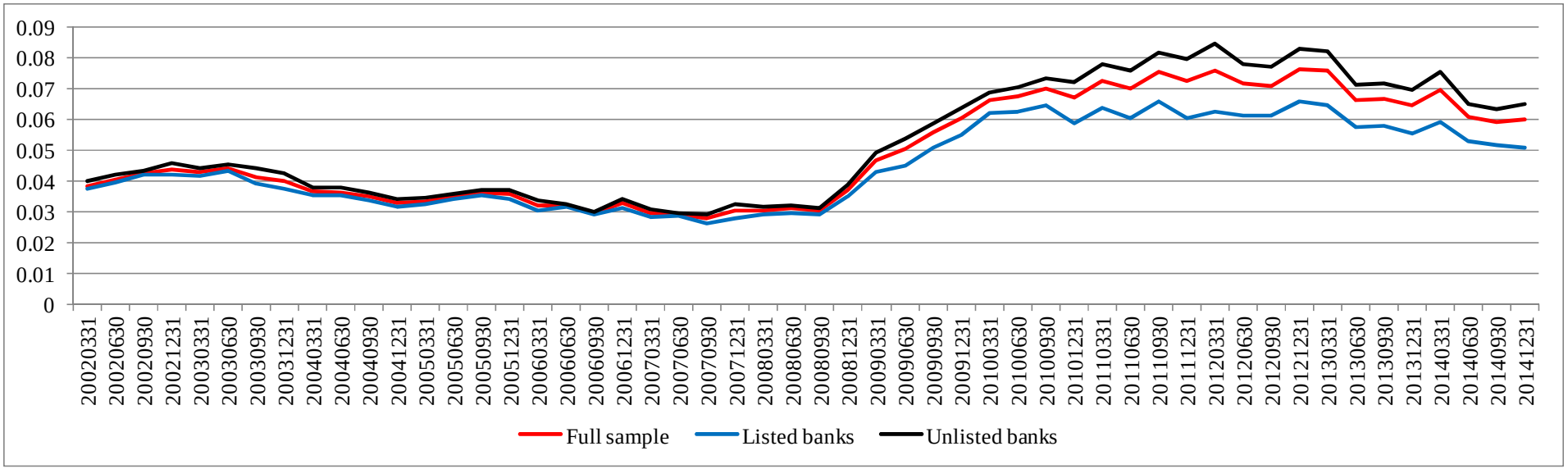

Table 1. Hypothesis Development on Excess Cash and Bank Business Policies

This table reports the predicted sign for the impact of excess cash on the bank business policies under the different hypothesis. The symbol + (-) denotes the expectation of a positive (negative) relationship between excess cash and the bank policy under a given hypothesis. The lack of a clear relationship is denoted with *n.a.*

Macro Policy	Policy	Hypothesis		
		Agency Cost	Precautionary	Strategic
Investment	Acquisitions	+	-	+
	Investment Securities	+	-	+
	Market power	+ (Increased moral hazard) / - (Decreased moral hazard)	+ (Safety; quiet life) / - (Decreased moral hazard)	- (Predation)
Lending	Loan growth	+	-	+
	Change in RWA	+	-	+
	Securitization	+	-	-

Table 2. Summary Statistics of Cash and Due from Depository Institutions

This table reports summary statistics of cash and due from depository institutions to total assets (CASH) for all BHCs at the end of each quarter (Panel A), and the samples of listed and unlisted BHCs at the end of the year (Panel B) over the period 2002 – 2014. CASH is winsorized at the 1 per cent of each tail. The row *Total* reports summary statistics that include also the quarters not shown in the table. The symbols ***, **, and * denote statistical significant at 1%, 5% and 10% levels, respectively, for tests of differences in means and medians between listed and unlisted banks. In panel B, the row *Total* reports summary statistics that include also the quarters not shown in the table.

Panel A – All BHCs

Year	Mean	Median	Std. Dev.	N. of obs.
2002Q1	0.038	0.032	0.026	662
2002Q2	0.040	0.034	0.026	685
2002Q3	0.042	0.036	0.027	702
2002Q4	0.043	0.037	0.026	703
2003Q1	0.042	0.036	0.027	720
2003Q2	0.044	0.038	0.027	740
2003Q3	0.041	0.034	0.026	742
2003Q4	0.039	0.034	0.025	748
2004Q1	0.036	0.030	0.024	756
2004Q2	0.036	0.031	0.024	771
2004Q3	0.034	0.031	0.025	777
2004Q4	0.032	0.027	0.025	787
2005Q1	0.033	0.027	0.027	792
2005Q2	0.034	0.029	0.025	819
2005Q3	0.036	0.030	0.026	842
2005Q4	0.035	0.030	0.024	859
2006Q1	0.032	0.027	0.023	833
2006Q2	0.032	0.028	0.020	844
2006Q3	0.029	0.025	0.020	851
2006Q4	0.032	0.027	0.023	858
2007Q1	0.029	0.024	0.022	862
2007Q2	0.029	0.024	0.021	868
2007Q3	0.027	0.023	0.022	865
2007Q4	0.030	0.025	0.021	865
2008Q1	0.030	0.025	0.022	881
2008Q2	0.031	0.026	0.024	882
2008Q3	0.030	0.023	0.026	883
2008Q4	0.037	0.026	0.034	885
2009Q1	0.046	0.032	0.040	948
2009Q2	0.050	0.035	0.041	938
2009Q3	0.055	0.038	0.047	929
2009Q4	0.060	0.044	0.048	921
2010Q1	0.066	0.049	0.051	957
2010Q2	0.067	0.052	0.052	935
2010Q3	0.069	0.054	0.054	920
2010Q4	0.066	0.050	0.054	917
2011Q1	0.072	0.058	0.054	948
2011Q2	0.070	0.055	0.052	941
2011Q3	0.075	0.059	0.056	933
2011Q4	0.072	0.054	0.055	937
2012Q1	0.075	0.061	0.055	1,086
2012Q2	0.071	0.054	0.054	1,080
2012Q3	0.070	0.053	0.055	1,072
2012Q4	0.076	0.059	0.056	1,066
2013Q1	0.075	0.059	0.057	1,097
2013Q2	0.065	0.048	0.053	1,085
2013Q3	0.066	0.045	0.054	1,079
2013Q4	0.064	0.045	0.054	1,070
2014Q1	0.069	0.051	0.054	1,089
2014Q2	0.060	0.043	0.049	1,071
2014Q3	0.058	0.042	0.050	1,068
2014Q4	0.059	0.042	0.049	1,060
Total	0.051	0.034	0.044	46,629

Panel B - Listed vs Unlisted BHCs

Year	Listed BHC				Unlisted BHC				Difference in means (I) – (II)	Difference in medians (I) – (II)
	Mean	Median	Std. Dev.	N. of obs.	Mean	Median	Std. Dev.	N. of obs.		
2002	0.042	0.036	0.027	400	0.045	0.040	0.026	303	-0.003	-0.004**
2003	0.037	0.031	0.026	406	0.042	0.037	0.025	342	-0.004**	-0.006***
2004	0.031	0.026	0.026	410	0.034	0.029	0.023	377	-0.003*	-0.003***
2005	0.034	0.029	0.024	416	0.037	0.032	0.025	443	-0.002	-0.008***
2006	0.031	0.026	0.022	406	0.034	0.029	0.024	452	-0.002*	-0.003***
2007	0.027	0.024	0.021	388	0.032	0.028	0.021	477	-0.004***	-0.004***
2008	0.034	0.023	0.035	374	0.038	0.027	0.033	511	-0.004*	-0.004***
2009	0.055	0.039	0.044	379	0.063	0.048	0.050	542	-0.007**	-0.009*
2010	0.058	0.043	0.049	355	0.071	0.054	0.057	562	-0.015***	-0.011***
2011	0.060	0.046	0.048	344	0.079	0.060	0.057	593	-0.021***	-0.014***
2012	0.065	0.048	0.051	409	0.082	0.065	0.058	657	-0.017***	-0,017***
2013	0.055	0.036	0.050	400	0.069	0.049	0.056	670	-0.016***	-0.013***
2014	0.050	0.035	0.044	376	0.048	0.048	0.051	684	-0.015***	-0.013***
Total	0.044	0.031	0.039	20,453	0.056	0.038	0.048	26,176	-0.011***	-0.007***

