Costs and Benefits of Fair Value Accounting: Evidence from the Crisis*

Andrew Bird and Thomas G. Ruchti

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Abstract

Policy changes in the last decade have codified the reporting, and expanded the use, of fair value accounting under US GAAP. We build a model of banks' fair value reporting decisions that involves a tradeoff between the benefit of recognizing high value assets and the cost of higher future volatility. The model predicts a positive correlation between the likelihood of reporting and a bank's capital ratio, and further, that this correlation should decline with increasing macroeconomic stability. Using panel data on fair value reporting from the Compustat Bank database from 2008-2012, we find strong support for both of these hypotheses. Our results have important implications for understanding the effects of fair value accounting on disclosure policies and bank regulation.

*Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA 15213. E-mail: apmb-at-andrew.cmu.edu and ruchti-at-andrew.cmu.edu. For helpful discussion and advice, the authors thank Carlos Corona, Jon Glover, Pierre Liang, and Stephen Ryan.

1 Introduction

Recent changes in US GAAP codified the measurement and reporting of fair value by firms. We build a model of banks' disclosure[1] decisions following the framework outlined by a series of FASB standards implemented in the 1990s and 2000s on fair value disclosure. Engaging the tradeoff between the benefits of disclosing fair value and the costs of higher future volatility, our model predicts that the likelihood of disclosing is correlated with a bank's capital ratio and that this relationship should decline in importance over time. We examine these testable implications using panel data from the Compustat Bank database from 2008-2012, and find support for both hypotheses across a variety of different empirical specifications. The effects of fair value disclosure on the financial industry have been a topic of great interest in the years following the financial crisis. We identify a robust channel for the adoption of fair value accounting and subsequent disclosure of asset fair values. Our results have important implications for understanding the effects of fair value accounting on disclosure policies and bank regulation.

Firms, when creating an asset without a liquid market, have the option of valuing at historical cost or marking to market in some fashion. FAS 115 and FAS 159 are important to describing the discretion banks face in the use of fair value accounting for *existing* assets. Whether intentional or not, these regulations gave banks significant discretion over the fraction of their assets to disclose at fair value. FAS 115 broke down assets into three categories. The first, *held-to-maturity*, is accounted for at amortized cost, with possible other-than-temporary (OTT) impairments.[2] *Available-for-sale* securities are always recorded at fair value on the balance sheet, but other-than-temporary impairments are recorded and affect net income in the same fashion as securities that are *held-to-maturity*. *Trading* securities are

[1] For consistency and simplicity, we will use the terminology *disclose* and *disclosure* when referring to fair value reporting. There are, however, many aspects of these fair value reporting decisions that involve both disclosure and recognition, depending upon the context and relevant institutions. We discuss these details of fair value accounting in Section 2.

[2] Prior to FASB Staff Position FAS 115-2 and FAS 124-2 in April 2009, other-than-temporary impairments wrote down the cost basis of securities to fair value. Accounting for these assets now depends on firm intent and ability to hold the security to recovery of the amortized cost basis.

recorded on the balance sheet at fair values with unrealized gains and losses recorded in net income as they occur. While the spirit of FAS 115 is that an asset remains in one category or another, the financial crisis saw banks, for which the most important asset class is "loans and leases," moving assets from *available-for-sale* to *held-to-maturity*. Banks opportunistically valued at par rather than market value so as to avoid regulatory constraints (Huizinga and Laeven [2012]). In 2008, Citigroup, with at least the implicit consent of regulators, moved significant assets from *available-for-sale* to the *held-to-maturity* category, allowing a reversal of the effects of temporary impairments, while in principle still accounting for other-than-temporary impairments.[3] Subsequent to a massive bond rally in 2011, and again with regulatory forbearance, Citigroup decided to move these assets back to fair value.[4] FAS 115 categorization has evidently been used to allow a certain degree of latitude in the extent of fair value recognition. FAS 159 (and with hybrid instruments, FAS 155) expanded the option to fair value to a wider class of assets. Whether through asset creation, regulatory forbearance in these provisions, or asset turnover, there are avenues for banks to choose the level at which they report fair value, even after initial election. We study how banks respond to the costs of disclosure using these channels.

