J. Finan. Intermediation 23 (2014) 400–435

Contents lists available at ScienceDirect

J. Finan. Intermediation

journal homepage: www.elsevier.com/locate/jfi

Crisis-related shifts in the market valuation of banking activities

Charles W. Calomiris [a,*], Doron Nissim [b]

[a] 601 Uris Hall, Columbia Business School, New York, NY 10027, United States
[b] 604 Uris Hall, Columbia Business School, New York, NY 10027, United States

ARTICLE INFO

Article history:
Received 13 April 2012
Available online 22 May 2014

Keywords:
Bank holding companies
Valuation
Financial crisis

ABSTRACT

We examine changes in banks' market-to-book ratios over the last decade, focusing on the dramatic and persistent declines witnessed during the financial crisis. The extent of the decline and its persistence cannot be explained by the delayed recognition of losses on existing financial instruments. Rather, it is declines in the values of intangibles – including customer relationships and other intangibles related to business opportunities – along with unrecognized contingent obligations that account for most of the persistent decline in market-to-book ratios. These shifts reflect a combination of changed economic circumstances (e.g., low interest rates reduce the value of core deposits; meager growth opportunities reduce the value of customer relationships) and changed regulatory policies. Together, these changes in the business environment since the financial crisis have led investors to associate little value with intangibles. For example, changing market perceptions of the consequences of leverage have affected the way investors value banks; prior to the crisis, higher leverage, ceteris paribus, was associated with greater value (reflecting the high relative cost of equity finance), but during and after the crisis, as default risk and regulatory concerns came to the fore, lower leverage was associated with greater value. Reflecting the rising importance of regulatory risks (e.g., the uncertain consequences of the Volcker Rule), after controlling for other influences, dividend payments (a signal

* Corresponding author.
E-mail addresses: cc374@columbia.edu (C.W. Calomiris), dn75@columbia.edu (D. Nissim).

http://dx.doi.org/10.1016/j.jfi.2014.05.002

of management and regulatory perceptions of the persistence of financial strength) matter for market prices much more after the crisis, while increases in recurring fee income matter less.

1. Introduction

Market-to-book equity ratios of U.S. banks have fallen from an average of more than two prior to the financial crisis to about one during and after the crisis, with significant recovery occurring only since 2013. Some researchers argue that the decline in market-to-book ratios reflects, at least in part, the purposeful understatement of losses on financial assets in bank holding companies – especially losses related to mortgage activity – which was part of "an effort to preserve book capital" (Huizinga and Laeven, 2012). Their evidence reinforces a line of argument in a large literature about regulatory forbearance during financial crises, defined as regulatory understatement of bank losses on financial assets designed to limit the costs to banks from those losses. With respect to the recent U.S. crisis, several researchers have argued that the under-recognition of losses on financial assets may have been 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; Calomiris and Herring, 2012).[1]

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. The fact that market-to-book ratios have remained depressed for several years after the crisis – long after concerns about delays in loss recognition have subsided – suggests that these other influences are likely to be more important than delayed loss recognition for understanding the persistent declines in bank stock values.

First, the market values of intangible 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. Loan relationships that were valuable prior to the crisis may have declined in value or even become a net cost during the crisis. Core deposit relationships that were valuable as a source of interest expense saving prior to the crisis also may have become much less valuable as the result of monetary policy changes that resulted in the decline in market interest rates on non-core deposit liabilities of banks during and after the crisis.

Second, perceptions of the value of other sources of bank income, or the market capitalization multiples 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 persistent adverse expected changes in the extent of mortgage refinancing and origination activity, mortgage default rates, or expected interest income earned on mortgage servicing-related float. Market values may have reacted to banks' plans to reduce their future trading activities to preserve scarce capital or to comply with new regulatory initiatives (e.g., the Volcker Rule, which some financial institutions saw as a threat both to their proprietary trading activities as well as their market making activities). Uncertain prospective legal liabilities related to litigation concerning mortgage origination prior to the crisis likely also weighed on market values of banks.

Third, even independent of regulatory concerns or bank income expectations, investors may have altered their views about the desirability of some bank practices and attributes in light of the crisis. For example, as we will show, investors seem to have favored higher leverage by banks prior to the crisis (which could result from the higher tax and adverse-selection costs of financing through equity capital – see Aiyar et al., 2014). But after the crisis, in the wake of significant bank losses, higher default risk

[1] Laux and Leuz (2010) find little evidence that such effects are the result of inherent pro-cyclical biases in fair value accounting, per se, indicating that extraordinary features of the crisis account for the findings documented by Huizinga and Laeven.

and increased regulatory and market concerns about the need to bolster bank balance sheets, higher leverage was penalized by investors.

Fourth, banks engage in the "carry trade," borrowing primarily in the form of very short-term debts, and lending a substantial amount of those funds at fixed rates for longer terms. Changes in the term structure of interest rates may affect the profitability of the carry trade: less steepness in the yield curve implies lower profit from a given duration mismatch between assets and liabilities.[2]

We develop an empirical methodology for taking each of these four categories of influences on the market-to-book value of banks into account simultaneously to track changes over time in the importance of the four categories of influence on bank valuation. We find that each of these four types of influences contributed importantly to the decline in bank market-to-book ratios, and we show that only a small portion of the large decline in the market-to-book ratio since the beginning of the financial crisis can be explained by unrecognized losses on financial assets.

2. Empirical methodology and data

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 and in over-the-counter (OTC) markets, both in the context of market making and for proprietary trading; 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, we capture cross-sectional differences in the intensity of different banking activities by employing accounting measures from balance sheets and income statements. We model the valuation effects of differences in banking activities cross-sectionally for each quarter, and then compare the regression results for each cross-section over time. This allows us to measure changes over time in the extent to which various bank characteristics – for example, a high proportion of core deposits in a bank's balance sheet, or earning a dollar more of mortgage servicing fee income – contributed to the market value of a bank.

The approach is based on the cross-sectional relationship between the market-to-book ratio (our dependent variable) and proxies for bank attributes and for the size and profitability of the various bank activities, which are based on measures derived from accounting concepts.[3] In other words, we start with a summary measure of balance sheet information (book value) and examine the extent to which the various banking activities add a market premium to book value.

Bank accounting practices make BHCs uniquely suited to such an exercise for two reasons. First, unlike non-financial companies, it is possible to use accounting information to reasonably ascertain the financial value of BHCs's assets. Book values are a reasonable starting point, especially when, as in banking, they frequently capture "fair values." 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). Second, cross-sectional differences in the extent of intangible assets for BHCs (e.g., core deposit relationships, lending relationships, trading platforms, or various other areas of business expertise within the bank) can be captured either through balance sheet ratios or income statement ratios. For example, the extent to which a BHC is more heavily involved in trading or mortgage servicing is reflected in the proportion of its earnings that are related to those activities. Similarly, the extent to which a bank possesses core deposit or loan relationships can be measured by the composition of its balance sheet. Within each activity category (e.g., loan relationships, or deposit relationships) we also employ a combination of characteristics that collectively capture the value of relationships. For example, some deposits or loans may be more valuable than others.

[2] Of course, bank interest rate spreads reflect many other influences, including the riskiness of loans, changes over time in loan risk premia, and the composition of bank funding.

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

In simplified form, our model is summarized by the following equation:

$$M/B = a + b(Loans/B) + c(Deposits/B) + d(NoninterestIncome/B) + e(Otherattributes),$$

where M is the market value of equity, B is the book value of equity, a is a constant, and b, c, d, and e are functions of the composition of loans, deposits, noninterest income and other attributes, respectively. We describe our multivariate regression model in detail in Section 4. The estimated coefficients of the regression model that we employ to link financial ratios and other bank characteristics to market value differences do not provide a structural identification of the actual profits or losses associated with particular business activities, but that limitation of the model is not a major shortcoming for our purposes. We are not able to attribute, for example, how much of a bank's noninterest expense is associated with servicing its core deposits. Nor are we able to measure the extent to which core deposits create revenue synergies through cross-selling opportunities for the bank. For these reasons, we are not able to translate the coefficient on core deposits in our regression into a valuation consequence of the strategic decision of a bank to increase its core deposits. Nevertheless, we are able to capture in a relative sense how a greater presence of core deposits in a bank's balance sheet affects its market value, holding constant the total noninterest expenses and fee income of the bank. Changes over time in the size of the estimated coefficient on core deposits (and other estimated coefficients) – which are the focus of our study – will capture changes over time in the extent to which core deposit relationships add market value after controlling for the noninterest expense of maintaining core deposits and the cross-selling opportunities related to core deposits that are reflected in noninterest income.

To measure the market-to-book ratio and other variables that may affect it we rely on a variety of data sources. We extract accounting data from regulatory consolidated financial statements (FR Y-9C reports) that BHCs submitted to the Federal Reserve System for the period Q1:2000–Q3:2013. 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 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. This information is made available by the Federal Reserve approximately two months after the end of each calendar quarter.[4] 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.[5]

The sample period begins 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 variables used in our regressions.[6]

We measure the market-to-book ratio as the ratio of what we call "adjusted" market value of equity to tangible common equity. Our adjusted market value measure attempts to take account of the date at which the accounting data are known to the market. End-of-quarter stock prices are not likely to fully reflect the value implications of FR Y-9C information. The accounting reports are prepared and disseminated after the end of the quarter. FR Y-9C data are generally available within two months from fiscal quarter end. Hence, we assume a 75-day lag between the accounting date

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

[5] To merge the files, we 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.

[6] Extreme values of the variables are identified using the following procedure. For each variable, we calculate the 5st and 95th percentiles of the empirical distribution each quarter (P5 and P95 respectively) and trim observations outside the following range: P5 − 0.5 × (P95 − P5) to P95 + 0.5 × (P95 − P5). For normally distributed variables, this range covers approximately 3.3 standard deviations from the mean in each direction (=1.645 + .5 × (1.645 − (−1.645)), which is more than 99.9% 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.

Table 1
Summary statistics for the full sample.

	Obs.	Mean	SD	5%	25%	Med.	75%	95%
Adjusted market value/tangible book value	18,821	1.9211	1.0366	0.5121	1.1911	1.7437	2.4851	3.8966
Gross loans/tangible book value	18,855	9.6365	3.5850	4.3359	7.4034	9.3882	11.589	15.667
Average tax-equivalent loans' yield	18,099	0.0679	0.0132	0.0491	0.0581	0.0664	0.0767	0.0908
Allowance/gross loans held for investment	18,850	0.0155	0.0070	0.0080	0.0114	0.0138	0.0177	0.0290
Nonperforming loans/gross loans	18,797	0.0178	0.0220	0.0009	0.0044	0.0093	0.0223	0.0638
Prov. for loan losses/average gross loans	18,245	0.0069	0.0093	0.0001	0.0020	0.0038	0.0078	0.0256
Net charge-offs/average gross loans	18,287	0.0057	0.0081	0.0000	0.0011	0.0028	0.0067	0.0222
Core deposits/tangible book value	18,872	8.7885	3.1283	3.9213	7.0727	8.6027	10.314	14.193
Noninterest-bearing deposits/core deposits	18,946	0.1882	0.1023	0.0440	0.1198	0.1734	0.2410	0.3883
Interest rate on interest-bearing core depo.	18,275	0.0215	0.0126	0.0040	0.0115	0.0197	0.0303	0.0440
Small denom. time deposits/core deposits	19,090	0.2837	0.1494	0.0507	0.1749	0.2823	0.3776	0.5411
Recurring fees/tangible book value	18,128	0.1532	0.1205	0.0290	0.0766	0.1241	0.1908	0.3822
Other nonint. income/tangible book value	17,927	0.0141	0.0312	−0.0149	0.0001	0.0062	0.0204	0.0740
Noninterest expense/tangible book value	18,164	0.4285	0.1890	0.2019	0.3106	0.3932	0.4991	0.7802
Log of total assets	18,982	14.778	1.4516	13.240	13.692	14.375	15.479	17.834
Tangible book value/total assets	18,874	0.0731	0.0232	0.0405	0.0583	0.0709	0.0851	0.1145
Dividend/tangible book value	18,898	0.0111	0.0094	0.0000	0.0027	0.0104	0.0167	0.0282
Fixed rate gap/tangible book value	18,896	−0.0800	2.8736	−4.8062	−1.7339	−0.1349	1.4851	4.8195

The sample period is Q1:2000 through Q3:2013. 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.

and the date that information is reflected in stock prices.[7] We calculate adjusted market value by multiplying the end-of-quarter market value of common equity by one plus the cumulative stock return over the subsequent 75 days.[8] Tables 1 and 2 present summary statistics for the sample as a whole and for various subsamples, while Fig. 1 presents statistics from the cross-sectional distribution of the market-to-book ratio for each quarter during the period Q1:2000–Q3:2013. The market-to-book ratio has declined from an average of more than two prior to the financial crisis to about one in 2009–2012, but has recovered significantly during 2013. In relative terms, the lower tail of the distribution declined even more; the bottom 5th 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 fourth. Market-to-book values did not improve much from 2009 to 2012 despite the improvements in banks' tangible book value relative to assets (see Table 2), and despite the fact that the financial crisis (measured by market indicators such as the TED spread) ended in 2009. The cross-sectional variation in the market-to-book ratio has narrowed since the beginning of the financial crisis, especially due to a reduction in the positive skewness of the distribution of market-to-book values that had been apparent during the period of high average market-to-book ratios. Interestingly, while the entire distribution of the market-to-book ratio trended up during 2013, the cross-sectional variation in the ratio remained at historically low levels.

[7] Our results remain essentially the same if instead we assume a 30-day or 60-day lag.

[8] This adjustment is consistent with standard practice in other academic studies. Banks' market-to-book ratios are typically measured using tangible common equity and market prices after the dissemination of book value. 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.

Table 2
Summary statistics by sub-sample.

	Q1:00–Q3:13		Q1:00–Q2:07		Q3:07–Q4:09		Q1:10–Q3:13	
	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.
Adjusted market value/tangible book value	1.9211	1.7437	2.4334	2.2671	1.3063	1.2201	1.2415	1.1826
Gross loans/tangible book value	9.6365	9.3882	9.6145	9.5150	11.383	11.100	8.4916	7.9834
Average tax-equivalent loans' yield	0.0679	0.0664	0.0737	0.0724	0.0674	0.0667	0.0551	0.0548
Allowance/gross loans held for investment	0.0155	0.0138	0.0133	0.0129	0.0162	0.0139	0.0199	0.0180
Nonperforming loans/gross loans	0.0178	0.0093	0.0069	0.0055	0.0248	0.0164	0.0363	0.0292
Prov. for loan losses/average gross loans	0.0069	0.0038	0.0036	0.0028	0.0121	0.0069	0.0107	0.0068
Net charge-offs/average gross loans	0.0057	0.0028	0.0026	0.0018	0.0079	0.0042	0.0110	0.0074
Core deposits/tangible book value	8.7885	8.6027	8.7495	8.6008	9.3529	8.9761	8.4883	8.2626
Noninterest-bearing deposits/ core deposits	0.1882	0.1734	0.1888	0.1706	0.1726	0.1629	0.1976	0.1909
Interest rate on interest-bearing core depo.	0.0215	0.0197	0.0260	0.0239	0.0258	0.0258	0.0082	0.0072
Small denom. time deposits/ core deposits	0.2837	0.2823	0.3026	0.3104	0.3291	0.3225	0.2122	0.1984
Recurring fees/tangible book value	0.1532	0.1241	0.1588	0.1270	0.1622	0.1300	0.1344	0.1125
Other nonint. income/tangible book value	0.0141	0.0062	0.0170	0.0072	0.0100	0.0045	0.0105	0.0052
Noninterest expense/tangible book value	0.4285	0.3932	0.4263	0.3958	0.4550	0.4106	0.4147	0.3762
Log of total assets	14.778	14.375	14.669	14.255	14.830	14.481	14.976	14.553
Tangible book value/total assets	0.0731	0.0709	0.0718	0.0701	0.0654	0.0646	0.0811	0.0786
Dividend/tangible book value	0.0111	0.0104	0.0136	0.0131	0.0105	0.0091	0.0060	0.0038
Fixed rate gap/tangible book value	−0.080	−0.1349	0.0831	0.0664	0.1541	0.1145	−0.5894	−0.6844

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.