Table 3. Summary Statistics

This table reports summary statistics of the dependent and control variables, for the full sample of all BHCs (Panel A) and the samples of listed and unlisted BHCs (Panel B), over the period 2002 – 2014. Variable definitions are provided in the Appendix (see Table A.1). All variables are winsorised at the 1 per cent of each tail. The symbols ***, **, and * denote statistical significant at 1%, 5% and 10% levels, respectively, for tests of differences in means and medians between listed and unlisted BHCs.

Panel A – All BHCs

Variables	Mean	Median	Std. Dev.	N. of obs.
Control variables:				
SIZE	10041.62	1047.051	42308.86	46,629
ROAA	0.004	0.004	0.006	46,617
ROAE	0.049	0.048	0.086	46,567
CIR	0.378	0.377	0.084	46,616
ETA	0.093	0.090	0.031	46,629
REVENUE_HHI	0.731	0.731	0.117	46,616
NPL	0.013	0.007	0.017	46,623
STD_DEV_ROAA	0.004	0.003	0.003	45,516
CORE_DEP	0.627	0.651	0.134	43,025
TOT_DEP_TA	0.770	0.798	0.119	43,923
COST_LIAB	0.010	0.007	0.008	46,629
LOAN_RATIO	0.660	0.680	0.135	46,629
LOAN_HHI	0.627	0.621	0.161	46,542
UNREALIZED_LOSSES	-0.0002	-0.0001	0.003	44,455
UNUSED_COMMITMENTS	0.097	0.089	0.055	46,629
NII_NOR	0.187	0.160	0.132	46,613
D_FED_LIQ_INJ	0.002	0	0.045	46,629
D_TARP_INJ	0.006	0	0.079	46,629
D_TARP_REIMB	0.007	0	0.084	46,629
OR_INV_AMOUNT	0.021	0.022	0.005	293
CAP_REP_AMOUNT	0.016	0.016	0.008	332
DELTA	546.509	141.251	1012.407	1,220
VEGA	151.300	29.373	306.966	1,238
REL_SIZE	0.185	0.077	0.257	379
D_SAME_STATE	0.588	1	0.492	513
D_PUBLIC_TARGET	0.331	0	0.471	513
Dependent variables:				
D_ACQ	0.018	0	0.135	46,629
TA_ACQ	0.003	0	0.118	46,406
LERNER	0.321	0.323	0.096	43,177
TOT_SEC	0.208	0.179	0.119	46,593
RISKLESS_SEC	0.094	0.074	0.080	46,544
RISKY_SEC	0.112	0.092	0.096	46,543
LN_LGR	0.015	0.012	0.044	44,750
DELTA_RWA	0.012	0.008	0.032	43,524
SECURITIZATION	0.015	0	0.083	46,426

Panel B – Listed vs Unlisted Banks

Variables	Listed banks (I)				Unlisted banks (II)				Difference in means (I) – (II)	Difference in median (I) – (II)
	Mean	Median	Std. Dev.	N. of obs.	Mean	Median	Std. Dev.	N. of obs.		
Control variables:										
SIZE	16079.970	1733.353	53543.36	20,453	5323.471	838.479	29965.84	26,176	10756.5***	894.874***
ROAA	0.004	0.004	0.006	20,453	0.004	0.004	0.006	26,164	-0.0004***	0
ROAE	0.044	0.047	0.085	20,441	0.052	0.050	0.086	26,126	-0.008***	-0.003***
CIR	0.366	0.365	0.080	20,453	0.387	0.388	0.086	26,163	-0.021***	-0.023***
ETA	0.096	0.092	0.029	20,453	0.091	0.088	0.032	26,176	0.005***	0.004***
REVENUE_HHI	0.727	0.727	0.118	20,453	0.735	0.735	0.115	26,163	-0.010***	-0.015***
NPL	0.012	0.007	0.016	20,451	0.013	0.007	0.017	26,172	-0.001***	0***
STD_DEV_ROAA	0.004	0.003	0.003	20,130	0.004	0.003	0.003	25,386	0.0002***	0***
CORE_DEP	0.610	0.631	0.135	19,067	0.641	0.665	0.130	23,958	-0.031***	-0.034***
TOT_DEP_TA	0.746	0.772	0.120	19,394	0.790	0.816	0.114	24,529	-0.044**	-0.044***
COST_LIAB	0.010	0.008	0.008	20,453	0.010	0.007	0.008	26,176	0***	-0.005***
LOAN_RATIO	0.662	0.680	0.134	20,453	0.659	0.680	0.137	26,176	0.003**	0**
LOAN_HHI	0.630	0.627	0.160	20,417	0.625	0.615	0.162	26,125	0.005***	0.012***
UNREALIZED_LOSSES	0.00005	0.00001	0.003	19,458	-0.0004	-0.0002	0.003	24,997	0.0004***	0.00021***
UNUSED_COMMITMENTS	0.101	0.093	0.057	20,453	0.093	0.085	0.053	26,176	0.008***	0.008***
NII_NOR	0.193	0.164	0.135	20,452	0.183	0.158	0.130	26,161	0.012***	0.006***
D_FED_LIQ_INJ	0.003	0	0.058	20,453	0.0009	0	0.031	26,176	0.002***	0***
D_TARP_INJ	0.010	0	0.099	20,453	0.003	0	0.057	26,176	0.006***	0***
D_TARP_REIMB	0.011	0	0.104	20,453	0.003	0	0.062	26,176	0.007***	0***
OR_INV_AMOUNT	0.021	0.022	0.002	205	0.021	0.022	0.001	88	-0.0007	0
CAP_REP_AMOUNT	0.016	0.016	0.001	228	0.017	0.016	0.001	104	-0.002*	0
Dependent variables:										
D_ACQ	0.030	0	0.171	20,453	0.009	0	0.097	26,176	0.021***	0***
TA_ACQ	0.005	0	0.071	20,302	0.001	0	0.145	26,104	0.004***	0***
LERNER	0.328	0.333	0.094	19,097	0.314	0.316	0.097	24,080	0.015***	0.017***
TOT_SEC	0.207	0.190	0.114	20,437	0.208	0.189	0.123	26,156	-0.001	0.001
RISKLESS_SEC	0.079	0.061	0.069	20,421	0.106	0.087	0.086	26,123	-0.027***	-0.026***
RISKY_SEC	0.127	0.111	0.095	20,421	0.101	0.076	0.094	26,122	0.026***	0.035***
LN_LGR	0.018	0.013	0.046	19,718	0.013	0.011	0.042	25,032	0.004***	0.002***
DELTA_RWA	0.014	0.010	0.034	19,281	0.010	0.008	0.030	24,243	0.003***	0.002***
SECURITIZATION	0.022	0	0.099	20,357	0.009	0	0.068	26,069	0.013***	0***

Table 4. Determinants of Cash Holdings

This table reports estimates of bank fixed-effect (FE) regressions for the full sample of BHC filing FRY-9C forms with total assets above $500 million for the period 2002 -2014 (Panel A) and for the sample of listed and unlisted BHCs (Panel B). The dependent variable is cash and due from depository institutions, scaled by total assets (CASH). Variable definitions are provided in the Appendix (see Table A.1). All non-binary variables are winsorized at the 1% of each tail. Quarter dummy variables are also included in the models (I), (II), and (III), while Year dummy variables are also included in the models (IV), (V), and (VI). Bank clustered standard errors are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests. Panel C presents descriptive statistics the target cash level obtained from Equation 1 (end-of-the-year), for the full sample of BHCs, listed and unlisted BHCs, over the period 2002 - 2014. The row *Total* reports summary statistics that include also the quarters not shown in the table.

