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Do Federal Home Loan Bank membership and advances increase bank risk-taking?

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Abstract

Since the early 1990s, commercial banks have turned to Federal Home Loan Bank (FHLBank) advances to plug the gap between loan and deposit growth. Is this trend worrisome? On the one hand, advances implicitly encourage risk by insulating borrowers from market discipline. On the other, advances give borrowers greater flexibility to managing interest rate and liquidity risk. And access to FHLBank funding encourages members to reshape their balance sheets in ways that could lower credit risk. Using quarterly financial and supervisory data for banks from 1992 to 2005, we assess the effect of FHLBank membership and advances on risk. The evidence suggests liquidity and leverage risks rose modestly, but interest-rate risk declined somewhat. Credit risk and overall failure risk were largely unaffected. Although the evidence suggest FHLBank membership and advances have had, at best, only a modest impact on bank risk, we caution that our sample period constitutes one observation and that moral hazard could be pronounced if leverage ratios revert to historical norms.

JEL classification: G21; H25; G28

Keywords: Government-sponsored enterprises; Federal Home Loan Bank; Market discipline; Bank risk; Liquidity management

1. Introduction

Since the early 1990s, commercial banks have turned to Federal Home Loan Bank (FHLBank) advances to plug the gap between loan and deposit growth. Between 1992 and 1999, for example, annual loan growth at US commercial banks averaged 7.6% while annual core deposit growth averaged just 3.0%. The pickup in loan growth in the 1990s reflected the length and strength of the economic expansion while the slowdown in core-deposit growth reflected heightened consumer interest in deposit substitutes such as money-market mutual funds. Between 2000 and 2005, the economic recession and the stagnant stock market brought loan growth and core deposit growth more in line, with each growing at an annual rate of just over 7%. Nevertheless, FHLBank advances remain an important and growing source of bank funding.

The increasing importance of the FHLBank System to commercial banks can be seen in the jump in membership and advances as illustrated in Table 1. Between 1992 and 2003 (the latest available audited financial statements), the number of FHLBank members – banks, thrifts, and credit unions – more than doubled to 8101 while advances outstanding to System members increased more than six-fold to $501.6 billion. This dramatic growth was fueled by the opening of FHLBank membership to commercial banks beginning in 1989. In addition, the Gramm–Leach–Bliley Act (GLBA) of 1999 relaxed membership and collateral requirements for community financial

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Table 1
Trends in FHLB membership and advances outstanding

	1992	2003	Average annual percent change
Membership by type of financial institution			
Thrifts	2291	1344	−4.8%
Large Commercial Banks	116	648	15.6%
Community Banks	1235	5260	13.2%
Total System Members	3624	8101	7.3%
Advances outstanding by member type ($Mil)			
Thrifts	$72,331	$192,500	8.9%
Large Commercial Banks	$4,295	$196,890	34.8%
Community Banks	$1,573	$38,015	29.0%
Total System Advances	$78,780	$501,600	16.8%

Sources: Federal Housing Finance Board, Reports of Income and Condition for US Commercial Banks, 1992 and 2003.
Between 1992 and 2003, Home Loan Bank membership more than doubled, and advances outstanding increased by more than sixfold. During this period, commercial banks came to dominate membership and borrowings while the number of thrift institutions belonging to the System declined. At year end 2003, the last year for which audited financial statements were available, 5908 commercial banks were members, holding $235 billion in advances. Community financial institutions (CFIs) – banks with fewer than $500 million in assets in 1999 dollars – account for the bulk of Home Loan Bank members, though they hold just 7.6% of System advances. Note that total members and total advances also include credit unions and insurance companies.

institutions (CFIs), defined as banks with less than $500 million in (inflation-adjusted) assets. As a consequence, nearly all of the nation's commercial banks are eligible to join the FHLBank System (Feldman and Schmidt, 2000). At year-end 2003, 5908 banks (77%) were members, holding $234.9 billion in advances. This total included 5260 CFIs, which held a collective $38 billion in advances. Although the FHLBank System was originally accessible only to thrifts and a few insurance companies, bank membership far outnumbers the declining thrift membership, and during 2002, advances outstanding to banks topped advances to thrifts for the first time.[1]

Do FHLBank membership and advances lead to greater bank risk-taking? In theory, advances could lead to an increase or decrease in risk. On the one hand, FHLBank advances permit member banks to fund risky activities without paying a market penalty for increases in failure probability. Indeed, previous research (Ashley et al., 1998) has demonstrated that troubled thrifts used FHLBank funding to evade market discipline during the savings and loan crisis of the late 1980s and early 1990s. On the other hand, the FHLBank System allows banks of all sizes to tap the capital markets at minimal transactions costs. Advances come in a myriad of structures (fixed rate, adjustable rate, and blended) and maturities (overnight to 30 years), and the FHLBanks provide asset/liability-management consulting services to help members use products and maturities to manage interest rate and liquidity risk. Finally, access to FHLBank funding implicitly encourages members to reshape their balance sheets in ways that could lower credit risk. Evidence about the cumulative impact of FHLBank activity on risk would help bank managers and bank supervisors distinguish between prudent and imprudent uses of advances.

It is a particularly opportune time to assess the impact of FHLBank activity on bank risk. In the past few years, the other housing government-sponsored enterprises (GSEs), Freddie Mac and Fannie Mae, have come under fire for ineffective interest-rate hedges and irregular accounting practices (Frame and White, 2004). Freddie and Fannie have also drawn criticism for allegedly diverting housing subsidies to their shareholders and threatening the financial system with their explosive growth (CBO, 2004; Passmore, 2003; Poole, 2003). Because the FHLBank System has also grown rapidly, and some FHLBanks have also suffered losses from ineffective hedges, advocates of stronger housing-GSE oversight have lumped the three together, arguing that one safety-and-soundness supervisor be given authority over Freddie, Fannie, and the FHLBanks (Carnell, 2004). But the principal business line of the FHLBank system is "discounting" eligible mortgages, not securitizing conforming mortgages. And the FHLBank System is organized as a cooperative, not a publicly traded firm. These differences argue for a close look at the policy issues arising from FHLBank activity to ensure that reforms in housing-GSE governance appropriate for Freddie and Fannie are also appropriate for the FHLBank System.

Despite its potential public-policy importance, little research has been conducted on FHLBank activities. To date, scientific study of the System has focused on the wisdom of their mortgage-partnership program (Frame, 2003) and the implicit subsidy of community-bank lending (Craig and Thomson, 2003). Some attempt has also been made to model the decisions of community banks to join the FHLBank System (Collender and Frizell, 2002), to quantify the influence of FHLBank funding on the behavior of troubled thrifts (Ashley et al., 1998), to assess the impact of Gramm–Leach–Bliley on the solvency of the FHLBank System (Nickerson and Phillips, 2002), and to gauge the effect of FHLBank advances on the deposit-insurance fund (Bennett et al., 2005). We are aware of no work on the impact of FHLBank membership and funding on bank risk. To remedy this gap in the literature, we utilize quarterly financial and supervisory data to compare the risk profiles of members and nonmembers for the full 1992–2005 sample period, and for two sub-periods before and after implementations of the GLBA in March 2000. We then examine the relationship between dependence on advances and risk-taking among member banks over the same intervals. The evidence suggests liquidity and leverage risks rose modestly for members, but interest-rate risk declined somewhat. Credit risk and overall insolvency risk were largely unaffected, though reliance on commercial real-estate loans picked up after 1999. Although these find-

[1] Except where noted, all structure and financial data for the FHLBank System were drawn from the Federal Housing Finance Board.

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ings suggest that the cumulative impact of FHLBank membership and advances on bank risk is modest, we caution that our sample period was primarily one of robust economic growth, and that serious moral-hazard problems could arise if bank leverage ratios revert to historical norms.

Despite the lack of a "smoking gun," our research leads to two policy implications that legislators and supervisors might pursue. First, FHLBank advances provide banks with moral hazard incentives that parallel the incentives embedded in brokered deposits. Consequently, policy makers might consider imposing restrictions on advances to troubled banks similar to the current restrictions on brokered deposits. Second, FHLBank advances potentially increase losses to the Federal Deposit Insurance Corporation (FDIC) insurance fund because the fully collateralized advances represent a senior claim over deposits. The FDIC may wish to impose a capital charge for depository institutions' use of advances and other collateralized liabilities.

2. A primer on the FHLBank System

The FHLBank System was the first housing GSE.[2] Congress established the System in 1932 to advance funds against mortgage collateral. The FHLBanks provided a source of long-term stable funding, thereby facilitating separation of the credit and liquidity risks of mortgage lending.[3] Originally, only thrifts and insurance companies could join the FHLBank System, but Congress broadened membership in the late 1980s. The Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIREA) opened the System to commercial banks and credit unions with at least 10% of their assets in residential mortgage loans.[4] The Federal Home Loan Bank Modernization Act of 1999 (Title VI of the Gramm–Leach–Bliley Act) further widened access by eliminating the 10% test for community financial institutions (CFIs). The Act also permitted CFIs to pledge small business, small farm, and small agri-business loans against long-term advances, thereby making membership even more attractive.

The FHLBank System comprises 12 member-owned banks, a centralized debt issuance facility (the Office of Finance) and a safety-and-soundness supervisor (the Federal Housing Finance Board). Each FHLBank is a cooperative corporation, wholly owned by its members. Members contribute capital by purchasing stock in their regional bank. Prior to the GLBA, FHLB member banks were required to purchase stock equal to the greater of 1.0% of the member's residential mortgage assets or 5% of outstanding advances. Membership could be withdrawn and stock redeemable after six months written notice by the member. After the GLBA, each FHLBank had to devise and submit a capital plan to the FHFB, and each plan varies slightly. The Dallas Home Loan Bank's capital plan, for example, requires member banks to hold stock equal to the sum of 0.09% of total assets and 4.1% of outstanding advances. (Federal Home Loan Bank of Dallas, 2005.) These ratios can be adjusted within a narrow range depending on the capital needs of the Dallas FHLBank. Stock redemption requires five years written notice, although the FHLBank can repurchase members' excess stock at any time. In return for the capital investment, members receive dividends and a wide range of financial products and services. Between 1997 and 2002, the average dividend paid by the twelve FHLBanks ranged from 5.13% to 7.63% (GAO, 2003). Products and services include advances, letters of credit, irrevocable lines of credit, interest-rate swaps, asset/liability-management consulting and deposits. Although some FHLBanks have begun to purchase conforming mortgages through the Mortgage Partnership Finance Program, the System's primary business line is still provision of short- and long-term advances (Frame, 2003).

