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ABSTRACT

We examine changes in the market valuation of banking activities over the last decade, focusing on the effects of the financial crisis. Our valuation model recognizes that banks create value through the types of assets and liabilities that they create and the various types of risk they undertake (including their leverage, their lending risk, and their interest rate risk). The model also allows for heterogeneous bank income streams, dividend signaling effects, and changes in capitalization rates for income streams over time depending on changing market conditions. This approach explains substantial cross-sectional variation in observed market-to-book values, allowing us to identify the market pricing of various banking activities and changes in market pricing over time. We find that the declines in bank stock values since 2007 reflect declining values of various categories of banking activity and changes in market conditions. Dividend payments matter for market values increasingly over time. "Carry-trade" effects from taking on interest rate risk are also apparent. The effects of leverage on bank valuation changed sign during the crisis; while the market rewarded high leverage with higher market values prior to the crisis, leverage become associated with lower values during and after the crisis. Contrary to the view that the declines in market-to-book values for U.S. banks from 2006-2011 mainly reflect unrecognized losses, we find that other factors explain most of the decline in market-to-book ratios. Although model parameters do change over time, more than three-quarters of the change in market-to-book values that occurred from 2006 to the end of 2008 were predictable based on changes in fundamental determinants of value using the model coefficients estimated in 2006.

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1. INTRODUCTION

This study examines the market valuation of banking activities and how it has changed over the last decade, focusing on the effects of the financial crisis in changing the way the market perceives the relationship between various dimensions of bank performance and bank value.

Many researchers have drawn attention to the dramatic declines in banks' market-to-book values. Those researchers have argued that the declining market-to-book ratios largely reflect the purposeful understatement of losses in bank holding companies – especially losses related to mortgage activity – "in an effort to preserve book capital" (Huizinga and Laeven 2011). Huizinga and Laeven (2011) argue that: (1) the presence of greater proportions of mortgage-related assets on a bank's balance sheet was associated with greater declines in the ratio of market-to-book value, (2) banks augmented their book values in 2008 by classifying mortgage-backed securities (MBS) as held-to-maturity rather than as available-for-sale, a behavior that increased in the difference between the amortized cost and fair value of a bank's MBS portfolio, and (3) banks with greater mortgage exposure reported relatively low rates of loan loss provisioning and loan charge-offs. In the working paper version of their paper, Huizinga and Laeven (2009) also report that at moments when accounting rules for valuing assets under "fair value" accounting standards were relaxed, banks with larger mortgage exposure experienced higher excess returns (reflecting the value to banks of possessing more book capital for regulatory purposes).[1]

This evidence reinforces a line of argument in a large literature about regulatory forbearance during financial crises, defined as regulatory understatement of bank losses designed to limit the costs to banks from those losses. The inflation of bank capital via forbearance may be motivated either by political favoritism toward banks or by the desire to encourage banks not to cut the supply of credit to

[1] Transfers of securities from available-for-sale category to the held-to-maturity category should not affect book value under GAAP, since transferred securities are supposed to be valued at current fair value, not at amortized cost. The authors, however, believe that violations of this rule were tolerated, and that transferred securities were valued at amortized cost. Furthermore, it is important to note that provision for loan losses under GAAP rules is not supposed to measure expected losses but rather incurred losses, and therefore, the fact that provisions understate expected losses is inherent in the accounting rule, not a violation of the rule.

borrowers. Kane (1989), Brewer (1995), and Kroszner and Strahan (1996), for example, argued that forbearance kept under-capitalized savings and loans afloat in the 1980s, and encouraged risk taking by those under-capitalized institutions. Brown and Dinc (2005, 2011) show that forbearance is a more general international phenomenon, especially in the wake of severe financial crises, and especially prior to elections. With respect to the recent U.S. crisis, in addition to Huizinga and Laeven (2009, 2011), many other researchers have argued that the under-recognition of loss was significant for U.S. banks, reinforcing the view that the decline in market-to-book values largely reflects flawed accounting rules, and banks' and regulators' attempts to preserve book capital (Goh et al. 2009, Knaup and Wagner 2009, Kolev 2009, Plantin et al. 2008). Laux and Leuz (2010) find little evidence that such effects are the result of pro-cyclical biases in fair value accounting, per se, indicating that regulatory forbearance with regard to particular aspects of bank behavior (as documented by Huizinga and Laeven) are more important than the presence of fair value accounting, per se, for encouraging the understatement of loss by banks. Although these authors provide powerful evidence in favor of the view that the understatement of expected loss by book values contributed to the observed declines in banks' market-to-book values during and after the crisis, there are many other potential sources of change that could have contributed to the dramatic decline in the market-to-book value ratio of banks.

First, the market values of loan and deposit relationships may have been affected by changes in market conditions that do not affect book values. The costs of servicing loan relationships during the crisis included banks' having to honor draw-downs on lines of credit at a time when banks themselves were scrambling for liquidity. More generally, the values of loan and deposit relationships may have declined as a consequence of reductions in the expected per-period profits flowing from those relationships, or because of increases in the risk factors and discount rates used to value those flows. With respect to the value of deposit relationships, the crisis was associated with a dramatic change in

monetary policy and a decline in interest rates, which reduced the value of zero- or low-interest deposits to banks.

Second, perceptions of the value of other sources of income, or the capitalization rates applied to those sources of income, may have fallen during the crisis. For example, mortgage servicing fees may have been perceived as highly valuable before the crisis, but less valuable after the crisis, perhaps because of expected changes in the extent of mortgage refinancing and origination, rising mortgage defaults, or a decline in expected interest income earned on mortgage servicing-related float. Market capitalization of banks' trading income also may have fallen, as banks saw a greater need to reduce trading to preserve scarce capital, or because of regulatory initiatives (e.g., the Volcker Rule) which reduced the expected ability of banks' to continue engaging in proprietary trading.

Third, investors may have altered their views about the desirability of some bank practices in light of the crisis. For example, as we will show, investors seem to have favored higher leverage by banks prior to the crisis (as a source of greater returns on equity), but after the crisis, higher leverage was penalized by investors.

Fourth, banks engage in the "carry trade," borrowing primarily short-term debts, and lending a substantial amount of those funds at fixed rates for longer terms. Changes in interest rates, and particularly changes in the term structure of interest rates, likely affected banks' profitability, depending on the extent to which they engaged in the carry trade.

In order to explore all of the potential influences on banks' market-to-book values related to the crisis, we construct an econometric valuation model of banks that takes all of these various categories of influence into account, and use that model to "decompose" the sources of change in the market-to-book ratio of capital, which can be linked to the various influences posited above. Although our model is not structural (and therefore the interpretation of coefficients and the decomposition of effects must be

treated with some caution), we are able to show that these alternative sources of influence on banks' market-to-book values are substantial, and that they likely account for more of the decline in market-to-book values than does the understatement of expected losses.

Bank holding companies (BHCs) engage in different types of activities, including obtaining and maintaining deposits; generating, acquiring and servicing loans; investing in securities; trading a wide range of financial instruments on securities and futures exchanges, as well as the over-the-counter (OTC) markets; borrowing; providing fee-based financial services (e.g., fiduciary, advisory, underwriting, brokerage, and acting as counterparties for clients in swaps and other hedges); and selling and securitizing financial assets. The extent of each of these activities is reflected in financial reports, including balance sheets and income statements. Using information from FR Y-9C reports, which are prepared by BHCs for each calendar quarter, we estimate the value created in the various banking activities as reflected in market valuations.

The approach is based on the cross-sectional relationship between the market-to-book ratio (our dependent variable) and proxies for the value generated by the various bank activities and bank attributes, which are based on measures derived from accounting concepts.[2] The estimated coefficients of the valuation model are generally consistent with expectations. For example, we find that persistent streams of noninterest income have larger valuation coefficients than less persistent ones. Furthermore, the model generates reasonable estimates of the contributions of different bank activities to value, both in terms of magnitude and time-series variation. For example, the estimated average value creation per dollar of loans changed from more than five cents on the dollar prior to the financial crisis to a slightly negative amount during the financial crisis. Similarly, the estimated average value creation per dollar of

[2] This approach follows the valuation methodology developed in Calomiris and Nissim (2007).

core deposits has ranged between five and eight cents throughout the 2000s, but has declined significantly in the last two years as a result of the post-crisis low interest rate environment.

The individual valuation coefficients we report for various activities – including deposits, loans and components of income and expense – are partial correlations estimated in regressions, and thus cannot be interpreted as measures of the overall valuation consequences of strategic business decisions. For example, acquiring a customer loan relationship may have value, in part, because of the deposits or noninterest income items that tend to be associated with that loan relationship, but in our analysis the various components of a relationship enter separately. Furthermore, to the extent that there are production economies of scope across different activities, our approach will not identify them, although the valuation consequences of any economies of scope, measured at the sample mean, will affect our regression estimates for each activity. For both reasons, caution is required in using the estimated coefficients to measure business concepts like "the value of acquiring a loan relationship." Our estimates, however, are able to capture the average valuation consequence of each activity or financial instrument, irrespective of the nature of the relationship that gives rise to it. Despite the inherent limitations, we find that the magnitudes of the estimated coefficients in our regressions are broadly consistent with expectations. Furthermore, and perhaps even more interestingly, the magnitudes of those coefficients substantially vary over time, and co-vary in plausible ways with measures of market conditions that should matter for valuation.

The estimated effects on bank value of activity-specific attributes generally have the expected signs and are significant. For example, estimated value creation by loans increases with average loan yield and decreases with the relative magnitude of nonperforming loans. The value of loan relationships also varied dramatically over time, and actually fell to negative values in the midst of the financial crisis (perhaps reflecting the costs to banks of maintaining loan customers' access to credit during the crisis).

The estimated value creation by core deposits decreases with the average interest rate paid on deposits, and increases with the relative proportions of transactions and savings accounts, which typically have greater "relationship" value than certificates of deposit. Furthermore, changes over time in the value of deposits are closely related to changes in market interest rates, albeit apparently with a lag.

Noninterest expense flows have negative effects on value, while noninterest income flows have positive effects. Interestingly, the value consequences of these effects shrink in absolute value in the post-crisis period, suggesting either a perception of lower expected persistence of these streams of expense and income, or higher discount rates during the aftermath of the crisis, or both.

Other attributes of banks also matter importantly for market value ratios. Banks that pay higher dividends, ceteris paribus, exhibit higher market value ratios. This effect becomes much higher during and after the crisis than before, a fact that is consistent with the view that dividends provide a signal of hard-to-observe bank quality, which should be more important during times of greater uncertainty.

Our measure of the "carry trade" also contributes to bank profitability (the difference in the amount of assets and liabilities subject to fixed interest rates), and the magnitude of that contribution varies over time with the term structure of interest rates.

Higher bank leverage was associated with higher market values prior to the crisis, but this relationship reversed during the crisis; higher leverage became associated with lower market values. This finding suggests that, consistent with recent work by Cheng, Hong, and Schenkman (2010), the market may have rewarded the high leveraging of financial institutions prior to the crisis (see also Adrian and Shin 2009), but that once the crisis revealed problems in banks' balance sheets and saw rising concerns about bank counterparty risk, high leverage became penalized by the market.

The paper proceeds as follows. The valuation model is developed in Section 2. Section 3 presents empirical results, and Section 4 concludes.