Panel A – All BHCs

Variables	(I)	(II)	(III)	(IV)	(V)	(VI)
LN_SIZE	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*	-0.005*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
ROAA	-0.165**	-0.160**	-0.161**	-0.119**	-0.116**	-0.117**
	(0.071)	(0.071)	(0.071)	(0.058)	(0.058)	(0.058)
CIR	0.038***	0.038***	0.038***	0.035***	0.035***	0.035***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
ETA	-0.108***	-0.110***	-0.109***	-0.114***	-0.115***	-0.114***
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
REVENUE_HHI	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
NPL	0.047	0.046	0.046	0.065	0.064	0.064
	(0.050)	(0.050)	(0.051)	(0.050)	(0.050)	(0.050)
STD_DEV_ROAA	1.002***	1.003***	1.004***	1.042***	1.043***	1.044***
	(0.229)	(0.228)	(0.228)	(0.226)	(0.226)	(0.226)
CORE_DEP	0.041***	0.041***	0.041***	0.042***	0.043***	0.042***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
UNREALIZED_LOSSES	0.380**	0.380**	0.381**	0.173	0.171	0.172
	(0.171)	(0.171)	(0.171)	(0.149)	(0.149)	(0.149)
UNUSED_COMMITMENTS	-0.084***	-0.085***	-0.084***	-0.086***	-0.086***	-0.086***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
TED_SPREAD				0.003	0.004	0.004
				(0.027)	(0.027)	(0.027)
D_FED_LI_INJ		-0.000	-0.000		-0.001	-0.001
		(0.002)	(0.002)		(0.002)	(0.002)
D_TARP_INJ		0.004**			0.003*	
		(0.002)			(0.002)	
D_TARP_REIMB		-0.005**			-0.004**	
		(0.002)			(0.002)	
OR_INV_AMOUNT			0.129*			0.078
			(0.075)			(0.073)
CAP_REP_AMOUNT			-0.235**			-0.194*
			(0.098)			(0.099)
D_LISTED	-0.006**	-0.006**	-0.006**	-0.006**	-0.006**	-0.006**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
D_quarter	Yes	Yes	Yes	No	No	No
D_year	No	No	No	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	40,240	40,240	40,240	40,240	40,240	40,240
R-squared	0.278	0.278	0.278	0.271	0.271	0.271

Panel B – Listed vs Unlisted BHCs

Variables	Listed BHCs			Unlisted BHCs		
	(I)	(II)	(III)	(IV)	(V)	(VI)
LN_SIZE	-0.004	-0.004	-0.004	-0.003	-0.003	-0.003
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)
ROAA	-0.134	-0.128	-0.129	-0.193*	-0.193*	-0.193*
	(0.095)	(0.095)	(0.095)	(0.108)	(0.108)	(0.108)
CIR	0.053***	0.053***	0.053***	0.028**	0.028**	0.028**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
ETA	-0.120***	-0.122***	-0.121***	-0.042	-0.042	-0.042
	(0.040)	(0.041)	(0.040)	(0.072)	(0.072)	(0.072)
REVENUE_HHI	-0.031***	-0.031***	-0.031***	0.003	0.003	0.003
	(0.011)	(0.011)	(0.011)	(0.014)	(0.014)	(0.014)
NPL	0.067	0.067	0.066	0.041	0.041	0.041
	(0.074)	(0.074)	(0.074)	(0.066)	(0.066)	(0.066)
STD_DEV_ROAA	1.042***	1.044***	1.045***	1.279***	1.278***	1.278***
	(0.241)	(0.241)	(0.241)	(0.409)	(0.409)	(0.409)
CORE_DEP	0.031**	0.031**	0.031**	0.063***	0.063***	0.063***
	(0.012)	(0.012)	(0.012)	(0.019)	(0.019)	(0.019)
UNREALIZED_LOSSES	0.105	0.106	0.108	0.640***	0.640***	0.641***
	(0.281)	(0.281)	(0.281)	(0.220)	(0.220)	(0.220)
UNUSED_COMMITMENTS	-0.076***	-0.076***	-0.076***	-0.080***	-0.080***	-0.080***
	(0.024)	(0.024)	(0.024)	(0.026)	(0.026)	(0.026)
D_FED_LI_INJ		-0.004	-0.004		0.002	0.002
		(0.003)	(0.003)		(0.004)	(0.004)
D_TARP_INJ		0.004**			0.000	
		(0.002)			(0.004)	
D_TARP_REIMB		-0.003			-0.002	
		(0.002)			(0.004)	
OR_INV_AMOUNT			0.117			-0.014
			(0.085)			(0.151)
CAP_REP_AMOUNT			-0.185*			-0.078
			(0.105)			(0.189)
D_quarter	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	17,981	17,981	17,981	22,259	22,259	22,259
R-squared	0.259	0.259	0.259	0.307	0.307	0.307

Panel C – Summary statistics of target cash level

	All BHCs					Listed BHCs				Unlisted BHCs			
	Mean	Median	Std. Dev.	N. of obs.	N. of obs. EXCESS_CASH>0 (EXCESS _CASH<=0)	Mean	Median	Std. Dev.	N. of obs.	Mean	Median	Std. Dev.	N. of obs.
2002	0.042	0.041	0.008	646	254 (392)	0.041	0.041	0.008	383	0.044	0.043	0.009	263
2003	0.039	0.039	0.007	685	249 (436)	0.037	0.036	0.006	392	0.042	0.042	0.007	293
2004	0.032	0.031	0.008	724	273 (451)	0.031	0.029	0.008	395	0.034	0.033	0.008	329
2005	0.035	0.035	0.009	797	305 (492)	0.034	0.033	0.009	407	0.036	0.036	0.008	390
2006	0.032	0.032	0.007	836	295 (541)	0.031	0.031	0.007	398	0.033	0.033	0.006	438
2007	0.030	0.029	0.008	848	322 (526)	0.027	0.027	0.008	386	0.032	0.032	0.008	462
2008	0.037	0.035	0.012	868	295 (573)	0.035	0.032	0.014	371	0.038	0.038	0.010	497
2009	0.060	0.059	0.016	915	346 (569)	0.056	0.055	0.017	378	0.063	0.061	0.014	537
2010	0.066	0.064	0.020	904	356 (548)	0.058	0.053	0.020	352	0.071	0.068	0.018	552
2011	0.072	0.072	0.018	850	323 (527)	0.058	0.056	0.016	304	0.079	0.077	0.014	546
2012	0.077	0.077	0.018	829	325 (504)	0.066	0.065	0.018	290	0.083	0.082	0.015	539
2013	0.065	0.065	0.016	593	218 (375)	0.057	0.055	0.016	206	0.070	0.069	0.014	387
2014	0.060	0.061	0.015	597	222 (375)	0.049	0.047	0.014	193	0.066	0.065	0.011	404
Total	0.049	0.044	0.021	40,240	15,107 (25,133)	0.043	0.039	0.018	17,981	0.054	0.052	0.023	22,259