The System raises the funds necessary for offering its products and services by selling debt instruments, which are joint obligations of the 12 FHLBanks. As of December 2003, consolidated obligations summed to $740.9 billion or 95% of System liabilities. On the other side of the balance sheet, advances outstanding totaled $514.2 billion, or 62% of assets. The System also invests in obligations of the US government and the other mortgage GSEs; as of December 2003, security holdings summed to $129.6 billion, or 15.8% of assets. The FHLBank System is not required to pay federal income tax, but it is required to set aside a portion of earnings to service Resolution Funding Corporation debt and to fund affordable housing initiatives.[5]

Circulars for FHLBank securities warn of the lack of a Treasury guarantee, but debt spreads suggest the capital markets have discounted this warning. The Congressional Budget Office estimated an historical funding advantage of roughly 41 basis points on housing-GSE debt securities (CBO, 2001). The funding advantage derives, in part, from past actions by the federal government such as bailouts of two similar GSEs – the Farm Credit System in the 1980s and the Financing Corporation in the 1990s (Leggett and

[2] Except where noted, institutional details about the FHLBank System and its history were drawn from GAO reports, CBO reports, individual FHLBank websites, the Federal Housing Finance Board website, Hoover (1952), and interviews with FHLBank System employees.

[3] OFHEO (2003, Chapter 2), "The Development of the US Secondary Mortgage Market."

[4] "Residential mortgage loans" are defined as first- and junior-lien home mortgage loans, multifamily mortgage loans, manufactured housing loans, home equity loans, mortgage-backed securities, residential construction loans, dormitory, retirement home, nursing home, and single-room occupancy loans.

[5] The FHLBanks must pay 20% of net earnings to the Resolution Funding Corporation (REFCORP) for part of the interest on the bonds issued by REFCORP. The FHLBanks must make these payments until the total amount of payments actually made is equivalent to a $300 million annual annuity whose final maturity date is April 15, 2030. Although we do not address this issue explicitly, incentives suggest that the FHLBanks may become more aggressive in marketing their products and services to banks when their earnings are no longer subject to this earnings transfer.

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Strand, 1997). The consolidated obligations of the FHLBank System enjoy AAA ratings from Moody's and Standard and Poor's. But even without the implicit backing of the Treasury, the System would enjoy a strong credit rating because of its remarkable credit risk record – no FHLBank has ever suffered a credit loss on an advance.

3. FHLBanks and member risk: The theory

Advances implicitly encourage risk-taking because their price does not rise with the failure risk of the borrower. At the same time, FHLBank products and services help members manage interest rate and liquidity risk. And access to FHLBank funding encourages members to reshape their balance sheets in ways that could lower credit risk. So, in theory, FHLBank membership and advances could increase or decrease bank risk. This section brings these arguments into sharper focus.

Access to advances creates a classic moral-hazard problem. When a depository institution assumes more risk, it must typically pay a higher default premium to uninsured, unsecured creditors. Insured depositors, in contrast, do not demand compensation for increasing failure risk because the FDIC stands ready to make them whole. The resulting moral-hazard problem is well known (Merton, 1977). What is not well know is that FHLBanks, like insured depositors, face no credit risk and, consequently, have little incentive to charge more for advances when a member's failure risk increases. FHLBanks face no credit risk because of privileges conferred by their GSE status and monopoly position.[6] For example, FHLBanks insist on collateralization far in advance of that demanded by other secured creditors – the market value of single-family mortgage collateral typically covers 125–170% of an advance and can go much higher.[7] (GAO, 2003.) Moreover, FHLBanks are privy to confidential state and federal examination reports, so they can learn about deterioration in a member's loan portfolio – and demand more collateral – before other creditors become aware of problems.[8] Finally, should a member fail and collateral prove insufficient, the exposed FHLBank can assert statutory lien priority on the other assets – thereby gaining priority over all unsecured creditors. Because of this protection, no FHLBank has ever lost a penny on an advance. It is feasible, therefore, for an FHLBank to set an "all-in" price on advances – the collateral terms and interest rate – that is independent of the borrower's failure risk. Hence, the moral-hazard problem: banks can use advances to take risks, keep the upside, and shift the downside to someone else.[9]

As with insured deposits, the FDIC is the "someone else." If it were a private insurer, the FDIC would recalculate expected losses every time an FHLBank member borrowed advances.[10] The resulting change in deposit-insurance premiums would compensate for the absence of default-risk premiums on advances, thereby raising the marginal cost of risk-taking and removing the perverse incentive. But the FDIC is not a private insurer, and its latitude to change premiums is limited by statute.[11] Premium schedules are currently set for six-month intervals, based on bank supervisory ratings, bank capital ratios, and the Deposit Insurance Fund's (DIF) designated reserve ratio. As of December 2005, only 464 of 7765 (6.0%) commercial and savings banks paid any premium for deposit insurance, and the average annual assessment rate was just 0.11 basis points (FDIC, 2006). Even by the FDIC's own reckoning, the 27 basis point spread between assessments on the safest and riskiest banks is inadequate to cover expected losses. Indeed, the FDIC estimates that the premiums necessary to cover average 1984–1999 losses range from 3.7 basis points to 96.8 basis points (FDIC, 2001). Academic research corroborates the need for a greater spread in the premium structure (see Duffie et al., 2003 and Falkenheim and Pennacchi, 2003; for example.).

Discipline from other funding markets is unlikely to reduce moral hazard. Irrespective of the level of uninsured deposits and FHLBank funding, uninsured unsecured bank creditors do have an incentive to demand higher default premiums as risk increases. And empirical evidence does confirm a link between failure probability and default premiums on uninsured, unsecured bank debt. (For example, see Hall et al., 2005; Morgan and Stiroh, 2001; Flannery, 1998; Flannery and Sorescu, 1996; Gilbert, 1990.). But, as Billett et al. (1998) have noted, discipline from uninsured, unsecured creditors is weakened by the availability of funds with no default premium. They document a tendency in the early 1990s for risky bank holding companies

[6] FHLBanks have, of course, suffered losses for other reasons. For example, the Federal Home Loan Bank of Seattle has recently been forced to suspend dividends and cut staff because of plunge in earnings, a plunge largely traceable to a lost bet on interest rates. For more details see Shenn (2005).

[7] The haircut applied by the Federal Reserve's discount window on single-family collateral ranges between 1.10 and 1.18. See www.frbdiscountwindow.org for a current collateral discount table.

[8] Several researchers have shown that on-site bank examinations produce information that is unknown to the market for a considerable period of time, perhaps as long as 18 months (see DeYoung et al., 2001; Hirtle and Lopez, 1999; Berger and Davies, 1998; Cole and Gunther, 1998).

[9] Member banks must, of course, hold eligible collateral to take down advances. So an implicit cost of FHLBank funding is the opportunity cost of holding more pledgeable assets than a member bank otherwise would. Evidence suggests, however, that this cost has not been large. According to a recent FDIC survey of FHLBank members, the principal reason for taking down advances is to fund loan growth (Stark and Spears-Reed, 2004).

[10] Even if advances do not alter failure risk, they do subordinate the FDIC's position – thereby increasing loss-given-failure. So a private deposit insurer would recalculate expected losses with every change in advances outstanding. For more discussion, see Bennett et al. (2005).

[11] The Federal Deposit Insurance Reform Act of 2005 gave the FDIC the authority to change premiums to meet a designated reserve ratio range from 1.15% to 1.50%, but they are still unable to fully risk-price premiums.

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to escape market discipline by substituting insured deposits for market-priced debt.

FHLBank funding provides an easier escape from market discipline than insured deposits. With unfettered access to world capital markets and an unlimited implicit Treasury guarantee, the FHLBank System faces an almost perfectly elastic supply curve for its debt. And FHLBanks impose only two substantive constraints on member borrowing: the borrower must have eligible collateral and an acceptable supervisory rating. Because FHLBanks will advance funds to purchase eligible assets – including assets in abundant supply such as mortgage-backed securities – the collateral constraint is not binding. Moreover, in practice FHLBanks define an "unacceptable" supervisory rating as a CAMELS 4 or 5 composite.[12] At year-end 2005, only 44 US banks (0.59%) posted such a rating, and just 34 of those banks were FHLBank members. In contrast, banks that use insured deposits to escape market discipline face more significant constraints. Attracting local core deposits requires advertising expenditures and possibly investment in branch facilities. In addition, an increase in the marginal certificate of deposit interest rate requires that the bank offer that higher rate to all customers as the CDs roll over. Although insured wholesale funds are available through the brokered deposit market at a constant marginal interest rates, such funds invite regulatory scrutiny because of the role that brokered deposits played in fueling the savings and loan crisis. More importantly, FDICIA severely limits the ability of a bank to borrow brokered deposits as its capital falls and its risk increases. FDICIA, however, places no restrictions on the use of FHLBank advances.

Fig. 1, adapted from Billett, Garfinkel, and O'Neal (B–G–ON), pull the various threads of the argument together. Fig. 1 depicts optimal lending and funding choices for a representative bank with access to core deposits (insured) and jumbo CDs (uninsured deposits). The interest rate, r, appears on the vertical axis and the quantity of loans made and funds required, Q, appears on the horizontal axis. Following B–G–ON (who were drawing on Klein, 1971), the bank's marginal revenue from booking loans, MR_L, slopes downward reflecting the assumption that lending opportunities are restricted because of regulatory or expertise constraints. The bank's marginal cost curve for core deposits (MC_{ID}) slopes upward sloping because of retail adjustment costs. We depict the marginal cost curve for uninsured deposits (MC_{UD}) as perfectly elastic, reflecting the assumptions that jumbo CDs are homogeneous instruments priced in a national market, and each bank is a price-taker in that market. For simplicity, we assume initial failure risk of the bank is so low that the credit risk exposure of a jumbo-CD holder is comparable to the exposure of an FHLBank.

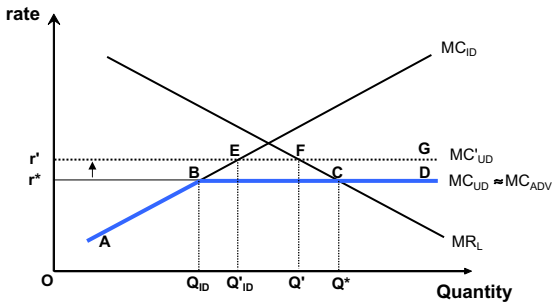

Fig. 1. Advances as an escape from market discipline. This figure shows how banks can utilize FHLB advances to escape market discipline. If a bank initially funds its loans with the combination of insured deposits and uninsured deposits, its marginal cost is ABCD. Now the bank increases risk, and uninsured depositors demand a risk premium. The relevant marginal cost curve becomes AEFG, and the bank curtails its lending, however, if the bank can substitute advances for uninsured deposits, it can continue to operate the same as before the increase in risk.

Under these assumptions, the bank's marginal cost of funding curve will be the darkened line ABCD. After the bank has raised OQ_{ID} in core deposits, it will switch to jumbo CDs because they are now relatively cheaper. The bank maximizes profits by equating the marginal cost of funds and the marginal revenue from loans at point C, with an interest rate of r^* and a quantity of loans-made/funds-raised of Q^*.