In our model, a bank decides whether or not to disclose the fair value of a single asset. Recognizing fair value for an asset subjects the bank's balance sheet to a cost, dependent on the stability of the bank as measured by its capital ratio. Contrastingly, recognizing that an asset is of high quality could have positive aspects in terms of increasing liquidity, meeting capital requirements, or signalling overall fitness.[5] A bank recognizes fair value for an asset only if the asset is valued above some threshold, otherwise pooling with other banks in the economy—all of whom face similar recognition decisions. In the absence of costs,

[3]Regulatory forbearance is by no means sufficient for such practices. Banks are subject to oversight by the SEC and are required to have their decisions approved by their independent auditor.

[4]See *http://reut.rs/1g9Fkis* for further discussion. Other recent examples of moving to *held-to-maturity* involve JPMorgan Chase and Wells Fargo choosing to do so with significant assets in anticipation of rising interest rates. See *http://bloom.bg/1pEw35k* and *http://bv.ms/1evqQbs*.

[5]Basel III, yet to be fully implemented, would require less capital to be held against trading securities vs. those held to maturity. Trading securities are in principal more liquid and so could be more easily sold if necessary.

there is an incentive to recognize lower and lower quality assets, a phenomenon commonly known as unraveling. That is, the bank with the highest quality asset not recognized wants to recognize, so that its asset will be valued higher than the average of all worse assets. However, in the setting of fair value, at some point this marginal asset goes unrecognized because doing so is too costly for the bank. The threshold for recognition is lower, allowing for more fair value, if the bank's capital ratio is higher. This means banks, which are less susceptible to future shocks, are more willing to take on the risk to their balance sheets of recognizing the fair value of an asset.

Given the importance of macroeconomic fluctuations to the banking sector, especially in the recent past, we are also interested in studying how the choice to fair value changes over time. Extending this model so that the bank issues another asset in a second period, the bank must make a second disclosure decision. The second period's costs of disclosure are uncertain at the time of the first decision. We find that banks follow a threshold strategy as before. When uncertainty resolves as higher costs, the effect of the capital ratio on disclosing fair value is more pronounced. However, when uncertainty resolves as lower costs, the effect on bank decisions is diminished. The story of falling costs over time best fits our sample period, with the economy recovering from the financial crisis of 2008.

We test our model's predictions using data on banks' fair value choices, studying the propensity of firms to take on the added risk of reporting assets at fair value. We define the fraction fair value as the fraction of assets on a bank's balance sheet that are reported at fair value, and regress this on the Tier-1 capital ratio, which is essentially shareholder's equity divided by risk weighted assets, a measure of bank stability. We find that the effect is positive, and that there is more fair value reporting over time. These effects remain when including controls related to bank performance, leverage (to focus our attention on the risk weighting included in definition of Tier-1 capital), liquidity, size, and potential merger activities. We cluster our standard errors, and employ fixed effects, both at the bank level, and the effects still confirm the first testable implication of our model—that more stable

banks are more willing to bear the cost of reporting the fair value of assets.

In the years following 2008, uncertainty about the financial crisis eventually eased, which means the costs to declaring fair value should go down as well. We test this using a capital ratio-quarterly interaction term. We find that the effect of having a high capital ratio on the choice of fair value is much higher for banks at the beginning of the sample, in the first quarter of 2008, and that this effect decreases statistically significantly over time, in keeping with the second testable implication of our model. This result is maintained after adding the same set of control variables, bank fixed effects, and time interactions for all the controls. We also consider alternative tests, restricting to data following FAS 159 elections in 2008, looking at only discretionary asset types, using a measure of market stability instead of a time trend, and using a Tobit model to consider the non-negativity of our dependent variable—our results are consistent across these specifications.

Our work is related to research on various fair value provisions. Nelson [1996] finds that FAS 107 fair value disclosures have incremental value relevance only in the case of investment securities.[6] Beatty et al. [1996] evaluate the adoption of FAS 115 and find that bank holding companies had negative abnormal returns around adoption, especially those banks that were fully hedged. Cornett et al. [1996] more broadly study provisions for fair value, finding that more fair value hurts banks, particularly banks with low primary capital ratios—intuition similar to that in our model of disclosure. This is consistent with Khurana and Kim [2003], who find that fair value is more informative where objective market-determined values are available. Related to the framework set up by FAS 157, Ahmed et al. [2006] examines the changes to markets as a result of FAS 133, showing that recognition of fair value incrementally increases transparency for financial derivatives over simple disclosure. Davis-Friday et al.