2. VALUATION APPROACH

BHCs generate value through the different activities they undertake. They compete in the market to obtain noninterest or low-interest bearing deposits ("core deposits") and invest these funds in loans and other financial assets, with the spread earned being the primary source of income for most BHCs. They also generate noninterest income from traditional fees related to deposits, loans, and fiduciary activities, as well as from other sources, such as trading, securities brokerage, investment banking, asset management, servicing, insurance, securitization, and loan sales. In addition, many BHCs engage in the "carry trade," that is, they obtain short-term funds (e.g., federal funds, repos, commercial paper, brokered deposits) and invest these funds in longer term instruments, primarily securities.[3] These various activities contribute to bank value in ways that should vary significantly over time and across banks depending on the volume, profitability, persistence, risk and other attributes of the activities, as well as on bank-specific attributes, such as size, capital and diversification.

Furthermore, valuations should also vary with market circumstances. For example, banks that engage more in the carry trade should show higher valuation effects related to the carry trade when the term structure is steep. Similarly, core deposits are more profitable when interest rates are high (implying more savings on interest paid from possessing the deposit relationship). Capitalization rates associated with any income or expense stream (which are captured by the estimated coefficients in our regressions) should vary over time, too, depending on changes in the riskless interest rate and the time-varying risk premia associated with various activities.

[3] This strategy is typically profitable due to the "liquidity premium," and it is value-creating if, compared to other investors, banks have a greater ability to absorb interest rate risk.

Our approach to identifying the market valuation consequences of bank activities is to start with balance sheet information – captured using financial ratio concepts – and then capture additional concepts related to value creation using ratios from the income statement and supplementary schedules. The use of balance sheet accounting concepts for banks is likely to be a more accurate point of departure than for other firms since banks' balance sheet assets and liabilities are often reported at amounts close to fair value or, at least, provide a reasonable starting point for valuation. For non-bank firms this is less likely to be the case for important classes of assets (e.g., when assets are long-term physical assets, carried at historical cost and subject to valuation bias from price inflation and depreciation schedules). Income statements and related information can also be used to supplement balance sheet information, and in particular, to account for systematic differences between the market and book values of reported assets, as well as to incorporate the value of economic assets and liabilities that are omitted from the balance sheet (e.g., most intangibles, including relationship values of deposits and loans).

Assets and liabilities reported at fair value on the balance sheet include the following concepts: cash and balances due from depository institutions, available-for-sale securities, federal funds sold and reverse repos, trading assets, federal funds purchased and repos, and trading liabilities. In addition, short-term borrowing – primarily commercial paper – and floating rate debt are reported at amounts that are typically close to fair value. And while held-to-maturity securities are generally reported on the balance sheet at amortized cost, their fair value is disclosed in the FR Y-9C report and can be used to adjust equity book value by adding the difference between the fair and book value of the securities, times one minus the marginal tax rate.[4]

[4] BHCs are also required to disclose fair value estimates for most other financial instruments, including loans and deposits. However, these fair value estimates are not available on the FR Y-9C reports. More importantly, the disclosed fair value of existing loans and deposits do not reflect the value of relationship intangibles. This is especially true for transactions accounts and savings deposits whose disclosed fair value is the current account balance. Finally, the disclosed fair values of loans and other illiquid financial instruments are often unreliable (e.g., Barth at el (1996), Nissim (2003)).

While we recognize that book values do not perfectly capture value creation in the above mentioned activities, they should serve as a reasonable basis for gauging the relative extent of various activities. For some asset and liability categories – those with respect to which we expect to find little value creation – market and adjusted book values should be similar. In particular, most securities are traded in relatively liquid and efficient capital markets, and we expect that banks' ability to create value by investing in securities is limited. Similarly, banks' ability to generate value from federal funds and repo-related activities is limited since the market for borrowing reserves among banks is highly competitive. In addition, the effect on earnings from holding cash and below-market interest rate reserves should be captured elsewhere in our model. Specifically, to the extent that banks' motive for holding reserves is to facilitate deposit-taking activities and generate deposit service fees, the cost of forgone interest will be reflected in our model in a lower estimated value for core deposits and noninterest income. Similarly, any value creation due to short-term borrowings that fund investments in long-term securities should be captured in our model using a proxy for interest-rate exposure.

Unlike cash and investment securities, trading activities are likely to generate significant value above that reflected in the fair value of existing trading assets and liabilities. After all, if trading activities were not expected to generate future risk-adjusted returns, banks would not commit economic resources such as capital, human resources and information technology to support trading. We proxy for the ability of the BHC to generate value in future trading activities by using the amount of trading revenue included in noninterest income, as discussed in detail below.

Other economic assets and liabilities either have book values that could significantly differ from fair value or are not reported at all. These include loans, fixed assets, intangible assets, "other assets," deposits, long-term fixed-rate debt, and "other liabilities." In addition, non-controlling (minority) interest in consolidated subsidiaries and perpetual preferred stock, which are included in equity, are

reported at amounts which are likely to differ significantly from fair value. From the perspective of common equity, these equity instruments represent outside claims, similar to liabilities.

To capture value creation in activities with omitted assets or liabilities, or for which the fair and book values of the related net assets may differ significantly, we use the following approach. We explicitly model value creation associated with loans and core deposits using identifiable attributes of these activities (e.g., the type of deposit or loan), and we capture the value of intangibles and the impact of fair-book differences related to fixed assets using income statement and related information. For example, to the extent that depository banking is associated with higher noninterest expense (i.e., brick and mortar costs of servicing deposits, which are not accounted for separately), those cost consequences of deposit relationships – while not incorporated into the measure of the book value of a deposit – would affect bank valuation through the capitalized value of noninterest expense.

Fixed assets are recorded in the books at depreciated historical cost. Due to inflation and conservative accounting principles, the book value of fixed assets typically understates their fair value, often significantly so. Unfortunately, BHCs are not required to disclose the fair value of their fixed assets. Still, fixed assets are a small proportion of bank value, and to the extent that low asset book values result in low depreciation expense, our model will capture the fair-book difference related to fixed assets through the impact on non-interest expense.

Intangible assets (goodwill, servicing rights, favorable leasehold rights, the values of different types of customer relationships, etc.) are generally recognized only when acquired; under GAAP, most internally developed intangibles are not reported on the balance sheet. As a result, the book value of intangible assets is likely to be a poor proxy for their economic value. Indeed, including intangible assets in a valuation model would introduce non-comparability across banks, related to their varying experiences in mergers and acquisitions, which generally would not be associated with similar variation

in the valuation consequences of those transactions. We therefore capture the value of intangible assets (both recognized and unrecognized) using other measures, including the characteristics of loans and deposits (which proxy for the value of lending relationships and core deposit intangibles), and measures of non-interest income and expense (which proxy for the value of intangibles used in generating fee-based income).

The valuation model can be presented as follows:

$$\frac{\text{Adj. market}}{\text{Adj. book}} = 1 + \frac{\text{Gross loans}}{\text{Adj. book}} \times \text{Value creation per \$1 of loans}$$
$$+ \frac{\text{Core deposits}}{\text{Adj. book}} \times \text{Value creation per \$1 of core deposits}$$
$$+ \text{Value creation in other activities}$$

Here adjusted book value is calculated as the book value of common equity, minus intangible assets, plus the product of the allowance for loan and lease losses and one minus the marginal tax rate, and plus the difference between the fair and book values of held-to-maturity securities times one minus the tax rate. The held-to-maturity and intangibles adjustments are explained above. The allowance-related adjustment is motivated by its discretionary nature, as explained in the "Loans and Leases" section below.

Adjusted market value is calculated by multiplying the end-of-quarter market value of common equity by one plus the cumulative stock return over the subsequent 75 days. The reason for this time adjustment is that end-of-quarter stock prices are not likely to fully reflect the value implications of FR Y-9C information. These reports are prepared and disseminated after the end of the quarter. As discussed in Section 3 below, FR Y-9C data are generally available within two months from fiscal

quarter end.[5] Hence, we assume a 75-day lag between the accounting date and the date that information is actually available to the market.

Exhibit 1 below lists the variables used in our regression model of value creation, grouped into three categories by lending, deposit taking, and other activities, with value creation in each activity being specified as a linear combination of a constant and the corresponding variables. The subsequent discussion explains the rationales for the inclusion of these variables, and can be skipped without loss of continuity.[6]

Exhibit 1: Summary of the Variables

Value Creating Activity	Variables
Loans and leases	Average tax-equivalent loans' yield Allowance / gross loans held for investment Nonperforming loans / gross loans Provision for loan losses / average gross loans Net charge-offs / average gross loans
Core deposits	Noninterest-bearing deposits / core deposits Small denomination time deposits / core deposits Average interest rate on interest-bearing core deposits
Other activities and attributes	Recurring fees / adjusted book value Other noninterest income / adjusted book value Noninterest expense / adjusted book value Total assets – four Box-Cox transformations (λ = 0, -.33, -.67, -1) Adjusted book value / total assets Dividend / adjusted book value (Fixed-rate assets – fixed rate liabilities) / adjusted book value

[5] An alternative approach is to simply use the market value of equity 75 days after the end of the quarter with no further adjustment. However, market capitalization after the publication of the quarterly report may not be properly aligned with the book value since the bank may pay dividends or issue or repurchase shares between the end of the quarter and the report publication date. Such changes in market capitalization are not reflected in the book value of equity and may therefore bias the results.

[6] An important consideration in specifying the model is to restrict the number of free parameters.

Loans and Leases

Consistent with much of the theoretical literature on value creation by banks (e.g., Diamond 1984, Calomiris and Kahn 1991, Rajan 1992), for many BHCs, loans and leases are the primary driver of value on the asset side of the balance sheet. Banks' ability to generate value by investing in securities (the main alternative to loans) is limited since most securities are traded in competitive markets. In contrast, banks are often able to generate value in lending activities due to their special access to customer relationships (based on privileged information or special control rights associated with bank lending contracts) or potential market power in some market areas and product niches with fewer competitors. Thus, the economic value of existing loans is typically larger than their book value, and this difference possibly could explain a large portion of the difference between the market and book values of bank equity.

The value premium of existing loans should not be uniform, but rather should reflect the effects of access to different types of customer relationships, as well as differences in banks' abilities to monitor borrowers and control their activities, which bankers hope will result in current and future (expected) earnings that more than compensate for the economic (risk-adjusted) cost of funding, originating, servicing and monitoring the loans. Some banks should be more successful at managing those relationships than others. Although our measures are derived from cross-sectional differences in accounting information, customer relationships and the human and physical resources of banks persist. The persistence of relationships may also vary across banks: for example, since the value premium of existing loans increases with the strength of customer relationships, it may also proxy for expected persistence of value creation in future lending (i.e., a relationship today may imply a greater probability of obtaining another relationship in the future).

As described above, we model value creation related to loans and leases (hereafter loans) as the product of the gross book value of loans and the average value creation per dollar of loans. All else equal, we assume that the value of existing loans and the value of lending relationships increase with the loans' average yield, and decrease with the loans' credit risk. We therefore specify average value creation per dollar of loans as a linear combination of an intercept, the ***average tax-equivalent yield on loans***, and the following four (imperfect) measures of credit risk.[7]

The ratio of the allowance for loan losses to the gross book value of loans held for investment. The allowance for loan losses represents management's estimate of the amount of loans held for investment that the bank will be unable to collect, based on current information and events as of the date of the financial statements.[8] Thus, the allowance-to-loans ratio should inform on the extent to which the bank's loans are at risk of not being repaid.