3. Unrecognized losses and the market-to-book ratio

To what extent is the persistent decline in the market-to-book ratio a reflection of unrecognized losses in banks' financial assets? The primary assets reported by banks are loans and investments in debt securities. The latter is unlikely to be a significant source of unrecognized losses because book values generally reflect fair valuation, and the proportion of investments that could be a source of hidden losses in book value accounting is quite small. Investments in securities are classified as either "held-to-maturity," "trading," or "available-for-sale." Investments classified as held-to-maturity are the category of investments for which unrecognized loss is potentially important because these assets are generally reported at amortized historical cost, while available-for-sale and trading securities are reported at fair value. Nevertheless, when there is an "other-than-temporary" impairment of held-to-maturity securities, banks are required to mark the securities down to fair value. Furthermore, most investments are classified as available-for-sale, and so book value already reflects the majority of unrealized investment gains and losses. Investments classified as available-for-sale include primarily mortgage-backed securities and Treasury and Agency securities. While it is possible that the reported fair value of available-for-sale securities are measured with error, any effect from mis-valuation of MBS would be very small compared to the swing in the market-to-book ratio observed in Fig. 1, because non-government guaranteed MBS were less than three percent of total assets as of June 2007.

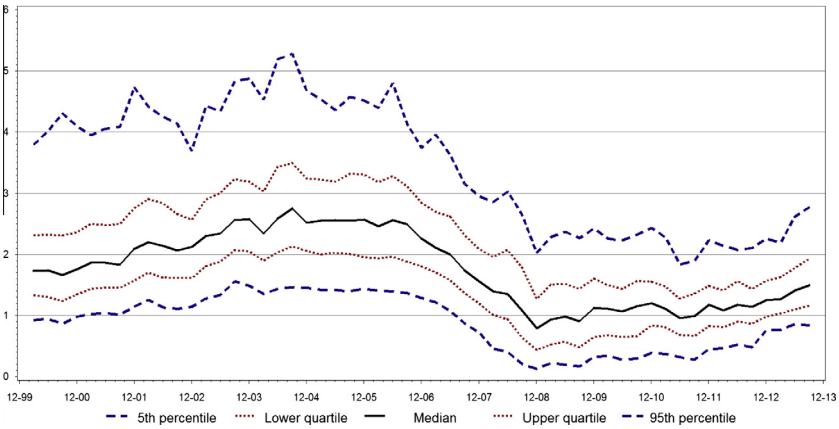


Fig. 1. The distribution of the market-to-book ratio over time. *Notes:* The figure presents statistics from the cross-sectional distribution of the market-to-book ratio (market value of equity divided by tangible common equity) over time. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

Loans are the primary asset category for which unrecognized losses might be relevant. Loans receivable include loans held for investment and loans held for sale. Loans held for investment are generally reported on the balance sheet at amortized historical cost net of allowance for incurred loan losses. Loans held for sale are reported at the lower of cost or fair value. Most loans are classified as held for investments.

Unrecognized loan losses conceivably could be a significant contributor to the swing in the market-to-book ratio shown in Fig. 1, either as the result of a failure to properly recognize incurred losses, or as the result of the failure to incorporate expected but not incurred losses into provisions for loan losses. GAAP requires the recognition of the former but disallows the recognition of the latter (Kahn et al., 2014; Ryan, 2012). Forecasts of losses due to expected future events (e.g., an expected downturn in the economy) may not be included in the allowance because these involve non-incurred losses. How much of the swing in the market-to-book ratio could be due to unrecognized loan losses arising from these two influences?

To investigate the question of how much of the decline in market-to-book ratios may reflect unrecognized losses in banks' loans and investments, we apply fair value accounting to the financial assets and liabilities that banks report at amortized cost, which enables us to reconstruct a fair value balance sheet for each bank. If unrecognized losses are important in explaining the decline in market-to-book values, then the ratios of market-to-book value and the disclosed fair-to-book value should either be equal to each other or move in parallel fashion over time.[9] The measurement of the disclosed fair value of equity is made possible by an accounting change in 1992. Since 1992 on an annual basis, and since Q2:2009 on a quarterly basis, companies are required to disclose the estimated fair value of their financial assets and liabilities as of the balance sheet date. These disclosures are quite comprehensive. They include essentially all loans, securities, debts payable, time deposits, derivatives, and most other financial instruments. We obtain these data from SNL Financial, and use them to calculate the disclosed fair value of banks' equity, which reflects the amount that would have been reported if all financial instruments were reported at fair value. Fig. 2 shows the cross-sectional means (Panel A) and medians (Panel B) of the reported market-to-book value and fair-to-book value ratios. We find that the disclosed fair-to-book value was close to one throughout the sample period, and that changes in the market-to-book value over time were substantially larger than changes in the disclosed fair-to-book value. Thus, under the assumption that fair value is estimated reasonably accurately, unrecognized losses on loans and securities could only explain a tiny portion of the large decline in the market-to-book ratio since the beginning of the financial crisis. The similarity in the time profile of the book value of equity and its disclosed fair value

[9] Disclosed fair value of equity is defined as the proforma book value of equity inferred from the fair value balance sheet.

implies that the book value measure we use in our empirical work below is quite close to disclosed fair value.[10]

Of course, it is possible that fair values are measured with error (e.g., Barth et al., 1996; Nissim, 2003; Kahn et al., 2014). Nevertheless, the errors would have to be very large to explain the large difference between the two figures. For example, between Q4:2006 and Q4:2008, the mean market-to-book ratio declined from 2.34 to 0.90 while the mean fair-to-book ratio declined from 1.01 to 0.97. Thus, to fully explain the decline in the market-to-book ratio, the change in the fair-to-book ratio would have to have been on the order of magnitude of at least thirty times (=[2.34–0.9]/[1.01–0.97]) the reported change. It is unlikely that any error in the fair value estimates would have been that large, particularly when one considers that the aggressive marking down of assets under fair value accounting methods was frequently criticized as a potential contributor to the financial crisis.

The persistence of a large implied fair valuation error for several years after the crisis is implausible. How could massive unrecognized losses not accounted for in fair value accounting continue to weigh on banks' market values as late as 2013, especially when one considers the improvements in real estate markets and in the economy that have taken place since 2008 (which are reflected in asset valuation improvements under fair value accounting and in the declining path of non-performing loans and loan charge-offs)?[11] Moreover, crisis-related losses were largely reflected in banks' book values through timely provisions and write-downs (referred to as charge-offs in the context of loans). For example, between Q4:2006 and Q4:2008, the mean allowance for loan losses increased from 1.17% of loans book value (approximately 12% of book equity value) to 1.63% of loans book value (20% of book equity value). If one takes a closer look at the timing of provisions, net charge-offs, and the allowance for loan losses (noting that, in any quarter, Δ allowance = provision − net charge-offs), it is clear that provisioning was adequate relative to ultimate losses over the period 2007–2013 (see Panel C of Fig. 4). Provisioning led net charge-offs, and the allowance rose after the crisis and remained elevated. If banks had hidden their loan losses and then eventually written off more than their accumulated provisions, then the allowance would have declined over time. Moreover, if provisioning had been inadequate initially, then the market-to-book ratio would have risen as losses were realized. Instead, the market-to-book ratio remained depressed in 2011–2012, long after losses had been written off.

4. Modeling the market-to-book ratio

Our model posits that BHCs generate market value over and above the values of their tangible assets and liabilities through the combination of different activities they undertake, and through other differences they exhibit. These various activities and aspects of banks should capture important differences in bank value over time and across banks, which should be reflected in the ratio of market-to-book value.[12]

We model value creation associated with loans and core deposits using attributes of these activities (e.g., the type of deposit or loan, the riskiness of the loan, and the interest earned on the loan). We capture the value of other intangibles related to franchise value by estimating capitalization multiples on various categories of noninterest income and expense. The valuation drivers in our model can be usefully divided into four groups: (1) those that capture the value of loans and related relationship intangibles, (2) those that capture the value of core deposit and related relationship intangibles, (3) those that capture the capitalization multiples attached to various types of bank fee income and noninterest expenses, and (4) a final category of "other characteristics" influences, including bank asset size, leverage, dividend payments, and net asset re-pricing (a proxy for banks' duration mismatch). We estimate the following "Valuation Equation," which captures all of these influences:

[10] Because quarterly data on disclosed fair value are not available prior to 2009, we cannot use the SNL Financial data in our empirical work.

[11] The improvements in charge-offs and non-performing loans are shown in Panel C of Fig. 4.

[12] We use the standard measure, tangible book value, as our measure of book value. In a previous version of this paper, we made adjustments to tangible book value based on a variety of considerations relating to taxes, allowances for losses, and fair valuation. All of our results are unchanged when making those adjustments, but for the sake of simplicity, and comparability with other studies, we report results here using simply tangible book value.

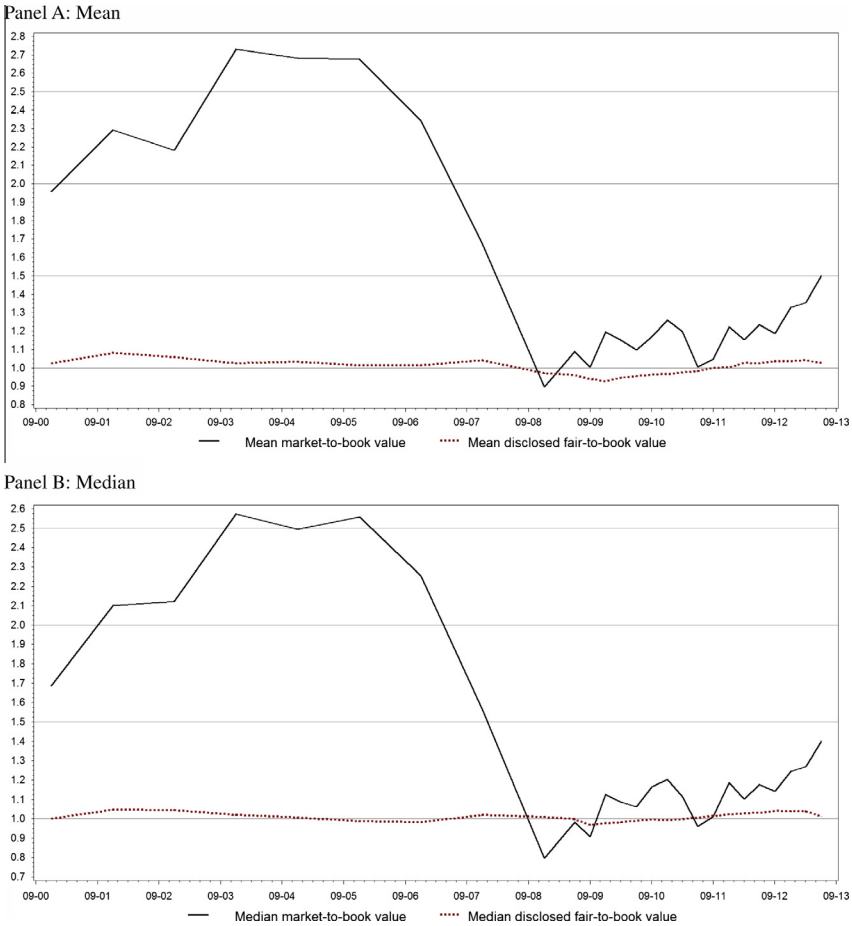


Fig. 2. Market-to-book value versus disclosed fair-to-book value. *Notes:* The figures present the time-series of cross sectional means (Panel A) and median (Panel B) of the following ratios: market value of equity divided by tangible common equity (market-to-book value), and pro-forma tangible common equity calculated using the disclosed fair values of financial instruments divided by tangible common equity (disclosed fair-to-book value). The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices and available fair value disclosure information in SNL Financial.

$$\frac{AdjMarValEq}{TanComEq} = \alpha_0 + \left(\beta_0 + \beta_1 \frac{IntLoans}{AveLoans} + \beta_2 \frac{ALLL}{Loans} + \beta_3 \frac{NPL}{Loans} + \beta_4 \frac{PLLL}{AveLoans} + \beta_5 \frac{NCO}{AveLoans}\right) \times \frac{Loans}{TanComEq} + \left(\gamma_0 + \gamma_1 \frac{NonIntDepo}{CoreDepo} + \gamma_2 \frac{IntCoreDepo}{AveCoreDepo} + \gamma_3 \frac{CoreTimeDepo}{CoreDepo}\right) \times \frac{CoreDepo}{TanComEq} + \alpha_1 \frac{RecNonIntInc}{TanComEq} + \alpha_2 \frac{TranNonIntInc}{TanComEq} + \alpha_3 \frac{NonIntExp}{TanComEq} + \alpha_4 log(TotAsst) + \alpha_5 \frac{TanComEq}{TotAsst} + \alpha_6 \frac{Dividend}{TanComEq} + \alpha_7 \frac{FixedRateGap}{TanComEq} + \varepsilon$$

where

AdjMarValEq	adjusted market value of equity
TanComEq	tangible common equity
IntLoans	trailing-four-quarters (TFQ) tax-equivalent interest on loans and leases
AveLoans	TFQ daily average balance of gross loans and leases
ALLL	allowance for loan and lease losses
Loans	gross loans and leases
NPL	nonperforming loans
PLLL	provision for loan and lease losses
NCO	net charge-offs
NonIntDepo	noninterest-bearing deposits
CoreDepo	core deposits
IntCoreDepo	TFQ interest on core deposits
AveCoreDepo	TFQ daily average balance of core deposits
CoreTimeDepo	core time deposits
RecNonIntInc	recurring noninterest income
TranNonIntInc	transitory noninterest income
NonIntExp	noninterest expense
TotAsst	total assets
Dividend	common dividends
FixedRateGap	Fixed rate earning assets minus fixed rate liabilities

An important consideration in specifying any model is to restrict the number of estimated parameters to permit sufficient degrees of freedom in estimation. There are many balance sheet ratios that are not taken into account in our model. In particular, we do not include securities that are traded in relatively liquid and efficient capital markets. The reason for excluding these is that there should be no intangible assets related to banks' holdings of these securities. In other words, 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 our proxy for interest-rate risk exposure.

We do not include fixed assets (like bank buildings) in our model. These assets, which are recorded in the books at depreciated historical cost, are small as a fraction of total assets, do not vary much across banks, and are not a core value-generating activity of banks.[13] In addition, mis-valuations of these assets are mitigated in our model by their effect on noninterest expense. For example, if the value of these assets is understated due to inflation, the depreciation expense attached to them would be commensurately lower.[14]

[13] The mean (median) of fixed assets is 1.5% (1.4%) of total assets, its lower quartile is 1%, its upper quartile is 2%, its 5th percentile is 0.5% and its 95th percentile is 3.2%.