Now suppose the bank undertakes risky activities that significantly increase failure probability. The marginal cost curve for core deposits, MC_{ID}, does not shift because insured depositors do not care about failure risk. Jumbo-CD holders, however, will insist on compensation, so the MC_{UD} will shift upward at every Q to r' – the interest rate hike from r^* reflects the actuarially fair increase in the default premium. The bank's new marginal cost of funding curve will be the line AEFG. The bank now maximizes profits at point F, lending OQ' and funding with OQ'_{ID} insured deposits and Q_{ID}'Q' uninsured deposits. The jumbo-CD market does discipline the bank by reducing the optimal quantity of loans, but the effect is muted by the substitution towards insured funding.

Suppose instead that advances are available from a regional FHLBank at marginal cost MC_{ADV} and they are close substitutes for jumbo CDs. Once again, suppose the bank undertakes risky activities, and MC_{UD} shifts upward. As before, the MC_{ID} does not shift. Because the lending FHLBank also faces no default risk, MC_{ADV} will not shift, and the marginal cost of funding curve will remain the darkened line ABCD. The optimal quantity of lending does not change, and the optimal volume of core deposits does not change. The funding mix, however, does change – the bank substitutes advances for the only source of discipline, jumbo CDs. The end result: the bank uses advances to escape discipline from the jumbo-CD market and continue lending at Q^*.

[12] Bank examiners assess six aspects of safety and soundness – "C" for capital adequacy, "A" for asset quality, "M" for management competence, "E" for earnings strength, "L" for liquidity risk, and "S" for sensitivity to market risk. At the conclusion of the exam, a grade of 1 (best) to 5 (worst) is awarded overall and to each component.

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In addition to the moral hazard incentives from substituting advances for jumbo CDs, the expected loss to the FDIC increases. The FDIC's expected loss increases because, in the liquidation of a failed bank, the FDIC and jumbo CD holders have the same priority so they share in the losses. In contrast, FHLBanks have a higher priority than the FDIC because of their collateral agreements with the bank that failed (see Bennett et al., 2005).

To be fair, these perverse incentives are not peculiar to FHLBank advances. In theory, any bank could use insured deposits or discount window loans (which are also collateralized) to exploit risk subsidies in deposit insurance. In the 1980s, for example, many thrifts used brokered deposits to fund high-risk ventures (White, 1991) while risky banks turned to the Federal Reserve Discount Window (Schwartz, 1992). There are two key differences, however, between Discount Loans and advances. First, Discount Loans are designed to enable banks to cover short-term payments imbalances that occur late in the business day. FHLBank lending is predominately long-term. Second, the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) put strict limits on the ability of Federal Reserve Banks to loan to troubled financial institutions. These differences show up in the data: at year-end 2003, Discount Loans outstanding to commercial banks totaled $0.1 billion while advances outstanding totaled $235 billion. In addition, although in theory banks could "gamble for resurrection" by borrowing from the Fed, the evidence from the late 1980s and early 1990s suggests that troubled banks used the discount window to obtain needed liquidity, not to book additional risky assets (see Gilbert, 1994, 1995).

Despite the moral-hazard problem, FHLB membership and advances could reduce bank risk. As noted, the FHLBanks make advances against a broad range of collateral, thereby reducing the liquidity risk of member banks. In addition, FHLBank members can use advances to manage interest-rate risk. Unlike most transaction deposits, advances carry finite maturities ranging from one day to thirty years, so funding with them can reduce confidence intervals around measured exposures. More important, the flexible terms on advances make them a potentially effective tool for hedging exposures arising elsewhere on the balance sheet. Finally, real-estate-backed loans – residential mortgages in particular – secure the majority of FHLBank advances. Member banks either stock up on these loans ex ante to maintain an option on advances, or purchase them ex post with advances as part of a leveraged-growth strategy. Either way, FHLBank members have an incentive to alter their portfolio mix in favor of loans with low credit risk. Between 1992 and 2005, for example, the net charge-off rate for real-estate-backed loans (apart from commercial real-estate loans) averaged 0.12%. The charge-off rate for the remainder of the loan portfolio averaged 0.93%. So, ultimately, the net effect of FHLBank membership and advances on bank risk is an empirical issue.

4. FHLBanks and member bank risk-taking: The evidence

In this section, we assess the effects of FHLBank membership and advances on commercial bank risk. We treat membership and advances separately because each may have a separate effect on risk. Membership carries an option on advances and that option will influence bank behavior irrespective of whether it is exercised. In addition, new members often wait for a considerable period before taking down an advance. Between 1992 and 2005, for example, the median number of quarters between the time that banks joined an FHLBank and the date of the first advance was two. On average, banks waited 1.3 years after membership to draw their first advance, and 10% of members waited 3.5 years.

For the empirical analysis, we drew on three data sources: The Federal Housing Finance Board, the Federal Financial Institutions Examination Council, and the National Information Center of the Federal Reserve System. We obtained most of the income and balance sheet data from the Reports of Condition and Income (Call Reports), which are warehoused by the Federal Financial Institutions Examination Council. We obtained data prior to 2001 on FHLBank membership and advances from the Federal Housing Finance Board because these data were not line items on the call reports until 2001. Finally, we obtained supervisory ratings from the confidential National Information Center (NIC) database. Our data set includes quarterly observations for all US commercial banks over a 13-year period, from year-end 1992 to year-end 2005, and includes 519,111 observations. Due to consolidation, the number of commercial banks decreased during the sample period, from 11,365 at year-end 1992 to 7458 at year-end 2005.

4.1. Composite and specific measures of bank risk

We analyze the effects of FHLBank membership and advances with a range of composite and specific measures of bank risk for members and nonmembers. For our principal measure of composite risk, we rely on output from an econometric model of financial distress. During our sample period, the Federal Reserve used two econometric models in off-site surveillance, collectively known as SEER, the System to Estimate Examination Ratings.[13] The first model (the SEER *risk rank* model) combines financial ratios to estimate the probability that a given bank will fail within the next two years. The second model (the SEER *rating* model) estimates the CAMELS rating that would be awarded based on the bank's latest balance sheet and income statement information. Historically, the SEER framework has performed quite well in identifying poten-

[13] In 2006 the Federal Reserve adopted a new econometric framework called the Supervision and Regulation Statistical Assessment of Bank Risk (SR-SABR). See "Enhancements to the System's Off-Site Bank Surveillance Program", Supervison and Regulation Letter 06–2, Federal Reserve Board of Governors, February 2006.

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tial bank risk. Cole et al. (1995) demonstrate that the SEER model outperformed a surveillance approach based on supervisory screens, both as a predictor of failures and as an identifier of troubled institutions. Gilbert et al. (2002) show that both SEER models perform on par with a CAMELS downgrade model as a tool for flagging downgrades in supervisory ratings. We use the predicted failure probabilities from the SEER *risk rank* model to measure the composite risk of the banks in our sample. To produce the predicted failure probabilities, we obtained the coefficients from the SEER risk rank model, which are kept confidential, from the Board of Governors.

To supplement the econometric measure of composite risk, we also look at the growth rate of total assets for members and nonmembers. In the past, rapid asset growth has often signaled declining underwriting standards, a lax approach to risk management, or outright fraud – all of which can lead to failure. For example, between year-end 1982 and year-end 1985, total assets in the S&L industry grew by 56%, more than twice the growth rate of savings banks and commercial banks over the same period. Later, the fastest growing thrifts dominated the list of failures (Moysich, 1997). This perceived link between rapid growth and failure risk led the FDIC to develop a surveillance system centered on asset growth, the Growth Monitoring System or GMS, in the mid-1980s (Reidhill and O'Keefe, 1997; King et al., 2006). Although econometric models based on financial ratios currently play a dominant role in off-site surveillance at all three Federal bank supervisors, many individual surveillance analysts and field examiners still look at asset growth for clues about impending safety-and-soundness problems.

Unlike composite risk measures, specific risk measures identify the particular areas of bank risk that might be affected by FHLBank membership and advances. We rely on two ratios from each risk category, which include leverage risk, liquidity risk, credit risk, and interest rate risk. These ratios are commonly used by bank examiners and supervisors to assess a bank's risk profile.

Leverage risk is the risk that losses will exceed capital, rendering a bank insolvent. We measure leverage risk with total equity as a percentage of total assets, and total qualifying capital allowable under regulatory guidelines divided by credit-risk-weighted measures of assets and off-balance sheet activity. This risk-weighted equity measure is available beginning in 1996. Lower levels of both equity ratios indicate higher leverage risk.

Liquidity risk is the risk that a bank will be unable to fund loan commitments or meet withdrawal demands at a reasonable cost. We assess liquidity risk with noncore funding as a percentage of assets, and loans as a percentage of core deposits. "Core" funding includes deposits that are relatively insensitive to the difference between the interest rate paid by the bank and the market rate, such as checking accounts, savings accounts, and small time deposits. In contrast, "noncore" funding – which includes brokered deposits, jumbo certificates of deposit (CDs over $100,000), and Home Loan Bank advances – can be quite sensitive to interest rate differentials. Although, strictly speaking, advances will not flee the bank like other noncore funding, they do reprice in step with market rates at maturity or on repricing dates. Higher values for these liquidity ratios imply greater liquidity risk.

Credit risk is the risk that a borrower will fail to make promised interest and principal payments. We measure credit risk with the ratio of nonperforming loans to total loans, and the ratio of commercial real estate loans to total assets. Nonperforming loans – loans that are more than 89 days past due or are no longer accruing interest – are highly correlated with future charge-offs. Commercial real-estate loans consist of construction and land development loans and loans secured by nonfarm, nonresidential properties. Historically, the default rate on commercial real-estate loans has exceeded the default rates on most other loans. For example, at the beginning of our sample period in 1992, commercial real-estate loans were charged-off (net of recoveries) at a rate of 2.1%, compared with a rate of 1.3% for all loans. Moreover, in every year between 1980 and 1993, the ratio of commercial real-estate loans to total assets was higher for banks that subsequently failed than for banks that did not fail (Freund et al., 1997). An increase in both these ratios suggests higher credit risk. In addition, an increase in commercial real-estate holdings would suggest that member banks are not using advances to reduce their holdings of relatively risky loans.