The ratio of nonperforming loans to the gross book value of loans. Prior research has demonstrated that banks often "manage" the allowance for loan and lease losses, hence reducing the meaningfulness of that proxy for credit risk (e.g., Beaver et al., 1989; Elliott et al., 1991; Griffin and Wallach, 1991). The NPL-to-loans ratio may therefore contain incremental information about credit risk. Of course, NPLs may not be a perfect measure of portfolio risk either, since banks have some discretion in measuring nonperformance (e.g., loan terms can be recast to avoid delinquency, a practice sometimes referred to as "evergreening"). To increase the comparability of NPLs in the cross-section, we include in our NPL measure all loans past due 90 days or more that are still accruing interest. This adjustment is important since banks differ in the delinquency periods that trigger non-accrual classification. We also

[7] Note that the value created from a higher loan interest rate should be measured relative to some money market benchmark interest rate. Because banks participate in the same market for such instruments, and because we use cross-sectional analysis, interest rates in our model can be expressed in simple levels rather than as differentials with respect to a common market benchmark.

[8] Loans held for sale are reported at the lower of cost or fair value and therefore require no allowance.

reduce non-performing loans by the portion guaranteed or otherwise covered by the U.S. government or its agencies.

The allowance and non-performing loans measures are not likely to fully capture lending-related credit risk for three additional reasons apart from their discretionary nature. First, firms that employ relatively conservative charge-off policies will have lower allowance and NPL levels since they tend to remove large portions of problem loans from their books (the allowance and NPL relate to reported loans only, not to loans that already have been charged off). Second, under current U.S. GAAP, the allowance only reflects incurred losses, not expected ones. Indeed, under GAAP banks are specifically prohibited from forecasting future losses in their allowances, even when they have strong reason to believe that those losses will occur. Similarly, nonperforming loans reflect loans that have already been proven problematic, not those that may become problematic. Third, both the allowance and NPL measures provide a snapshot at a point in time and do not reflect activity during the entire accounting period. This omission is important especially because loans' yields, which measure interest income during the period, are likely correlated with the rate of credit loss. We therefore include the following two additional risk "flow" proxies: ***the annualized ratio of the provision for loan losses to the average balance of loans***, and ***the annualized ratio of net loan charge-offs to the average balance of loans***.[9]

While the value of existing loans and the value of lending relationships generally decrease with the loans' credit risk, there is a possibly offsetting effect related to the value of relationships. Firms develop relationships with bank lenders to mitigate the costs of screening and monitoring attendant to borrowing, which are higher for high-risk firms or firms with less transparent credit risks. So high risk loans may indicate more valuable lending relationships. To the extent that opacity and relationship value

[9] Note that while gross charge-offs is affected by management discretion regarding the events that trigger charge-off, *net* charge-offs is less sensitive to variation in charge-off policies since firms that use conservative charge-off policies have large recoveries which offset the inflated charge-offs.

is paid for by borrowers – as theory suggests it should be (Rajan 1992) – those concepts should be captured in higher interest rates on loans.

Core Deposits

On the liability side, banks generate value primarily by obtaining and maintaining deposits which carry low or zero interest. The nonpecuniary benefits to depositors that are associated with deposits, along with the brick and mortar costs of producing deposits, explain why in a competitive market deposits will not pay an interest rate equal to other debt instruments. Deposits contribute, in a gross sense, to bank earnings and value creation by reducing banks' financing costs, as well as by potentially creating "cross-selling" opportunities, which allow banks to generate earnings from selling non-deposit services to depositors. So long as those gross contributions to earnings offset the incremental brick and mortar costs (non-interest expenses) of attracting deposits, attracting low-interest deposits will also make a net contribution to earnings.

In most cases, the book value of deposits, which generally equals the amount payable on demand, overstates the economic liability attached to deposits. The contribution of deposits to bank value increases with the spread between market borrowing rates and the average interest rate on deposits, since this spread reflects the impact of deposits on net interest income (compared to the alternative of funding earning assets with capital market borrowings). The value contribution of deposits also increases with service charges, cross selling opportunities for the particular customer niche, and the stability of deposits, and it decreases with non-interest costs of servicing the deposit and the forgone interest on required reserves associated with offering the deposit. These characteristics, which are captured in some of our income and cost measures, potentially contribute to our model as proxies for omitted aspects of the future value expected from deposits – the core deposit intangible – given that the intangible itself is typically omitted from the balance sheet, but is correlated with these other

characteristics.[10] Nonetheless, we expect that most of the intangible value of deposits is captured by our measures of the ratio of core deposits to equity, the composition of core deposits, and the interest rate paid on core deposits.

Core deposits consist of demand deposits and other noninterest-bearing deposits as well as most interest-bearing deposits. Interest-bearing core deposits include NOW, ATS, and other interest-bearing transaction accounts, money market deposits and other savings accounts, and time deposits of less than $100,000. Noninterest-bearing deposits may be particularly valuable if the cost to maintain them is not significantly greater than that for interest-bearing deposits. We accordingly use ***the ratio of noninterest-bearing deposits to core deposits*** in modeling the value per dollar of core deposits. We also include the following two variables.

Average interest rate on interest-bearing core deposits. This variable should be negatively related to the value created by core deposits for two reasons. First, all else equal, the economic liability associated with existing time deposits increases with their average interest rate. Second, the current interest rate on core deposits predicts future interest rates, which in turn affect the value of the core deposits intangible. [11,12]

The ratio of small-denomination time deposits to core deposits. The average interest cost and stability of deposits, and therefore their value implications, are not identical across the various categories of deposits. Although we include the average interest cost of interest-bearing core deposits as an

[10] The core deposit intangible is recognized on the balance sheet only when the branches giving rise to this asset were purchased from other banks. Organically developed core deposit intangibles are never recognized. When recognized, the core deposit intangible is amortized to earnings over a period selected by the bank.

[11] Note that the value created from a low deposit interest rate should be measured relative to some money market benchmark interest rate. Because banks participate in the same market for such instruments, and because we use cross-sectional analysis, interest rates in our model can be expressed in simple levels rather than as differentials with respect to a common market benchmark.

[12] The value of the core deposits intangible is equal to the present value of net interest savings in future periods due to the use of core deposits instead of borrowed money to fund assets, plus the value added from cross-selling services to depositors, and minus the present value of cash outflows required to obtain and maintain core deposits. The latter benefits and costs are reflected primarily in noninterest income and expense, which we account for separately.

explanatory variable, this variable is not likely to fully capture the value implications of differences in interest cost across deposit categories. For example, a bank that generates large amounts of time deposits during a period of particularly low interest rates is not likely to be able to sustain the low interest cost of deposits. In contrast, a bank that primarily provides NOW accounts for its customers is likely to have persistently low interest cost.

Noninterest Income

Non-interest income is an important source of income for most banks, especially large ones. To capture value creation related to this source of income, we define two measures of non-interest income, deflated by the adjusted book value of common equity. These variables partition non-interest income based on categories that we expect will reflect different degrees of income persistence. The more persistent the income stream, the higher should be the valuation coefficient on that income stream. By partitioning income streams according to expected persistence, which should be reflected in different coefficient magnitudes – higher magnitudes for more persistent streams – we improve the accuracy of the valuation model.

The ratio of recurring fees to adjusted book value. Recurring fees include service charges on deposit accounts in domestic offices, income from fiduciary activities, investment banking, advisory, brokerage, underwriting fees and commissions, insurance commissions and fees, and net income from servicing real estate mortgages, credit cards and other financial assets held by others. We also include in this variable unspecified sources of noninterest income ("other noninterest income"), because FR Y-9C instructions suggest that the items included in this category relate primarily to recurring activities.

The ratio of other noninterest income to adjusted book value. Some BHCs, primarily mortgage banks or the largest financial institutions, generate significant gains from activities such as trading, venture capital, securitization, and loan sale. To the extent that these gains persist over time, they should

contribute to market value incremental to the amounts already reflected in equity book value. Still, we expect that the income stream associated with these activities is likely to be viewed by the market as less persistent than income from fees.[13]

Noninterest Expense

Non-interest expenses are incurred in obtaining and servicing core deposits and loans, and in generating non-interest income. Failure to account for cross-sectional variation in these expenses, therefore, would result in biased valuation of core deposits, lending relationships and fee-related intangibles. For example, if two banks had the same composition of deposits, but one could achieve that composition with lower noninterest expenses related to deposit acquisition (so-called "brick and mortar costs"), then that bank would be more valuable. We measure non-interest expense as the total of salaries and employee benefits, expenses of premises and fixed assets, and "other non-interest expense," divided by the adjusted book value of common equity. We exclude amortization and impairment charges because we do not include the book value of intangibles in our model, but rather focus on their earnings-generating ability. To the extent that intangible assets have been impaired, this will be captured in our model by the lower associated earnings stream.

Size

Large banks may enjoy implicit government subsidies by virtue of their size – that is, they may be perceived to be "too big to fail" (O'Hara and Shaw, 1990; Stern and Feldman 2004). They also may have more market power (e.g., Berger, Demsetz, and Strahan, 1999), enjoy economies of scale (e.g., Sitroh, 2000; Hughes, Mester and Moon, 2001) or scope (e.g., Demsetz and Strahan, 1997), or benefit

[13] In addition to noninterest income, BHCs income statements include net gains (losses) on realized gains and losses on held-to-maturity and available-for-sale securities. These gains and losses are highly transitory so their value effect is generally captured by existing assets (e.g., the cash that was received when the gain or loss was recognized). In fact, net gains are sometimes associated with negative firm performance. Several studies have demonstrated that realized securities gains and losses are used for earnings, capital and tax management (e.g., Warfield and Linsmeier, 1992; Collins, Shackelford and Wahlen, 1995), so that firms are more likely to realize gains when they have low earnings, low regulatory capital, or negative taxable income.

from increased diversification (e.g., Penas and Unal, 2004). Compared to small banks, large banks also may have greater financial flexibility, as they may be able to obtain capital market funds more readily when needed (e.g., Jayaratne and Morgan, 2000; Kashyap and Stein 1995, 2000). Size may also proxy for some of the omitted details of banks' activities and strategies (e.g., small banks rarely engage in some types of trading activities) and may affect the cost of capital (e.g., large banks may have lower information risk and higher stock liquidity). Given the importance of firm size in explaining market-to-book ratios as well as the non-linearity of this relationship, we include four BOX-Cox transformations of firm size, measured using total assets (λ = 0, -.33, -.67, -1).

Interest Rate Risk Exposure

The value of fixed-rate financial instruments is inversely related to interest rates. Therefore, the sensitivity of the market value of equity to changes in interest rates should be related to the difference between fixed-rate earning assets and fixed-rate financial liabilities. BHCs do not report data that would permit a full analysis of the "duration gap" of each bank (that is, a measure of interest rate risk exposure of equity that is based on the Macaulay duration of bank assets and liabilities). Instead, as a proxy for the duration gap, we use ***the difference between fixed-rate earning assets and fixed-rate financial liabilities, divided by the adjusted book value of common equity***. This rough measure compares the magnitude of net assets exposed to interest rate risk with total net assets (i.e., common equity), without taking account of cross-bank differences in the durations of their fixed-rate earning assets or fixed-rate financial liabilities.

Many banks engage in the so-called "carry trade" – a strategy whereby an investor borrows at a relatively low interest rate, and then uses the proceeds to buy securities with higher yields, typically further out in the yield curve. In doing so, banks earn higher returns from bearing interest rate risk. Banks take advantage of this strategy by borrowing short-term funds and buying bonds, primarily

mortgage-backed securities (MBS). If the value impact of carry trade-related earnings is larger than the risk effect – that is, if banks have a greater ability to absorb interest rate risk than other investors – their value should increase with the difference between fixed-rate earning assets and fixed-rate financial liabilities.

Furthermore, this gap variable is also relevant as a proxy for the ex post impact of interest rate exposure. For example, in periods of increasing interest rates, a positive (negative) gap implies a declining (increasing) market value of equity, and vice versa in declining interest rate environments. Thus, our estimated effects of interest rate risk combine expected discounted risk-adjusted gains/losses with those that are realized during the sample period.