[14] Intangible assets (goodwill, servicing rights, favorable leasehold rights, the values of different types of customer relationships, etc.) are also excluded from the model. These generally are recognized only when a bank is acquired; under GAAP, most internally developed intangibles are not reported on the balance sheet. As a result, cross-sectional differences in the book value of intangible assets are likely to be a poor proxy for cross-sectional differences in their economic value; accounting differences mainly capture differences in the acquisition history of banks. Including intangible assets in a valuation model, therefore, 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. Instead, we capture the value associated with these assets using the earning streams that they generate and their effects on the size and characteristics of loans (e.g., yield), deposits (e.g., composition), and other bank attributes.

Our model does not include all assets and liabilities because doing so would induce perfect multicollinearity (given that all variables are deflated by the book value of equity and the model includes an intercept). Loans and deposits are by far the largest balance sheet items, are the elements of assets and liabilities that generate the most obvious intangible relationship values, and they capture most of the cross-sectional variation in net assets. In fact, the cross-sectional variation in all other net assets is smaller than the cross-sectional variation in either loans or deposits (the time-series mean of the cross-sectional standard deviation of the ratio of "other net assets" to tangible common equity is 2.33, while the related statistics for the loans and core deposits ratios are 3.56 and 3.24, respectively). Moreover, we are able to model the cross-sectional variation in loans and deposits because we can observe various aspects of the composition and characteristics of loans and deposits, while for other assets and liabilities no such information is available. Still, we do not completely ignore other assets and liabilities – their average pricing is captured by the intercept and by other explanatory variables. For example, as noted above, to the extent that the value of fixed assets is understated, depreciation and therefore noninterest expense will be lower and the predicted market-to-book value will be higher.

4.1. 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 intangible driver of value on the asset side of the balance sheet.[15] According to this literature, banks are 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 possibly as the result of 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 could explain a large portion of the difference between the market and book values of bank equity.

Bankers hope that loans will result in current and future earnings that more than compensate for the economic (risk-adjusted) cost of funding, originating, servicing and monitoring loans. But this need not be the case. For example, if a banker commits to allow a borrower to draw upon a line of credit at a pre-specified cost, honoring that commitment may entail more costs than benefits if the borrower's creditworthiness declines or if the bank's own cost of funding the line of credit goes up sufficiently. Thus, lending relationship intangibles could have positive or negative values over time, depending on whether the state of the world is one in which it is profitable to fulfill commitments to borrowers. Furthermore, to the extent that banks use loans as a "loss leader" in their customer relationships to attract business in other more lucrative products and services, lending could appear to be a source of negative intangibles in an empirical model that takes account of those other products and services. In general, the value premium of existing loans should not be uniform across loans, but rather should reflect the effects of different types of customer relationships: some lending relationships may entail higher "quasi rents" than others (Rajan, 1992), and different types of loans may create different opportunities for expanding customer relationships into other products or services.

As shown in the equation 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, which is captured by several interaction effects. 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.[16] We therefore specify average value creation per dollar of loans as a linear combination of an intercept, the average tax-equivalent yield on loans $\left(\frac{IntLoans}{AveLoans}\right)$, and the four

[15] There is a large empirical literature demonstrating the importance of banks as processors and users of private information about borrowers, including James (1987), Slovin et al. (1993), Petersen and Rajan (1994, 2002), Degryse and Ongena (2005), Aschcraft (2005), and Loutskina and Strahan (2011).

[16] While the value of existing loans and the value of lending relationships generally decrease with the loans' credit risk, there is a potentially 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 is paid for by borrowers – as theory suggests it should be (Rajan, 1992) – those concepts should be captured in higher interest rates on loans. Thus, our inclusion in the model of the loans' yield should help capture this offsetting effect.

(imperfect) measures of credit risk described below.[17] We emphasize that this interactive modeling of the factors that determine the market value of loan intangibles means that the various coefficient estimates of the model must be combined in order to be interpreted properly (a point to which we shall return in Section 5).

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. The allowance only pertains to incurred losses, defined as losses that will be triggered by events that have already occurred, even if the specific incidence of those losses are not yet known to the banker. Forecasts of losses due to expected future events (e.g., an expected downturn in the economy) may not be included in the allowance because these involve non-incurred losses.[18] Thus, the ratio of the allowance for loan losses to the gross book value of loans held for investment $\left(\frac{ALLL}{Loans}\right)$ should inform on the extent to which the bank's loans are at risk of not being repaid.

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 ratio of nonperforming loans to the gross book value of loans $\left(\frac{NPL}{Loans}\right)$ may therefore contain incremental information about credit risk. Of course, NPLs are also an imperfect measure of portfolio risk because 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 because banks differ in the delinquency periods that trigger non-accrual classification. We adjust downward the measure of non-performing loans to take account of 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 because they have already removed large portions of problem loans from their books (the allowance and NPL relate to reported loans only, and do not include loans that already have been charged off). Second, as noted above, the allowance only reflects incurred losses, not expected ones. 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 especially important because loans' yields, which measure interest income during the period, are likely to be correlated with the rate of credit loss. We therefore include the following two additional risk "flow" proxies: the ratio of the provision for loan losses to the average balance of loans $\left(\frac{PLLL}{AveLoans}\right)$, and the ratio of net loan charge-offs to the average balance of loans $\left(\frac{NCO}{AveLoans}\right)$.[19]

4.2. Core deposits

On the liability side, banks generate value primarily by obtaining and maintaining deposits that carry low or zero interest. The non-pecuniary benefits to depositors that are associated with the convenience of holding wealth in the form of deposits, along with the brick and mortar costs to banks of producing deposits, explain why in a competitive market deposits cannot pay an interest rate equal to other debt instruments. Deposits contribute, in a gross sense, to bank earnings and value creation by

[17] 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.

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

[19] 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.

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 (noninterest 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 (that is, deposit relationships have net positive value). The contribution of deposits to bank value increases with the spread between market borrowing rates and the average interest rate on deposits because 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 decreases with deposit insurance cost, noninterest costs of servicing the deposit, and the forgone interest on required reserves associated with offering the deposit. These characteristics, which are captured implicitly 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.[20] 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 $\left(\frac{NonIntDepo}{CoreDepo}\right)$ in modeling the value per dollar of core deposits. We also include the following two variables.

The average interest rate on interest-bearing core deposits $\left(\frac{IntCoreDepo}{AveCoreDepo}\right)$ 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, cross-sectional differences in interest costs tend to persist: the current interest cost on core deposits predicts future interest cost, which in turn affects the value of the core deposits intangible.[21,22]

The average interest cost and withdrawal risk of deposits, and therefore their value implications, are not identical across the various categories of deposits. Although we include the average interest cost of all interest-bearing core deposits as an 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. Therefore, the ratio of small-denomination time deposits to core deposits $\left(\frac{CoreTimeDepo}{CoreDepo}\right)$ should add explanatory power to the estimation of the core deposit intangible.

[20] 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.

[21] 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.

[22] 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.

4.3. Noninterest income

Noninterest 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 noninterest income, both deflated by tangible common equity. These variables partition noninterest income based on categories that we expect to 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, we improve the accuracy of the valuation model by capturing the higher coefficient magnitudes associated with more persistent streams. The two variables we define are the ratio of recurring fees to tangible book value $\left(\frac{RecNonIntInc}{TanComEq}\right)$ and the ratio of other noninterest income to tangible book value $\left(\frac{TranNonIntInc}{TanComEq}\right)$.

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.

Some BHCs, primarily mortgage banks and 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, and hence we expect capitalization multiples to be lower for this category.[23]

4.4. Noninterest expense

Noninterest expenses are incurred for many reasons: most importantly, for obtaining and servicing core deposits and loans, and for generating noninterest 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 noninterest expense as the total of salaries and employee benefits, expenses of premises and fixed assets, and “other noninterest expense,” divided by tangible common equity $\left(\frac{NonIntExp}{TanComEq}\right)$. 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.

4.5. Size

Large banks may enjoy implicit government subsidies – 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 et al., 1999), enjoy scale economies (e.g., Stiroh, 2000; Hughes et al., 2001) or scope (e.g., Demsetz and Strahan, 1997), or benefit from increased diversification (e.g., Penas and Unal, 2004). Compared to small banks, they 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

[23] 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 et al., 1995), so that firms are more likely to realize gains when they have low earnings, low regulatory capital, or negative taxable income.

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). Although we will not be able to disentangle all of the potential influences that might contribute to residual size effects on valuation, including bank asset size ($log(TotAsst)$) in our estimation model helps to control for these differences, which are not captured by the other model regressors.

4.6. Interest rate risk exposure

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. To capture the interest rate risk exposure of banks and any potential net benefits from engaging in carry trades, we construct the following proxy, which we label the "fixed rate gap."

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 ratio of "fixed rate gap" to tangible common equity $\left(\frac{FixedRateGap}{TanComEq}\right)$, where fixed rate gap is the difference between fixed-rate earning assets and fixed-rate financial liabilities. 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.

4.7. Book capital ratio

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.[24] 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 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, if equity is a relatively costly source of financing (e.g., due to tax considerations, adverse-selection costs, or agency costs – see, for example, Myers and Majluf, 1984; Calomiris and Kahn, 1991; Diamond and Rajan, 2000; Aiyar et al., 2014) higher equity-to-asset ratios may be associated with lower market-to-book values of equity. Furthermore, to the extent that banks may seek to benefit from the value of safety net protection (via deposit insurance and anticipated

[24] 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.

government bailouts), they may be rewarded by the market for undertaking higher leverage (e.g., Brewer, 1995). Adrian and Shin (2009) have shown 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 et al. (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. Our empirical model is capable of asking whether this market encouragement of leverage was reflected in higher market-to-book values leading up to the crisis, and identifying whether and when the crisis altered market perceptions of the value of high leverage.

Another reason that market-to-book ratios may be related to leverage is that capital ratios may be correlated with 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. Depending on market perceptions of the value consequences of that risk, leverage could be associated either with higher or lower market-to-book equity ratios. Therefore, the empirical relationship between the market-to-book equity ratio and book leverage is ambiguous in sign. Nevertheless, all of the above arguments suggest that leverage 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 that are measured at historical cost for regulatory capital purposes). Still, research has demonstrated that regulatory capital measures are more "noisy" than book capital in reflecting capital adequacy (e.g., Blankespoor et al., 2011). We therefore measure capital adequacy using the ratio of tangible common equity to total assets $\left(\frac{TanComEq}{TotAsst}\right)$.[25]

4.8. 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 for a variety of reasons. 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. In other words, in the case of banks, signaling via dividend payout decisions reflects the signals provided both by management and by regulators. Our measure of dividend payment is the ratio of quarterly cash dividends declared on common stock to tangible common equity $\left(\frac{Dividend}{TanComEq}\right)$.

5. Estimation results

As a first step, Table 3 reports panel estimates of the Valuation Equation from Section 4, which pool observations for various sub-periods. For these regressions, the model is supplemented with fixed time effects, and the *t*-statistics are calculated using two-ways (firm and time) clustered standard errors (Petersen, 2009). Table 3 also shows the effect of dividing banks into two sub-groups based on size. As Table 3 shows, coefficient signs typically conform to the expectations of the theoretical discussion in Section 4, and coefficient estimates are often statistically significant. We find that differences between large and small banks are statistically significant but relatively small, and so in the remainder

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

of our paper we only discuss the results of models that are estimated for the full sample of banks.[26] In contrast, there are substantial differences in coefficients over time. For example, the coefficient on the ratio of tangible equity to assets switches from negative prior to the crisis to positive after Q3:2007.

Our main results are cross-sectional estimates of the Valuation Equation developed in Section 4 for every quarter from Q1:2000 to Q3:2013.[27] Due to the large number of cross-sectional regressions (one for each of 55 quarters), and given our focus on identifying high-frequency time-series patterns, we present our main results using time-series plots, which offer the most economical and informative means of reporting summary statistics, coefficient estimates, and other statistics. Fig. 3 presents summary model statistics from the cross-sectional quarterly regressions. The number of observations each quarter ranges between 221 and 307, with a maximum reached in Q2:2006. The number of estimated parameters is 18 per regression; thus in each of the regressions there are more than 5 observations per parameter (an often-used rule of thumb for adequacy in degrees of freedom). The *R*-squared is very high throughout the sample period, indicating that the model performs well in explaining value. The RMSE declined significantly since the beginning of the financial crisis, consistent with the decline in the cross-sectional dispersion of the market-to-book ratio (see Fig. 1).

5.1. Lending

Panels A and B of Fig. 4 plot the cross-sectional coefficients and *t*-statistics, respectively, of each of the lending-related variables and intercept (β_0). Panel C (Panel D) depicts the time series of the cross-sectional mean (standard deviation) of each of the lending-related variables. Loan yield was by far the most significant lending-related variable through most of the sample period (Panel B). However, this variable lost its explanatory power during the financial crisis. A possible explanation for the decline in the significance of the loans' yield coefficient is the increase in investors' risk aversion during the financial crisis. High-yield loans are on average more risky than other loans, perhaps increasingly so, and in ways that are not fully captured by the loan quality variables. In 2013 the loans' yield coefficient has become significant again, which is consistent with a recent decline in investors' risk aversion.

The overall value related to lending is captured in Panel E of Fig. 4 by the line labeled "mean lending-related fitted value." That is the product of "mean loans" (the mean of the ratio of loans to book equity) and the "mean fitted loan coefficient", which combines the estimated interacted coefficients (β_0 through β_5) for each quarter with the mean values of respective regressors in that quarter (specifically, $\beta_0 + \beta_1 \frac{IntLoans}{AveLoans} + \beta_2 \frac{ALLL}{Loans} + \beta_3 \frac{NPL}{Loans} + \beta_4 \frac{PLLL}{AveLoans} + \beta_5 \frac{NCO}{AveLoans}$). Both series are also plotted in Panel E. As is apparent in the figure, the main source of variation over time in the value of loan intangibles is variation in the "mean fitted loan coefficient," not the average amount of loans.

According to the "mean lending-related fitted value" line, the value associated with existing loans and lending relationship intangibles declines substantially during 2007 and 2008, reaching its lowest level at the end of 2008. Since then, lending value has trended up although it remained below the pre-crisis level. The changes over time in the value of loans and lending intangibles likely reflect a combination of factors, including: (1) the large increase in loans' credit risk (captured by the increases in allowance, NPL, provision, and net charge-offs in Panel C); (2) the increase in the pricing of credit risk (for illustrative purposes, we provide a measure of credit risk spreads for Baa bonds in Panel C); (3) the negative effect of the crisis on banks' funding cost and liquidity position, as banks were forced to fund credit lines to existing borrowers (Ivashina and Scharfstein, 2009); (4) a decline in the value of long-term lending relationships due to lower expected loan growth; and (5) an increase in the opacity of loans combined with the price discount for opacity. Our model cannot reliably decompose those influences, but it does offer several useful insights about the changes over time in the value of lending relationships.

[26] For example, focusing on the full sample period, most of the coefficients that are significant for at least one sample are within 20% of the related coefficients estimated for the other sample (e.g., interest rate on loans, small denomination time deposits, recurring fees, noninterest expense, dividends). In addition, we find similar results to those reported in Panel C of Table 3 when we exclude the largest banks from the sample (those with asset size greater than $50 billion).