Interest rate risk is the risk that changes in interest rates or security prices will reduce bank income and the market value of bank equity. Interest rate risk arises predominantly from mismatches in the durations of assets and liabilities. Unfortunately, call report data do not allow precise estimation of asset and liability duration for our entire sample. Instead, we rely on the 1-year GAP, which offers a crude estimate of yearly earnings at risk due to interest rate movements. One-year GAP is the absolute value of the difference between assets and liabilities that reprice within one year, expressed as a percentage of total assets. Currently, the Board of Governors of the Federal Reserve System uses a duration-based, Economic Value of Equity (EVE) model to measure interest rate risk exposure (Embersit and Houpt, 1991; Houpt and Wright, 1996). This model simulates the impact of a 200 basis point interest rate increase on the bank's EVE relative to the bank's assets; higher absolute values indicate higher levels of interest rate risk. Recent research by Sierra and Yeager (2004) shows that this model accurately ranks banks by their interest rate sensitivity. Data for the EVE measure of interest rate risk, however, are available only after 1997. Increases in GAP or EVE would suggest that interest rate sensitivity is increasing despite access to advances.

4.2. Economic significance benchmarks

When analyzing differences in composite and specific risk ratios, we pay careful attention to the distinction

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Table 2
Economic significance benchmarks

CAMELS Component	Rating	Median Value	Difference	Median Value	Difference
Composite		Failure Probability		1-year Asset Growth	
	2	0.05	0.28	6.30	−4.07
	3	0.33		2.23	
Capital Adequacy (''C'')		Equity to Total Assets		Risk Based Capital to Risk Weighted Assets	
	2	8.23	−0.80	12.69	0.01
	3	7.43		12.70	
Asset Quality (''A'')		Nonperforming Loans to Total Loans		CRE Loans to Total Assets	
	2	0.98	1.03	10.61	0.95
	3	2.01		11.56	
Profitability (''E'')		Return on Assets		Return on Equity	
	2	1.07	−0.39	11.56	−3.91
	3	0.68		7.65	
Liquidity Risk (''L'')		Noncore Funding to Total Assets		Loans to Core Deposits	
	2	15.35	2.20	88.74	6.62
	3	17.55		95.36	
Sensitivity (''S'')		1-year GAP to Total Assets		Change in EVE to Assets	
	2	36.73	1.76	0.75	0.32
	3	38.49		1.07	

This table displays the median difference in risk ratios for commercial banks with composite or component CAMELS ratings of 2 and 3 over the sample period. These ratio differences serve as our measures of economic significance to assess ratio differences between Home Loan Bank members and nonmembers. For example, the median bank with a composite CAMELS rating of 2 had an estimated probability of failure of 0.05% compared with 0.33% for the median bank with a composite CAMELS rating of 3. The difference of 0.28 percentage points is used as the benchmark for an economically significant difference in failure probability between members and nonmembers and as the benchmark for change in the failure probability for members as a result of increased dependence on advances. The sample period is December 1992 through December 2005 except for risk based capital as a percent of risk weighted assets (March 1996–December 2005) and Change in EVE to Assets (March 1997–December 2005).

between statistical significance and economic significance (McCloskey and Ziliak, 1996). We use differences in median risk ratios based on CAMELS ratings to assess economic significance. Banks with 1 or 2 composite ratings are considered safe-and-sound. Banks with composite ratings greater than 2 are considered less than satisfactory; these banks face considerable supervisory pressure – in the form of informal and formal enforcement actions – to regain safety and soundness.

Because supervisors consider a drop from a CAMELS 2 rating to a 3 rating a significant change in financial condition, we use the differences in composite and specific risk ratios for 2- and 3-rated institutions as benchmarks to evaluate economic significance. Table 2 displays the median values of these risk ratios by composite and component CAMELS rating over our sample. For example, over the 13-year sample, the median failure probability for composite 2-rated institutions was 0.05%, and the median failure probability for composite 3-rated institutions was 0.33%. Thus, we would consider a 28 basis point difference in failure probabilities between members and nonmembers to be economically large. Asset growth and the risk-based capital ratio are the only economic significance benchmarks with the unexpected signs. In fact, 3-rated banks have lower asset growth than 2-rated banks, possibly because regulators impose growth restraints on 3-rated institutions. And the median risk-based capital ratio at 2-rated banks is essentially the same as the median risk-based ratio at 3-rated banks, a pattern likely due to the record industry profits during our sample period.

4.3. Adverse selection incentives

We begin our assessment of the impact of FHLBank membership on risk-taking by exploring the adverse selection incentives. We employ a Cox proportional hazards model to estimate a bank's duration of time until it joins the FHLB. These models are commonly used in medicine to estimate, say, the change in the duration of a patient's life after receiving a particular treatment. The central idea in this banking context is that a riskier bank might choose to join the FHLB earlier than safer banks, reducing the bank's duration as a nonmember. The proportional hazards model is an ideal approach because it accounts for censored observations and the nonnormal distribution of the dependent variable. Certain observations of nonmember banks are censored because such banks leave the sample early (e.g. mergers) or the sample period ends before they join the FHLB. Moreover, the dependent variable, duration – the number of years after the fourth quarter of 1992 that the bank remains a nonmember – cannot be negative because the bank drops out of the sample the quarter after it joins the FHLB. We use quarterly data between 1992 and 2005, regressing each bank's duration as a nonmember on a set of risk and control variables as expressed in Eq. (1).

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Table 3
Adverse selection and a proportional hazard model

	Coefficient	Chi-Square	Hazard ratio	Adj. hazard ratio
Analysis of maximum likelihood estimates				
Risk variables:				
Failure probability	0.004***	89.81	1.00	1.00
Asset growth	0.001***	78.95	1.00	1.00
Equity to total assets	−0.059***	7680.03	0.94	0.95
Noncore funding to total assets	−0.022***	5782.87	0.98	0.95
Total loans to core deposits	0.000***	307.14	1.00	1.00
Nonperforming loans to total loans	0.022***	249.58	1.02	1.02
Commercial real-estate to total assets	−0.011***	1930.99	0.99	0.99
One year GAP	−0.024***	29206.95	0.98	0.96
Control variables:				
Log of total assets	0.086***	2058.71	1.09	1.09
ROA	0.034***	162.42	1.04	1.01
Spread	−2.555***	23380.76	0.08	0.67
Likelihood ratio			56,745.9***	
N			215,880	

We employ a Cox proportional hazards model to estimate the importance of adverse selection incentives on the decision by commercial banks to join the FHLB. Specifically, we regress the duration of time that a bank is a nonmember against a set of risk and control variables. Positive coefficients imply that banks are likely to join the FHLB sooner given an increase in the independent variable. Four of the eight risk coefficients – failure probability, asset growth, equity to total assets and nonperforming loans – reveal a statistically significant link between FHLBank membership and risk. The adjusted hazard ratio computes the likelihood of membership given an economically significant change in the risk variable such that ratios far away from one are economically significant. All of the adjusted hazard ratios in this regression are economically small. The adjusted hazard ratio for equity to total assets, for example, indicates that a bank with an equity to asset ratio that is 80 basis points higher than another bank is 0.95 times as likely to join the FHLB as the other bank.

$$F^{-1}(\text{Duration}_{it}) = \sum_{k=1}^{N} \alpha_k \text{Risk}_{kit} + \sum_{j=1}^{M} \beta_j \text{Control}_{jit} + \varepsilon_{it}.$$

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

$$F^{-1}(\text{Duration}_{it}) = \sum_{k=1}^{N} \alpha_k \,\text{Risk}_{kit} + \sum_{j=1}^{M} \beta_j \,\text{Control}_{jit} + \varepsilon_{it}. \tag{1}$$

$F^{-1}(\cdot)$ is the inverse of the Cox proportional hazard transformation. We exclude from the risk variables the risk-based capital ratio and the change in EVE to assets because of the high numbers of missing observations.[14] Control variables include the log of total assets, the yield spread between AAA and BAA corporate bonds, and ROA. The yield spread controls for the general business cycle while ROA controls for the risk-return tradeoff that banks face. If high-risk banks have stronger incentives to join the FHLB, that risk may be at least partially offset by high returns.

The regression results, reported in Table 3, provide mixed evidence of adverse selection incentives. The likelihood ratio is statistically significant at the 1% level, suggesting that the variables have joint explanatory power to predict FHLBank membership, but the link between risk and membership is inconsistent. A positive coefficient on a specific variable suggests that the membership event is *more* likely to occur. Our measures of economic significance suggest that adverse selection incentives are modest. The hazard ratios, reported in the second-to-last column of the table, are computed by taking the exponentials of the coefficients. A hazard ratio of 1.50, for example, would indicate that a one unit change in the independent variable makes the event (FHLB membership) 1.5 times as likely to occur. The *adjusted* hazard ratio is the likelihood of membership given an economically significant change – the CAMELS benchmark change – in the risk variable. Most of the adjusted hazard ratios are near one, reflecting small economic significance. The most economically significant risk ratio that identifies adverse selection incentives is equity to assets, which shows that a bank with a ratio that is 80 basis points higher than the ratio at another bank is only 0.95 times as likely to become a member. In addition, a bank with a nonperforming loan ratio that is 103 basis points higher than the same ratio at another bank is 1.02 times as likely to join the FHLB as another bank. Other ratios suggest that lower-risk firms are more likely to join the FHLBank System. Banks with economically significant differences in the absolute value of 1-year GAP and noncore funding to total assets are only, respectively, 0.96 and 0.95 times as likely to become members. And composite risk measures show no evidence of adverse selection. In

[14] We also ran the hazard-model regression including these variables. Results are qualitatively similar.

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Table 4
Risk-taking following membership

	Number of banks	Membership Status	Means of changes	Difference in means of changes	T-statistic	Significance	
						Statistical	Economic (%)
Failure probability	4465	Joiner	0.17	−0.01	−0.20		−4
		Peer	0.18				
Asset growth	3957	Joiner	−1.02	3.29	9.47	***	−81
		Peer	−4.31				
Equity to total assets	5691	Joiner	−1.00	−0.70	−12.54	***	88
		Peer	−0.29				
Risk-based capital to risk-weighted assets	3214	Joiner	−2.93	−1.51	−12.58	***	−15110
		Peer	−1.42				
Noncore funding to total assets	5425	Joiner	3.03	1.95	19.29	***	89
		Peer	1.08				
Loans to core deposits	5679	Joiner	7.45	3.89	11.48	***	59
		Peer	3.57				
Nonperforming loans to total loans	5184	Joiner	0.01	−0.10	−4.70	***	−10
		Peer	0.11				
Commercial real-estate to total assets	5270	Joiner	2.25	0.75	8.05	***	78
		Peer	1.50				
One-year GAP to total assets	5340	Joiner	3.66	0.01	0.06		1
		Peer	3.65				
Change in EVE to assets	533	Joiner	−0.45	−0.03	−0.72		−10
		Peer	−0.42				

This table compares changes in composite and specific risk measures for matched pairs of Home Loan Bank members and nonmembers. Each bank that joined the System between December 1992 and December 2003 was matched with a comparable institution that was not a member and would not become a member for at least two years. We then conducted *t*-tests of the hypotheses that the means of the changes in risk ratios for the two groups over the two years were equal. Leverage and liquidity risks increased the most following membership. For example, equity as a percent of assets of joiners decreased, on average, over the two years since joining by 100 basis points. At peer banks, equity as a percent of assets decreased by 29 basis points. The 70 basis point difference (due to rounding) between the two means is statistically significant at the 1% level.