Capital Adequacy

The capital position of the bank may be value-relevant for several reasons. First, BHCs with high capital ratios pay lower FDIC insurance premiums, incur lower regulatory costs and risks, and have higher flexibility in operations and greater ability to grow.[14] Second, related to the previous point, high capital ratios may reflect the purposeful accumulation of capital to facilitate value-creating growth. Capital in excess of regulatory requirements creates option value for banks by allowing them to forego having to raise external equity in the market (which would entail physical costs of underwriting, as well as adverse-selection announcement effects on the value of bank stock). Third, excess capital may proxy for market power or franchise value, since banks with greater market power may perceive that they have more to lose from regulatory intervention than other banks (e.g., Keeley, 1990) and consequently have a

[14] For example, undercapitalized banks are required to submit capital restoration plans to regulators and are subject to restrictions on operations, including prohibitions on branching, engaging in new activities, paying management fees, making capital distributions such as dividends, and growing without regulatory approval. They may even be required to dispose of assets. Some of these costs and restrictions also apply to banks that are classified as adequately capitalized, especially restrictions on growth and new operations. In general, there is probably a monotonic relationship between capital ratios and regulatory costs and restrictions.

greater incentive to maintain excess capital. These effects suggest that the market-to-book ratio should be positively related to measures of capital adequacy.

On the other hand, to the extent that banks may seek to benefit from the value of safety net protection (via deposit insurance and anticipated government bailouts), they may be rewarded by the market for undertaking higher leverage (e.g., Brewer 1995). Adrian and Shin (2009) argue that the rise in leverage by financial institutions leading up to the crisis was a key contributor to the severity of the crisis, and Cheng, Hong and Schenkman (2010) argue that institutional investors may have actively encouraged financial institutions to take on greater leverage, rewarding them for doing so with higher demand for their shares, and thus, higher market values.

Another reason that market-to-book ratios may be positively related to leverage is unobserved cross-sectional heterogeneity related to aspects of risk that are not captured fully by the measures of risk in our model. A high level of bank capital may indicate relatively risky operations or opaque assets (e.g., Calomiris and Wilson, 2004) which require more of a capital cushion. This effect might lead to a negative observed empirical relationship between capital adequacy and bank value given the incomplete measurement of risk in our model. Moreover, higher capital could reflect a lack of positive net present value investments or the presence of inefficient management which fails to maximize the net benefits from leverage; in that case, higher capital should also have negative consequences for the market-to-book ratio.[15] Therefore, the empirical relationship between the market-to-book ratio and measures of capital adequacy is an open question. Still, the above arguments suggest that capital ratios may explain cross-sectional variation in market-to-book ratios and should therefore be included in our analysis.

In evaluating capital adequacy, regulators use various capital ratios and apply different benchmarks to those ratios. They also use other relevant information (e.g., the fair values of instruments

[15] Benefits from leverage include the ability to increase the asset base (and consequently income), the tax-benefits of debt and, specific to banks, the maximization of the deposit insurance put option.

that are measured at historical cost for regulatory capital purposes). Indeed, research has demonstrated that regulatory capital measures are more "noisy" than book capital in reflecting capital adequacy (e.g., Blankespoor at el. 2011). We therefore measure capital adequacy using the ratio of ***the adjusted book value of common equity to total assets***.[16]

Dividends

Firms are reluctant to cut dividends (e.g., Lintner, 1956). Hence high dividend payments may indicate management expectations of higher earnings or more sustainable earnings, ceteris paribus, both implying a positive relationship between the market-to-book ratio and dividend payments. More generally, dividends may be a signal of the unobserved qualities of a bank. If earnings and risk are measured with error, then banks with better asset quality and management may use dividends to signal their unobservable quality. The signaling role of dividends may be especially important for banks, since banks that are perceived as weak by their regulators – based on supervisory examinations, which include privileged as well as public information – sometimes are restricted in their ability to pay dividends, giving dividend payout even more significance as a proxy for the bank's strength. We therefore include ***the ratio of cash dividends declared on common stock to the adjusted book value of common equity***.

3. EMPIRICAL ANALAYSIS

Sample and Data

We extract all accounting data from regulatory consolidated financial statements (FR Y-9C reports) that BHCs submitted to the Federal Reserve System for the period Q1:2000-Q3:2011. Under the Bank Holding Company Act, BHCs with total consolidated assets above a certain threshold amount, or that satisfy certain other conditions (e.g., have public debt), are required to file the FR Y-9C report on a

[16] Adding regulatory capital measures alongside the book value of common equity has an insignificant effect, and does not materially affect the results reported here.

quarterly basis. The asset-size threshold for filing the FR Y-9C report was $150 million through the fourth quarter of 2005, after which it was increased to $500 million. To make the sample comparable over time, we delete observations with total assets less than $500 million in March 2006 prices.

FR Y-9C reports contain a uniform and detailed calendar year-to-date income statement, an end-of-quarter balance sheet, and supplementary information. Approximately two months after the end of each calendar quarter, the Federal Reserve creates a file with data for all domestic BHCs and makes it available on its web site.[17] To create our sample, we downloaded these files and merged them with the quarterly COMPUSTAT files and CRSP files to obtain market value and return data.[18]

We start the sample period in 2000 primarily because many of the variables we use were added to FR Y-9C reports in 2000. We measure all income statement quantities combining the trailing four quarters of data to eliminate the effects of seasonality and smooth out short-term shocks. To mitigate the impact of outliers, we trim extreme values of each of the analysis variables (listed in Exhibit 1).[19] Summary statistics from the distributions of these variables are provided in Table 1.

[Table 1 about here]

Preliminary Results and Model Statistics

Due to the large number of regressions (one for each of 47 quarters), and given our focus on time-series patterns, we present our main results using time-series plots. To ease pattern identification over time, all

[17] FR Y-9C reports are available at http://chicagofed.org/applications/bhc_data/bhcdata_index.cfm.

[18] To identify CUSIPs, we first used a dataset that is provided by the federal reserve bank of New York (http://www.newyorkfed.org/research/banking_research/datasets.html), which documents the historical linkage between regulatory entity codes and CRSP permcos for publicly traded banks and bank holding companies. The link is valid through December 2007 for supervised institutions that are listed on the NYSE, AMEX, or NASDAQ. We supplemented this matching with an alternative matching that we developed, which uses COMPUSTAT and FR Y-9C data and considers bank name and financial characteristics. We verified that all matches are valid and unique.

[19] Extreme values of the variables are identified using the following procedure. For each variable, we calculate the 1st and 99th percentiles of the empirical distribution (P1 and P99 respectively) and trim observations outside the following range: P1 – 0.5 × (P99 – P1) to P99 + 0.5 × (P99 – P1). For normally distributed variables, this range covers approximately 4.7 standard deviations from the mean in each direction (= 2.33 + .5 × (2.33 - (-2.33)), which is more than 99.99% of the observations. For variables with relatively few outliers, the percentage of retained observations is also very high (often 100%). However, for poorly-behaved variables a relatively large proportion of the observations is deleted.

plots are smoothed using a spline function (Reinsch 1967). As an alternative way to describe our results, we also report four sets of panel data regressions which pool data for different sample periods, namely, the entire sample, and three sub-periods: the pre-crisis (Q1:2000-Q2:2007), the crisis (Q3:2007-Q4:2009), and the post-crisis (Q1:2010-Q3:2011). The three sub-periods were characterized by very different market conditions, as indicated by the differences in the period-specific average values of the variables in Table 2.

[Table 2 about here]

Turning to the panel data regressions, the results, reported in Table 3, demonstrate the instability of many of the coefficients across the different sub-periods. We therefore focus on the cross-sectional regressions, although many of the patterns that emerge in the cross-sectional regressions are also reflected in the sub-period panel data regressions.

[Table 3 about here]

Figure 1 presents statistics from the cross-sectional distribution of the market-to-book ratio for each quarter during the period Q1:2000-Q3:2011. The market-to-book ratio has declined from an average of more than two prior to the financial crisis to about one in 2011. The cross-sectional variation in the market-to-book ratio has also declined significantly since the beginning of the financial crisis, although there is still substantial variation in the sample throughout. The bottom 10^{th} percentile of the market-to-book value began the sample period with values at or above one, but at the height of the crisis, it fell to less than one third.

[Figure 1 about here]

Figure 2 presents summary statistics from the 47 separate cross-sectional quarterly regressions (Q1:2000-Q3:2011) of the valuation model. The number of observations each quarter ranges between 250 and 350, with a maximum reached just prior to the beginning of the financial crisis. Thus, although the number of estimated parameters is quite large – 21 per regression – in each of the regressions there

are more than 5 observations per parameter (an often-used rule of thumb). The R-squared is very high throughout the sample period, indicating that the model performs well in explaining value. Since the early 2000s, there is a slight positive trend in R-squared, which is due to a strong declining trend in the RMSE. The decline in RMSE is consistent with the decline in the cross-sectional dispersion of the market-to-book ratio (see Figure 1).

[Figure 2 about here]

Lending

Panels A and B of Figure 3 plot the cross-sectional coefficients and t-statistics, respectively, for each of the five variables used to model value creation per dollar of loans. Since the beginning of the financial crisis, all the coefficients appear to converge toward zero. This is due in part to a decline in the explanatory power of the variables (particularly loans' yield), but also to the large increases in the variability of the credit loss variables (not shown in the figure). Indeed, the magnitudes of the t-statistics of the credit loss variables have not changed significantly.

[Figure 3 about here]

As expected, value creation per dollar of loans increases with the average yield on loans. In fact, loans' yield was by far the most important determinant of the value of loans throughout most of the sample period. However, as noted above, this variable lost its explanatory power during and after the financial crisis. A possible explanation for the decline in the significance of the loans' yield coefficient is the increase in investors' risk aversion since the financial crisis. High-yield loans are on average more risky than other loans, perhaps increasingly so, and perhaps in ways that are not fully captured by the credit risk variables.

Consistent with prior research (e.g., Beaver et al., 1989) the provision and allowance for loan losses do not subsume the information about credit risk contained in nonperforming loans and loan charge-offs. In fact, nonperforming loans is the only variable that was consistently significant

throughout the sample period; in contrast, the allowance coefficient was insignificant throughout the sample period. The coefficient on the provision for loan losses was marginally significant during recessions (in 2001 and during the financial crisis) and was insignificant in other periods. Net charge-offs exhibits the opposite pattern. It appears that during recessions the provision variable captures real losses, while at other times it is "noisy" and possibly "managed." In contrast, charging-off loans during recessions may indicate a willingness to "clean the books" and recognize the required provisions (charge-offs reduce the allowance and so often lead to increased provisions), which may explain the positive effect of charge-offs during the financial crisis.

Panel C of Figure 3 presents statistics from the cross sectional distribution of the predicted bank/quarter-specific value creation per dollar of loans, calculated as the fitted value from that portion of the model that explains value creation per dollar of loans. Prior to the financial crisis, each dollar of loans on average generated more than five cents of value. However, at the height of the financial crisis, the average value creation by loans was negative. This is probably due to a combination of factors, including (1) the large increase in the loans' credit risk (see the period-specific average values of the credit risk variables in Table 2), (2) the increase in the pricing of credit risk, as measured by credit spreads (discussed below), (3) the negative effect on the bank's own liquidity position during the crisis from having to provide credit to its existing borrowers (Ivanova and Scharfstein 2009), (4) a decline in the value of lending relationship due to lower expected loan growth, and (5) an increase in the opacity of loans combined with the price discount for opacity.