[27] When estimating the cross-sectional regressions, we constrain the cross-sectional regressions for each quarter so that the estimated intercept is constant over time. Doing so enables us to attribute all the changes in the market-to-book ratio over time to changes in the pricing of the various activities. Nevertheless, if we allow the intercept to vary over time, the results are similar.

Table 3
Panel data regressions of the market-to-book ratio on proxies for value creation.

	Q1:00–Q3:13		Q1:00–Q2:07		Q3:07–Q4:09		Q1:10–Q3:13	
	Coef.	*t*-Stat	Coef.	*t*-Stat	Coef.	*t*-Stat	Coef.	*t*-Stat
Panel A: full sample								
Loans' equation intercept	−0.069	−2.6	−0.142	−4.3	−0.003	−0.1	0.004	0.2
Average tax-equivalent loans' yield	2.067	6.1	3.425	8.6	0.191	0.5	0.659	1.8
Allowance/gross loans held for investment	0.536	1.5	0.934	1.3	−0.019	0	0.267	0.9
Nonperforming loans/gross loans	−0.461	−5	−2.061	−6	−0.479	−4.8	−0.383	−6
Prov. for loan losses/average gross loans	−0.761	−2.7	0.533	0.6	−0.685	−1.8	0.071	0.4
Net charge-offs/average gross loans	0.063	0.2	−4.745	−4.4	0.584	1.7	−0.081	−0.4
Deposits' equation intercept	0.139	6.9	0.199	10.2	0.116	5.3	0.04	2.3
Noninterest-bearing deposits/core deposits	0.066	2.8	0.066	2.1	0.071	3.1	0.051	3
Interest rate on interest-bearing core dep.	−1.963	−4.7	−3.422	−7.9	−0.743	−1.8	−1.945	−3.1
Small denom. time deposits/core deposits	−0.117	−6.2	−0.117	−5	−0.085	−3.8	−0.056	−2.8
Recurring fees/tangible book value	2.632	6.3	4.28	10.8	1.898	4.2	1.091	2.8
Other nonint. income/tangible book value	1.941	3.9	3.166	4.4	1.121	1.9	0.81	2.1
Noninterest expense/tangible book value	−2.433	−6.8	−3.955	−10.7	−1.468	−4.1	−0.891	−3.7
Log of total assets	0.100	4.4	0.121	3.9	0.057	1.8	0.094	4.8
Tangible book value/total assets	1.285	0.9	−4.418	−2.2	5.756	2.1	2.062	1.7
Dividend/tangible book value	24.014	8.5	20.499	6	22.599	6.7	30.635	8.1
Fixed rate gap/tangible book value	0.029	3.8	0.025	3.1	0.036	4.2	0.02	2.1
R-squared	0.938		0.952		0.914		0.938	
Observations	15,782		9,062		2,845		3,875	
Panel B: Small BHCs (total assets less than 2 billion USD)								
Loans' equation intercept	−0.053	−1.9	−0.098	−3.0	0.015	0.3	0.003	0.1
Average tax-equivalent loans' yield	1.769	4.8	2.642	6.2	0.352	0.6	−0.032	−0.1
Allowance/gross loans held for investment	0.680	1.6	1.083	1.2	−0.342	−0.8	0.237	0.7
Nonperforming loans/gross loans	−0.428	−4.7	−1.563	−4.3	−0.42	−4.2	−0.248	−3.8
Prov. for loan losses/average gross loans	−0.192	−0.6	1.107	1.2	−0.049	−0.1	0.020	0.1
Net charge-offs/average gross loans	−0.251	−0.7	−4.364	−4.1	0.052	0.1	−0.068	−0.3
Deposits' equation intercept	0.102	4.8	0.162	7.3	0.073	2.6	0.014	0.7
Noninterest-bearing deposits/core deposits	0.106	4.2	0.136	4.2	0.033	1.1	0.026	1.4
Interest rate on interest-bearing core dep.	−1.125	−2.7	−2.444	−5.8	0.133	0.3	−0.053	−0.1
Small denom. time deposits/core deposits	−0.114	−5.9	−0.107	−4.1	−0.1	−4.8	−0.080	−3.6
Recurring fees/tangible book value	2.670	4.8	4.112	7.8	1.769	2.8	1.037	1.5
Other nonint. income/tangible book value	1.914	3.1	2.930	3.3	−0.606	−0.8	0.599	1.7
Noninterest expense/tangible book value	−2.209	−6.0	−3.674	−9.0	−0.996	−2.9	−0.176	−1.1
Log of total assets	0.229	5.4	0.237	4.7	0.127	1.9	0.279	6.7
Tangible book value/total assets	2.743	2.0	−0.995	−0.6	9.31	4.3	2.056	1.5
Dividend/tangible book value	24.438	8.1	20.005	5.7	29.605	6.9	30.153	6.3
Fixed rate gap/tangible book value	0.013	1.5	0.01	1.0	0.021	3.0	0.004	0.5
R-squared	0.938		0.951		0.915		0.938	
Observations	8,745		5,387		1,468		1,890	
Panel C: Large BHCs (total assets greater than 2 billion USD)								
Loans' equation intercept	−0.051	−1.4	−0.133	−2.7	0.007	0.2	0.010	0.3
Average tax-equivalent loans' yield	1.813	3.9	3.651	6.3	−0.460	−0.9	1.084	2.2
Allowance/gross loans held for investment	0.462	0.9	0.411	0.4	0.315	0.6	0.278	0.7
Nonperforming loans/gross loans	−0.602	−3.5	−3.220	−5.0	−0.662	−3.9	−0.443	−3.2
Prov. for loan losses/average gross loans	−1.076	−3.1	0.398	0.3	−1.057	−2.1	0.193	0.8
Net charge-offs/average gross loans	0.468	1.2	−5.092	−3.3	1.065	2.2	−0.268	−0.9
Deposits' equation intercept	0.168	6.7	0.215	8.2	0.135	4.7	0.060	2.9
Noninterest-bearing deposits/core deposits	0.033	1.0	−0.001	0.0	0.102	3.3	0.045	1.9
Interest rate on interest-bearing core dep.	−2.532	−4.0	−3.859	−5.5	−1.721	−2.7	−4.468	−4.9
Small denom. time deposits/core deposits	−0.122	−3.6	−0.147	−3.5	−0.053	−1.5	−0.029	−0.8
Recurring fees/tangible book value	2.989	6.0	4.800	8.5	1.931	4.1	1.271	3.3
Other nonint. income/tangible book value	2.620	3.7	4.034	3.5	2.604	3.2	1.474	2.3
Noninterest expense/tangible book value	−2.775	−5.7	−4.210	−6.9	−1.580	−3.3	−1.484	−3.5
Log of total assets	−0.002	−0.1	−0.021	−0.4	−0.030	−0.6	0.040	1.5
Tangible book value/total assets	−0.980	−0.4	−8.951	−2.4	1.059	0.2	−0.234	−0.1
Dividend/tangible book value	20.899	5.4	20.385	4.2	17.959	5.0	25.619	5.8
Fixed rate gap/tangible book value	0.039	3.5	0.036	2.7	0.044	3.1	0.028	2.3

(*continued on next page*)

Table 3 (*continued*)

	Q1:00–Q3:13		Q1:00–Q2:07		Q3:07–Q4:09		Q1:10–Q3:13	
	Coef.	*t*-Stat	Coef.	*t*-Stat	Coef.	*t*-Stat	Coef.	*t*-Stat
R-squared	0.945		0.96		0.927		0.949	
Observations	7,037		3,675		1,377		1,985	

The regressions include fixed time effect. The *t*-statistics are calculated using two-ways (firm and time) clustered standard errors (Petersen, 2009).

Similar to the loan yield coefficient, the coefficients of the four credit-related variables (provision, allowance, NPLs, and net charge-offs) decreased in magnitude following the financial crisis. However, unlike the loan yield coefficient, these decreases have coincided with large increases in the cross-sectional variability of the credit-related variables (Panel D), and thus the *t*-statistics of these coefficients have not changed significantly (Panel B). As discussed below, these patterns suggest that investors viewed the elevated values of the credit-loss related variables of some banks during the financial crisis as less persistent than in "normal" times, resulting in lower coefficient values.

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 relatively insignificant throughout the sample period. The coefficient on the provision also was insignificant in most of the quarters; however, it was marginally significant during recessions (in 2001 and at the beginning of the financial crisis) as well as in the last two years of the sample period (mid-2011 through mid-2013). Apparently during recessions the provision variable captures important aspects of losses, while at other times it is "noisy" and possibly "managed."

Net charge-offs appears to exhibit an opposite pattern relative to the provision: it is significant during expansion periods but is insignificant or even positive during recessions. One interpretation of this finding is that charging-off loans during recessions is a sign of strength because it indicates a willingness to recognize additional provisions. Loan charge-offs reduce the allowance for loan losses, thereby inducing the bank to increase the provision for loan losses to bring the allowance-to-loans ratio back to "acceptable" levels. This indirect effect of loan charge-offs could explain the insignificant effect of charge-offs during the financial crisis.

Panel C shows that the cross-sectional means of the four loan quality variables increased significantly during the financial crisis. Consistent with the view that these variables contain different and complementary information about loan quality, those increases, however, did not coincide with one another. The first to increase was NPL, followed by the provision, and finally, by the allowance and net charge-offs. This pattern is expected given that accounting rules require banks to use an incurred (rather than expected) loss model in recognizing credit losses, and given that many loans that are eventually charged-off are classified as non-performing beforehand (Kahn et al., 2014).

Following the financial crisis, the trend in the credit loss variables was reversed. Since early 2010 there is a strong negative trend in the provision. NPL and net charge-offs developed negative trends about a year later, and the allowance started to trend downward in mid-2011. As of Q3:2013, the mean values of NPL and the allowance remain higher than their pre-crisis levels, but the provision and net charge-off means have reached their pre-crisis levels.

Panel D depicts the cross-sectional standard deviations of the lending-related variables. Although both means and standard deviations of the credit loss variables rose during the crisis, standard deviations increased more than means. In particular, the standard deviation of NPL increased almost ten-fold. Clearly, there were big differences in credit losses experienced by banks during the crisis. The decline in the coefficients of these variables during the crisis (Panel A) indicates that these losses were perceived as less likely to persist. In earlier periods, an increase in loan problems of one bank compared to the mean signaled a long-term change in that bank's lending outcomes, but during the crisis, cross-sectional differences were more indicative of a momentary, rather than lasting, difference. With the return to more "normal" times in recent quarters, the magnitudes of several of the coefficients have increased.

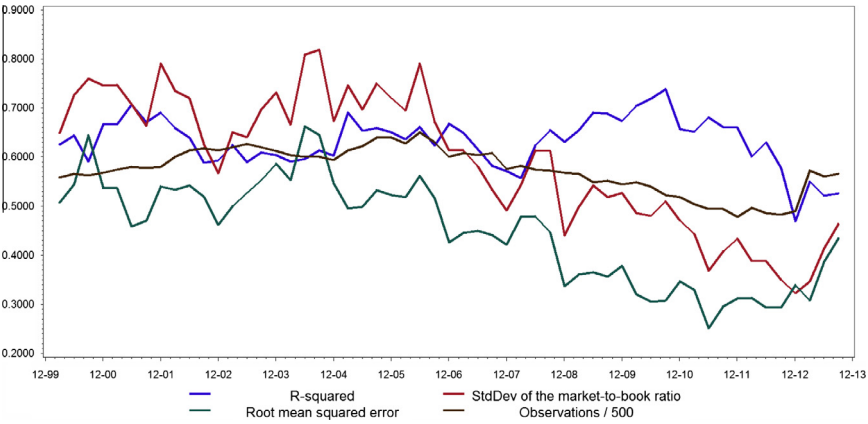


Fig. 3. Model statistics. *Notes:* The figure presents summary statistics from cross-sectional regressions of the "Valuation Equation" described in Section 4. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

5.2. Deposits

Fig. 5 plots statistics for the core deposit-related estimates. As for lending activities, the figure contains five panels. The "mean deposits-related fitted value" shown in Panel E captures the overall effect of core deposits on bank market-to-book values over time. Panel E also presents the time series of the components of the "mean deposits-related fitted value," namely the mean fitted deposit coefficient $\left(\gamma_0 + \gamma_1 \frac{NonIntDepo}{CoreDepo} + \gamma_2 \frac{IntCoreDepo}{AveCoreDepo} + \gamma_3 \frac{CoreTimeDepo}{CoreDepo}\right)$ and the mean of deposits (relative to book equity). Panels A and B plot the time series of the individual cross-sectional coefficients and *t*-statistics, respectively, for each of the deposit-related variables and intercept (γ_0). Panels C and D depict the time series of the cross-sectional mean and standard deviation of the deposit-related variables, respectively. All coefficients have the expected signs (Panel A) and are generally statistically significant (Panel B; note that consistent cross-sectional coefficients over time, even when only marginally significant individually, imply strong overall significance).[28] Noninterest bearing deposits are more valuable than NOW and savings accounts (the omitted category), which in turn are more valuable than time deposits. High interest paying deposits are less valuable than low interest paying ones.

Similar to the lending-related fitted value, the deposit-related fitted value is much lower after the financial crisis compared to the pre-crisis period (Panel E). However, the lending-related fitted value declined during 2007 and 2008, while the deposit-related fitted value declined in late 2008 and 2009. The time-series pattern of the deposit-related fitted value tracks changes in the interest rate environment (Panel C). Reductions (increases) in interest rates, primarily long-term ones, have led to declines (increases) in the deposit-related fitted value.[29] That is, core deposits do not save interest cost as much when interest rates on non-core debts are low, as they have been after the crisis.

Interestingly, the relationship between the deposit-related fitted value (Panel E) and the Treasury rates (Panel C) is not simultaneous. Changes in interest rates significantly lead (i.e., come before) changes in the deposit-related fitted value. Apparently, it takes investors significant time to fully understand the implications of changes in interest rates for the value of core deposits. The fact that

[28] Relatedly, the three deposit-related coefficients (γ_1, γ_2, and γ_3) are jointly significant at the 1% level in each of the quarters except Q2:2011 (*p*-value = 12%), Q3:2011 (*p*-value = 16%), Q4:2011 (*p*-value = 1.5%), and Q1:2012 (*p*-value = 2.5%).

[29] It is also conceivable that some of the decline in deposit value might reflect an increasing risk premium used for discounting the benefits of deposits, for example, as the result of risks associated with deposit withdrawal. Deposits, however, are a core line of business for banks that has not shown much instability over time (as shown in Fig. 5, Panel C, non-interest bearing deposits have been remarkably stable, and time deposits have varied predictably over time with changes in interest rates). Thus, although we are not able to rule out the importance of changes in deposit risk premia, we do not think that time variation in the risk premia used to discount interest cost savings from deposits is likely to have been very important for explaining our findings.