Table 5. Acquisition analysis

This table reports in Panel A the estimations of logit (columns I, II, and III) and tobit (columns IV, V, and VI) regressions for the period 2002 - 2014. Models I and IV show estimates for the full sample of BHC filing FRY-9C forms with total assets above $500 million; models II and V show estimates for the sample of listed banks; and models III and VI present the estimates for the sample of unlisted banks. The dependent variable in models (I) to (III) is D_ACQ, a dummy variable that takes the value of 1 if the bank completes at least an acquisition in the following quarter; 0 otherwise. The dependent variable models (IV) to (VI) is TA_ACQ, which is computed as the sum of total assets of the target banks acquired in the following quarter, scaled by the total assets of the acquiring bank. In addition, this table reports the summary statistics of the cumulative abnormal returns (CAR) around acquisition announcements (Panel B) and the estimations of ordinary least squared (OLS) regressions of abnormal returns on excess cash and other control variables in the period 2002 – 2014 (Panel C). Cumulative abnormal returns are computed in the event window (-2, 2) and (-1, 1) centered around the acquisition date. Variable definitions are provided in the Appendix (see Table A.1). All non-binary variables are winsorized at the 1% of each tail. Bank clustered standard errors are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Panel A – Propensity to Acquire

Variables	LOGIT			TOBIT		
	All	Listed	Unlisted	All	Listed	Unlisted
	(I)	(II)	(III)	(I)	(II)	(III)
CONSTANT	-8.103***	-7.817***	-6.376***	-2.009***	-2.132***	-0.926***
	(0.792)	(0.965)	(1.605)	(0.221)	(0.298)	(0.223)
EX_CASH	-1.868	-4.956**	2.653*	-0.203	-1.246**	0.476**
	(1.360)	(2.128)	(1.541)	(0.283)	(0.505)	(0.190)
SIZE	0.241***	0.246***	0.226***	0.048***	0.049***	0.028***
	(0.030)	(0.034)	(0.080)	(0.007)	(0.009)	(0.010)
ROAA	21.158	38.620**	-1.618	4.682*	8.717**	0.738
	(13.370)	(18.134)	(18.198)	(2.694)	(4.155)	(2.104)
CIR	0.440	0.511	0.236	0.092	0.086	0.042
	(0.674)	(0.863)	(1.046)	(0.148)	(0.229)	(0.117)
ETA	6.894***	8.312***	2.905	1.756***	2.762***	0.267
	(1.528)	(1.743)	(2.415)	(0.416)	(0.615)	(0.279)
REVENUE_HHI	-0.509	-0.068	-1.797**	-0.080	-0.058	-0.142
	(0.443)	(0.522)	(0.814)	(0.100)	(0.144)	(0.093)
NPL	-6.402	-5.758	-9.632	-1.523	-2.132	-0.942
	(5.959)	(8.589)	(7.687)	(1.215)	(1.981)	(0.836)
STD_DEV_ROAA	-48.940**	-92.739***	21.905	-8.249*	-16.534**	1.247
	(23.054)	(29.758)	(31.177)	(4.431)	(7.187)	(3.319)
D_LISTED	0.874***			0.179***		
	(0.108)			(0.025)		
D_quarter	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No	No	No
Cluster SE Bank	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	40,240	17,603	21,182	40,059	17,853	22,206
Pseudo R-squared	0.077	0.065	0.047	0.091	0.082	0.086

Panel B – Summary Statistics of the Abnormal Returns around Acquisition Announcements

	Mean (%)	Median (%)	N. of obs.
CAR (-2, 2)	0.101	0.036	609
CAR (-1, 1)	0.156	0.140	609

Panel C – Abnormal Returns Regressions

Variables	CAR (-2, 2)		CAR (-1, 1)	
	(I)	(II)	(III)	(IV)
CONSTANT	0.057	0.058	0.039	0.097
	(0.055)	(0.111)	(0.031)	(0.066)
EX_CASH	-0.020	0.078	0.013	0.007
	(0.054)	(0.108)	(0.043)	(0.099)
SIZE	-0.002	-0.007	-0.002*	-0.007**
	(0.002)	(0.005)	(0.001)	(0.003)
ROAA	-0.123	0.423	0.473	0.387
	(0.690)	(0.922)	(0.421)	(0.566)
CIR	-0.070	-0.012	-0.026	-0.009
	(0.045)	(0.072)	(0.028)	(0.040)
ETA	0.082	0.169	-0.002	-0.007
	(0.071)	(0.130)	(0.049)	(0.094)
REVENUE_HHI	-0.003	0.025	0.005	0.007
	(0.027)	(0.044)	(0.019)	(0.030)
NPL	0.291	0.577	0.030	0.294
	(0.228)	(0.412)	(0.210)	(0.275)
STD_DEV_ROAA	-1.049	-1.392	-1.370	-1.578
	(1.270)	(2.209)	(1.002)	(1.819)
REL_SIZE	0.000	-0.011	0.014	-0.001
	(0.009)	(0.012)	(0.013)	(0.009)
D_SAME_STATE	-0.001	-0.001	0.001	-0.000
	(0.004)	(0.007)	(0.003)	(0.005)
D_PUBLIC_TARGET	0.009**	0.013*	0.011***	0.011**
	(0.005)	(0.007)	(0.003)	(0.005)
LN_DELTA		0.001		0.001
		(0.003)		(0.002)
LN_VEGA		0.006**		0.004
		(0.003)		(0.003)
D_quarter	No	No	No	No
Bank FE	No	No	No	No
Cluster SE Bank	Yes	Yes	Yes	Yes
N. of obs.	334	146	334	146
R-squared	0.041	0.112	0.075	0.149