To the extent that loan relationships are durable, the expected value creation in future lending is correlated with value creation in past lending, and thus the estimated value creation per dollar of loans measures the long-term value of lending-related intangibles. However, this estimate does not reflect any value due to cross-selling, which is captured by other variables in the model (e.g., taking borrower

deposits, earning noninterest income by providing services to borrowers), nor does it reflect the noninterest expense that banks incur in generating and servicing the loan portfolio. The noninterest income and expense variables, as well as the deposit variables, are discussed below.

Panel C of Figure 3 also shows that the cross-sectional variation in estimated loans' value creation declined substantially since the beginning of the financial crisis. This trend likely reflects the fact that during the crisis the negative aspects of borrower relationships listed above, which drove the declining value of loans for all banks during the crisis, were more similar among banks than were the positive values of borrower relationships during the pre-crisis period. The positive aspects (the quasi rents associated with different borrowers) became less relevant than the negative aspects during the crisis, which compressed the cross-sectional variation of the value contribution of loans. Other contributing factors to the decline in the cross-sectional variation in estimated loans' value creation likely include the increase in the opacity of loans, and the heightened pricing of loans-related off-balance sheet exposures (e.g., Bank of America exposures related to Countrywide's mortgages), which are at best weakly captured by the model's variables.

Increased risk, increased opacity, and adverse liquidity consequences for banks of borrower relationships during the crisis, all imply that the value of loans should vary inversely with the Baa rate on bonds, which captures both a rising physical risk premium and a rising liquidity premium during the crisis (Schwarz 2010). Panel D of Figure 3 shows that there is a strong negative contemporaneous correlation between the implied loans' fair value and the yield on Baa-rated bonds. Unemployment and industrial production also co-vary with the value of loans, but less robustly.

Core Deposits

Panels A and B of Figure 4 plot the time series of the cross-sectional coefficients and t-statistics, respectively, for each of the variables used to model value creation per dollar of core deposits. All

variables have the expected signs and are statistically significant (note that consistent cross-sectional significance, even if marginal, implies strong overall significance, as reflected in the t-statistics of Table 3). Non-interest bearing deposits are more valuable than NOW and savings accounts (the omitted category), which in turn are more valuable than time deposits. High interest rate deposits are less valuable than low interest rate ones. Unlike the loans variables, the deposits variables remained significant during the financial crisis.

[Figure 4 about here]

Panel C of Figure 4 presents statistics from the cross sectional distribution of the predicted bank/quarter-specific value creation per dollar of core deposits, calculated as the fitted value from that portion of the model that explains value creation per dollar of core deposits. As expected, value creation per dollar of core deposits is quite substantial. As in the case of the loans' value creation estimate, however, it is important to bear in mind that the estimate of core deposit's value creation does not reflect the costs associated with obtaining and servicing deposits, nor does it reflect the service charges earned on deposits or the value of cross-selling opportunities that deposits create.

Similar to the loans' value creation statistics, the cross-sectional dispersion of value creation per dollar of core deposits has declined over time. However, unlike the loans-related statistics, the cross-sectional variation in core deposits' value creation remained substantial during and after the crisis.

Panel D of Figure 4 plots the average value creation per dollar of core deposits over time in relation to relevant macro variables. As one would expect, the time-series pattern of core deposits' value creation is consistent with changes in the interest rate environment. Reductions (increases) in interest rates, primarily long-term ones, lead to declines (increases) in value creation per dollar of core deposits. That is, core deposits do not save interest cost as much when interest rates on non-core debts are low.

One interesting fact shown in Panel D of Figure 4 about which we did not have strong priors is the lead-lag relationships between interest rates and value creation from core deposits. Changes in

interest rates significantly lead (i.e., come before) the change in estimated value creation. It appears that it takes investors significant time to fully understand the implications of changes in interest rates for the value of core deposits. The fact that changes in long-term rates have larger effect than changes in short-term rates is consistent with the "stickiness" of core deposits. But if core deposits are sticky, then the value consequences of an interest rate decline should be predictable, and thus it is surprising that investors' react with a substantial lag to the decline in interest rates.

Noninterest Income and Expense

Panel A of Figure 5 plots the time-series of the cross-sectional coefficients of the noninterest income and expense variables. As expected, recurring fees have a greater impact on bank value than other sources of noninterest income. However, the difference is not as large as might have been expected. In particular, income from trading, securitization, loan sale, and similar activities had a large capitalization coefficient in the first half of the last decade (about 4). Similar to noninterest income, the magnitude of the coefficient on the level of noninterest expense is large, suggesting that this variable is highly persistent. The capitalization rates or "earnings response coefficients" associated with noninterest income and noninterest expense have monotonically declined during the sample period.

[Figure 5 about here]

The decline in the capitalization rates (coefficients plotted in Panel A of Figure 5) is not merely due to increased "noise." As shown in Panel B of Figure 5, the coefficients remained significant, and the decline in the t-statistics is smaller than the decline in the coefficients. It appears that since the financial crisis investors view these sources of income and expense as either less persistent, more risky, or otherwise less valuable than in the past.

Bank Attributes

Panels A and B of Figure 6 present the time series of the cross-sectional coefficients and t-statistics, respectively, for the bank attributes. By far, the most significant variable since the financial crisis is the

dividend-to-book ratio. This variable captures much of what is missing from the financial statements – weak banks, including those with significant off-balance-sheet loss contingencies, pay low (if any) dividends. If dividends have a signaling role related to unobserved bank quality, then one would expect the magnitude of the effect of dividends to rise during times of greater uncertainty. That is, indeed, what we find; the magnitude of the effect of dividends on market values as well as its significance increased dramatically during the financial crisis.

[Figure 6 about here]

The value effects of the other bank attributes were even less consistent over the sample period. The "carry trade" contributed to bank value primarily in periods of upward slopping term structure (note that the term premium plots presented in Figure 6 measure the difference between the one- and ten-year Treasury rates, not a coefficient or t-statistic). High leverage increased the market-to-book ratio during "normal" times, but reduced it during the financial crisis. The shifting market consequences of leveraging are most consistent with the view that market participants encouraged high leverage of banks (perhaps to maximize the value of the safety net put option they enjoyed), as argued by Cheng, Hong and Schenkman (2010), but that once the crisis began, banks with lower leverage experienced less counterparty risk and were able to maintain their operations better than those that were scrambling to liquidate assets and shore up their positions more as a consequence of their higher leverage.

Summary of Average Value Creation

We next calculate total value creation for each of the three primary groups of activities – lending, core deposits, and all other activities. Figure 7 plots the time series of the cross sectional averages of value creation in each activity. On average, most of the market-to-book premium, and its change over time, is due to the value associated with traditional lending and deposit taking activities. Of the three sources of value creation, deposits are the only activity that consistently contributed to value creation, at least on average. In particular, the persistent value of deposits was a helpful stabilizer during the financial crisis.

However, in the post-crisis, low-interest rate environment, banks apparently lost much of the value creation associated with this important activity.

[Figure 7 about here]

Figure 7 also is useful for gauging the extent to which unrecognized expected losses can explain the decline in the market-to-book ratio during the crisis. Note that the potential effects associated with the under-valuation of mortgage-backed securities (discussed by Huizinga and Laeven 2011) cannot contribute to the variation measured in Figure 7, since we removed any potential valuation treatment effects by valuing all securities at their fair value (see our discussion in Section 2). Of course, any effect from misevaluation of mortgage-backed securities would be very small compared to the swing in the market-to-book ratio observed in Figure 7, since non-government guaranteed MBS were less than three percent of total assets as of June 2007.

Unrecognized loan losses, however, could be a significant contributor to the swing in the market-to-book ratio shown in Figure 7. Those unrecognized losses are of two kinds: the failure to properly recognize incurred losses, and the failure to incorporate expected but not incurred losses into provisions for loan losses. GAAP requires recognition of the former but disallows recognition of the latter.

How much of the swing in the market-to-book ratio is due to unrecognized losses? The graph of the value creation associated with loans reflects three kinds of influences: the value of relationships, unrecognized losses, and changes in the valuation of loan risk. The variables in our model cannot reliably decompose those influences. In particular, the effects associated with changes in loan yields likely reflect a mix of all three influences. The upturn in the loan value creation graph after 2008, we would conjecture, is driven more by the change in the pricing of risk than by the perceived reduction in expected loan losses, but in general, the three influences are almost impossible to disentangle. Nevertheless, we can bound the total potential contribution of unrecognized expected loan losses over the period 2004 to 2010 by comparing the loan value creation graph with the total value creation graph.

Of the total swing in value creation from about 1.5 in 2004 to 0 in 2010 only about 40 percent of that change can be attributed to value creation changes associated with lending. Thus, most of the swing in the market-to-book ratios of banks from 2004 to the present reflects influences other than unrecognized loan and securities losses.

To What Extent Did Fundamentals Capture Changes in the Average Market-to-Book Ratio During the Financial Crisis?

Our analysis shows that the marked decline in banks' market-to-book values during the crisis reflects a variety of influences. One way to decompose the change in the average market-to-book ratio over time is to divide it into two components: the portion explained by the changes in fundamentals, and the portion explained by changes in estimated coefficients. The latter component captures the effects of both changes in the pricing of the fundamentals (the slope coefficients) and changes in expected losses and other factors unrelated to the fundamentals (the change in the intercept).

Figure 8 plots the average change in the market-to-book ratio each quarter (y-axis) against the predicted change in the market-to-book ratio (x-axis), calculated by applying the prior quarter's estimated coefficients to the current quarter changes in the fundamentals. If changes in the fundamentals fully capture changes in the average market-to-book ratio, all points should lie on the 45^{o} line. If changes in the fundamentals, within a stable regression model, can only partially explain changes in the average market-to-book ratio, the relationship should be positive but imperfect, as is indeed the case. Still, the slope coefficient is close to one and is highly significant (slope = 1.21, t-statistic = 4.2). Thus, the fundamentals appear not only to explain cross-sectional differences in the market-to-book ratio but also to account for a significant portion of the time-series variation.[20]

[Figure 8 about here]

[20] To evaluate the robustness of these findings, we repeated the analysis using the quarterly median (rather than mean) values of the actual and predicted changes in the market-to-book ratio. The results are very similar to those reported.

As expected, Figure 8 indicates that the largest declines in the average market-to-book ratio occurred during the financial crisis (Y08Q4, Y08Q3, and Y07Q3). In each of these quarters the fundamentals captured a significant portion of the decline, but in two of the quarters (Y08Q4 and Y07Q3) most of the decline was due to changes in the coefficients. Interestingly, subsequent quarters (primarily in 2009) are substantially above the 45^{o} line, suggesting that during 2007 and 2008 market prices declined in anticipation of losses that materialized and were primarily reflected in the fundamentals during subsequent quarters. One interpretation of this result (e.g., Huizinga and Laeven 2011) is that banks used accounting discretion to delay the recognition of losses. Of course, under GAAP, at least a portion of the anticipated losses was not supposed to be recognized. Banks are required to recognize loan losses when losses are incurred, not when they are expected: "under GAAP, the purpose of the ALLL [allowance for loan and lease losses] is not to absorb all of the risk in the loan portfolio, but to cover probable credit losses that have already been incurred."[21]

Figure 9 is identical to Figure 8, but is constructed over longer intervals of time. Rather than capture the relative importance of changes in fundamentals vs. model coefficients quarter-by-quarter, Figure 9 considers changes that occurred within four long sub-periods – Q1:2000-Q1:2003, Q1:2003-Q1:2006, Q1:2006-Q4:2008, and Q4:2008-Q3:2011. These sub-periods correspond to the early pre-crisis period, the pre-crisis boom, the change from the peak of the boom to the height of the crisis, and the post-crisis period.