[6]Consistent with this, Barth [1994] finds that fair value numbers for investment securities have value relevance but also add measurement error. Eccher et al. [1996] argue that the reason this result obtains for securities is due to the better availability of accurate financial information. Indeed, Khurana and Kim [2003] present evidence that fair value is more informative where objective market determined values are available. Barth et al. [1996] study footnote disclosures by recalculating earnings using fair value and study these recalculated earnings via market reactions. Hodder et al. [2006] use a later panel of banks and find that recalculated earnings are more volatile than book earnings, but that this incremental volatility is significantly related to equity market risk.

[1999] find similar evidence for anticipated pension liabilities under FAS 106. Amel-Zadeh et al. [2014] studies whether fair value accounting contributes to procyclical leverage, finding results similar to our own. There is also interesting contributing evidence in this debate coming from experiments, such as Lunawat et al. [2013], Hirst et al. [2004], Koonce et al. [2011] and Gaynor et al. [2011].

Our work also follows an important analytical literature on costly disclosure, beginning with Verrecchia [1983], Dye [1985], and Dye [1986] for disclosure of nonproprietary and proprietary information, and work on optimal mandatory disclosure, as in Dye [1990]. Verrecchia [1990] finds that increases in private information lead managers to disclose more.[7] A recent literature explores fair value disclosure and liquidity risk borne within the financial sector, and the repercussions of contagion, insurance shocks, and reduced information value of prices, in Cifuentes et al. [2005], Allen and Carletti [2008], and Plantin et al. [2008], respectively. Our model of threshold disclosure, balancing the risk of fair value with bank stability, is also related to Corona et al. [2013].

More recently, the incentives surrounding adoption of fair value accounting under FAS 159 have been studied. Guthrie et al. [2011], following up on Henry [2009], investigate adoption of the FAS 159 option in 2007 and 2008 (they identify 72 early adopters of which only one third are in the financial sector) and look at the effect on earnings—perhaps counterintuitively, the effect is not obviously positive. Wu et al. [2013] find that financially vulnerable firms are more likely to adopt fair value for liabilities following FAS 159 and that they accordingly experience ex post negative abnormal returns, so that the adoption seems to have reflected unpriced information. Additionally, there has been much debate in the literature surrounding the possible connection between fair value accounting and the recent financial crisis, surveyed by Kothari and Lester [2012] and Laux and Leuz [2010].

We study the role that bank stability plays in the election and disclosure of fair value for banks following regulation FAS 157 and the financial crisis of 2008. Our discussion of the

[7] For a survey of the disclosure literature, see Dye [2001] and for a treatment of disclosure within continuous time, see Dye [2010].

relevant financial institutions is found in Section 2. In Section 3, we introduce our model and hypotheses. In Section 4, we describe our dataset from the Compustat Bank universe of U.S. financial institutions. We discuss our empirical strategy and results in Section 5. Section 6 concludes.

2 Institutions

Several major changes were made to fair value reporting in the 1990s. FAS 107 delineated requirements for footnote disclosures of financial instruments for fiscal years beginning after December 15, 1992.[8]. As amended by FASB Staff Position FAS 157-4 in April 2009, the standard requires the carrying and fair values for financial instruments—with some exceptions, such as practicability, which need not be invoked—to be disclosed for prior and current periods (whether it be year or quarter), indicating in particular what inputs are used in fair value measurement and any change in measurement approach during the period. This pushed the baseline disclosure to a relatively high level, regardless of the specific approach. Important to our analysis, there is evidence that disclosed fair values are of lower quality than recognized fair values (Davis-Friday et al. [1999], Ahmed et al. [2006]).

FAS 115 required classification of investments and respective treatment in earnings or other comprehensive income for fiscal years beginning after December 15, 1993 (FASB [1993]). This statement addressed the reporting for investments classified as *trading*, *available-for-sale*, and *held-to-maturity* equity securities with readily determinable fair values and for all debt securities. *Trading* securities are bought and held principally for the purpose of selling them in the near term, and are reported at fair value, with unrealized gains or losses included in earnings. *Available-for-sale* securities are considered neither *trading* nor *held-to-maturity* and are reported at fair value (lesser of historical cost and fair value), with

[8]FASB [1991] A financial instrument is defined here as cash, evidence of an ownership interest in an entity, or a contract that imposes on one entity a contractual obligation, and conveys to a second entity a contractual right. The fair value is defined as the amount at which the instrument could be exchanged in a current transaction between willing parties. Disclosures were required in the body of financial statements, or in accompanying notes.

unrealized gains and losses excluded from earnings and reported in a separate component of shareholders' equity. *Held-to-maturity* are considered those assets the enterprise has positive intent and ability to hold to maturity, and are reported at amortized costs. Huizinga and Laeven [2012] study the practice of moving assets from the *available-for-sale* category to the *held-to-maturity* category, which allowed banks to remove effects of temporary impairments rather than recognize at market value. While against the spirit of FAS 115, banks, such as Citigroup, appear to have been able to do this as a result of regulatory forbearance, either explicit or implicit.