Table 6. Investments in Securities

This table reports estimates of bank fixed-effect (FE) regressions for the period 2002 -2014. Models I, IV, and VII show estimates for the full sample of BHC filing FRY-9C forms with total assets above $500 million; models II, V, and VIII (III, VI, and IX) show estimates for the sample of listed (unlisted) BHCs. The dependent variables are: (i) total investment in securities (TOT_SEC) in models I to III; (ii) investment in riskless securities like U.S. Treasury securities, U.S. government agency obligations, and Securities issued by states and political subdivisions in the U.S (RISKLESS_SEC) in models IV to VI; and (iii) investment in risky securities like mortgage-backed securities, asset-backed securities and structured financial products, other debt securities, and investments in mutual funds and other equity securities (RISKY_SEC) in models VII to IX. Independent variables are lagged by one quarter with respect to the dependent variable. Variable definitions are provided in the Appendix (see Table A.1). All non-binary variables are winsorized at the 1% of each tail. Bank clustered standard errors are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Variables	TOT_SEC_{t+1}			$RISKLESS\_SEC_{t+1}$			$RISKY\_SEC_{t+1}$		
	All	Listed	Unlisted	All	Listed	Unlisted	All	Listed	Unlisted (IX)
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	
EX_CASH	-0.225***	-0.195***	-0.244***	-0.072**	0.000	-0.076**	-0.142***	-0.189***	-0.158***
	(0.042)	(0.055)	(0.043)	(0.030)	(0.038)	(0.032)	(0.038)	(0.052)	(0.038)
INT_EX_CASH_D_LISTED	-0.027			0.073			-0.108*		
	(0.070)			(0.050)			(0.065)		
D_LISTED	-0.015			-0.001			-0.012		
	(0.012)			(0.005)			(0.010)		
SIZE	0.015**	0.017*	0.013	0.014***	0.012**	0.021***	-0.001	0.003	-0.009
	(0.007)	(0.010)	(0.012)	(0.004)	(0.006)	(0.008)	(0.007)	(0.009)	(0.010)
ROAA	0.340***	0.359*	0.324**	0.038	-0.061	0.130	0.291**	0.402**	0.192
	(0.128)	(0.202)	(0.162)	(0.092)	(0.142)	(0.119)	(0.114)	(0.188)	(0.135)
CIR	0.042**	0.052	0.032	0.005	0.009	0.006	0.040**	0.050*	0.026
	(0.020)	(0.032)	(0.026)	(0.014)	(0.023)	(0.018)	(0.017)	(0.029)	(0.020)
ETA	-0.285***	-0.382***	-0.124	-0.012	-0.086	0.091	-0.266***	-0.293***	-0.206**
	(0.079)	(0.116)	(0.112)	(0.047)	(0.066)	(0.075)	(0.069)	(0.102)	(0.093)
REVENUE_HHI	0.042**	0.063**	0.022	0.002	-0.002	0.006	0.038***	0.059***	0.017
	(0.018)	(0.026)	(0.024)	(0.012)	(0.016)	(0.018)	(0.015)	(0.023)	(0.019)
NPL	-0.445***	-0.673***	-0.265**	-0.255***	-0.380***	-0.177**	-0.190**	-0.312**	-0.072
	(0.095)	(0.154)	(0.116)	(0.073)	(0.122)	(0.084)	(0.080)	(0.135)	(0.095)
STD_DEV_ROAA	0.384	0.717	-0.113	0.029	-0.384	0.527	0.381	1.191**	-0.717
	(0.393)	(0.587)	(0.575)	(0.303)	(0.427)	(0.426)	(0.356)	(0.517)	(0.474)
CORE_DEP	-0.056**	-0.084***	-0.010	-0.038**	-0.059***	-0.007	-0.019	-0.029	-0.002
	(0.024)	(0.032)	(0.032)	(0.016)	(0.022)	(0.020)	(0.021)	(0.030)	(0.030)
D_quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	39,008	17,493	21,515	38,988	17,487	21,501	38,988	17,487	21,501
R-squared	0.156	0.200	0.129	0.116	0.138	0.110	0.107	0.142	0.087

Table 7. Effects on Competition

This table reports estimates of bank fixed-effect (FE) regressions for the period 2002 -2014. Model I shows estimates for the full sample of BHCs filing FRY-9C forms with total assets above $500 million; model II (model III) shows estimates for the sample of listed (unlisted) BHCs. The dependent variable is the Lerner index (LERNER) in quarter *t+1*. Variable definitions are provided in the Appendix (see Table A.1). All non-binary variables are winsorized at the 1% of each tail. Bank clustered standard errors are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

	$LERNER_{t+1}$		
Variables	All	Listed	Unlisted
	(I)	(II)	(III)
EX_CASH	-0.110***	-0.149***	-0.112***
	(0.026)	(0.041)	(0.027)
INT_EX_CASH_D_LISTED	-0.026		
	(0.049)		
D_LISTED	0.010		
	(0.006)		
SIZE	0.015***	0.003	0.039***
	(0.005)	(0.006)	(0.007)
ROAA	1.747***	1.534***	1.875***
	(0.130)	(0.183)	(0.185)
CIR	-0.714***	-0.786***	-0.651***
	(0.019)	(0.026)	(0.025)
ETA	0.412***	0.409***	0.484***
	(0.048)	(0.065)	(0.077)
NPL	-1.099***	-1.112***	-1.052***
	(0.067)	(0.102)	(0.089)
NII_NOR	-0.060***	-0.036**	-0.076***
	(0.015)	(0.018)	(0.022)
D_FED_LIQ_INJ	0.004	0.004	0.008
	(0.005)	(0.006)	(0.011)
D_TARP_INJ	0.004	0.006	-0.001
	(0.004)	(0.005)	(0.005)
D_TARP_REIMB	-0.001	0.000	-0.005
	(0.003)	(0.004)	(0.005)
D_quarter	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Cluster SE Bank	Yes	Yes	Yes
N. of obs.	38,028	17,113	20,915
R-squared	0.529	0.558	0.512

Table 8. Loan growth rate, risk-taking, and securitization multivariate analysis

This table reports estimates of bank fixed-effect (FE) regressions for the period 2002 -2014. Models I, IV, and VII show estimates for the full sample of BHCs filing FRY-9C forms with total assets above $500 million; models II, V, and VIII (models III, VI, and IX) show estimates for the sample of listed (unlisted) BHCs. The dependent variables are: (i) the growth rate in gross loan (LN_LGR) in quarter *t+1* in models I to III; (ii) the difference between risk-weighted assets (RWA) in two consecutive quarters, scaled by lagged total assets (DELTA_RWA) in quarter *t+1* in models IV to VI; and (iii) securitized loans (SECURITIZATION) in quarter *t+1* in models VII to IX. Variable definitions are provided in the Appendix (see Table A.1). All non-binary variables are winsorized at the 1% of each tail. Bank clustered standard errors are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

	LN_LGR_{t+1}			$DELTA\_RWA_{t+1}$			$SECURITIZATION_{t+1}$		
Variables	All	Listed	Unlisted	All	Listed	Unlisted	All	Listed	Unlisted (IX)
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	
EX_CASH	0.008	-0.040**	0.009	0.020**	-0.007	0.022**	-0.022	-0.035	-0.032
	(0.015)	(0.019)	(0.016)	(0.010)	(0.015)	(0.010)	(0.023)	(0.048)	(0.025)
INT_EX_CASH_D_LISTED	-0.044*			-0.027			-0.024		
	(0.024)			(0.017)			(0.049)		
D_LISTED	0.000			0.001			0.007**		
	(0.003)			(0.003)			(0.003)		
SIZE	-0.024***	-0.023***	-0.027***	-0.023***	-0.023***	-0.024***	-0.003	-0.001	-0.003
	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.006)	(0.005)
ROAA	0.336***	0.452***	0.221**	0.363***	0.480***	0.232***			
	(0.068)	(0.094)	(0.099)	(0.051)	(0.075)	(0.070)			
ROAE							-0.008	-0.011	-0.006
							(0.007)	(0.015)	(0.007)
CIR	0.029***	0.009	0.041***	0.010	0.004	0.012*			
	(0.008)	(0.012)	(0.010)	(0.006)	(0.010)	(0.007)			
ETA	0.138***	0.103***	0.152***	0.104***	0.073***	0.121***	0.097*	0.116	0.101*
	(0.028)	(0.036)	(0.046)	(0.020)	(0.027)	(0.029)	(0.050)	(0.080)	(0.056)
REVENUE_HHI	-0.018***	-0.013	-0.024***	-0.013***	-0.001	-0.024***			
	(0.006)	(0.009)	(0.009)	(0.005)	(0.007)	(0.006)			
NPL	-0.808***	-0.784***	-0.837***	-0.526***	-0.552***	-0.519***	0.119**	0.170	0.079**
	(0.041)	(0.057)	(0.056)	(0.030)	(0.044)	(0.040)	(0.056)	(0.132)	(0.037)
LOAN_RATIO							-0.025**	-0.019	-0.026**
							(0.013)	(0.022)	(0.012)
LOAN_HHI							0.006	0.026	-0.019
							(0.018)	(0.032)	(0.013)
STD_DEV_ROAA	-0.791***	-0.963***	-0.669***	-0.677***	-0.797***	-0.576***			
	(0.129)	(0.161)	(0.218)	(0.097)	(0.134)	(0.148)			
CORE_DEP	0.002	-0.007	0.009	-0.006	-0.005	-0.010			
	(0.007)	(0.010)	(0.011)	(0.005)	(0.008)	(0.008)			
TOT_DEP_TA							0.004	-0.010	0.023
							(0.019)	(0.031)	(0.020)
COST_LIAB							-0.039	-0.225	0.182
							(0.291)	(0.512)	(0.207)
NII_NOR							0.048**	0.061*	0.038*
							(0.020)	(0.035)	(0.023)
D_quarter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusted SE Bank	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	39,024	17,500	21,524	38,983	17,489	21,494	38,807	17,416	21,391
R-squared	0.202	0.193	0.219	0.200	0.202	0.205	0.012	0.016	0.013