[Figure 9 about here]

Figure 9 shows that changes in fundamentals, rather than changes in model parameters, account for most of the changes in market-to-book values that occur during our sample period. Specifically, using Q1:2000 parameters, the mean predicted change in the market to book value based on changes in

[21] The Interagency Policy Statement on the Allowance for Loan and Lease Losses, issued by the federal financial institution regulatory agencies in December 2006 (http://www.fdic.gov/news/news/financial/2006/fil06105a.pdf).

the fundamentals from Q1:2000 to Q1:2003 is -0.215, while the actual change is 0.253. Using Q1:2003 parameters, the mean predicted change in the market to book value based on changes in the fundamentals from Q1:2003 to Q1:2006 is 0.347, while the actual change is 0.328. Using Q1:2006 parameters, the mean predicted change in the market to book value based on changes in the fundamentals from Q1:2006 to Q4:2008 is -1.225, while the actual change is -1.628. Using Q4:2008 parameters, the mean predicted change in the market to book value based on changes in the fundamentals from Q4:2008 to Q3:2011 is -0.016. The actual change is -0.010. Thus, for the most part, the overwhelming majority of changes reflect fundamental changes rather than changes in model parameters. For the period Q1:2006 to Q4:2008, during which the change in market-to-book values is the greatest, changes in fundamentals using the pre-crisis model parameters explain roughly three-fourths of the changes in market-to-book values.

4. CONCLUSION

We examine the market valuation of banking activities and how the market-to-book values of U.S. bank holding companies have changed over the last decade, focusing on the effects of the financial crisis. Standard methods for valuing nonfinancial firms do not lend themselves to the valuation of bank holding companies, due to fundamental differences between the structures and functions of financial intermediaries and nonfinancial firms. Debt is not just a financing source for banks; when it takes the form of deposits it is one of the value drivers of the banking franchise. For nonfinancial firms, EBITDA or some related measure of operating income is used to measure current and prospective cash flows. But income streams of banks do not lend themselves to this approach, since bank income flows from differing sources of interest income, noninterest fee income, and trading income, which differ in their margins of profitability and in their persistence.

Our valuation model recognizes that (1) banks create value through the types of assets and liabilities that they create (e.g., lending and deposit relationships), (2) bank income streams are heterogeneous, differing in their profitability and persistence, and (3) valuation of assets, liabilities or income streams varies over time depending on changing market conditions. This approach explains substantial cross-sectional variation in observed market-to-book values, allowing us to identify the market pricing of various banking activities and changes in market pricing over time.

We find that the declines in bank stock values since 2007 reflect declining values of various categories of banking activity (e.g., lending and deposit taking). These valuation consequences were associated with identifiable changes in market conditions (e.g., interest rate levels and term structure), suggesting that future changes in market conditions – especially with respect to interest rates – are likely to have important consequences for bank valuation. Dividend payments matter for market values, too, and increasingly over time. "Carry-trade" effects from taking on interest rate risk are also apparent. Finally, the effects of leverage on bank valuation changed sign during the crisis; while the market rewarded high leverage with higher market values prior to the crisis, leverage become associated with lower values during and after the crisis.

Contrary to the view that the decline in market-to-book values for U.S. banks from 2006-2011 mainly reflect unrecognized losses, we find that other factors explain most of the decline in market-to-book ratios. Furthermore, although model parameters do change over time, more than three-quarters of the change in market-to-book values that occurred from 2006 to the end of 2008 were predictable based on changes in fundamental determinants of value using the model coefficients estimated in 2006.

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Figure 1: Cross-sectional Distribution of the Market-to-book Ratio