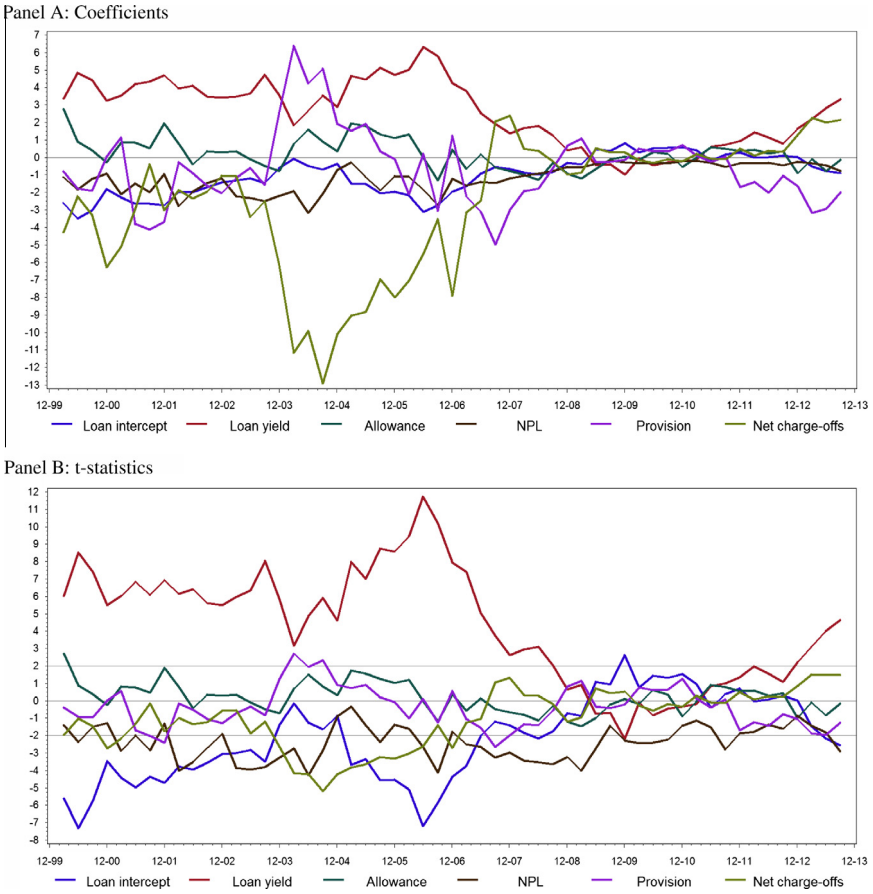


Fig. 4. Loans and lending relationships. *Notes:* The figures present summary statistics from cross-sectional regressions of the "Valuation Equation" described in Section 4, related to loans and lending-related intangibles. The series plotted include regression coefficients and related *t*-statistics, mean and standard deviation values of the regressors, and metrics calculated using the coefficients and the mean values of the regressors. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

changes in long-term rates have a 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 have been predictable; thus it is surprising that market values of banks seem to react with a lag to the recent decline in interest rates.

One potential explanation for the apparent lagging response of deposit intangibles to interest rates is the effect of another influence on the market value of deposits, namely the cost of deposit insurance. There have been numerous changes in the way deposit insurance premia have been calculated since 2006, which are not easily summarized, and the timing of market awareness of coming changes is hard to identify. Nonetheless, market values of core deposits likely were reduced by announcements of dramatic increases in deposit insurance premia from 2008 through 2011.[30]

[30] In 2006, premia ranged from 2 to 4 basis points. By the first quarter of 2009, premia for the lowest risk category varied between 12 and 14 basis points, and were much higher for higher risk categories, and rates rose further in 2009 and 2010. One-time emergency assessments were also instituted in September 2009. For details of FDIC policy changes, see Federal Register, Vol. 71, No. 230, November 30, 2006, Vol. 73, No. 246, December 22, 2008, Vol. 74, No. 41, March 4, 2009, and Vol. 76, No. 38, February 25, 2011.

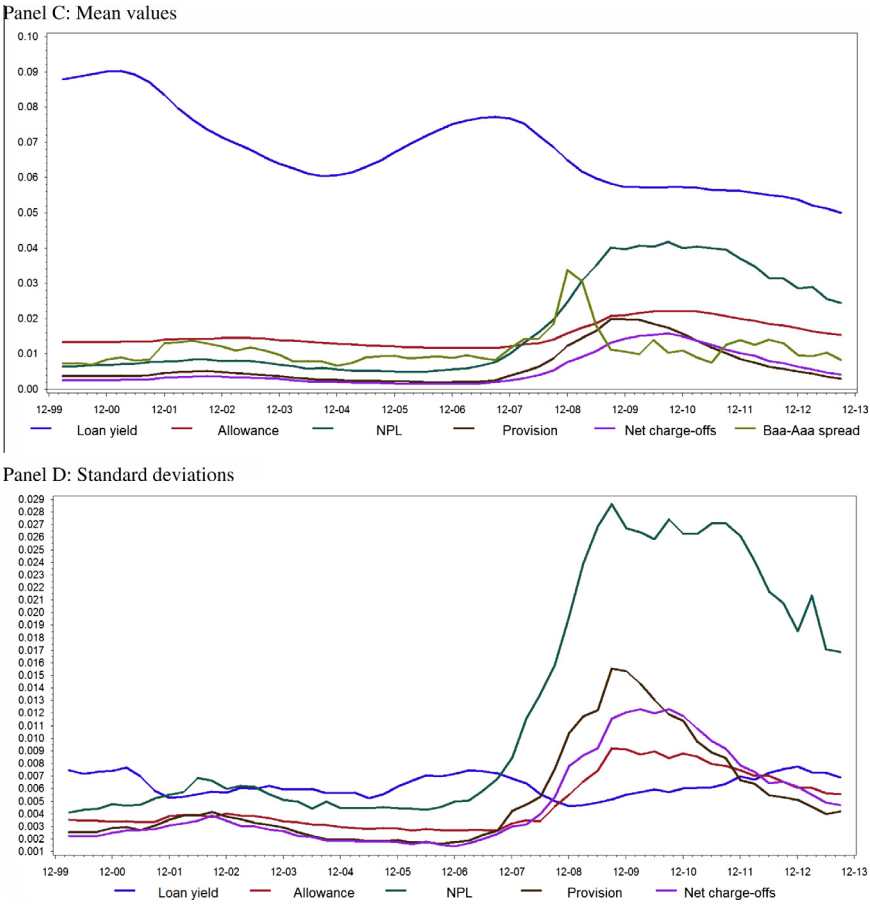


Fig. 4 (*continued*)

Panel C presents the cross-sectional means of the deposit-related variables alongside two interest rates – the 3 month and 10 year Treasury rates. The interest cost of core deposits is strongly correlated with lagged values of the 3 month Treasury rate. The lag is especially long for upward movements, reflecting banks' practice of delaying upward rate adjustments to maximize net interest income. For downward adjustments, the lagged relationship is the mechanical result of the fact that interest cost is a backward looking measure of interest rates, while Treasury yields are a forward looking measure.

Also correlated with lagged interest rates is the proportion of time deposits and, to a lesser extent, the proportion of noninterest bearing deposits. Interest rate increases (decreases) tend to produce protracted increases (decreases) in time deposits, and vice versa for noninterest-bearing deposits.

Panel D of Fig. 5 depicts the cross-sectional standard deviations of the deposit-related variables. Since early 2009 there are clear negative trends in the cross-sectional variability of time deposits and interest on deposits, and a positive trend in the cross-sectional variability of the proportion of noninterest-bearing deposits. The trend in the variability of the deposit interest rate is due to the large decline in interest rates, which reduced banks' ability to meaningfully differentiate themselves based on rates offered. The decline in the variability of the proportion of time-deposits and the increase in the variability of noninterest bearing deposits are correlated with the trends in the average proportions.

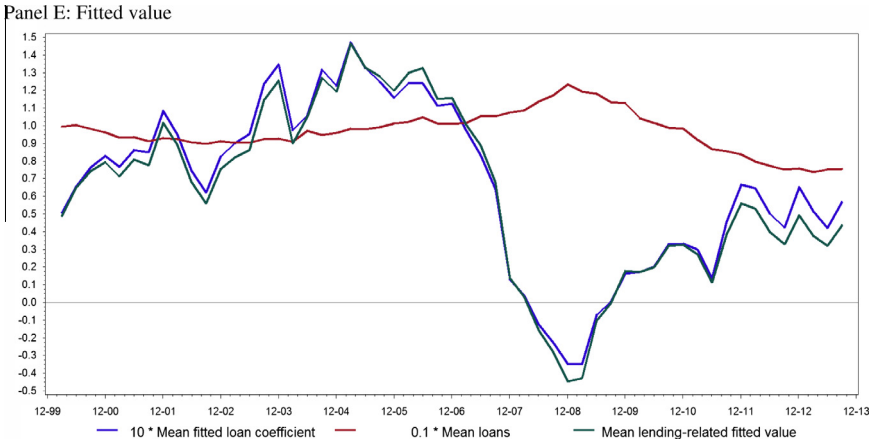


Fig. 4 (*continued*)

5.3. Noninterest income

Panels A through E of Fig. 6 present the model's statistics related to noninterest income. Before the financial crisis, as predicted in Section 4, a dollar of recurring fees had a greater impact on bank value than a dollar earned from other sources of noninterest income (Panel A). However, the difference in coefficients between the two sources of income was not as large as one might have expected. Income from trading, securitization, loan sale, and similar activities ("transitory income") had a capitalization multiple or "earnings response coefficient" of about 3 compared to about 5 for recurring fees.[31] That suggests that much of trading income was perceived as having a persistent component, reflecting either the implicit bid-ask spread earned from market making, or high "alphas" of proprietary traders. In the first half of the financial crisis (Q3:07–Q3:08), the capitalization multiples of the two sources of noninterest income converged and trended downward. Since then the two coefficients have been fluctuating around one, although they increased significantly in recent quarters (Q4:12–Q3:13). Apparently, since the financial crisis investors view these noninterest sources of income as some combination of less persistent, more risky, or otherwise less valuable than in the past. In other words, the intangible value associated with the ability to generate noninterest income has declined substantially.

The mean (Panel C) and standard deviation (Panel D) of recurring income over book equity increased during the financial crisis, primarily due to declines in book equity from recognized losses. These trends have reversed since early 2010, due to both a numerator effect (e.g., restrictions on deposit fees post the financial crisis) and a denominator effect (the increase in capital resulting from restrictions on dividends and share repurchases).

The substantial time-series variation in the capitalization coefficient (Panel A) and level (Panel C) of transitory income, as well as the positive correlation between them (i.e., the capitalization coefficient tends to be high in periods of high income), imply that the value impact of this income source is highly volatile over time. However, because the average value of transitory income is only a fraction of recurring income (Panel C), the value impact of noninterest income (Panel E) is due primarily to recurring income.

The mean noninterest income-related fitted value has declined from about 0.8 before the financial crisis to about 0.1 after the crisis (Panel E). As Panels A and C show, although the amounts of both components of noninterest income have declined somewhat, the dramatic decline in the contribution of noninterest income to bank value mainly reflects the steep declines in estimated capitalization multiples. It is important to bear in mind, however, that these estimated declines in the market value of noninterest income reflect the *gross* impact of noninterest income, which may be offset either by

[31] The difference between the two coefficients was insignificant in most quarters, especially since the financial crisis. The insignificance of the difference was due to the relatively small difference as well as to the high standard error of the coefficient on transitory income.

changes in the levels of noninterest expense or by changes in the capitalization multiples applied to noninterest expense (which are explored below). One would expect such offsetting effects. To the extent that banks earn less noninterest income they should be incurring less noninterest expense (e.g., lower bonuses). Furthermore, to the extent that markets anticipate less persistence in noninterest income (e.g., as the result of the implementation of the Volcker Rule), that should also imply lower capitalization multiples (in absolute value) applied to noninterest expense.

5.4. Noninterest expense

Noninterest (operating) expenses are incurred by banks in generating net interest income and noninterest income. Banks are able to generate high interest rate loans (relative to securities) and obtain noninterest-bearing and low interest deposits, thereby increasing net interest income, by investing in fixed assets and technology and by employing workers. Similar expenditures are required to generate noninterest income. These outlays are reflected in noninterest expense. To the extent that investors price expected net interest income and noninterest income from future activities (i.e., intangibles or

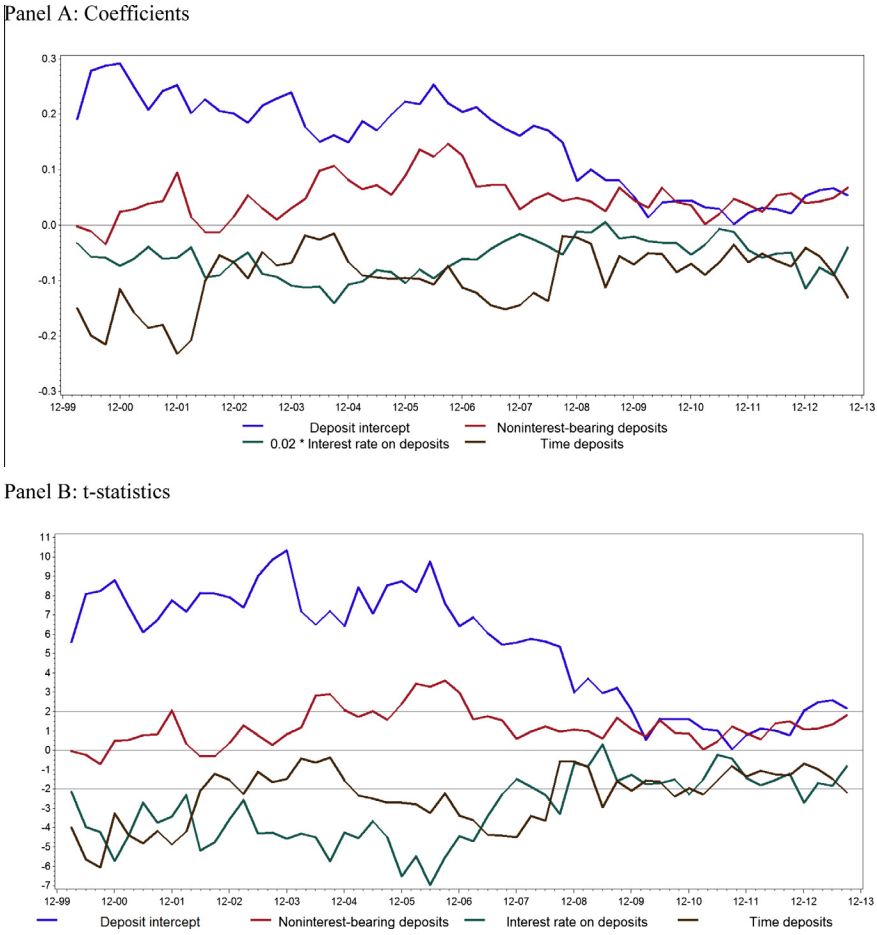
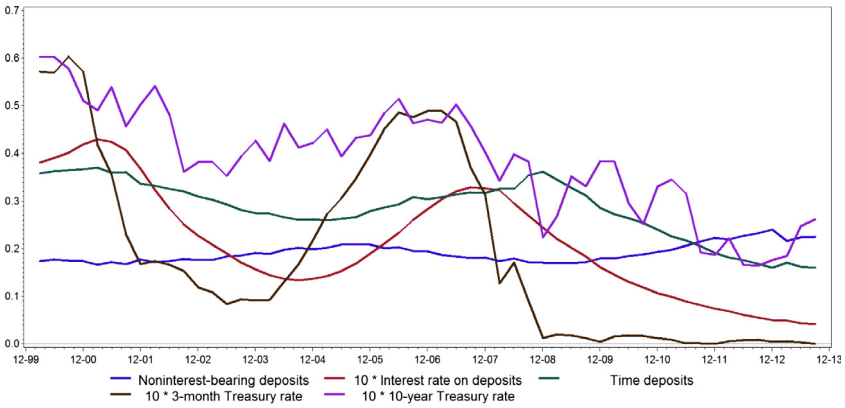
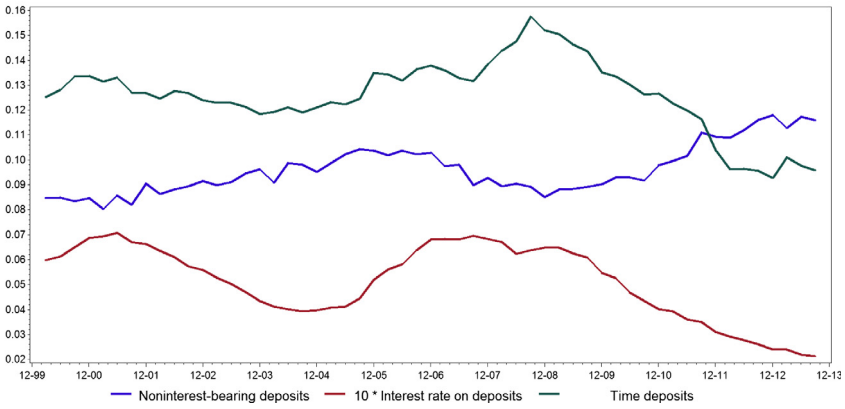