FAS 133 established standards for reporting derivative instruments outside of footnotes, and recognizing changes in value to earnings according to hedging activities, effective for fiscal years folowing June 15, 1999.[9] It was amended by FAS 155, which permitted fair value measurement for any hybrid financial instruments that contains an embedded derivative that otherwise requires bifurcation. It also clarified which interest-only and principal-only strips would not be subject to the requirements of FAS 133.[10]

The standard for reporting assets at fair value was codified and simplified with FAS 157, effective for fiscal years beginning after November 15, 2007.[11] FAS 157 provides guidance about fair value measurement and required many new disclosures about fair value measurements.[12] It does not, by itself, require anything to be fair valued, except in some cases of

[9]FASB [1998]. This statement established accounting and reporting for derivative instruments, including those embedded in contracts and for hedging. Derivatives would be designated as a hedge to the fair value changes of an asset or liability, hedge to the exposure to a forecasted transaction, or a hedge to the foreign currency exposure of a net investment, commitment, security, or currency transaction. These would be reflected in earnings, reported as a component of comprehensive income and subsequently reclassified into earnings when the forecasted transaction would affect earnings, and included in cumulative translational adjustment, respectively.

[10]FASB [2006a]

[11]FASB [2006b]

[12]From FAS 157: Fair value reflects the price received to sell the asset or paid to transfer the liability, not the price that would be paid to acquire the asset or received to assume the liability. It requires that an adjustment for nonperformance risk be included in fair valuation if market participants would use such an adjustment for pricing related assets or liabilities–FAS 133. Fair value should take into account restrictions on sale of an asset—FAS 115 and FAS 124. It requires that blocks of stock be measured at quoted price. It states that a liability value measurement must reflect nonperformance risk. It also requires the disclosure of measurements used to value assets with significant unobservable inputs (Level 3), to disclose the effect of measurements on earnings for the period, and to combine with fair value information disclosed under FAS 107. Applies to derivatives and other instruments measured at fair value under FAS 133.

eliminated practicability exceptions.[13] This standard created a measurable and consistent standard for fair value reporting and allows us to describe the fair value decisions made by banks using a single variable, whose evolution we can follow over time. It also defines Level 1,[14] Level 2, and Level 3 investments, according to the valuation methodology employed. Of note, Level 1 investments must be traded in active markets, and so include inputs with quoted prices from active markets for identical assets or liabilities accessible to the reporting entity at the measurement date. Level 2 investments require inputs other than quoted prices. This may include quoted prices of similar assets or liabilities in active markets, quoted prices for similar assets in markets that are not active, inputs that are observable over time, or from market corroboration. Level 3 investments require unobservable inputs in pricing. Unobservable inputs shall include the best information reasonably available.

While FAS 157 codifies and simplifies the reporting environment for fair value assets, FAS 159, effective November 15, 2007,[15] allows firms to elect, only at inception (except on adoption of the standard) and always irrevocably, to fair value most financial instruments with unrealized gains and losses recorded in net income as they occur.[16] The stated purpose was to allow firms to reduce volatility in reported earnings caused by measuring related assets and liabilities differently, and to increase the use of fair value measurement. Fair

[13]FAS 157 also shored up differences in prior reporting standards by applying retrospectively to:

1. Positions in financial instruments that were measured at fair value using a blockage factor.
2. A financial instrument measured at fair value at initial recognition under FAS 133 using the transaction price.
3. A hybrid measured at fair value at initial recognition under FAS 133 using the transaction price in accordance with FAS 133 (later FAS 155).

[14]Level 1 assets, or active market assets, are included in the fair value reporting standard of FAS 133.

[15]FASB [2007]. This standard is similar to the fair value option IAS 39, *Financial Instruments: Recognition and Measurement* of IFRS, although applying to different instruments.