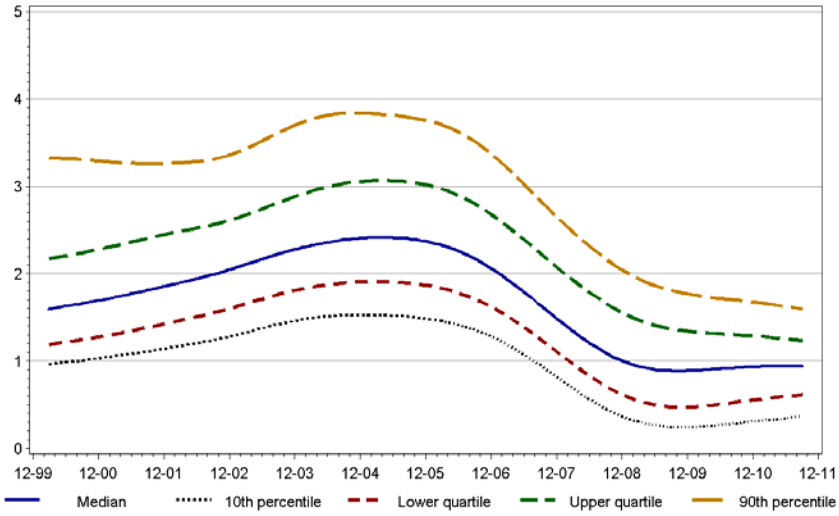

Figure 2: Model Statistics

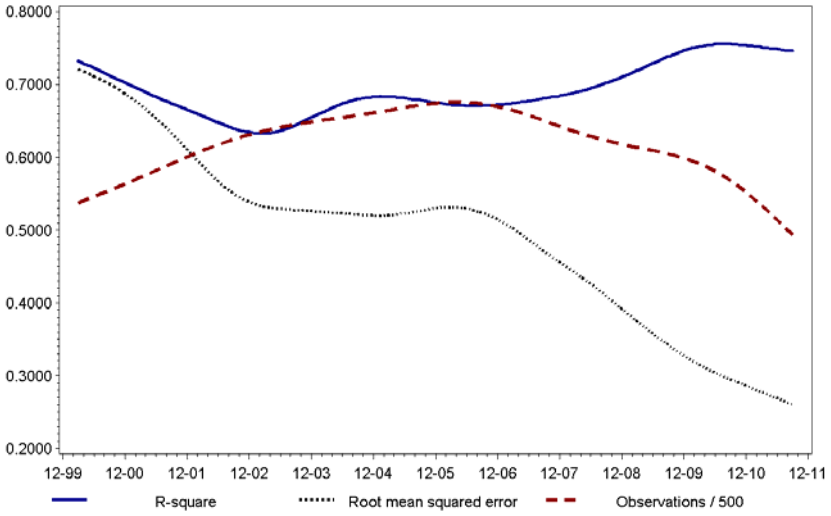

Figure 3: Estimates of the Loans' Value Creation Equation

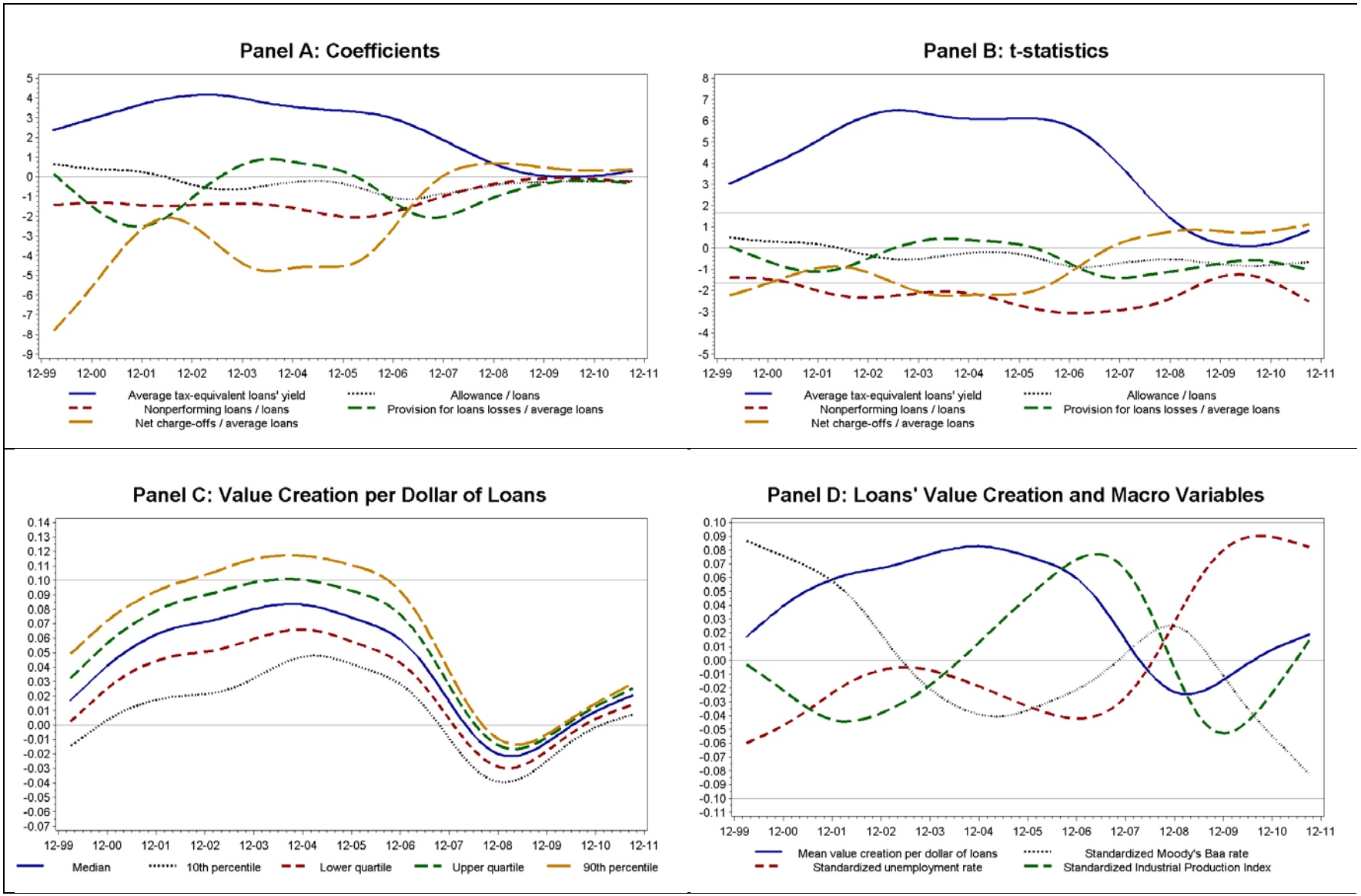

Figure 4: Estimates of the Deposits' Value Creation Equation

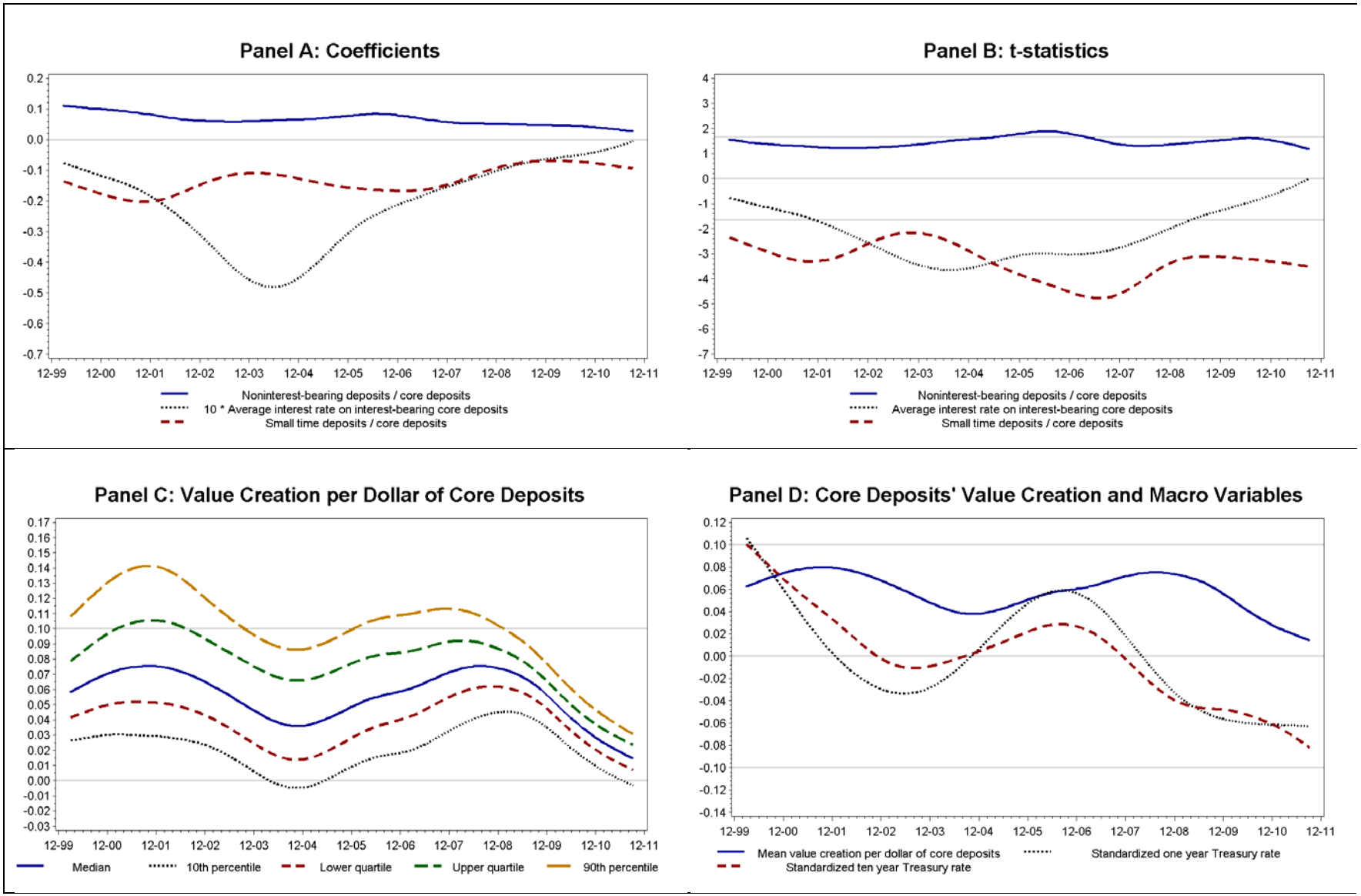

Figure 5: Noninterest Income and Noninterest Expense

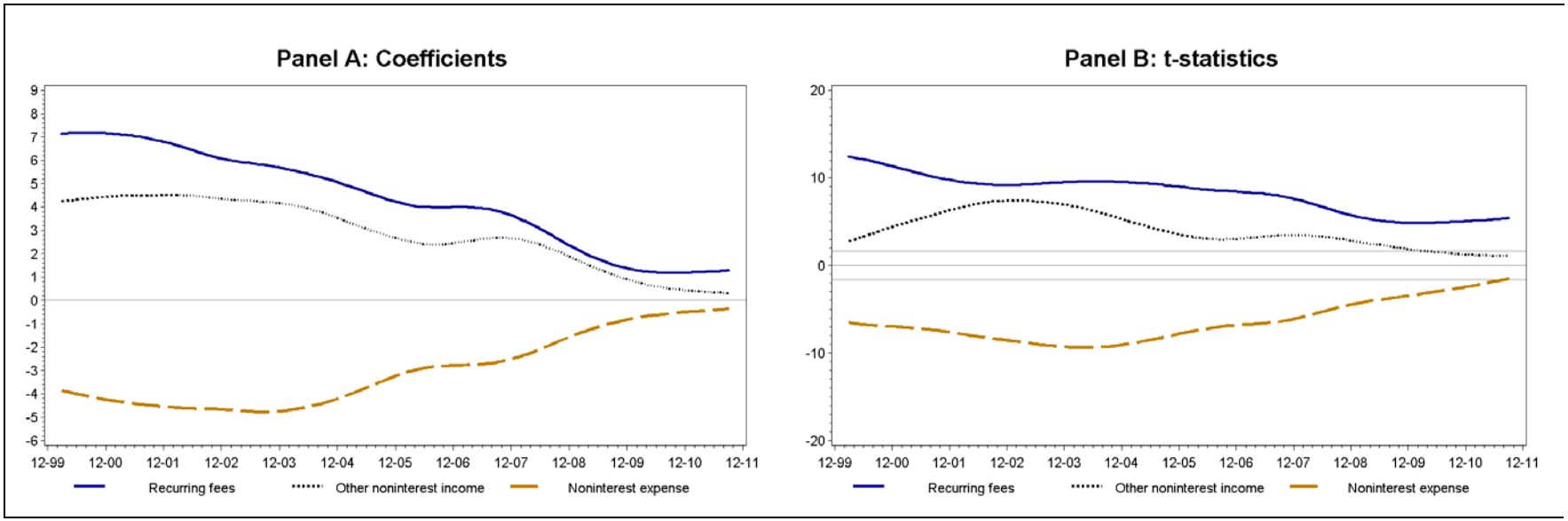

Figure 6: Bank Attributes

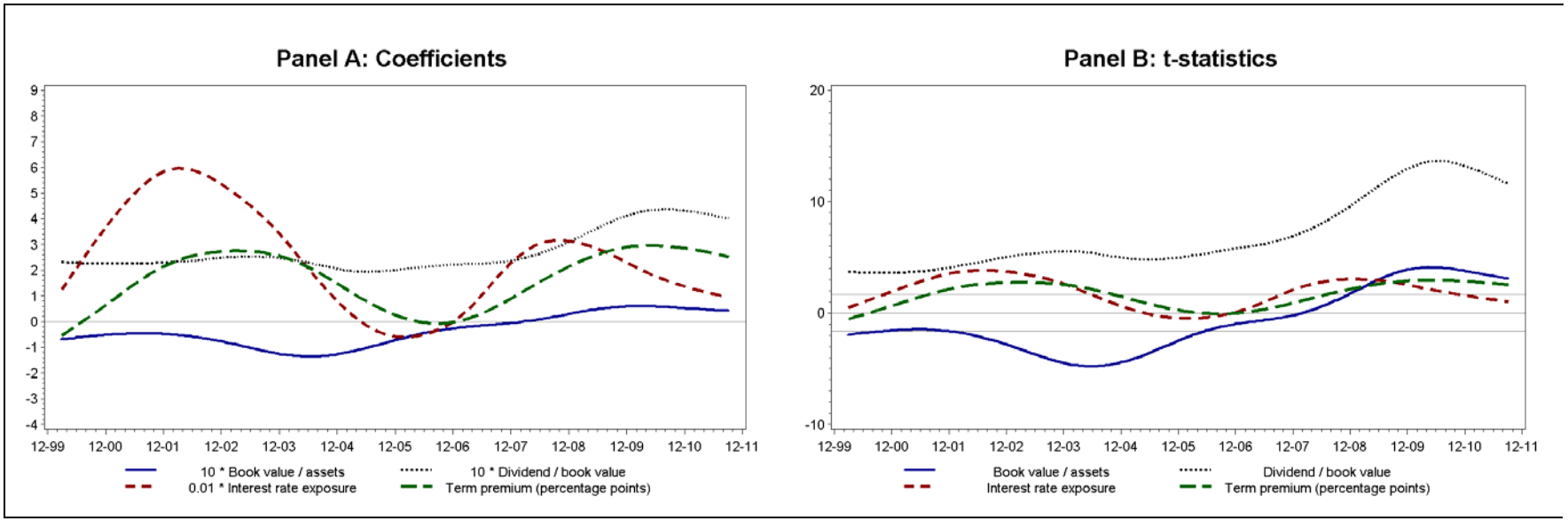

Figure 7: Mean Value Creation by Activity

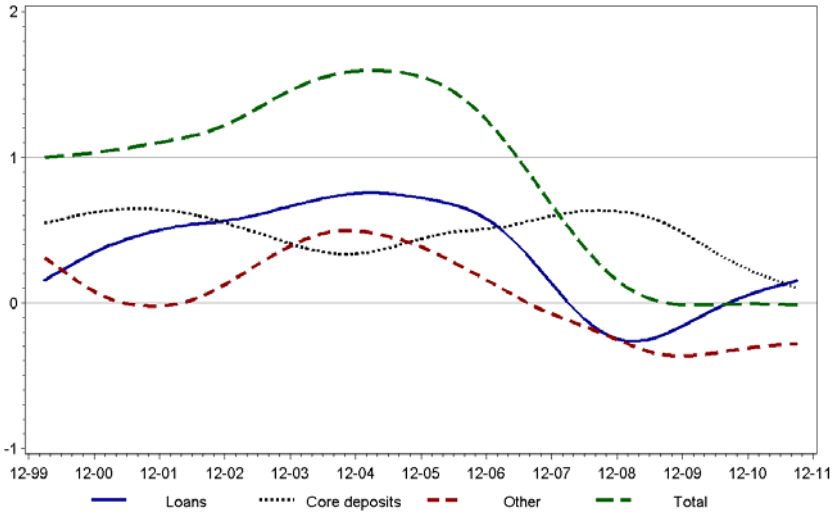

Figure 8: Decomposition of the Average Change in the Market-to-Book Ratio Quarter-by-Quarter

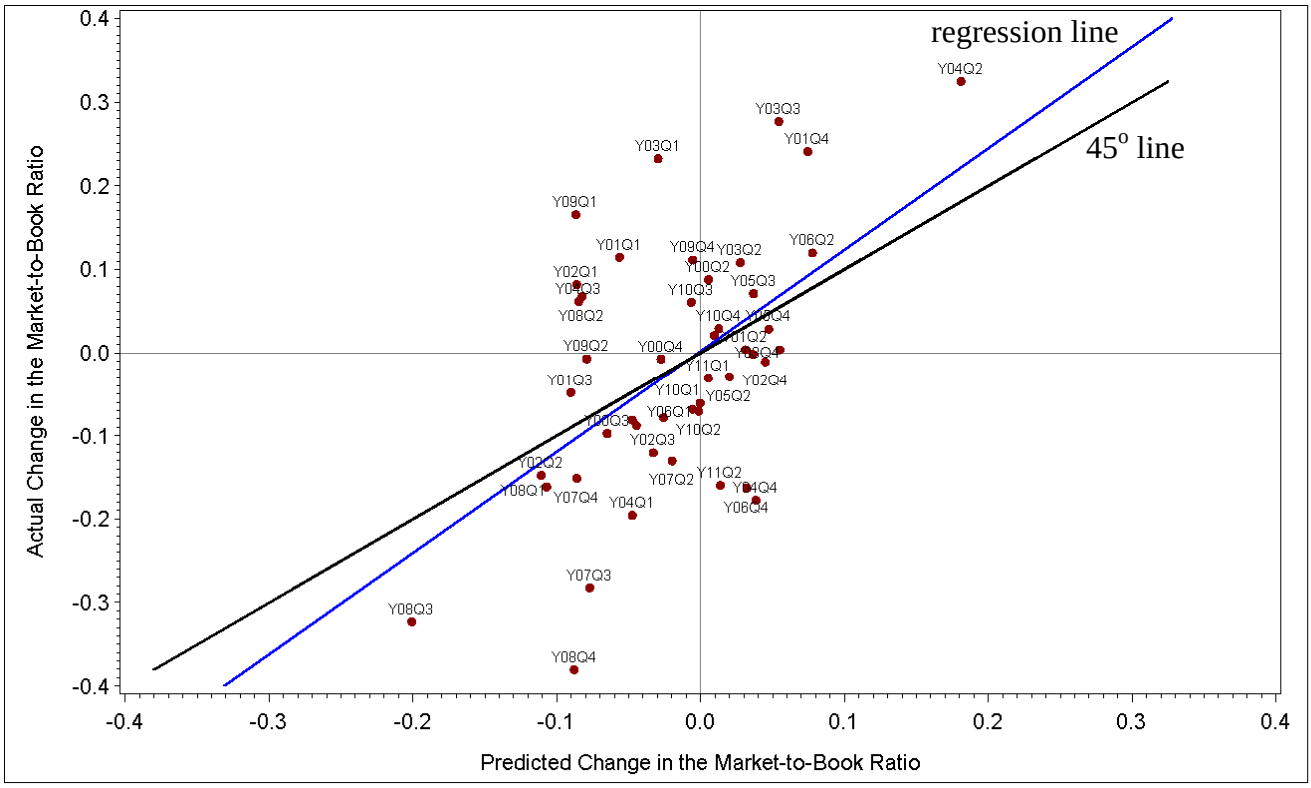

Figure 9: Decomposition of the Average Change in the Market-to-Book Ratio Over Long Sub-Periods