We assessed economic significance by comparing the difference in means to the benchmarks established in Table 2. For example, the difference in the change of equity to asset ratios between joiners and peers represents 88% of the economic significance benchmark. Taken together, the evidence suggests that membership had a statistically and economically important effect on risk-taking.

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

sum, the evidence suggests that the adverse selection incentives to join the FHLB are weak.[15]

4.4. Risk-taking incentives after membership: Matched pair analysis

After banks joined the FHLB, moral hazard incentives might have induced them to take on additional risk by funding that risk with advances. Conversely, advances may have given banks an opportunity to reduce their interest rate sensitivity and to focus more heavily on residential mortgage lending. We use matched pairs to estimate the moral hazard effects. Matched pairs is a valuable tool to measure risk effects because it controls for the (potential) adverse selection bias.

We followed the risk profiles for matched pairs of banks that were about to join the Home Loan Bank System and peer banks that would not join for at least eight quarters. Specifically, at time t we matched each sample bank that would join the system by time $t+1$ with a nonjoiner that had at least a 5-year operating history. To ensure a close match, we paired each joiner with a nonjoiner that (1) operated in the same Home Loan Bank District, (2) served a similar banking market (urban/rural), and (3) had the same initial composite CAMELS rating. We further reduced the adverse selection bias by insisting that peer composite and specific risk ratios as of time t were similar (within 10%) for joiners and nonjoiners. Among banks that matched up with joiners in all these respects, we selected the bank that was closest in asset size to the Home Loan Bank member and designated it the peer bank. Then, we traced changes in the composite and specific risk measures for joiners and peer nonjoiners over a 2-year period. Table 4 compares the 2-year changes in the various risk measures for matched pairs of joiners and nonjoiners.

The overall failure risk of Home Loan Bank joiners increased by 17 basis points – statistically indistinguishable from the 18 basis point increase that nonmembers banks experienced during the first two years of membership. Changes in asset growth gave somewhat stronger evidence of a membership effect. Two years after joining, members

[15] As a robustness check, we ran a logit model to predict FHLB membership by regressing membership status in 1992 on banks' risk ratios from year-end 1989. As with the hazard model, the results suggest that adverse selection incentives are weak.

decreased their annual growth by 1.02 percentage points while peer nonmember banks decreased their growth by 4.31 percentage points.

Turning to specific risk measures, members increased leverage risk significantly relative to nonmembers in the two years after joining. Equity as a percentage of assets slipped by a full percentage point at joiner banks but dropped by just 29 basis points at peer banks. This 70 basis point difference is statistically significant at the 1% level and constitutes 88% of the economic significance benchmark. Moreover, risk-based capital as a percentage of risk-weighted assets tumbled 151 basis points more at joiner banks over the first two years of membership relative to nonjoiners, a difference that is statistically significant at the 1% level.

The two measures of liquidity risk also provide evidence of a link between membership and risk-taking. Members increased their reliance on noncore funding by 1.95 percentage points relative to nonmembers. This difference is statistically significant and is 89% of the economic significance benchmark. Although the loan-to-core deposit ratio climbed at both joiners and nonjoiners, the ratio for members rose by a much larger margin (7.45 percentage points) than the ratio for nonmembers (3.57) – a difference that is statistically significant and 59% of the economic significance benchmark.

The specific measures of credit risk provide mixed signals from the membership effect. Nonperforming loans to total loans increased just 1 basis point in the two years following membership, but that same ratio increased eleven basis points at peer banks. The statistically significant −10 basis point difference in nonperforming loans to total loans between joiners and nonjoiners suggests that member banks had superior loan quality. Commercial real-estate as a percentage of total assets did rise for joiners, however, by 75 basis points more than the ratio for nonjoiners. This statistically significant difference amounted to 78% of the economic significance benchmark and suggests that member banks are not using advances to shift out of historically riskier assets.

The interest rate risk measures offered little evidence of an impact of membership on bank risk-taking. Following membership, joiners increased their 1-year GAP ratios by 3.66 percentage points – an increase just one basis point more than nonjoiners. In addition, no statistically or economically discernible differences emerged between the two groups when interest rate risk was measured by relative changes in the EVE, a more comprehensive gauge.

The matched-pair evidence suggests that between 1992 and 2005, commercial banks responded somewhat to the risk-taking incentives arising from access to advances and underpriced deposit insurance. Leverage and liquidity risks increased somewhat, and banks used advances to increase their holdings of commercial real-estate. However, nonperforming loans at joiner banks declined modestly relative to nonjoiners, and failure probability and interest rate sensitivity were essentially unchanged.

4.5. Risk-taking evidence from drawing advances

As noted, FHLBank funding and underpriced deposit insurance can combine to subsidize risk-taking implicitly. All other things equal, the size of this subsidy increases with bank risk. The subsidy increases because the value of an option on funding at a pre-specified risk premium increases as overall bank risk increases (Thakor, 1982; Thakor et al., 1981). Evidence of increased risk-taking behavior, therefore, may show up more clearly when the sample is partitioned by dependence on advances rather than with membership. Alternatively, banks that use advances more heavily may reduce their interest rate sensitivity and reliance on historically risky assets.

To look for a link between risk and dependence on advances, we estimated a set of ordinary-least-squares, fixed-effects panel regressions on member banks. Specifically, we estimated the following equation:

$$\mathrm{Risk}_{it} = \alpha_i + \sum_{k=5}^{8} \beta_k \,\mathrm{Advances}_{i,t-k} + \sum \gamma \,\mathrm{Date}_t + \eta \,\mathrm{Size}_{t-8} + \varepsilon_{it}, \tag{2}$$

where Risk_{it} is the composite or specific risk measure for bank i at time t, $\mathrm{Advances}_{i,t-k}$ is the ratio of Home Loan Bank advances to total assets of bank i at time $t-k$, Date_t is a vector of quarterly dummy variables that take a value of 1 in quarter t and 0 otherwise, and Size_{t-8} is the log of total assets of bank i at time $t-8$. We use advances lagged five to eight quarters rather than contemporaneous advances because changes in advances affect many of our risk measures concurrently through accounting identities. For example, a dollar in new Home Loan Bank advances increases total assets, which, all else equal, decreases a bank's equity to assets ratio. This lag structure reduces the correlation between advances and the error term. Date dummies capture differences in bank risk over time due to changing business cycle conditions. We use a lagged measure of bank size because advances endogenously influence contemporaneous bank size. We exclude Size as a control variable in the probability of failure regression because the SEER risk rank model uses size as an explanatory variable. The regression results appear in Table 5.[16]

Our approach to assessing the economic significance of coefficient estimates differs slightly from the approach we used in the membership analysis. Here, we compute the percentage point change in the summed advances-to-assets ratio needed to bring about a change in the benchmark difference in CAMELS composite or component ratings. For example, the coefficient on advances to assets when regressed on equity to total assets is −0.049. Because the

[16] As a robustness check to the panel regression approach, we ran Eq. (2) as a series of quarterly cross-sectional regressions. This approach allows us to observe any trends in the coefficients through time. The coefficients (not reported) fluctuate somewhat from year to year but they show no discernable pattern in bank risk-taking.

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Table 5
The impact of advances on bank risk

Dependent variable: measures of risk	Sum of coefficients on FHLB advances	*T*-statistic	Significance		Number of observations	*R*-squared
			Statistical	Economic		
Failure probability	0.019	6.96		15.1	178,709	0.00
1-Year growth of assets	−0.040	2.36	***	101.3	178,588	0.08
Equity/total assets	−0.049	34.14	***	16.3	178,692	0.27
Risk-based capital/risk-weighted assets	−0.066	16.84	***	−0.2	170,742	0.01
Noncore funding/total assets	0.436	104.62	***	5.0	178,669	0.25
Loans/core deposits	−0.418	2.40	***	−15.8	178,651	0.00
Nonperforming loans/total loans	0.003	3.23	***	374.4	178,638	0.02
Commercial real-estate loans/total assets	−0.044	10.95	***	−21.8	178,333	0.35
1-Year GAP/total assets	−0.159	16.22	***	−11.1	178,503	0.33
Change in EVE/assets	0.005	7.16	***	68.3	160,395	0.12

This table displays the results from fixed-effects regressions spanning the 1992–2005 sample period, regressing selected risk measures at commercial banks that belong to the Home Loan Bank System on advances lagged five to eight quarters, bank size lagged eight quarters, and quarterly time dummies. The coefficients on lagged advances are summed for each regression and reported in the table. We assess economic significance by calculating the percentage point change in the advances-to-total assets ratio necessary to produce the relevant CAMELS benchmark change. We view percentage point changes below 15 as significant because most banks can increase their ratios of advances to assets by 15 percentage points with little difficulty.
Overall, the evidence suggests that dependence on advances has a modest impact on bank risk. Most of the summed advances coefficients are statistically significant at the 1% level. However, with the exception of equity capital and noncore funding, the percentage point increases in the dependence ratios necessary to produce economically significant changes in the risk measures are quite large. In addition, some risk measures such as interest rate risk and commercial real-estate lending decrease with the use of advances.

$$\text{Risk}_{it} = \alpha_i + \sum_{k=5}^{8} \beta_k \text{Advances}_{i,t-k} + \sum \gamma \text{Date}_t + \eta \,\text{Size}_{t-8} + \varepsilon_{it}.$$

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

economic benchmark for equity to assets is −80 basis points, it would take a 16.3 percentage point increase (−0.80/−0.049) in the ratio of advances to assets to bring about a decrease in equity equal to the economic benchmark. Hence, lower numbers denote greater economic significance. A useful rule of thumb is to consider economic significance values below 15 to be economically large because most banks can increase without difficulty their ratios of advances to assets by 15 percentage points.

The regressions offer no evidence of a link between composite risk and dependence on Home Loan Bank advances. The coefficient on failure probability is statistically indistinguishable from zero, and the asset growth variable is negative, suggesting that banks with heavier reliance on advances grow more slowly.

Credit risk is also unaffected by banks' use of advances. Although the coefficient on nonperforming loans is positive and statistically significant at the 1% level, it would take a 374.4 percentage point change in the advances-to-assets ratio to bring about an economically significant increase in the ratio of nonperforming loans to total loans. In addition, the coefficient on commercial real-estate to total assets is negative, suggesting that member banks substitute away from these loans as they book new advances.

Interest rate risk seems to fall somewhat as banks increase reliance on advances. The coefficient on the 1-year GAP to asset ratio is negative, and it would take an 11.1 percentage point increase in advances to bring about an economically significant reduction in interest rate risk. Although the sign of the change in EVE to assets ratio is positive indicating an increase in interest rate risk, the economic significance is quite small. Overall, the evidence suggests that banks have used advances to reduce their interest rate sensitivity.