Fig. 5. Core deposits and related intangibles. *Notes:* The figures present summary statistics from cross-sectional regressions of the "Valuation Equation" described in Section 4, related to deposits. The series plotted include regression coefficients and related *t*-statistics, mean and standard deviation values of the regressors, and metrics calculated using the coefficients and the mean values of the regressors. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

Panel C: Mean values



Panel D: Standard deviations



Panel E: Fitted value

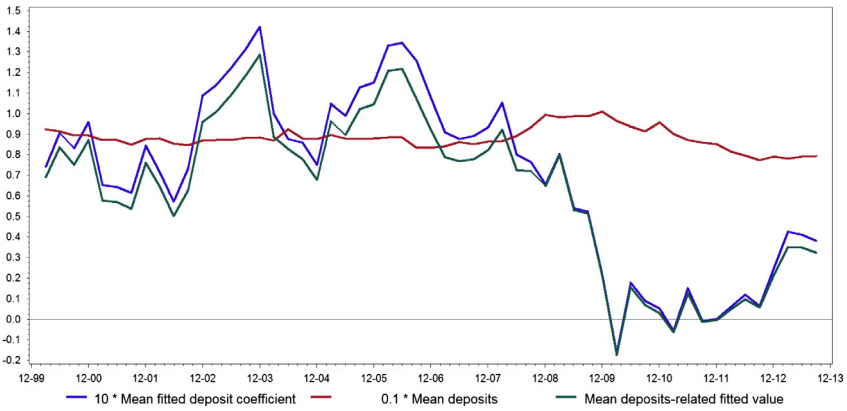


Fig. 5 (*continued*)

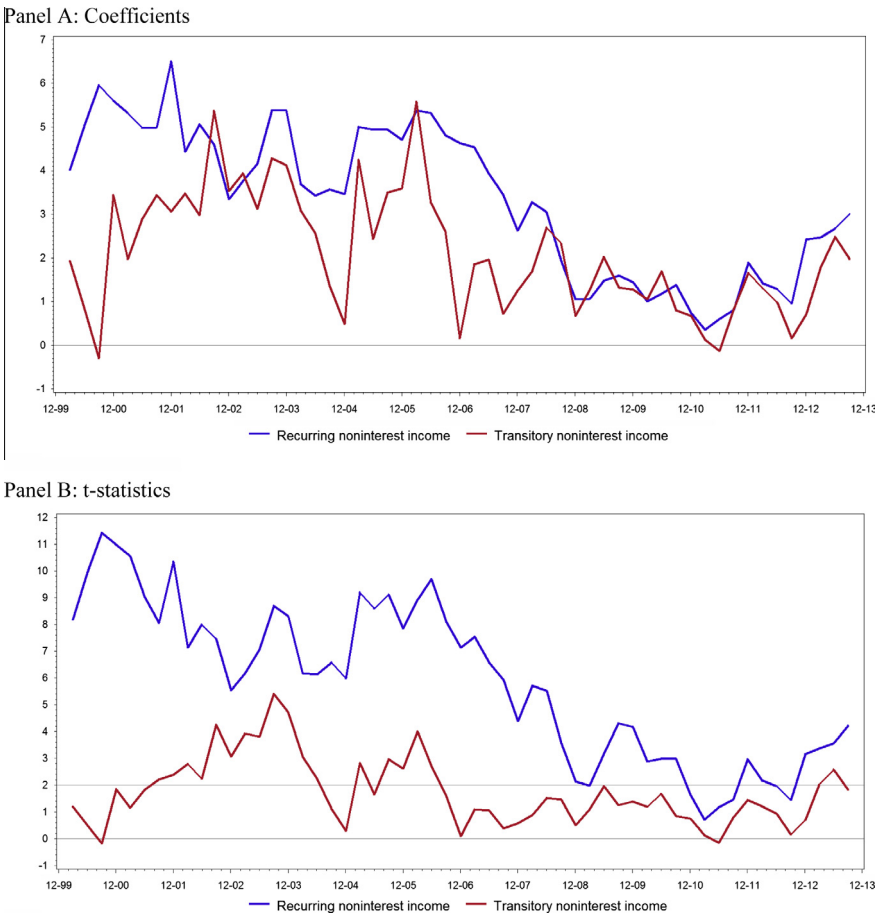


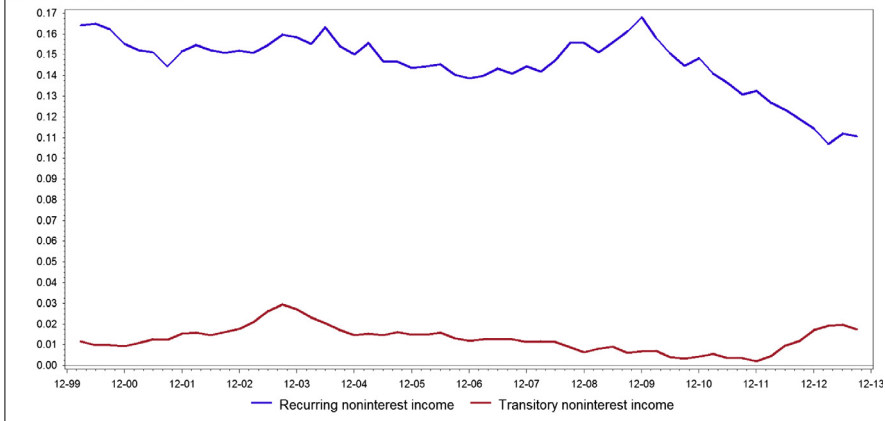
Fig. 6. Noninterest income. *Notes:* The figures present summary statistics from cross-sectional regressions of the "Valuation Equation" described in Section 4, related to noninterest income. The series plotted include regression coefficients and related *t*-statistics, mean and standard deviation values of the regressors, and metrics calculated using the coefficients and the mean values of the regressors. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

franchise value), they also consider the cost required to generate that income and accordingly capitalize future noninterest expense. Therefore, the declines in lending-related, deposit-related and noninterest income-related intangibles documented above imply that the capitalization multiples for noninterest expense should similarly decline (in absolute terms).

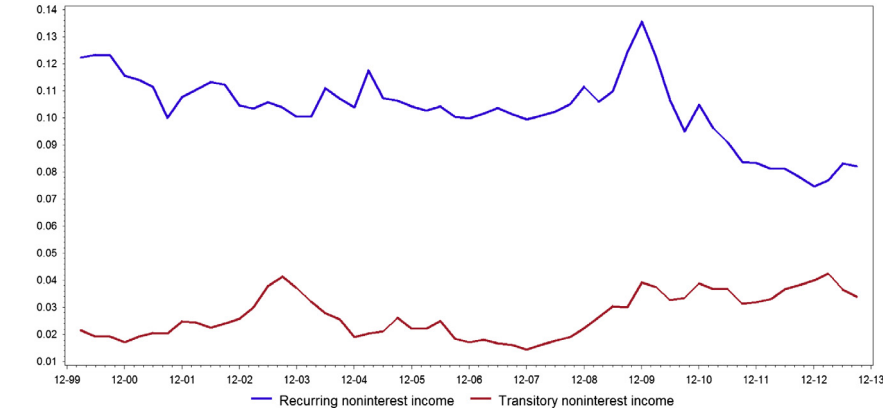
Panel A of Fig. 7 plots the cross-sectional coefficient and *t*-statistic of noninterest expense. The coefficient is significantly negative, as expected, throughout the sample period, but both its magnitude and statistical significance decreased substantially during and after the financial crisis. Before the financial crisis, the coefficient fluctuated around −4, but in the first part of the financial crisis (Q3:07–Q3:08) it declined to about −1 and generally remained at that level through 2012. In the last few quarters of the sample period (Q4:12–Q3:13), the magnitude of the coefficient has increased significantly. These patterns track similar movements for noninterest income.[32]

[32] Interestingly, the difference between the coefficients of noninterest income and noninterest expense remains essentially constant over time. We find that the differences between the (negative of) the coefficient on noninterest expense and each of the noninterest income coefficients were insignificantly different from zero in most quarters, especially since the financial crisis.

Panel C: Mean values



Panel D: Standard deviations



Panel E: Fitted value

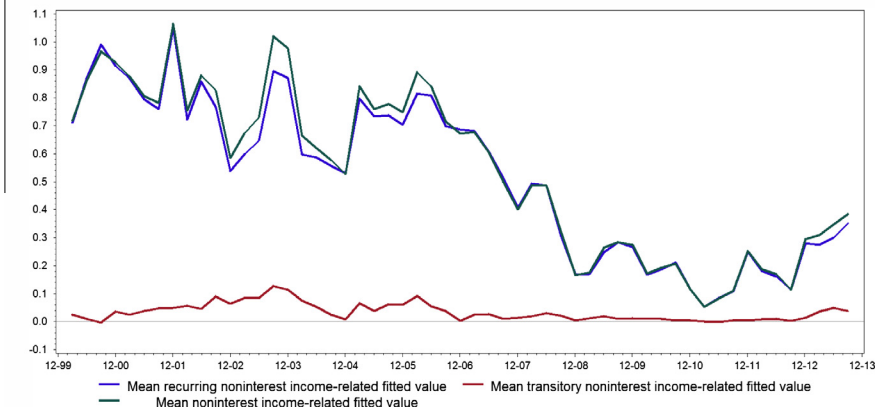
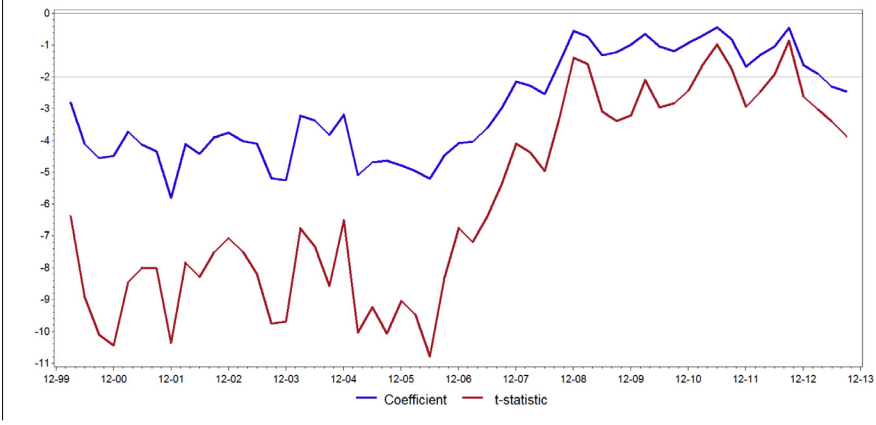


Fig. 6 (*continued*)

Panel A: Coefficient and t-statistic



Panel B: Mean and standard deviation

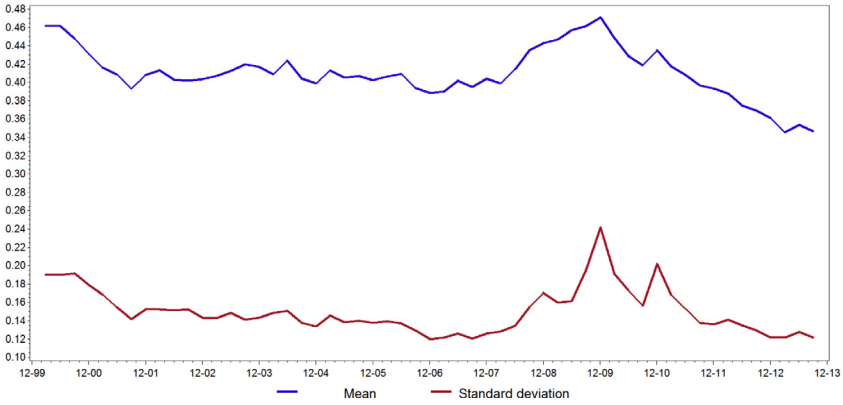


Fig. 7. Noninterest expense. *Notes:* The figures present summary statistics from cross-sectional regressions of the "Valuation Equation" described in Section 4, related to noninterest expense. The series plotted include regression coefficients and related *t*-statistics, mean and standard deviation values of the regressors, and metrics calculated using the coefficients and the mean values of the regressors. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

Similarly, as shown in Panel C of Fig. 7, the negative contribution of noninterest expense to bank value (the product of the estimated coefficient and the mean value of noninterest expense) has diminished dramatically over time, implying that noninterest expense has been a positive, and partly offsetting, influence on the negative trend in bank equity market-to-book values since the crisis. The mean noninterest expense-related fitted value has increased from about −2 before the financial crisis to about −0.5 after the crisis (Panel C). These statistics imply that the net intangibles-related decline in banks' market-to-book ratios during the financial crisis was smaller than implied by the reductions in the lending-related, deposit-related, and noninterest income-related fitted values shown in Figs. 4–6, as those declines were offset by the large increase in the noninterest expense-related fitted value.