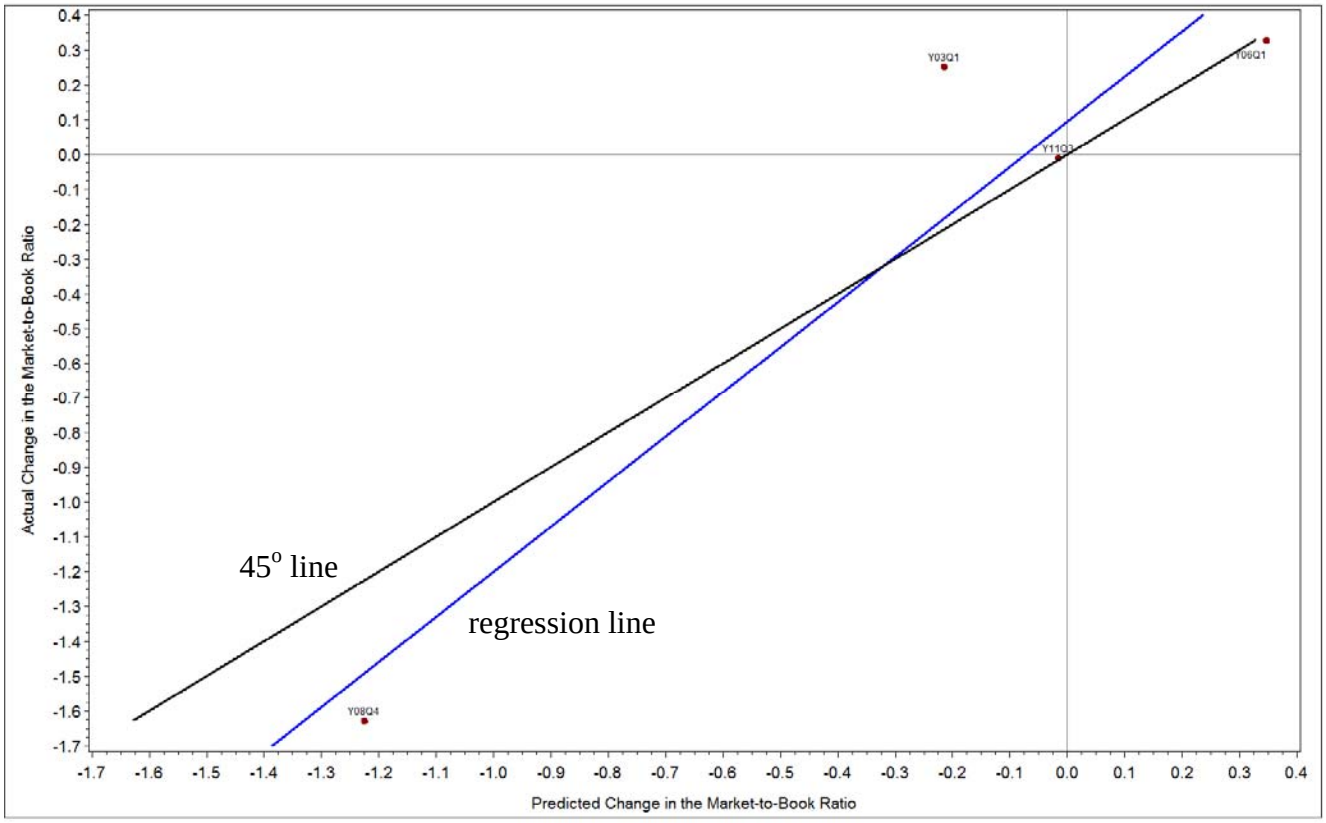

Table 1
Summary Statistics for the Full Sample

	Obs.	Mean	SD	5%	25%	Med.	75%	95%
Adjusted market value / adjusted book value	15,846	1.913	1.129	0.408	1.181	1.752	2.433	3.892
Gross loans / adjusted book value	16,185	9.186	3.340	4.591	7.252	8.918	10.796	14.219
Average tax-equivalent loans' yield	15,596	0.070	0.013	0.053	0.061	0.069	0.079	0.093
Allowance / gross loans held for investment	16,233	0.015	0.008	0.008	0.011	0.014	0.017	0.030
Nonperforming loans / gross loans	16,218	0.016	0.023	0.001	0.004	0.008	0.018	0.061
Prov. for loan losses / average gross loans	15,575	0.008	0.011	0.000	0.002	0.004	0.008	0.029
Net charge-offs / average gross loans	15,578	0.006	0.009	0.000	0.001	0.003	0.006	0.023
Core deposits / adjusted book value	16,222	8.249	3.095	4.100	6.682	7.982	9.474	13.066
Noninterest-bearing deposits / core deposits	16,178	0.189	0.106	0.047	0.121	0.171	0.237	0.392
Interest rate on interest-bearing core depo.	15,236	0.024	0.012	0.008	0.015	0.022	0.032	0.045
Small denom. time deposits / core deposits	16,261	0.301	0.150	0.061	0.197	0.302	0.389	0.556
Recurring fees / adjusted book value	15,714	0.166	0.180	0.031	0.076	0.119	0.186	0.467
Other nonint. income / adjusted book value	15,692	0.020	0.066	-0.012	0.000	0.006	0.020	0.090
Noninterest expense / adjusted book value	15,575	0.419	0.240	0.197	0.296	0.369	0.466	0.775
Adjusted book value / total assets	16,211	0.078	0.025	0.045	0.063	0.076	0.090	0.117
Dividend / adjusted book value	16,116	0.011	0.010	0.000	0.004	0.011	0.016	0.028
Fixed rate gap / adjusted book value	16,136	-0.003	2.915	-4.492	-1.589	-0.053	1.461	4.623

The sample period is Q1:2000 through Q3:2011. Balance sheet items are generally measured at the end of the quarter. Income statement items are measured using trailing four quarters data. Details on variable definitions are provided in the text.

Table 2
Summary Statistics by Sub-Sample

	Q1:00-Q3:11		Q1:00-Q2:07		Q3:07-Q4:09		Q1:10-Q3:11	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Adjusted market value / adjusted book value	1.913	1.752	2.310	2.099	1.238	1.119	1.016	0.956
Gross loans / adjusted book value	9.186	8.918	8.968	8.799	10.225	9.981	8.638	7.999
Average tax-equivalent loans' yield	0.070	0.069	0.074	0.072	0.068	0.067	0.058	0.057
Allowance / gross loans held for investment	0.015	0.014	0.013	0.013	0.017	0.014	0.023	0.021
Nonperforming loans / gross loans	0.016	0.008	0.008	0.006	0.027	0.017	0.044	0.036
Prov. for loan losses / average gross loans	0.008	0.004	0.004	0.003	0.013	0.007	0.017	0.013
Net charge-offs / average gross loans	0.006	0.003	0.003	0.002	0.008	0.004	0.016	0.012
Core deposits / adjusted book value	8.249	7.982	8.144	7.953	8.468	8.146	8.427	7.795
Noninterest-bearing deposits / core deposits	0.189	0.171	0.192	0.172	0.175	0.163	0.194	0.180
Interest rate on interest-bearing core depo.	0.024	0.022	0.026	0.024	0.026	0.026	0.011	0.011
Small denom. time deposits / core deposits	0.301	0.302	0.302	0.310	0.330	0.323	0.248	0.239
Recurring fees / adjusted book value	0.166	0.119	0.168	0.121	0.164	0.119	0.159	0.113
Other nonint. income / adjusted book value	0.020	0.006	0.025	0.007	0.013	0.004	0.008	0.003
Noninterest expense / adjusted book value	0.419	0.369	0.416	0.370	0.423	0.373	0.424	0.357
Adjusted book value / total assets	0.078	0.076	0.078	0.076	0.074	0.072	0.083	0.082
Dividend / adjusted book value	0.011	0.011	0.013	0.012	0.010	0.008	0.005	0.002
Fixed rate gap / adjusted book value	-0.003	-0.053	0.083	0.041	0.124	0.085	-0.627	-0.688

Balance sheet items are generally measured at the end of the quarter. Income statement items are measured using trailing four quarters data. Details on variable definitions are provided in the text.

Table 3
Panel Data Regressions of the Market-to-Book Model on Proxies for Value Creation

	Q1:00-Q3:11		Q1:00-Q2:07		Q3:07-Q4:09		Q1:10-Q3:11	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Loans' equation intercept	-0.061	-4.4	-0.131	-8.3	-0.026	-1.4	0.013	1.4
Average tax-equivalent loans' yield	1.605	9	2.949	13.3	0.275	1	0.101	0.9
Allowance / gross loans held for investment	0.054	0.3	0.317	1.1	0.419	1.3	-0.143	-1.1
Nonperforming loans / gross loans	0.015	0.2	-1.668	-13	-0.137	-2.5	-0.137	-3.3
Prov. for loan losses / average gross loans	-0.784	-2.9	0.15	0.4	-1.631	-4.6	-0.052	-0.4
Net charge-offs / average gross loans	0.167	0.6	-4.268	-9.1	1.389	4.1	0.062	0.5
Deposits' equation intercept	0.122	14.5	0.144	13.6	0.13	11.4	0.038	4.6
Noninterest-bearing deposits / core deposits	0.089	8	0.082	7.3	0.078	4.4	0.042	3.8
10 * Interest rate on interest-bearing core dep.	-0.143	-3.9	-0.218	-5	-0.092	-2.4	-0.063	-1.9
Small denom. time deposits / core deposits	-0.15	-12	-0.164	-12	-0.1	-6.6	-0.073	-8.5
Recurring fees / adjusted book value	3.839	18	5.188	16.8	2.375	10.9	1.199	8.6
Other nonint. income / adjusted book value	2.681	13.9	3.596	13.6	1.68	6.4	0.366	2.8
Noninterest expense / adjusted book value	-2.592	-15	-3.712	-14	-1.561	-9.9	-0.507	-5.1
Four BOX-Cox transformations of total assets								
10 * Adjusted book value / total assets	-0.227	-3.4	-0.686	-10	0.444	4.2	0.427	6.9
10 * Dividend / adjusted book value	2.637	19.1	2.507	17	2.75	15.5	4.299	25.2
0.01 * Fixed rate gap / adjusted book value	2.22	6.3	1.62	4.4	3.532	7.6	0.986	2.9
R-square	0.697		0.632		0.69		0.743	
Observations	14,470		9,453		3,063		1,924	

The regressions include fixed time effect. The t-statistics are calculated using heteroscedasticity-corrected standard errors.