The specific measures of leverage risk do offer evidence of an increase in risk-taking. An increase in the advances to assets ratio leads to statistically significant declines in both capital ratios. Moreover, the economic significance of the risk-based capital coefficient is large; a 16.3 percentage point increase in the advances-to-assets ratio is required to bring about the economic significance benchmark change. The coefficient on the risk-based capital ratio is even larger, though the economic significance benchmark for this ratio is not useful.

One of the two liquidity risk ratios offers evidence of a link between risk-taking and increased dependence on advances. It would take just a 5.0 percentage point increase in the noncore-funding-to-total-assets ratio to produce a change equal to the benchmark for economic significance. In contrast, the loan to core deposit ratio decreases with the use of advances, and the coefficient is both statistically significant and economically large.

As robustness checks, we tried several different specifications of the regression equation. In place of advances to total assets lagged five-to-eight quarters, we used advances to total assets lagged one-to-eight quarters. Not surpris-

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ingly, the statistical and economic significance of the leverage and liquidity risk coefficients were stronger than the coefficients derived from the regressions using just the five-to-eight quarter lags. Composite and credit risk coefficients, however, were weaker, reflecting the declining percentage of problem loans that accompany asset growth driven by advances. We also tried a two-stage least squares approach, instrumenting the four-quarters lagged advances-to-total-assets ratio with five-to-eight quarters lagged advances and time dummies. The resulting coefficients were similar to those obtained with ordinary least squares.

Overall, the regression analysis suggests that dependence on advances has had only a modest impact on risk at commercial banks. Leverage and liquidity risks increase somewhat while credit risk and interest rate sensitivity decrease.

5. Membership, advances and bank risk-taking in the post-GLBA era

As stated above, the Gramm–Leach–Bliley Act (GLBA) relaxed FHLBank membership criteria for community financial institutions by waiving the 10% residential loan requirement and expanding the list of eligible collateral to include loans to small businesses, small farms, and small agri-businesses. In addition, the US economy suffered a mild recession from March 2001 through November 2001. Either of these factors may have changed the relationship between bank risk-taking and FHLBank membership and/or advances by allowing banks to use the membership option or advances to book relatively risky assets such as commercial real-estate loans. We examine this conjecture by comparing the risk profiles of post-GLBA (post-1999) joiners with the risk profiles of pre-GLBA joiners.

We first test whether the GLBA induced relatively risky banks to join the FHLBank System. A proportional hazards model is inappropriate for such an adverse selection test because the distributional properties of the hazard model require the sample period to include the period of rapid growth in membership. However, the majority of banks had already joined the System by 1999. Instead, we employ a logit model and regress a bank's status at year-end 2000 as a member or nonmember on bank risk at year-end 1999 and control variables. Banks that were members prior to implementation of the GLBA were excluded from the sample. During 2000, 490 of 2,662 nonmembers joined the Home Loan Bank System.

Table 6
Adverse selection incentives from the GLBA

	Coefficient	Chi-Square	$Pr >$ Chi-Square	Odds ratio	Adjusted odds ratio
Analysis of maximum likelihood estimates					
Intercept	−0.97**	3.78	0.05		
Risk variables:					
Failure probability	−0.05	1.58	0.21	0.95	0.99
Asset growth	0.01**	5.01	0.03	1.01	1.03
Equity to total assets	−0.05***	11.79	0.00	0.95	0.96
Noncore funding to total assets	0.00	0.05	0.82	1.00	1.00
Total loans to core deposits	0.00	0.45	0.50	1.00	1.00
Nonperforming loans to total loans	−0.11**	5.44	0.02	0.90	0.90
Commercial real-estate to total assets	0.03***	26.97	0.00	1.03	1.02
1-Year GAP	0.00	0.45	0.50	1.00	1.00
Control variables:					
Log of total assets	−0.03	0.30	0.58	0.98	0.97
ROA	0.05	0.52	0.47	1.05	1.02
Number of joiners			490		
Number of nonjoiners			2172		
N			2662		
Likelihood ratio			83.6		

Community banks with relatively high risk in 1999 might have been the first to take advantage of the relaxed requirements for FHLB membership under provisions in the Gramm–Leach–Bliley Act, which became effective in March 2000. We investigated the importance of this adverse selection incentive by using a logit model to regress membership status at year-end 2000 on bank risk ratios from year-end 1999. Banks that were members before year-end 1999 were excluded from the sample. During 2000, 490 of 2662 nonmembers joined the system.

The results suggest that adverse selection incentives were modest. According to the adjusted odds ratio, banks with a (economically significantly) higher ratio of equity to assets were 0.96 times as likely to join the FHLB as other banks. However, banks with high credit risk as measured by nonperforming loans were just 0.90 times as likely to join as other. Finally, banks with higher ratios of commercial real estate loans were slightly more likely to join the System than other banks. Other risk measures were either statistically or economically insignificant.

$$F^{-1}(\text{Joiner}_{i,2000}) = \alpha_0 + \sum_{k=1}^{N} \alpha_k \text{Risk}_{ki,1999} + \sum_{j=1}^{M} \beta_j \text{Control}_{ji,1999} + \varepsilon_i.$$

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

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$$F^{-1}(\text{Joiner}_{i,2000}) = \sum_{k=1}^{N} \alpha_k \text{Risk}_{ki,1999} + \sum_{j=1}^{M} \beta_j \text{Control}_{ji,1999} + \varepsilon_i. \quad (3)$$

The logit results in Table 6 reveal modest adverse selection incentives. According to the adjusted odds ratio, banks that joined the System during the year 2000 that had equity to asset ratios 80 basis points higher than other banks at year-end 1999 were 0.96 times as likely to join the FHLB as other banks. However, banks with 1.03 percentage points more in nonperforming loans at year-end 1999 were just 0.90 times as likely to join as other banks. One interesting finding was that banks with higher ratios of commercial real-estate loans in 1999 were 1.02 times more likely to join the System than other banks. Other risk measures in Table 6 were either statistically or economically insignificant.

Post-GLBA joiners may have used the FHLBank membership option or advances to ramp up risk more than pre-GLBA joiners. We first examine the relationship between bank risk-taking and membership by splitting the matched pairs test into two time periods. Specifically, we compute the differences in means over a 2-year period of composite and specific risk measures for matched pairs of FHLBank members and nonmembers for two sub-groups: those that joined the System between 1992 and 1997 (left panel of Table 7) and those that joined the System between 2000 and 2003 (right panel of Table 7).

The matched-pairs results in Table 7 provide some evidence to support the claim that post-GLBA members are different from pre-GLBA members. Post-GLBA joiners reduced their equity ratios by 1.09 percentage points relative to nonjoiners – a faster clip than the 46 basis point difference in the pre-GLBA era. Liquidity risk also increased at a faster clip in the post-GLBA era as measured by the economically significant increases in noncore funding and loans to core deposits. Perhaps most importantly, joiners in the post-GLBA era increased their ratios of commercial real estate 1.67 percentage points more than nonjoiners – a fourfold increase from the gain in commercial real-estate loans in the pre-GLBA era, and an increase equal to 176% of the economic significance benchmark. Nonperforming loans at joiner banks, however, did not change by a statistically significant amount in the post-GLBA era relative to the nonjoiners.

Table 7
Membership and risk-taking pre- and post-GLBA

	Joiners between 1992 and 1997				Joiners between 2000 and 2003				
	Number of banks	Difference in means of changes	Significance		Number of banks	Difference in means of changes	*T*-statistic	Significance	
			Statistical	Economic (%)				Statistical	Economic (%)
Failure probability	2978	−0.03		−12	743	0.23	1.21		83
Asset growth	2577	3.27	***	−80	673	3.48	4.24	***	−86
Equity to total assets	3538	−0.46	***	57	1097	−1.09	−6.16	***	137
Risk-based capital to risk-weighted assets	1044	−1.32	***	−13,220	1110	−1.56	−7.25	***	−15,560
Noncore funding to total assets	3370	1.78	***	81	1062	2.07	7.44	***	94
Loans to core deposits	3534	2.92	***	44	1102	6.31	9.48	***	95
Nonperforming loans to total loans	3246	−0.13	***	−13	995	0.03	0.48		3
Commercial real-estate to total assets	3327	0.40	***	42	983	1.67	5.82	***	176
One-year GAP to total assets	3312	0.13		8	1030	−0.72	−1.23		−41
Change in EVE to assets	136	0.07		22	208	0.00	−0.05		−1

This table lists the differences in means over a 2-year period of composite and specific risk measures for matched pairs of Home Loan Bank members and nonmembers for two sub-groups: those that joined the System between 1992 and 1997 (left panel) and those that joined the System between 2000 and 2003 (right panel). Comparison of these sub-samples allows us to examine whether the GLBA and the mild 2001 recession induced banks to utilize FHLBank membership differently from the banks that became members before passage of the GLBA. For example, post-GLBA joiners might book more commercial real-estate loans relative to the historically safer residential real-estate loans that pre-GLBA joiners pledged because of the removal of the qualified lender test.

The results provide some evidence to support the claim that post-GLBA members are different from pre-GLBA members. Post-GLBA joiners reduced their equity ratios by 1.09 percentage points relative to nonjoiners–a faster clip than the 46 basis point difference in the pre-GLBA era. Liquidity risk also increased at a faster clip in the post-GLBA era as measured by the economically significant increases in noncore funding and loans to core deposits. Perhaps most importantly, joiners in the post-GLBA era increased their ratios of commercial real-estate 1.67 percentage points more than nonjoiners – a fourfold increase from the gain in commercial real-estate loans in the pre-GLBA era, and an increase equal to 176% of the economic significance benchmark. Nonperforming loans at joiner banks, however, did not change by a statistically significant amount in the post-GLBA era relative to the nonjoiners.

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

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Table 8
Do post-GLBA members utilize advances differently?