Table 9. IV approach

This table reports estimates of the coefficient for the instrumented EX_CASH from IV regression models on acquisitions (Panel A); Lerner index (Panel B); investment in securities (Panel C); loan growth rate, risk taking, and securitization (Panel D). In the first stage we employ as instrument the house price index (see Section 6.1) and the log of 1 plus the number of business bankruptcy cases filed in the bank state. Variable definitions are provided in the Appendix (see Table A.1). All non-binary variables are winsorized at the 1% of each tail. Quarter dummy variables are also included in all models. Bank clustered standard errors are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Panel A – Propensity to acquire

Variables	PROBIT			TOBIT		
	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)
EX_CASH	1.085	-14.063*	6.745*	1.152	-7.783	2.337**
	(4.056)	(8.532)	(3.933)	(1.902)	(5.538)	(1.179)

Panel B – Lerner index

Variables	$LERNER_{t+1}$		
	All (I)	Listed (II)	Unlisted (III)
EX_CASH	-1.943***	-1.676***	-0.422
	(0.453)	(0.334)	(0.470)

Panel C – Investment in securities

Variables	TOT_SEC_{t+1}			$RISKLESS\_SEC_{t+1}$			$RISKY\_SEC_{t+1}$		
	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)
EX_CASH	2.119***	1.237***	1.862**	-0.703**	0.056	-0.489	2.833***	1.105***	2.470**
	(0.640)	(0.394)	(0.899)	(0.313)	(0.206)	(0.459)	(0.734)	(0.358)	(1.004)

Panel D – Growth rate, risk taking, and securitization

Variables	LN_LGR_{t+1}			$DELTA\_RWA_{t+1}$			$SECURITIZATION_{t+1}$		
	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)
EX_CASH	-0.657*	-0.359	-0.602	-0.390	0.036	-0.599	-1.071**	-2.281***	-0.525
	(0.345)	(0.280)	(0.466)	(0.251)	(0.208)	(0.372)	(0.470)	(0.653)	(0.412)

Table 10. Excess Cash and the Financial Crisis

This table reports estimates for models on acquisitions (Panel A); Lerner index (Panel B); investment in securities (Panel C); loan growth rate, risk taking, and securitization (Panel D). All these models include the interaction between a post-crisis dummy and excess cash (INT_EX_CASH_D_CRISIS). The post crisis dummy takes value 1 in the period June 30 2007 to December 31 2014, and 0 otherwise. Variable definitions are provided in the Appendix (see Table A.1). All non-binary variables are winsorized at the 1% of each tail. Quarter dummy variables are also included in all models. Bank clustered standard errors are reported in parentheses. The superscripts ***, **, and * denote coefficients statistically different from zero at the 1%, 5%, and 10% levels, respectively, in two-tailed tests.

Panel A – Propensity to acquire

Variables	LOGIT			TOBIT		
	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)
CONSTANT	-8.099***	-7.808***	-6.341***	-2.008***	-2.131***	-0.910***
	(0.789)	(0.961)	(1.576)	(0.220)	(0.297)	(0.216)
EX_CASH	-9.757***	-9.742***	-5.643	-1.926***	-2.230***	-0.862
	(2.862)	(2.875)	(7.017)	(0.629)	(0.746)	(0.874)
INT_EX_CASH_D_CRISIS	9.885***	6.835*	9.065	2.108***	1.389	1.453
	(3.126)	(3.736)	(7.095)	(0.689)	(0.944)	(0.909)
D_LISTED	0.878***			0.181***		
	(0.108)			(0.025)		
CONTROL_VAR	Yes	Yes	Yes	Yes	Yes	Yes
D_quarter	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No	No	No
N. of obs.	40,240	17,603	21,182	40,059	17,853	22,206
Pseudo R-squared	0.079	0.065	0.048	0.093	0.083	0.089

Panel B – Lerner index

Variables	$LERNER_{t+1}$		
	All (I)	Listed (II)	Unlisted (III)
EX_CASH	-0.059	-0.074	-0.095
	(0.053)	(0.057)	(0.081)
INT_EX_CASH_D_CRISIS	-0.055	-0.088	-0.018
	(0.053)	(0.061)	(0.085)
INT_EX_CASH_D_LISTED	-0.030		
	(0.049)		
D_LISTED	0.010		
	(0.006)		
CONTROL_VAR	Yes	Yes	Yes
D_quarter/ Bank FE	Yes	Yes	Yes
N. of obs.	38,028	17,113	20,915
R-squared	0.529	0.559	0.512

Panel C – Investment in securities

Variables	TOT_SEC_{t+1}			$RISKLESS\_SEC_{t+1}$			$RISKY\_SEC_{t+1}$		
	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)
EX_CASH	-0.386***	-0.443***	-0.273**	-0.025	-0.002	0.010	-0.342***	-0.428***	-0.259**
	(0.095)	(0.138)	(0.135)	(0.063)	(0.083)	(0.085)	(0.097)	(0.149)	(0.124)
INT_EX_CASH_D_CRISIS	0.170*	0.286**	0.030	-0.050	0.003	-0.091	0.212**	0.275*	0.106
	(0.097)	(0.136)	(0.142)	(0.062)	(0.097)	(0.087)	(0.101)	(0.149)	(0.132)
INT_EX_CASH_D_LISTED	-0.015			0.069			-0.093		
	(0.069)			(0.050)			(0.063)		
D_LISTED	-0.015			-0.001			-0.012		
	(0.012)			(0.005)			(0.010)		
CONTROL_VAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
D_quarter/ Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	39,008	17,493	21,515	38,988	17,487	21,501	38,988	17,487	21,501
R-squared	0.157	0.203	0.129	0.116	0.138	0.111	0.109	0.146	0.088

Panel D – Growth rate, risk taking, and securitization

Variables	LN_LGR_{t+1}			$DELTA\_RWA_{t+1}$			$SECURITIZATION_{t+1}$		
	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)	All (I)	Listed (II)	Unlisted (III)
EX_CASH	0.026	-0.035	0.018	0.023	-0.009	0.025	0.113	0.135	0.030
	(0.034)	(0.037)	(0.043)	(0.021)	(0.028)	(0.028)	(0.082)	(0.148)	(0.056)
INT_EX_CASH_D_CRISIS	-0.019	-0.006	-0.009	-0.003	0.002	-0.003	-0.144*	-0.197	-0.066
	(0.032)	(0.040)	(0.042)	(0.020)	(0.030)	(0.028)	(0.086)	(0.146)	(0.053)
INT_EX_CASH_D_LISTED	-0.045*			-0.027*			-0.034		
	(0.024)			(0.017)			(0.048)		
D_LISTED	0.000			0.001			0.007**		
	(0.003)			(0.003)			(0.003)		
CONTROL_VAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
D_quarter/ Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. of obs.	39,024	17,500	21,524	38,983	17,489	21,494	38,807	17,416	21,391
R-squared	0.202	0.193	0.219	0.200	0.202	0.205	0.013	0.018	0.013

Appendix

Table A.1 Variable Definitions

This table reports the description of the variables used in our analysis, their construction and the source of data used to collect them. The symbol *l1.* in the Construction column denotes a lagged value for the variable. Data code are from FRY 9-C filings if not specified otherwise.