[16]Banks were able to choose whether to report fair value *instrument by instrument*. From the standard:

> Eligible items include financial assets and liabilities except investments in a subsidiary that the entity is require to consolidate, interest in a variable interest entity that the entity is require to consolidate, pension, postretirement, and postemployment benefits, stock option and repurchase plans, and other forms of deffered compensation benefits (see FAS 35, 87, 106, 112, 123, 43, 146, 158), leases, deposits, components of shareholder's equity

value election was required as of the end of the first quarter of the first fiscal beginning after November 15, 2007. One key feature of the implementation of FAS 157 is that fair value adjustments to income are dealt with more consistently, and that for the most part, the adjustment to fair value is included in earnings.[17]

3 Theory and Hypothesis Development

FAS 157 codified and standardized the recognition of fair valued assets, increasing the reliability of inference regarding election and fair value reporting. We describe here the theoretical setting underpinning our empirical analysis. Specifically, we outline hypotheses derived from testable implications of our theory and the institutional setting following FAS 157 and the related fair value provisions of FAS 107, FAS 115, FAS 133, and FAS 159.

3.1 Hypothesis 1 and Single Period Model

Volatility is a feature inherent to all financial interests. Whether equities, bonds, collateralized debt obligations, or real estate, the fundamentals of an asset are often uncertain. Furthermore, the macroeconomy can have widely differential effects across different industrial sectors, and even particular asset classes within those sectors. Disclosing assets at fair value comes at a cost, because when a bank discloses its assets at fair value, it subjects its balance sheet to higher risk in the future.[18]

Under historical cost reporting, the market would find it more difficult to distinguish if a specific instrument were performing well or performing poorly. A bank would therefore be incentivized to report the better performing parts of its balance sheet at fair value. Since, conditional on similar historical costs, a bank with a healthier balance sheet at fair value

[17]This excludes moving assets from available for sale to held to maturity as allowed—but not advised—by FAS 115, and described in Huizinga and Laeven [2012].

[18]This reasoning is stronger for level 1 and level 2 assets, which must rely on potentially volatile market valuations, either directly or in a 'mark-to-model' sense. For level 3 assets, managerial discretion may be quite important, though such assets make up only a small portion of balance sheets, as will be seen in Section 4.

might be undervalued by the market compared to a firm with lower asset fair values, there is a clear incentive for the latter bank to disclose fair value, and recognize some benefit from the higher value. We argue that banks, leading up to and during the crisis, considered seriously the risks of failure that came with reporting a high proportion of assets at fair value, and weighed the benefits against these costs. If a bank were to have an advantage in terms of stability, then we would expect it might be less responsive to the costs of disclosing fair value. We now illustrate this tradeoff using a costly disclosure model.

Each bank considers one asset denoted by α with value $\alpha \sim U[0,1]$ and is endowed with a capital ratio, $K \in [\underline{k}, \bar{k}]$, $0 < \underline{k} \leq \bar{k} < 1$.[19] For simplicity, we assume that the distribution of asset values does not depend on the capital ratio.[20] The manager must decide whether to reveal the value α through fair value reporting, or not. If the manager does report α, then its value becomes known, and if not, then the market must infer the value of the asset given knowledge of the set of assets disclosed and the underlying distribution of asset values.[21] Managers are paid proportionally to the market value of the bank's assets.[22] If fair value is reported, then the bank pays a cost, $c(K)$, where $c(\cdot) \in [0, C]$, is twice continuously differentiable, and $\dfrac{\partial c(K)}{\partial K} < 0$, meaning that a higher capital ratio lowers costs of fair value disclosure. We abstract from agency considerations so that managers pay this cost directly. The cost $c(K)$ can be interpreted as a reduced form measure of the increased risk placed

[19] In principal, the asset has a historical cost. A natural assumption in the post-crisis period is that the asset's underlying value has fallen below the historical cost. Regardless, the results in this section do not depend on whether the historical cost was higher or lower than this value.

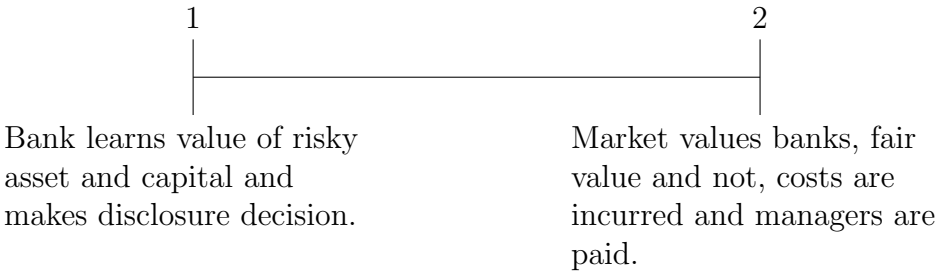
[20] If, as seems most likely, more stable banks have higher asset values, our theoretical results would be strengthened, since, under a cutoff strategy, the better asset values drawn for more stable banks would directly lead to more disclosure.