5.5. Other bank attributes

Panels A through E of Fig. 8 present the statistics for the other bank attributes included in the Valuation Equation, which include dividend payout relative to book equity (dividend), the common

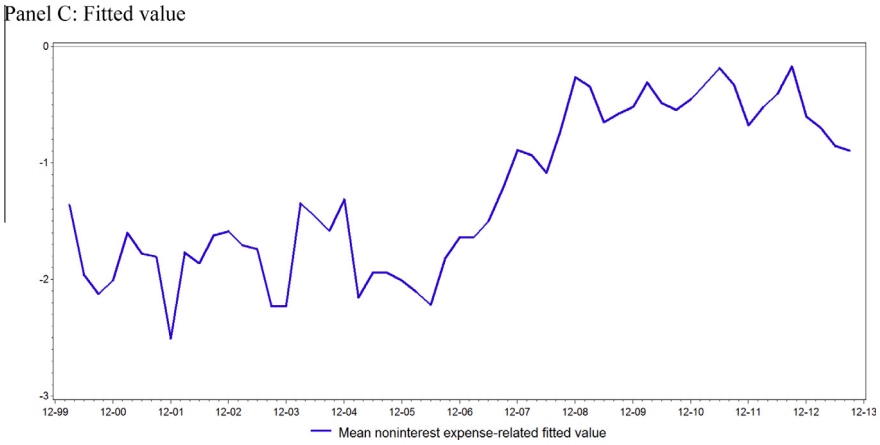


Fig. 7 (*continued*)

equity-to-asset ratio (capital), bank size (size), and the proxy for interest rate risk (gap). The most significant of these variables since the financial crisis is dividend payout (Panel B). 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 (shown in Panel A), as well as its statistical significance (Panel B), increased dramatically during the financial crisis.[33]

The "carry trade," as indicated by gap, contributed to bank value throughout the sample period (see also Table 3), but its effect was generally larger during periods of upward sloping term structure (the term spread is plotted alongside model statistics in Panel C). Yet the mean contribution of gap to the market-to-book equity ratio for the aggregate of banks was negligible throughout the sample period. The explanation for this apparent contradiction is that the cross-sectional mean value of gap is close to zero in essentially all quarters (Panel C) while its cross-sectional standard deviation is quite high (Panel D). In other words, in any given period, some banks engage in the carry trade while others have negative gap. Thus, the overall gap effect on the banking industry is small.

Asset size was a net positive contributor to value throughout the sample period, with a positive and significant coefficient in essentially all quarters (Panel B). The size effect was especially large during the recession of 2001, consistent with the perceived benefit of being "too-big-to-fail." This premium has declined substantially since the financial crisis, likely reflecting the regulatory costs associated with being considered systemically important. The changing contribution of asset size to market value (Panel E) closely tracks the changes in coefficient magnitude shown in Panel A, as the mean value of size was stable throughout the sample period (Panel C).

As shown in Panels A and E, high leverage (a low value of capital) increased the market-to-book equity ratio during "normal" times, but reduced market value during the financial crisis and afterward. After the financial crisis the capital coefficient is generally insignificant. The shifting market consequences of greater leveraging confirm the view that market participants encouraged high leverage of banks prior to the crisis (reflecting the high cost of equity finance, or perhaps to maximize the value of the safety net put option they enjoyed), as argued by Cheng et al. (2010), but apparently, once the crisis began, banks with lower leverage were rewarded for their relatively low counterparty risk and were able to maintain their operations better than those that were scrambling to liquidate assets and shore up their positions as a consequence of their higher leverage.

[33] We also experimented with including repurchases in our dividends variable. When we did so, we found similar results to those reported here. Although coefficient magnitudes and t-statistics are smaller when repurchases are included, they are still highly significant economically and statistically.

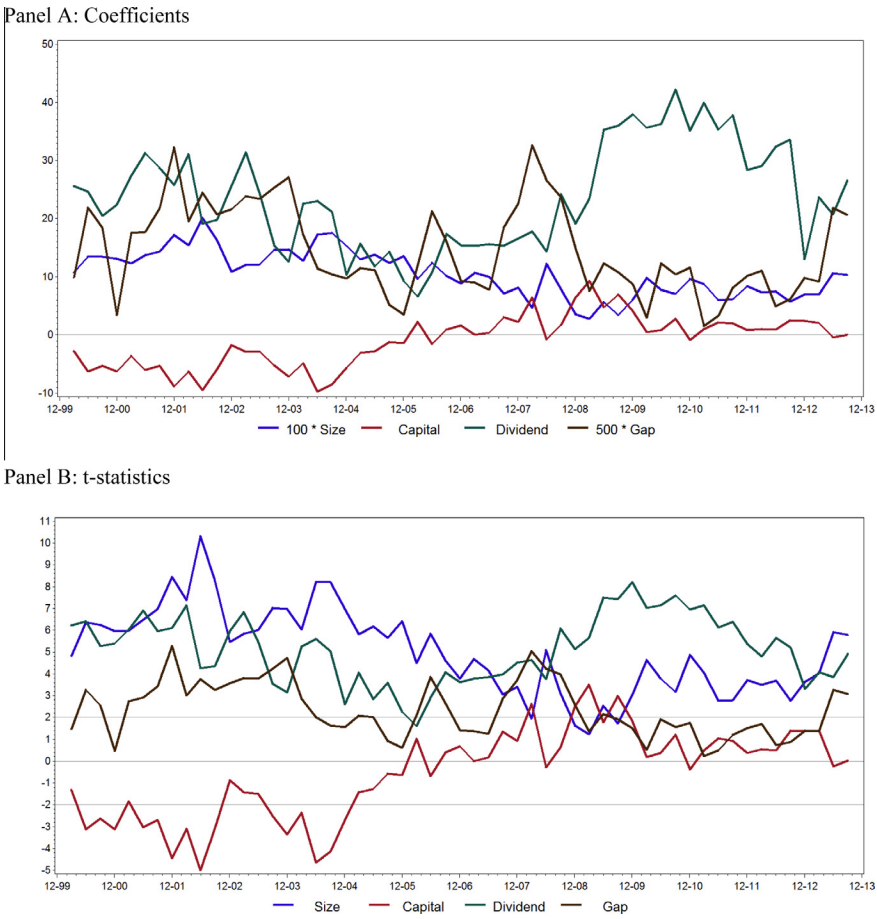
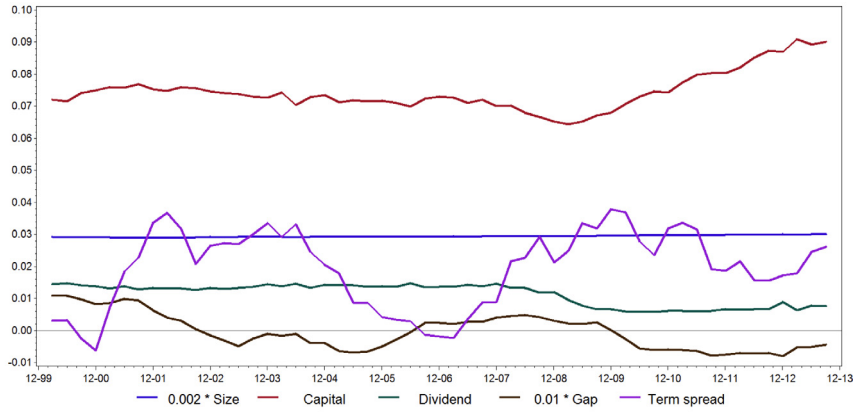


Fig. 8. Bank attributes. *Notes:* The figures present summary statistics from cross-sectional regressions of the "Valuation Equation" described in Section 4, related to bank attributes. The series plotted include regression coefficients and related *t*-statistics, mean and standard deviation values of the regressors, and metrics calculated using the coefficients and the mean values of the regressors. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

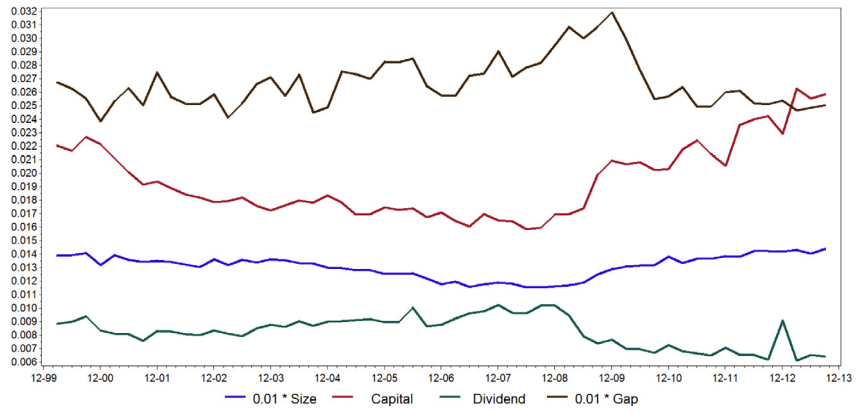
5.6. Decomposition of the market-to-book ratio

Fig. 9 summarizes the influences on market value described in Figs. 4–8. It plots the mean market-to-book equity ratio over time alongside the contributions to that ratio from each set of variables (loans, core deposits, noninterest income, noninterest expense, and attributes) included in the Valuation Equation. Each plot associated with a set of explanatory variables equals the cross sectional mean of the portion of the fitted value of the market-to-book ratio explained by that set of variables. Thus, the total of the five mean activity-related fitted values is equal to the mean market-to-book ratio. From 2007 through the beginning of 2009 there is a strong negative trend in the market-to-book ratio and in the portions of the fitted value explained by lending, noninterest income and the attributes. As shown above, these trends reflect changes in the estimated coefficients (e.g., the reductions in the coefficients on the components of noninterest income) as well as changes in the related variables (e.g., increases in NPLs). The negative trends in lending, noninterest income and the attributes were offset by a large increase in the portion of the market-to-book fitted value explained by noninterest

Panel C: Mean values



Panel D: Standard deviations



Panel E: Fitted value

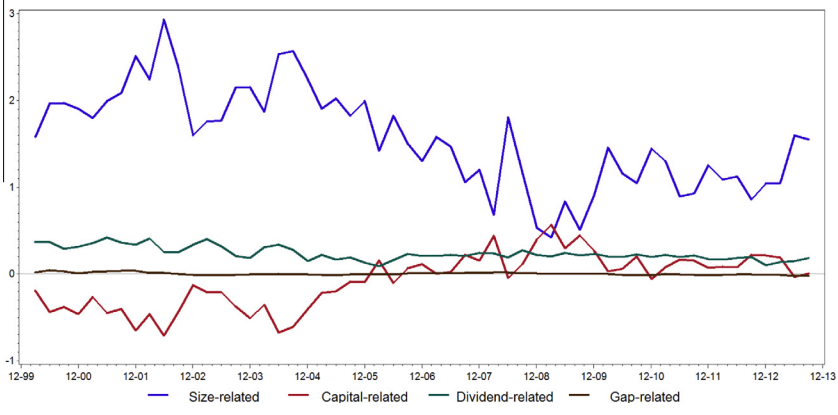


Fig. 8 (*continued*)

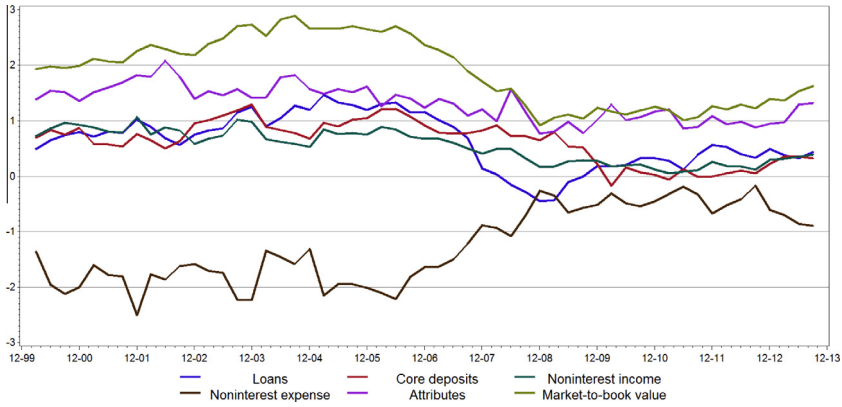


Fig. 9. Mean market-to-book ratio and its components over time. *Notes:* The figure plots the mean market-to-book value over time alongside the contributions to that ratio from each set of variables included in the Valuation Equation. The figure is constructed so that the total of the five groups of variables (loans, core deposits, noninterest income, noninterest expense, and other attributes) sum to the fitted value of the mean market-to-book ratio. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

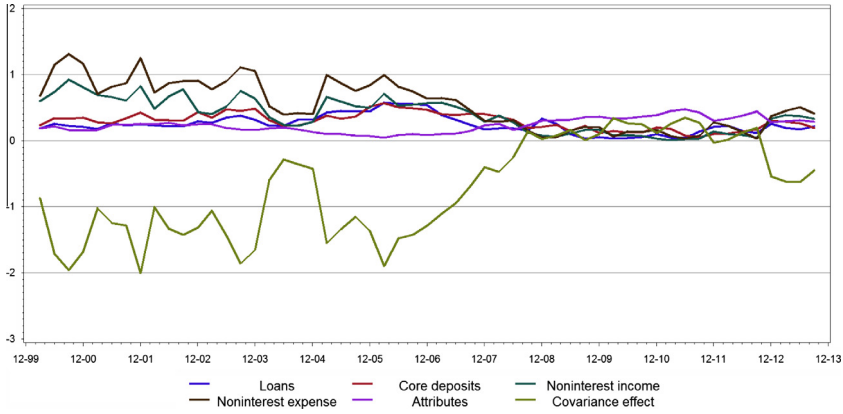


Fig. 10. Decomposition of the explained cross-sectional variation in the market-to-book ratio. *Notes:* The figure plots the cross-sectional variation in the various activity-related fitted values relative to the total cross-sectional variation in the fitted market-to-book ratio. The covariance effect captures the cross-sectional variation in the fitted market-to-book ratio that is explained by the covariances among the various value effects. By construction, the individual plots sum to unity at each point in time. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

expense. Of the three sources of value creation, deposits are the only one that did not decline at the beginning of the crisis. However, in the post-crisis, low-interest rate environment, banks lost much of the value creation associated with that important activity. The decline in the value of deposits after the financial crisis offset the partial recovery in lending, leaving the average market-to-book ratio at about one through mid-2012.

While Fig. 9 captures the relative contribution over time of the various value drivers in the Valuation Equation to the mean market-to-book equity ratio, Fig. 10 examines the relative contributions of the value drivers to the *cross-sectional variation* in the market-to-book ratio, and how those contributions changed over time. Because the regressors in the Valuation Equation are not mutually orthogonal, Fig. 10 includes a covariance term, which captures the cross-sectional variation in the fitted market-to-book ratio that is explained by the sum of the covariances among the various value

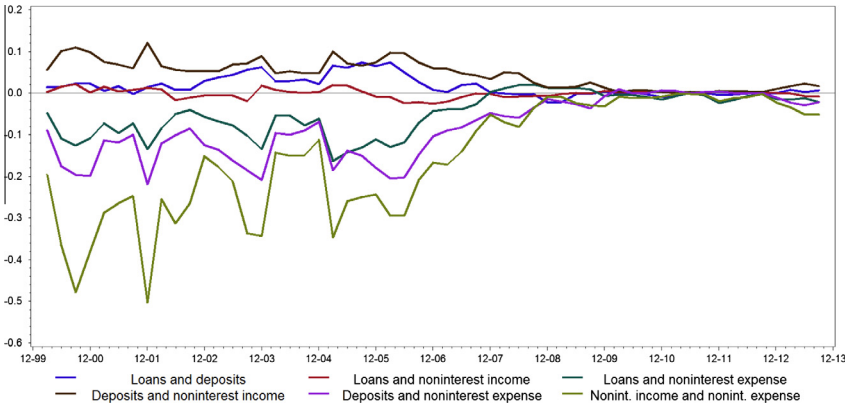


Fig. 11. Covariances across activities. *Notes:* The figure plots the cross-sectional covariances of the fitted values of each of the value drivers for which synergies are likely to be important (loans and deposits, loans and noninterest expense, deposits and noninterest expense, loans and noninterest income, deposits and noninterest income, and noninterest income and noninterest expense). The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

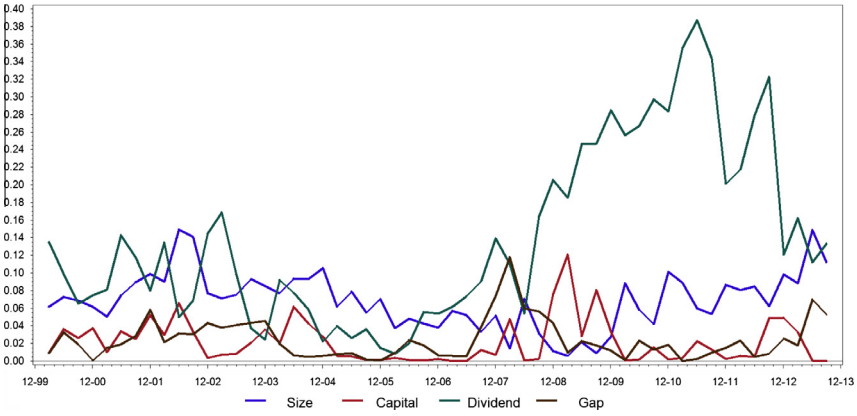


Fig. 12. Attribute-related components of the explained cross-sectional variation in the market-to-book ratio. *Notes:* The figure plots the cross-sectional variation in the various attribute-related fitted values relative to the total cross-sectional variation in the fitted market-to-book ratio. The sample comprises all public U.S. bank holding companies with total assets of at least $500 million in March 2006 prices.

effects. By construction, the individual plots sum to unity at each point in time. These covariances are described in detail in Fig. 11.