Variable	Definition	Construction
Dependent variable:		
CASH	The ratio of cash and due from depository institutions to total assets.	BHCK0010/BHCK2170
D_ACQ	Binary variable that takes the value of 1 if the bank completes at least an acquisition in the following quarter; 0 otherwise. Mergers & Acquisition data are from Federal Reserve Bank of Chicago (BHC Merger Bank file).	
TA_ACQ	The sum of total assets of the target banks acquired in the following quarter, scaled by the total assets of the acquiring bank. Mergers & Acquisition data are from Federal Reserve Bank of Chicago (BHC Merger Bank file)	
CAR (-2, 2) [(-1, 1)]	Cumulative Abnormal Returns in the event window (-2, 2) or (-1, 1) centered around the acquisition date. Abnormal returns are obtained using a market model with CRSP value-weighted portfolio returns.	
LERNER	The index is defined as the difference between price (P_{it}) and marginal cost (MC_{it}), divided by price (P_{it}), where P_{it} is the price of banking outputs for bank i at time t and MC_{it} is marginal costs for bank *i* at time *t*. The variable P_{it} is calculated as the ratio of total bank revenues (interest plus non-interest income) to total assets. The term MC_{it} is estimated on the basis of a trans-log cost function with one output, that is, total assets, and three input prices, that is, the prices of labour, physical capital, and borrowed funds.	BHCK4135: salaries and employee benefits; BHCK4092: other operating expenses; BHCK4073: total interest exp.
TOT_SEC	The ratio of the sum between Held-to-maturity (HTM) and Available-for-sale (AFS) securities to total assets.	(BHCK1754+BHCK1773)/BHCK2170
RISKLESS_SEC	The ratio of the sum of investments in U.S. Treasury securities, U.S. government agency obligations, and Securities issued by states and political subdivisions in the U.S to total assets.	(BHCK0211+BHCK1289+BHCK1294+ BHCK8496+BHCK1287+BHCK1293+ BHCK1298+BHCK8499)/BHCK2170
RISKY_SEC	The ratio of the sum of investments in mortgage-backed securities, asset-backed securities and structured financial products, other debt securities, and investments in mutual funds and other equity securities to total assets.	(BHCK1754-BHCK0211-BHCK1289-BHCK1294-BHCK8496)+(BHCK1773-BHCK1287-BHCK1293-BHCK1298-BHCK8499)/ BHCK2170
LN_LGR	The natural logarithm of the ratio of gross loans in quarter t to gross loans in quarter t-1.	LN(BHCK2122/l1.BHCK2122)
DELTA_RWA	The ratio of the difference between risk-weighted assets (RWA) in quarter t and t-1 to total assets in t-1.	(BHCKA223-l1.BHCKA 223)/l1.BHCK2170
SECURITIZATION	The sum of family residential loans, home equity lines, credit card receivables, auto loans, other consumer loans, commercial and	(BHCKB705+BHCKB706+BHCKB707 +BHCKB708+BHCKB709+BHCKB71 0+BHCKB711)/BHCK2122

	industrial loans, and all other loans, all divided by gross loans.	
Target variable:		
EX_CASH	Residuals of the regression model in Eq. 1	
Bank-specific factors:		
LN_SIZE	The natural logarithm of total assets.	LN (BHCK2170)
ROAA	The ratio of net income to quarterly average of total assets.	BHCK4340/ BHCK3368
ROAE	The ratio of net income to quarterly average of equity capital.	BHCK4340/ BHCK3368
CIR	The ratio of overheads to the sum of net interest income and other operating income.	(BHCK4135+BHCK4150)/(BHCK4074 +BHCK4079)
ETA	The ratio of equity to total assets.	BHCK3210/BHCK2170
REVENUE_HHI	The sum of the squared of the ratio of interest income to the sum of interest income and total non- interest income and the squared of the ratio of total non-interest income to the sum of interest income and total non-interest income.	(BHCK4107/(BHCK4107+BHCK4079))^2 +(BHCK4079/(BHCK4107+BHCK4079))^2
NPL	The ratio of non-performing loans to total assets.	(BHCK5525+BHCK5526)/BHCK2170
STD_DEV_ROAA	The standard deviation of ROAA computed over 10 quarters.	STD. DEV. (BHCK4340/ BHCK3368)
CORE_DEP	The sum of deposits under $100,000 plus all transactions deposits all divided to total assets.	(BHCB2210+BHCB3187+BHCB2389+ BHCB6648+BHOD3189+BHOD3187+ BHOD2389+BHOD6648)/BHCK2170
TOT_DEP_TA	The ratio of total deposits to total assets.	(BHDM6631+BHDM6636+BHFN6631 +BHFN6636)/BHCK2170
COST_LIAB	The ratio of total interest expense to total liabilities.	BHCK4073/BHCK2948
LOAN_RATIO	The ratio of gross loans to total assets.	BHCK2122/BHCK2170
LOAN_HHI	Herfindhal-Hirscham index of bank loans	(BHCK1410/(BHCK1410+BHCK1590+ BHCK1763+BHCK1764+loan_house+o ther_loan))^2 + (BHCK1590/(BHCK1410+BHCK1590+ BHCK1763+BHCK1764+loan_house+o ther_loan))^2 + [(BHCK1763+BHCK1764)/(BHCK141 0+BHCK1590+BHCK1763+BHCK176 4+loan_house+other_loan)]^2+[(loan_h ouse)/(BHCK1410+BHCK1590+BHCK 1763+BHCK1764+loan_house+other_lo an)]^2 + (other_loan/(BHCK1410+BHCK1590+ BHCK1763+BHCK1764+loan_house+o ther_loan))^2 where loan_house=loan_house= BHCKB538+ BHCKB539+ BHCKK137+ BHCKK 207; other_loan=BHCK2122 - (BHCK1410+ BHCK1590+ BHCK1763+ BHCK1764 + loan_house).
UNREALIZED_LOSSES	The ratio of unrealized losses in securities holdings to total assets.	(-BHCK8434+BHCKA221- BHCK4336)/BHCK2170
UNUSED_COMMITMEN TS	The ratio of unused commitments to unused commitments plus total assets.	(BHCK3814+BHCKJ455+BHCKJ456+ BHCK3816+BHCK6550+BHCK3817+ BHCKJ457+ BHCKJ458+BHCKJ459+ BHCK6566+BHCK3411+BHCK3430)/(BHCK3814+BHCKJ455+BHCKJ456+ BHCK3816+BHCK6550+BHCK3817+