[21] We assume that this decision does not directly impact the capital ratio since we consider an asset which makes up a small portion of the balance sheet. Indeed, Badertscher et al. [2011] find that fair value losses had only small effects on regulatory capital.

[22] This compensation structure could be generated in a more generally contracting framework with agency issues, or else corresponds to an owner-manager for which agency conflicts are not present.

on the balance sheet of the bank.[23] The cost could arise from increased probabilities of becoming liquidity constrained, violating covenants, or becoming insolvent altogether. We focus here on the costs associated with the balance sheet measured according to GAAP. A bank with a higher capital ratio is mechanically less susceptible to liquidity crises. If the manager does not fair value, then no cost is borne by the bank, but then the bank pools with all non-disclosing banks. The timeline of the single period model is described in Figure 1.

Figure 1: Single period fair value disclosure



Lemma 1. *Managers will disclose according to a cut-off strategy,* $A(K) \in [0, 1]$.

Proof. Let there be two banks, denoted by α_L and α_H such that $\alpha_L < \alpha_H$, with the same capital ratio, K. By means of contradiction, assume α_L discloses, while α_H does not. Banks which do not disclose are all valued the same.

We know that the value of disclosure to a bank with asset α is $\alpha - c(K)$.

$$\alpha_L - c(K) \geq \text{Value of not disclosing } \alpha_L,\ \alpha_H > \alpha_H - c(K) \tag{1}$$

$$\implies \alpha_L > \alpha_H \tag{2}$$

[23] A simplification inherent in this parametrization is that the cost does not depend on the bank-specific value of α. We do this to focus on the key implication of disclosing more fair value assets – opening up the balance sheet to more future shocks. This seems particularly relevant in the context of high systematic risk during the financial crisis. The magnitude of this effect is not obviously related to the current fair value of the asset. In addition, if lower quality assets imply higher future costs, our results would actually be strengthened, as this makes banks with high value assets more likely to disclose relative to those with low value assets.

Which is a contradiction. If a bank with asset α does not disclose, neither do any banks with lower valued assets. By compactness, there exists a lowest $A(K) \in [0,1]$ such that disclosure is made, constituting a cut-off strategy in which all banks with capital ratio K and $\alpha \geq A(K)$ disclose. □

Proposition 2. *Let a bank have capital ratio K, and let $C < \frac{1}{2}$, then the manager discloses iff*

$$\alpha \geq 2c(K) \tag{3}$$

Proof. A manager will disclose if and only if the value of disclosing, less the disclosure cost, is worth pooling with the remaining non-disclosing banks. Because the distribution of assets is uniform, this means that given the cutoff for a bank, considering the capital ratio, the market infers that the value of assets going undisclosed is half this cutoff value. As such, a manager will disclose if and only if

$$\alpha - c(K) \geq \frac{1}{2}A(K) \tag{4}$$

where $A(k)$ is the cutoff for a firm with capital ratio k. Only the manager on the boundary determines the cut-off condition, so substituting $A(K)$ in for α, we get the desired result:

$$A(K) = 2c(K) \tag{5}$$

□

From Lemma 1, we have that banks disclose asset by asset, picking assets which are healthier to disclose. Proposition 2 shows that disclosure depends on the specific costs borne by the bank, $c(K)$. As capital ratios improve, $c(K)$ decreases, and the threshold for disclosing a particular asset decreases. This means that banks with higher capital ratios will be *more likely* to choose fair value.

While there are many factors in determining bank stability, the reason we would expect the bank with the higher capital ratio to be more stable is that it has a larger equity cushion relative to the riskiness of the assets on its balance sheet. We call the fraction of total assets reported at fair value the fair value reporting ratio. Using the capital ratio as a proxy for bank stability, we come to our first hypothesis.

Hypothesis 1. *There is a positive correlation between a bank's fair value reporting ratio and its capital ratio.*

Our hypothesis states that banks that have a higher capital ratio should be less responsive to the costs of fair value reporting, and so report more of their assets at fair value. A bank with a high capital ratio is going to be more stable, and subject to a lower risk of insolvency. As a matter of course, a stable bank will be less likely to miss a covenant, or go under water if the markets sour on a particular asset class it holds on its books. Therefore, such a bank would be more likely to report the better performing assets on its balance sheet at fair value. The tradeoff is clear because of the institutional design. In the spirit of FAS 115 and FAS 159, fair value disclosure entails a firm keep the fair value of an asset represented on its balance sheet until it sells that asset, which would come at a loss if they sell when the asset does poorly. Of course, an asset can potentially be switched back to historical cost—as Citigroup, JPMorgan Chase, and Wells Fargo have done—but this does not eliminate the previous exposure volatility.