The most significant pattern in Fig. 10 is the large decline in the contribution of the covariance term since the beginning of the crisis. As we mentioned in Section 3, our model is not structural; covariances among regressors reflect the fact that bank decisions that increase, say, fee income, also may increase core deposits and noninterest expense, and vice versa. The fact that the covariance term becomes smaller over time suggests that as the value contribution of different activities declines over time in absolute value so do the effects of covariances among them on value (which makes sense given that covariance is scale-dependent). In other words, as the value of bank intangibles become small, the perceived valuation covariance effects across categories of assets and liabilities or income and expense streams also become smaller. Fig. 11 confirms that interpretation. It plots the individual covariances between each category of variables in the Valuation Equation. Specifically, we plot the covariances of the fitted values of each of the value drivers for which synergies are likely to be important (loans and

deposits, loans and noninterest expense, deposits and noninterest expense, loans and noninterest income, deposits and noninterest income, and noninterest income and noninterest expense). These covariances are often large prior to the crisis, but after 2007 they are all effectively zero.

The covariance effect in Fig. 10 is not the only effect that becomes smaller over time. In fact, the financial crisis is associated with a decline in the explanatory power of loans, core deposits, noninterest income, and noninterest expense. The only variables that gained explanatory power during the financial crisis are attributes. To identify which of the attributes are responsible for this trend, we plot in Fig. 12 the time-series of the explained cross-sectional variation associated with each attribute. Consistent with the large increase in the dividend coefficient (Panel A of Fig. 8), we find that the increase in the explanatory power of the attributes is due to dividends. Interestingly, the dividend variable appears to have lost much of its explanatory power since Q4:2012, consistent with other indications throughout the analysis of a post-2012 return to normalcy.

6. Conclusion

We examine the market valuation of banking activities and why market-to-book ratios of U.S. bank holding companies changed over the last decade. We develop a Valuation Equation that uses bank balance sheets, income statements, and other attributes to identify the drivers of bank value and how they have changed over time. Our valuation model recognizes that: (1) banks possess valuable intangible assets through the types of assets and liabilities that they create (e.g., lending and deposit relationships), as well as other activities related to noninterest income (e.g., market making, loan servicing, and underwriting); (2) banks' noninterest income streams are heterogeneous, differing in their profitability and persistence; (3) bank value also depends on other attributes, including the ability of the bank to signal its value to the market through dividends, the bank's choice of financing structure (capital ratio), bank size, and the extent to which the bank bears interest rate risk; and (4) the valuation of assets, liabilities or income streams varies over time depending on changing market conditions.

This approach allows us to identify the changes in market pricing of intangibles over time. The model explains substantial cross-sectional variation in observed market-to-book equity values, as well as changes in the average market-to-book values of equity over time. Contrary to the view that the substantial decline in market-to-book values for U.S. banks from 2006 to 2012 mainly reflects unrecognized losses, we find that other factors explain most of the decline in market-to-book ratios. We find that the declines in bank stock values since 2007 primarily reflect declining market perceptions of the intangible values attached to various categories of banking activity.

We find that the value of loan intangibles fell substantially during the crisis, but has begun to recover recently. The value of core deposit intangibles also declined during the crisis, but has remained depressed as the result of the low-interest rate environment. The capitalization multiples associated with noninterest income and noninterest expense have also shrunk substantially in absolute value in the crisis and post-crisis period, suggesting either a perception of lower expected persistence of these streams of income and expense, or higher discount rates during the aftermath of the crisis, or both.

Other attributes of banks also matter importantly for bank market values. Banks that pay higher dividends, ceteris paribus, exhibit higher market value ratios. This effect became much stronger 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.

The results with respect to our measure of interest rate risk (the difference in the amount of assets and liabilities subject to fixed interest rates) indicate that the "carry trade" also contributes to bank profitability, and the magnitude of that contribution varies over time with the term structure of interest rates. Carry trade valuation effects matter positively for some banks, but negatively for others, reflecting cross-sectional differences in banks' exposure to interest rate risk. Times when the term structure is steep are associated with greater contributions of carry trade effects to cross-sectional differences in bank values, but cross-sectional differences in bank exposures to interest rate risk imply that carry trade has a small effect on average values of banks as a whole.

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 et al. (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.

These results have important implications for policy, especially for the new macro-prudential policy framework toward banks, which seeks to identify risk factors to guide policy makers about changes in financial fragility. Regulators focus on book values of equity when thinking about financial fragility. Recent research has pointed toward market values as useful indicators of bank fragility, and shown that such measures can lead to dramatically different conclusions about capital adequacy (Acharya et al., 2013; Acharya and Steffen, 2013). Our analysis shows that a focus on market values is useful, not only because market values "correct" errors in accounting for the book values of tangible assets (i.e., unrecognized loan losses), but also because book values of equity omit important drivers of value that are related to expected future cash flows associated with intangible assets and liabilities. The fact that some U.S. banks today display market-to-book ratios below one indicates that some of those banks' investments in human capital, information technology, and physical branch networks are projected to generate negative economic profits in the future. Attention to market values, and their drivers, is essential for regulators to identify points of vulnerability for banks, many of which are unrelated to balance sheet book values.

Acknowledgments

The authors gratefully acknowledge the helpful comments and suggestions made by seminar participants at Baruch College, Columbia University, FASRI, Insead, Northwestern, and Yale University, as well as those of two anonymous referees and the editor, Viral Acharya.

References

Acharya, Viral, Steffen, Sascha, 2013. Falling Short of Expectations? Stress Testing the European Banking System. Working Paper, NYU Stern School.

Acharya, Viral, Engle, Robert, Pierret, Diane, 2013. Testing Macroprudential Stress Tests: The Risk of Regulatory Risk Weights. Working Paper, NYU Stern School.

Adrian, Tobias, Shin, Hyun-Song, 2009. Financial intermediaries, financial stability and monetary policy. In: Maintaining Stability in a Changing Financial System, Federal Reserve Bank of Kansas City 2008 Symposium, pp. 287–345.

Aiyar, Shekhar, Calomiris, Charles W., Wieladek, Tomasz, 2014. Does macro-prudential regulation leak? Evidence from a UK policy experiment. J. Money, Credit, Bank. 46, 181–214.

Aschcraft, Adam, 2005. Are banks really special? New evidence from the FDIC-induced failure of healthy banks. Am. Econ. Rev. 95, 1712–1730.

Barth, Mary E., Beaver, William H., Landsman, Wayne R., 1996. Value-relevance of banks' fair value disclosures under SFAS No. 107. Account. Rev. 71, 513–537.

Beaver, William H., Eger, Carol, Ryan, Stephen, Wolfson, Mark, 1989. Financial reporting, supplemental disclosures, and bank share prices. J. Account. Res. 27, 157–178.

Berger, Allan N., Demsetz, Rebecca S., Strahan, Philip E., 1999. The consolidation of the financial services industry: causes, consequences, and implications for the future. J. Bank. Finance 23, 135–194.

Blankespoor, Elizabeth, Linsmeier, Thomas J., Petroni, Kathy R., Shakespeare, Catherine, 2011. Fair Value Accounting for Financial Instruments: Does it Improve the Association Between Bank Leverage and Credit Risk? Available at SSRN: <http://www.ssrn.com/abstract=1565653>.

Brewer III, Elijah J., 1995. The impact of deposit insurance on S&L shareholders' risk/return trade-offs. J. Financ. Serv. Res. 9, 65–89.

Calomiris, Charles W., Herring, Richard, 2012. Why and how to design a contingent convertible debt requirement. In: Fuchita, Y., Herring, R., Litan, R. (Eds.), Rocky Times: New Perspectives on Financial Stability. Brookings, pp. 117–162.

Calomiris, Charles W., Kahn, Charles M., 1991. The role of demandable debt in structuring optimal banking arrangements. Am. Econ. Rev. 81, 497–513.

Calomiris, Charles W., Nissim, Doron, 2007. Activity-Based Valuation of Bank Holding Companies. NBER Working Paper No. 12918.

Calomiris, Chares W., Wilson, Berry, 2004. Bank capital and portfolio management: the 1930 'capital crunch' and scramble to shed risk. J. Bus. 77, 421–455.

Cheng, Ing-Haw, Hong, Harrison G., Schenkman, Jose A., 2010. Yesterday's Heroes: Compensation and Creative Risk-Taking. ECGI Finance Working Paper No. 285/2010.

Collins, Julie H., Shackelford, Douglas A., Wahlen, James M., 1995. Bank differences in the coordination of regulatory capital, earnings, and taxes. J. Account. Res. 33, 263–291.
Degryse, Hans, Ongena, Steven, 2005. Distance, lending relationships and competition. J. Finance 60, 231–266.
Demsetz, Rebecca S., Strahan, Philip E., 1997. Diversification, size and risk at bank holding companies. J. Money, Credit, Bank. 29, 300–314.
Diamond, Douglas, 1984. Financial intermediation and delegated monitoring. Rev. Econ. Stud. 51, 393–414.
Diamond, Douglas W., Rajan, Raghuram G., 2000. A theory of bank capital. J. Finance 55 (6), 2431–2465.
Elliott, John A., Douglas Hanna, J., Shaw, Wayne H., 1991. The evaluation by the financial markets of changes in bank loan loss reserve levels. Account. Rev. 66, 847–861.
Goh, Beng Wee, Ng, Jeffrey, Yong, Kevin Ow, 2009. Market Pricing of Banks' Fair Value Assets Reported Under SFAS 157 During the 2008 Economic Crisis. Working Paper, MIT.
Griffin, Paul A., Wallach, Samoa J.R., 1991. Latin American lending by major U.S. banks: the effects of disclosures about nonaccrual loans and loan loss provisions. Account. Rev. 66, 830–846.
Hughes, Joseph P., Mester, Loretta J., Moon, Choon-Geol, 2001. Are scale economies in banking elusive or illusive? Incorporating capital structure and risk-taking into models of bank production. J. Bank. Finance 25, 2169–2208.
Huizinga, Harry, Laeven, Luc, 2012. Bank valuation and accounting discretion during a financial crisis. J. Financ. Econ. 106, 614–634.
Ivashina, Victoria, Scharfstein, David, 2009. Bank Lending During the Financial Crisis of 2008. Working Paper, Harvard University.
James, Christopher, 1987. Some evidence on the uniqueness of bank loans. J. Financ. Econ. 19, 217–235.
Jayaratne, Jith, Morgan, Donald P., 2000. Capital market frictions and deposits constraints at banks. J. Money, Credit, Bank. 32, 74–92.
Kahn, Urooj, Harris, Trevor, Nissim, Doron, 2014. The Expected Rate of Credit Losses on Banks' Loan Portfolios. Working Paper, Columbia University.
Kashyap, Anil, Stein, Jeremy, 1995. The impact of monetary policy on bank balance sheets. In: Carnegie-Rochester Conference Series on Public Policy, vol. 42, pp. 151–195.
Kashyap, Anil, Stein, Jeremy, 2000. What do a million observations on banks say about the transmission of monetary policy? Am. Econ. Rev. 90, 407–428.
Keeley, Michael C., 1990. Deposit insurance, risk, and market power in banking. Am. Econ. Rev. 80, 1183–1200.
Knaup, Martin, Wagner, Wolf, 2009. A Market-based Measure of Credit Quality and Banks' Performance During the Subprime Crisis. Working Paper, Tilburg University.
Kolev, Kalin, 2009. Do Investors Perceive Marking-to-Model as Marking-to-Myth? Early Evidence from FAS 157 Disclosure. Working Paper, NYU Stern School of Business.
Laux, Christian, Leuz, Christian, 2010. Did fair-value accounting contribute to the financial crisis? J. Econ. Perspect. 24, 93–118.
Lintner, John, 1956. Distribution of income of corporations among dividends, retained earnings, and taxes. Am. Econ. Rev. 46, 97–113.
Loutskina, Elena, Strahan, Philip E., 2011. Informed and uninformed investment in housing: the downside of diversification. Rev. Financ. Stud. 24, 1447–1480.
Myers, Stewart C., Majluf, Nicholas S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. J. Financ. Econ. 13 (2), 187–221.
Nissim, Doron, 2003. Reliability of banks' fair value disclosure for loans. Rev. Quant. Financ. Account. 20, 355–384.
O'Hara, Maureen, Shaw, Wayne, 1990. Deposit insurance and wealth effects: the value of being 'too big to fail'. J. Finance 45, 1587–1600.
Penas, Maria F., Unal, Haluk, 2004. Gains in bank mergers: evidence from the bond markets. J. Financ. Econ. 72, 149–179.
Petersen, Mitchell A., 2009. Estimating standard errors in finance panel data sets: comparing approaches. Rev. Financ. Stud. 22, 435–480.
Petersen, Mitchell A., Rajan, Raghuram, 1994. The benefits of lending relationships. J. Finance 49, 3–37.
Petersen, Mitchell A., Rajan, Raghuram, 2002. Does distance still matter? The information revolution in small business lending. J. Finance 57, 2533–2570.
Plantin, Guillaume, Sapra, Haresh, Shin, Hyun S., 2008. Marking-to-market: Panacea or Pandora's box? J. Account. Res. 46, 435–460.
Rajan, Raghuram, 1992. Insiders and outsiders: the choice between informed and arm's-length debt. J. Finance 47, 1367–1400.
Ryan, Stephen G., 2012. Financial reporting for financial instruments. Found. Trends. Account. 6 (3–4), 187–354.
Slovin, Mryon, Sushka, Marie, Polonchek, John, 1993. The value of bank durability: borrowers as bank stakeholders. J. Finance 48, 2533–2570.
Stern, Gary H., Feldman, Ron J., 2004. Too Big to Fail: The Hazards of Bank Bailouts. Washington, DC: Brookings.
Stiroh, Kevin J., 2000. How did bank holding companies prosper in the 1990s? J. Bank. Finance 24, 1703–1745.
Warfield, Terry D., Linsmeier, Thomas J.D., 1992. Tax planning, earnings management, and the differential information content of bank earnings components. Account. Rev. 67, 546–562.