		BHCKJ457+ BHCKJ458+BHCKJ459+ BHCK6566+BHCK3411+BHCK3430+ BHCK2170)
NII_NOR	The ratio of non-interest income to net operating revenue.	BHCK4079/(BHCK4107+BHCK4079)
Market-specific factors:		
TED_SPREAD	The difference between the three month LIBOR and the three month Treasury rate. Data are from Fed.	
Fed and TARP variables:		
D_FED_LIQ_INJ	Binary variable that takes the value of 1 if the bank participated in one or more of these Fed liquidity program (TAF, AMLF, TALF, PDCF, TSLF) in quarter *t*, 0 otherwise.	
D_TARP_INJ	Binary variable that takes the value of 1 if the bank received cash injections from the US Treasury under the CPP in quarter *t*, 0 otherwise.	
D_TARP_REIMB	Binary variable that takes the value of 1 if the bank repaid the Treasury of the capital injection under the CPP in quarter *t*, 0 otherwise	
OR_INV_AMOUNT	The original investment amount received by the bank from the US Treasury under the CPP in quarter *t*, scaled by total assets.	
CAP_REP_AMOUNT	The capital repayment amount repaid by the bank to the US Treasury in quarter *t*, scaled by total assets.	
Variables specific to listed banks:		
LN_DELTA	The natural logarithm of the (1+ delta). Delta is the change in the dollar value of the CEO wealth for a one percentage point change in stock price at the end of the fiscal year.	
LN_VEGA	The natural logarithm of the (1+ vega). Vega is the change in the dollar value of the CEO wealth for a one percentage change in the annualized standard deviation of stock returns at the end of the fiscal year.	
REL_SIZE	Ratio of the target bank's total assets to the bidding bank's total assets.	
D_SAME_STATE	Binary variable that takes value 1 if target and bidder are from the same state; 0 otherwise.	
D_PUBLIC_TARGET	Binary variable that takes value 1 if the target bank is listed; 0 otherwise.	
D_LISTED	Binary variable that takes the value of 1 if the bank is listed, 0 otherwise.	

Table A.2 – Correlations matrix

This table shows the correlation matrix for the variables used in the empirical analysis over the period 2002 - 2014. Variable definitions are provided in the Appendix (see Table A.1). Bold indicates statistically significance at the 5 per cent level.

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	CASH	1																	
2	TA_ACQ	-0.01	1																
3	LERNER	**-0.07**	**0.02**	1															
4	TOT_SEC	**-0.12**	**-0.01**	**0.05**	1														
5	RISKLESS_SEC	**-0.06**	**-0.01**	**0.09**	**0.59**	1													
6	RISKY_SEC	**-0.10**	-0.01	**-0.02**	**0.73**	**-0.12**	1												
7	LN_LGR	**-0.19**	0.01	**0.13**	-0.01	**-0.02**	0.01	1											
8	DELTA_RWA	**-0.17**	**0.01**	**0.14**	**-0.04**	**-0.03**	**-0.03**	**0.82**	1										
9	SECURITIZATION	**0.02**	**0.01**	**0.04**	**-0.06**	**-0.11**	**0.01**	**0.02**	0.00	1									
10	SIZE	0.01	**0.01**	**0.21**	-0.01	**-0.23**	**0.18**	**0.05**	**0.03**	**0.36**	1								
11	ROAA	**-0.11**	**0.02**	**0.52**	**0.11**	**0.15**	0.00	**0.25**	**0.27**	**0.06**	**0.05**	1							
12	ROAE	**-0.13**	0.00	**0.45**	**0.10**	**0.13**	0.01	**0.25**	**0.27**	**0.02**	**0.02**	**0.89**	1						
13	CIR	**0.12**	**-0.02**	**-0.71**	**-0.03**	0.00	**-0.03**	**-0.07**	**-0.09**	**-0.07**	**-0.25**	**-0.39**	**-0.32**	1					
14	ETA	**0.04**	**0.03**	**0.26**	**0.08**	**0.06**	**0.04**	**0.04**	**0.05**	**0.05**	**0.10**	**0.27**	**0.10**	**-0.15**	1				
15	REVENUE_HHI	**-0.13**	0.01	**-0.12**	**-0.06**	**-0.07**	**-0.02**	**-0.02**	-0.01	**-0.18**	**-0.30**	**-0.19**	**-0.17**	**-0.06**	**-0.05**	1			
16	NPL	**0.20**	**-0.01**	**-0.25**	**-0.21**	**-0.19**	**-0.10**	**-0.33**	**-0.33**	**0.03**	**-0.02**	**-0.48**	**-0.48**	**0.10**	**-0.12**	**0.12**	1		
17	STD_DEV_ROAA	**0.18**	**0.02**	**-0.01**	**-0.07**	**-0.10**	0.00	**-0.19**	**-0.19**	**0.08**	**0.06**	**-0.22**	**-0.28**	**-0.03**	**0.05**	**0.05**	**0.42**	1	
18	CORE_DEP	**0.08**	**-0.02**	**0.05**	**0.05**	**0.19**	**-0.10**	**-0.07**	**-0.05**	**-0.29**	**-0.39**	**-0.01**	**0.01**	**0.17**	**-0.10**	**-0.05**	0.00	**-0.07**	1
19	TOT_DEP_TA	**0.10**	**-0.03**	**0.01**	**-0.06**	**0.16**	**-0.20**	**-0.07**	**-0.04**	**-0.34**	**-0.48**	**-0.09**	**-0.04**	**0.16**	**-0.21**	**0.10**	**0.10**	**-0.06**	**0.79**
20	COST_LIAB	**-0.26**	0.00	**-0.19**	**-0.13**	**-0.09**	**-0.09**	**0.02**	**0.02**	**0.03**	**-0.03**	**0.07**	**0.08**	**-0.12**	**-0.17**	**0.24**	0.00	0.00	**-0.25**
21	LOAN_RATIO	**-0.26**	**-0.01**	**0.02**	**-0.79**	**-0.42**	**-0.61**	**0.07**	**0.10**	**-0.13**	**-0.22**	**-0.06**	**-0.02**	**-0.02**	**-0.15**	**0.19**	**0.13**	**-0.03**	**0.16**
22	LOAN_HHI	-0.01	**-0.01**	**-0.16**	**-0.04**	**-0.10**	**0.03**	**-0.05**	**-0.05**	**-0.10**	**-0.27**	**-0.15**	**-0.14**	**0.06**	**-0.02**	**0.33**	**0.21**	**0.07**	0.00
23	UNREALIZED_LOSSES	**-0.03**	0.00	**-0.16**	**-0.12**	**-0.13**	**-0.04**	**0.03**	**0.02**	**0.02**	**0.08**	**-0.11**	**-0.08**	**0.07**	**-0.16**	0.00	**0.01**	**0.03**	**-0.11**
24	UNUSED_COMMITMENTS	**0.06**	0.00	**0.14**	**-0.22**	**-0.17**	**-0.13**	**0.08**	**0.10**	**0.04**	**0.26**	**0.07**	**0.08**	**-0.01**	**0.05**	**-0.19**	**-0.09**	**-0.10**	**0.11**
25	NII_NOR	**0.25**	**0.02**	**0.05**	**0.08**	**0.02**	**0.08**	**0.02**	0.00	**0.27**	**0.35**	**0.22**	**0.15**	**0.02**	**0.17**	**-0.77**	**-0.09**	**0.12**	**-0.17**

		19	20	21	22	23	24	25
19	TOT_DEP_TA	1						
20	COST_LIAB	**-0.16**	1					
21	LOAN_RATIO	**0.29**	**0.20**	1				
22	LOAN_HHI	**0.06**	**0.06**	**0.10**	1			
23	UNREALIZED_LOSSES	**-0.08**	**0.10**	**0.08**	**0.06**	1		
24	UNUSED_COMMITMENTS	**0.08**	**-0.23**	**0.19**	**-0.11**	**0.04**	1	
25	NII_NOR	**-0.33**	**-0.22**	**-0.36**	**-0.24**	**0.01**	**0.10**	1

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