3.2 Hypothesis 2 and Two Period Model

Whether choosing to disclose the fair value of assets a bank already owns or those it acquires, the bank faces a tradeoff between the benefits of fair value—instrument by instrument revelation of the health of an asset—and the costs—in terms of volatility and risk of insolvency. In 2008 and in the years thereafter, the financial system was in upheaval. Uncertainty over markets was high, and so was information asymmetry. Fair value disclosure costs were particularly high because of the increased likelihood of liquidity crises, regulatory interventions

or binding capital constraints. Conversely, the benefits of disclosing were likely very high because of the associated information asymmetry. However, the benefits and costs of fair value disclosure likely decreased over time, as uncertainty over market outcomes fell, and information asymmetry dissipated. Naturally, as information asymmetry and uncertainty fell, banks would be less sensitive to their capital constraints. We now evaluate these dynamics in a two period extension of the model in the previous subsection.

Just as in the single period model, each bank acquires or holds one asset with value $\alpha_1 \sim U[0,1]$ and is endowed with capital ratio, $K \in [\underline{k}, \bar{k}]$, $0 < \underline{k} \leq \bar{k} < 1$. After learning this information, the manager can choose to disclose the fair value α_1. However, in the second period, the bank acquires a second asset with value $\alpha_2 \sim U[0,1]$ and retains the same capital ratio.[24] We assume that the values of the assets in the two periods are uncorrelated, $cov(\alpha_1, \alpha_2) = 0$.[25] As in the first period, the manager makes the choice of whether or not to disclose the fair value α_2 in the second period.

Managers are paid proportionally to the market value of assets in each period, less any disclosure costs incurred, as in the one period model. In the first period, if fair value is reported for the first asset, α_1, then the bank pays a cost, $c(K)$, where $c(\cdot) \in [0, C]$, is twice continuously differentiable, $\frac{\partial c(K)}{\partial K} < 0$, meaning that a higher capital ratio lowers disclosure costs, and $\frac{\partial^2 c(K)}{\partial K^2} > 0$, meaning costs are convex. In the second period, if fair value is reported for the second asset, α_2, then the bank pays $c(K+\epsilon)$, where ϵ is an additive capital shock that is uncorrelated with asset values in either period. Specifically, with probability p, $\epsilon = \gamma$ and with probability $(1-p)$, $\epsilon = -\gamma$, with $\gamma \in [0, \min(\underline{k}, 1-\bar{k})]$.[26] Essentially, at the time of the second period decision about the second period asset, disclosure costs are different from those faced in the first period, which allows the reporting environment to vary stochastically over time. They can be higher or lower than the expected cost when the first

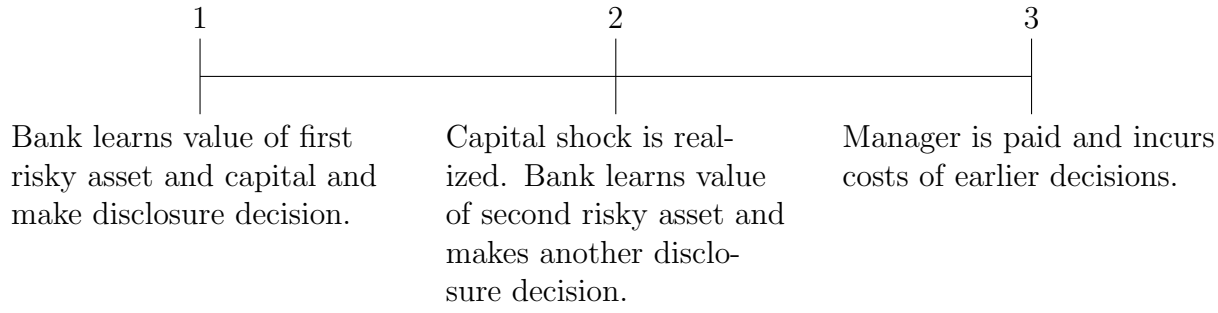
[24] Allowing the capital ratio itself to change will cause a similar dynamic effect to the change in disclosure costs described below.

[25] This assumption could be relaxed, which would add a potentially interesting signalling incentive to the disclosure decisions; we leave this to future work in order to focus on our particular tradeoff.