Dependent variable: measures of risk	Sum of coefficients on FHLB advances	$Pr > T$	Significance		Sum of coefficients on post-GLBA joiners × FHLB advances	$Pr > T$	Significance		Number of observations	R^2
			Statistical	Economic			Statistical	Economic		
Failure probability	−0.01	0.254		−33.3	0.03	0.04	**	9.0	5473	0.01
1-Year growth of assets	−0.10	0.052	*	39.4	0.71	< .0001	***	−5.7	5470	0.02
Equity/total assets	−0.06	< .0001	***	13.0	0.03	0.12		−31.1	5473	0.04
Risk-based capital/risk-weighted assets	−0.10	< .0001	***	−0.1	−0.01	0.88		−1.8	5472	0.05
Noncore funding/total assets	2.90	< .0001	***	0.8	0.30	< .0001	***	7.2	5472	0.25
Loans/core deposits	−0.77	0.627		−8.6	1.32	0.68		5.0	5473	0.00
Nonperforming loans/total loans	0.00	0.092	*	209.3	−0.01	0.03	**	−79.2	5472	0.01
Commercial Real Estate Loans/total assets	−0.22	< .0001	***	−4.4	0.65	< .0001	***	1.5	5436	0.08
1-Year GAP/ total assets	−0.21	< .0001	***	−8.3	−0.15	0.14		−11.8	5439	0.08
Change in EVE/ assets	−0.02	< .0001	***	−14.4	0.01	0.04	**	25.0	5473	0.03

This table displays the results from cross-sectional regressions at year-end 2005, regressing selected risk measures at commercial banks that belong to the Home Loan Bank System on advances lagged five to eight quarters, post-GLBA joiners (GLBA) × advances lagged five to eight quarters, and bank size lagged eight quarters. GLBA is a dummy variable equal to one for banks that joined the Home Loan Bank System after 1999. The coefficients on lagged advances are summed for each regression and reported in the table. Statistically and economically significant coefficients on the interactive variables would suggest that post-GLBA joiners have different risk profiles from the use of advances relative to pre-GLBA joiners. The economic significance is calculated the same way as in Table 6.

The results suggests that post-GLBA joiners do have a slightly different risk profile than pre-GLBA joiners. Failure probability increases by a statistically and economically significant 3 basis points more for post-GLBA joiners while the change is not statistically significant from zero for all banks. In addition, post-GLBA joiners grow faster with the use of advances relative to all banks, and they rely much more on noncore funding. While the commercial real-estate to assets ratio declines with the use of advances for all banks, it increases for the post-GLBA joiners by a statistically and economically significant 65 basis points for each percentage point increase in advances. However, equity ratios at post-GLBA joiners do not fall as sharply as the all-bank sample, and the ratio of nonperforming loans to total loans declines with an increase in advances.

$$\text{Risk}_i = \alpha + \sum_{k=5}^{8}(\beta_k \text{Advances}_{i,2005:4-k} + \lambda_k \text{GLBA}_i \times \text{Advances}_{i,2005:4-k}) + \eta \text{Size}_{2005:4-8} + \varepsilon_i.$$

* Statistically significant at the 10% level.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

In addition to membership, we wish to examine whether the relationship between risk-taking and banks' use of advances is different for post-GLBA joiners relative to other banks. To do so, we ran a series of cross-sectional regressions on FHLBank members for year-ends 2002–2005.[17] Eq. (4) depicts the regression equation for year-end 2005:

$$\text{Risk}_i = \alpha + \sum_{k=5}^{8}(\beta_k \text{Advances}_{i,2005:4-k} + \lambda_k \text{GLBA}_i \times \text{Advances}_{i,2005:4-k}) + \eta \text{Size}_{2005:4-8} + \varepsilon_i, \quad (4)$$

where GLBA is a dummy variable equal to one if the bank joined the FHLB after 1999 and zero otherwise, and the remaining variables are the same as in Eq. (3). The interactive term $\text{GLBA}_i \times \text{Advances}_{i,2005:4-k}$ isolates the marginal relationship between advances at post-GLBA joiners and bank risk. We report the sum of the coefficients lagged 5–8 quarters in Table 8.

[17] We chose to run a series of cross-sectional regressions rather than a fixed-effects panel regression because of the collinearity between GLBA and the date variable. Although we report only the 2005 regression results, the coefficients from the other regressions are consistent except for those on the interest rate risk variables.

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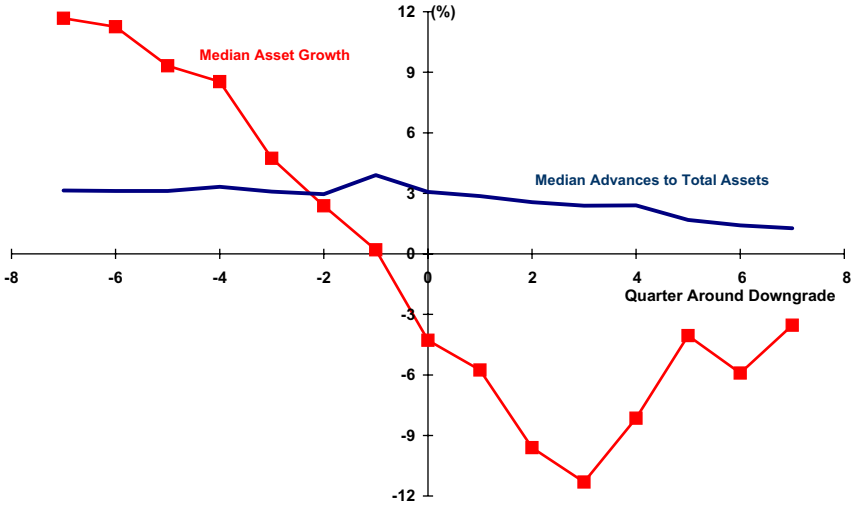

Fig. 2. Median asset growth and advances around initial CAMELS downgrade. This figure shows median asset growth and advances to total assets for FHLB member banks around the first date of being downgraded to a composite CAMELS 4 or 5 rating. If moral hazard incentives were strong between 1992 and 2005, we would expect to observe asset growth and advances increasing around the downgrade date. In fact, downgraded banks tend to shed assets while the ratio of advances to assets falls modestly.

As with the matched-pairs results, the results suggests that post-GLBA joiners have a slightly different risk profile than pre-GLBA joiners. Failure probability increases by a statistically and economically significant three basis points more for post-GLBA joiners while the change is not statistically significant from zero for all banks. In addition, post-GLBA joiners grow faster with the use of advances relative to all banks, and they rely much more on noncore funding. While the commercial real-estate to assets ratio declines with the use of advances for all banks, it increases for the post-GLBA joiners by a statistically and economically significant 65 basis points for each percentage point increase in advances. However, equity ratios at post-GLBA joiners do not fall as sharply as the all-bank sample, and the ratio of nonperforming loans to total loans declines with an increase in advances. In sum, banks that became FHLBank members after implementation of the GLBA are somewhat riskier than member banks that joined earlier, but the increased risk is not reflected in problem loans.

6. Explaining the evidence: Where is the increase in risk-taking?

The evidence suggests that Home Loan Bank membership and advances have had modest impact on risk-taking at banks. Perhaps the risk-taking occurs only when banks experience substantial deterioration. If moral hazard incentives were strong between 1992 and 2005, we would expect to observe asset growth and median advances increasing around the time that a bank's condition deteriorates because the bank potentially could use advances to gamble for resurrection. Fig. 2 shows median asset growth and median advances to total assets for a dozen member banks around the first date of being downgraded to a composite CAMELS 4 or 5 rating.[18] In fact, downgraded banks tend to shed assets while the ratio of advances to assets falls modestly – signs that market or regulator discipline is keeping risk-taking in check.

We believe that the high charter values of banks over our sample period account for the small increase in risk-taking. Keeley (1990) has theorized that high charter values deter bankers from exploiting defects in the pricing of deposit insurance because the owners cannot sell the charter once the bank is declared insolvent. Well-capitalized banks with strong earnings horizons are less likely to take imprudent risks because the owners have more of their own money at risk. Keeley adduced evidence that risk-taking at bank holding companies increased as charter values declined in the 1970s and 1980s in response to branching deregulation that intensified bank competition. Despite the erosion of banks' market power, the unprecedented economic expansion of the 1990s produced charter value and capital ratios that are high by historical standards: the average equity-to-asset ratio for banks was 10.57% between 1992 and 2005, 130 basis points above the average equity ratio in the 1984–1989 period (see Flannery and Rangan (2007) for an explanation of this run-up in book capital.) Moreover, fewer than 1.2% of banks had leverage ratios below the 5% threshold for well-capitalized banks set by FDICIA in the same 1992–2005 period.

Although bank capital positions are currently strong, these ratios can deteriorate quickly. Indeed, banks' capital positions declined rapidly between 1984 and 1987. Supervisors consider banks with equity-to-asset ratios less than 2% to be critically undercapitalized. At year-end 1984, just 180 of the 14,390 banks (1.25%) had capital ratios below 2%;

[18] The chart shows the same trends when including CAMELS 3 banks as well.

by year-end 1987, 333 banks (2.46%) were critically undercapitalized. If a serious decline in capital positions were to occur, reflecting diminished charter values, banks could be tempted to use FHLBank funding to grow their way out of trouble. Looking at the Home Loan Bank borrowing by thrifts in the late 1980s and early 1990s, Ashley et al. (1998) found just this pattern. They found that advances outstanding to thrifts ballooned in the late 1980s as the industry sank deeper and deeper into trouble. More to the point, financially distressed thrifts borrowed more from the FHLBank System than financially stronger thrifts. Finally, the advances-to-asset ratios at thrifts that were later resolved well exceeded the ratios at thrifts that were not resolved.

Other researchers provide historical examples of moral hazard incentives that seemed to have limited effects on risk early on, but eventually led to financial distress. Wheelock and Kumbhakar (1995) study the voluntary Kansas state deposit-insurance system, which began operating in 1909. The authors attribute the lower capital to asset ratios at insured banks as weak evidence of adverse selection and moral hazard effects. Nevertheless, the system operated for 20 years before dissolving following a collapse in farm output prices in the mid-1920s. Insured banks failed at a rate of 4.6% – twice the failure rate of state uninsured banks. Grossman (1992) studies savings and loans in Chicago and Milwaukee following the introduction of national deposit insurance. He finds that moral hazard emerged gradually at insured thrifts. Specifically, it took about five years for insured thrifts' risk-taking to surpass the risk of uninsured thrifts.

7. Conclusion

In the last several years, commercial banks have relied on FHLBank advances to help plug the gap between loan growth and core deposit growth. The increasing reliance is a potential safety and soundness concern because access to advances can undermine market discipline, and the Federal Deposit Insurance Corporation cannot raise premiums sufficiently to deter risk-taking.

Using quarterly income and balance sheet data between 1992 and 2005, we assess the effect of Home Loan Bank membership and advances on bank risk. The evidence suggests that Home Loan Bank members do exhibit somewhat riskier leverage and liquidity profiles than nonmembers and that risk does increase with dependence on advances, especially after 1999. But, the differences, thus far at least, do not appear to be large. In addition, member banks have lower interest rate sensitivity and no significant change in overall risk.

We believe that high charter values at commercial banks since the early 1990s have kept risk-taking in check. The effects of FHLB advances on bank risk might be stronger in a different environment. Because charter value can deteriorate quickly in a highly competitive banking environment, we argue that bank supervisors should remain vigilant. In a low-charter-value environment, only careful monitoring by state and federal supervisors can prevent distressed banks from responding to the moral hazard incentives associated with FHLBank funding and underpriced deposit insurance.

Although the evidence fails to produce a "smoking gun," the worrisome incentives embedded in FHLBank advances should give policymakers pause. We put forth two options for consideration. First, because the moral hazard incentives embedded in advances are similar to the incentives embedded in insured brokered deposits, legislators and regulators may wish to impose usage restrictions on advances similar to those on brokered deposits. That is, as bank risk increases and capital ratios decline, access to advances is curtailed. A second issue that we have only tangentially addressed here is the implications of the use of advances on the deposit-insurance fund (see Bennett et al., 2005 for a full treatment of this issue.) Collateralized liabilities such as advances and repurchase agreements have senior claims over deposits in the resolution process. Consequently, such liabilities potentially exacerbate losses to the FDIC. The FDIC and other regulators may wish to remedy this situation by imposing a capital charge on banks with large amounts of collateralized obligations.

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References

Ashley, Lisa K., Brewer III, Elijah, Vincent, Nancy, E., 1998. Access to FHLB Advances and the performance of thrift institutions. Federal Reserve Bank of Chicago. Economic Perspectives, 33–52.

Bennett, Rosalind L., Vaughan, Yeager, Mark D., Timothy, J., 2005. Should the FDIC worry about the FHLB? The Impact of Federal Home Loan Bank Advances on the Bank-Insurance Fund, FDIC working paper.

Berger, Allen N., Davies, Sally M., 1998. The information content of bank exams. Journal of Financial Services Research 14 (2), 117–145.

Billett, Matthew T., Garfinkel, Jon A., O'Neal, Edward S., 1998. The cost of market versus regulatory discipline in banking. Journal of Financial Economics 48, 333–358.

Carnell, Richard, 2004. Improving the Regulation of Fannie Mae, Freddie Mac, and the Federal Home Loan Bank System. Statement prepared for the Committee on Banking, Housing, and Urban Affairs, U.S. Senate, February 10, 2004.

Cole, Rebel A., Gunther, Jeffery W., 1998. Predicting bank failures: A comparison of on- and off-site monitoring systems. Journal of Financial Services Research 13 (April), 103–118.

Cole, Rebel A., Cornyn, Barbara G., Gunther, Jeffrey W., 1995. FIMS: A new monitoring system for banking institutions. Federal Reserve Bulletin (January), 1–15.

Collender, Robert N., Frizell, Julie A., 2002. Small commercial banks and the Federal Home Loan Bank system. International Regional Science Review 25, 279–303.

Craig, Ben R., Thomson, James B., 2003. Federal Home Loan Bank lending to community banks: Are targeted subsidies desirable? Journal of Financial Services Research 23, 5–28.

DeYoung, Robert, Flannery, Mark J., Lang, William W., Sorescu, Sorin M., 2001. The information content of bank exam ratings and subordinated debt prices. Journal of Money, Credit, and Banking 33 (4), 900–925.

Duffie, Darrell, Jarrow, Robert, Purnanandam, Amiyatosh, Yang, Wei, 2003. Market pricing of deposit insurance. Journal of Financial Services Research 24, 83–120.

Embersit, James A., Houpt, James V., 1991. A method for evaluating interest rate risk in U.S. Commercial Banks. Federal Reserve Bulletin (August), 625–637.

Falkenheim, Michael, Pennacchi, George, 2003. The cost of deposit insurance for privately held banks: A market comparable approach. Journal of Financial Services Research 24, 121–148.

Federal Deposit Insurance Corporation, 2006. BIF Assessment Rates for the First Semiannual Assessment Period of November 4, 2005.

Federal Deposit Insurance Corporation, 2001. Keeping the Promise: Recommendations for Deposit Insurance Reform, April 2001.

Federal Home Loan Bank of Dallas, 2005. Capital Plan for the Federal Home Loan Bank of Dallas: Summary of Major Provisions, October 7, 2005.

Federal Home Loan Bank System, 1999. Legislative Update, A Practical Guide to the Federal Home Loan Bank System Modernization Act of 1999. Available from: <http://www.fhlbanks.com/summary2.htm>.

Federal Home Loan Banks Office of Finance, various years. Various financial reports. Federal Home Loan Bank System, Washington, DC. Available from: <www.fhlb-of.com>.

Feldman, Ron J., Schmidt, Jason E., 2000. Agricultural banks, deposits and FHLB funding: A pre- and post-financial modernization analysis. Journal of Agricultural Lending, 45–52.

Flannery, Mark J., 1998. Using market information in prudential bank supervision: A review of U.S. empirical evidence. Journal of Money, Credit and Banking 30, 273–305.

Flannery, Mark J., Rangan, Kasturi P., 2007. What caused the bank capital build-up of the 1990s? Review of Finance, forthcoming.

Flannery, Mark J., Sorescu, Sorin, 1996. Evidence of bank market discipline in subordinated debenture yields: 1983–1991. Journal of Finance 50, 1347–1377.

Frame, W. Scott, White, Lawrence J., 2004. Regulating housing GSEs: Thoughts on institutional structure and authorities. Economic Review, 87–102.

Frame, W. Scott, 2003. Federal Home Loan Bank mortgage purchases: Implications for mortgage markets. Federal Reserve Bank of Atlanta. Economic Review, 17–33.

Freund, James, Curry, Timothy, Hirsch, Peter, Kelley, Theodore, 1997. Commercial real estate and the banking crises of the early 1980s and early 1990s. In: History of the Eighties: Lessons for the Future, vol. 1. Federal Deposit Insurance Corporation, Washington, DC.

General Accounting Office, 2003. Federal Home Loan Bank System: Key Loan Pricing Terms Can Differ Significantly, GAO-03-973, September, 2003.

Gilbert, R. Alton, Meyer, Andrew P., Vaughan, Mark D., 2002. Could a CAMELS downgrade model improve off-site surveillance? Federal Reserve Bank of St. Louis. Review 84 (1), 47–63.

Gilbert, R. Alton, 1995. Determinants of federal reserve lending to failed banks. Journal of Economics and Business 47 (5), 397–408.

Gilbert, R. Alton, 1994. Federal reserve lending to banks that failed: Implications for the Bank Insurance Fund? Federal Reserve Bank of St. Louis. Review 76 (1), 3–18.

Gilbert, R. Alton, 1990. Market discipline of bank risk: Theory and evidence? Federal Reserve Bank of St. Louis. Economic Review, 3–17.

Grossman, Richard S., 1992. Deposit insurance, regulation, and moral hazard in the thrift industry: Evidence from the 1930s. American Economic Review 82 (4), 800–821.

Hall, John R., King, Thomas B., Meyer, Andrew P., Vaughan, Mark D., 2005. Did FDICIA enhance market discipline? Evidence from the Jumbo CD Market. Federal Reserve Bank of St. Louis, Supervisory Policy Analysis Working Paper, May 2005.

Hirtle, Beverly J., Lopez, Jose A., 1999. Supervisory information and the frequency of bank examinations? Federal Reserve Bank of New York. Economic Policy Review 5 (April), 1–20.

Hoover, Herbert., 1952. In: The Memoirs of Herbert Hoover: The Great Depression, vol. 2. Macmillan, Newyork.

Houpt, James V., Wright, David M., 1996. An analysis of commercial bank exposure to interest rate risk. Federal Reserve Bulletin (February), 115–128.

Keeley, Michael C., 1990. Deposit insurance, risk and market power in banking. American Economic Review 80, 1183–1200.

King, Thomas B., Nuxoll, Daniel A., Yeager, Timothy J., 2006. Are the causes of bank distress changing? Can researchers keep up? Federal Reserve Bank of St. Louis. Review 88 (1), 57–80.

Klein, Michael A., 1971. A theory of the banking firm. Journal of Money, Credit and Banking 3, 205–218.

Leggett, Keith J., Strand, Robert W., 1997. The financing corporation, government-sponsored enterprises, and moral hazard. Cato Journal 17 (2), 179–187.

McCloskey, Deidre N., Ziliak, Stephen T., 1996. The standard error of regressions. Journal of Economic Literature 35, 97–114.

Merton, Robert C., 1977. An analytic derivation of the cost of deposit insurance loan guarantees. Journal of Banking and Finance 1, 3–11.

Morgan, Donald P., Stiroh, Kevin J., 2001. Market discipline of banks: The asset test. Journal of Financial Services Research 20 (October/December), 195–208.

Moysich, Alane., 1997. The savings and loan crises and its relationship to banking. In: History of the Eighties: Lessons for the Future, vol. 1. Federal Deposit Insurance Corporation, Washington, DC.

Nickerson, David, Phillips, Ronnie J., 2002. Financial Déjà vu? The farm credit system's past woes could strike the federal home loan bank system. Regulation (Spring), 40–45.

Office of Federal Housing Enterprise Oversight, 2003. Report to Congress. OFHEO, Washington, DC.

Passmore, Wayne, 2003. The GSE implicit subsidy and value of government ambiguity. Working Paper 2003–64, Board of Governors of the Federal Reserve System, December 2003.

Poole, William., 2003. Housing in the macroeconomy? Federal Reserve Bank of St. Louis. Review 85 (3), 1–8.

Reidhill, Jack, O'Keefe, John, 1997. Off-site surveillance systems. In: History of the Eighties: Lessons for the Future, vol. 1. Federal Deposit Insurance Corporation, Washington, DC.

Schwartz, Anna J., 1992. The misuse of the fed's discount window. The Federal Reserve Bank of St. Louis. Review (September/October), 58–69.

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Shenn, Jody., 2005. How a bet on rates went wrong for the FHLB of Seattle. American Banker (April), 19.

Sierra, Gregory E., Yeager, Timothy J., 2004. What does the federal reserve's economic value model tell us about interest rate risk at U.S. community banks? Federal Reserve Bank of St. Louis. Review (November/December), 45–60.

Stark, William A., Spears-Reed, Darlene, 2004. Federal home loan bank advances: A supervisory perspective, Federal Deposit Insurance Corporation. Supervisory Insights (Summer), 18–25.

Thakor, Anjan, 1982. Toward a theory of bank loan commitments. Journal of Banking and Finance 6, 55–83.

Thakor, Anjan, Hong, Hai, Greenbaum, Stuart I, 1981. Bank loan commitments and interest rate volatility. Journal of Banking and Finance 5, 497–510.

U.S. Congressional Budget Office, 2001. Federal Subsidies and the Housing GSEs, Congress of the United States, Washington, DC.

U.S. Congressional Budget Office, 2004. Updated Estimates of the Subsidies to the Housing GSEs. Congress of the United States, Washington, DC.

Wheelock, David C., Kumbhakar, Subal C., 1995. Which banks choose deposit insurance? Evidence of adverse selection and moral hazard in a voluntary insurance system. Journal of Money, Credit and Banking 27 (1), 186–201.

White, Lawrence J., 1991. The S&L Debacle: Public Policy Lessons for Bank and Thrift Regulation. Oxford, New York.

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