[26] The purpose of the second shock is to allow simple cost dynamics over time.

period disclosure decision was made. The sum of these costs still reflects the increased risk borne on the balance sheet of the bank from the fair value decision. In each period, a bank with a higher capital ratio is less susceptible to such liquidity crises. If the manager does not fair value, then no cost is borne by the bank, but then the bank pools with all non-disclosing banks. If in the first period, the bank chooses to fair value α_1, then the benefit and cost is incurred in each period. In the second period, if fair value is chosen for α_2, then the cost is borne. The timeline of the two period model is described in Figure 2.

Figure 2: Two period fair value disclosure with uncertain costs



Cost of disclosure in the first period is $c(K)$, and in the second is $c(K+\epsilon)$. From Proposition 2, the first period cutoff is $A_{\alpha_1,1}(K) = 2c(K)$. The intuition of this is clear, given the lack of correlation between α_1 and α_2, and the fact that costs are the same for each period. However,

Proposition 3. *Given upper limit on costs, $C < \frac{1}{2}$—that is, costs are not prohibitively high*[27] *—then the second period cutoff is*

$$A_{\alpha_2,\, high}(K) = 2c(K-\gamma) \tag{6}$$

$$\textit{and,} \qquad A_{\alpha_2,\, low}(K) = 2c(K+\gamma) \tag{7}$$

[27] This technical condition can be weakened, depending on the functional form of $c(\cdot)$, and the distribution of the capital ratio K.

Proof. The proof is clear from the proof to Proposition 2. As $c(0) < \frac{1}{2}$, $K \in [\underline{k}, \bar{k}]$, and $\gamma \in [0, \min(\underline{k}, 1 - \bar{k})]$, it is clear that both cutoffs are within bounds, and when costs are high, the disclosure decision is more restrictive, as opposed to when the costs are low, and the disclosure decision is less so. □

We now extend the model to allow for second period disclosure of the first period asset, α_1, in the case when disclosure had not been elected in the first period. As discussed in Section 2, this could occur due to restructuring of an asset or loan agreement under FAS 159, or shifting assets between *held-to-maturity* and *available-for-sale*. Cost of disclosure in the first period is $c(K)$, and in the second is $c(K + \epsilon)$. As such, no bank will disclose when cost of disclosure in the second period is higher. If the costs are lower, we know from Proposition 2 that the second period cutoff for α_1 is $2c(K+\gamma) \equiv A_{\alpha_1,2}(K)$. From convexity of $c(\cdot)$, we know that banks are less sensitive to capital ratios when making fair value decisions in period 2 when costs are low, but are more sensitive when costs are high. We now examine the change this optionality will allow in the first period

Proposition 4. *Given upper limit on costs, $C < \frac{1}{2}$—that is, costs are not prohibitively high*[28] *—then the first period cutoff for asset α_1 is*

$$A_{\alpha_1,1}(K) = \frac{2}{2-p}[c(K) + (1-p)c(K-\gamma)] > 2c(K+\gamma) \tag{8}$$

Proof. A manager will disclose if and only if the value of disclosing, less the cost, is worth pooling with the remaining non-disclosing banks on α_1. However, there is an additional shock. Because the distribution of assets is uniform, this means that given the cutoff for a bank, considering the capital ratio, the market infers that the value of assets going undis-

[28] This technical condition can be weakened, depending on the functional form of $c(\cdot)$, and the distribution of the capital ratio K.

closed is half this cutoff value. As such, a manager will disclose if and only if

$$2\alpha - c(K) - pc(K+\gamma) - (1-p)c(K-\gamma) \geq \frac{1}{2}A_{\alpha_1,1}(K) + (1-p)\frac{1}{2}A_{\alpha_1,1}(K) + p(\alpha - c(K+\gamma) \tag{9}$$

where $A_{\alpha_1,1}(K)$ is the cutoff for a firm with capital ratio K in period one. Only the manager on the boundary determines the cut-off condition, so substituting $A_{\alpha_1,1}(K)$ in for α,

$$2A_{\alpha_1,1}(K) - c(K) - pc(K+\gamma) - (1-p)c(K-\gamma) = A_{\alpha_1,1}(K) + \frac{1}{2}pA_{\alpha_1,1}(K) - pc(K+\gamma) \tag{10}$$

$$\implies (2-p)A_{\alpha_1,1}(K) = 2(c(K) + (1-p)c(K-\gamma)) \tag{11}$$

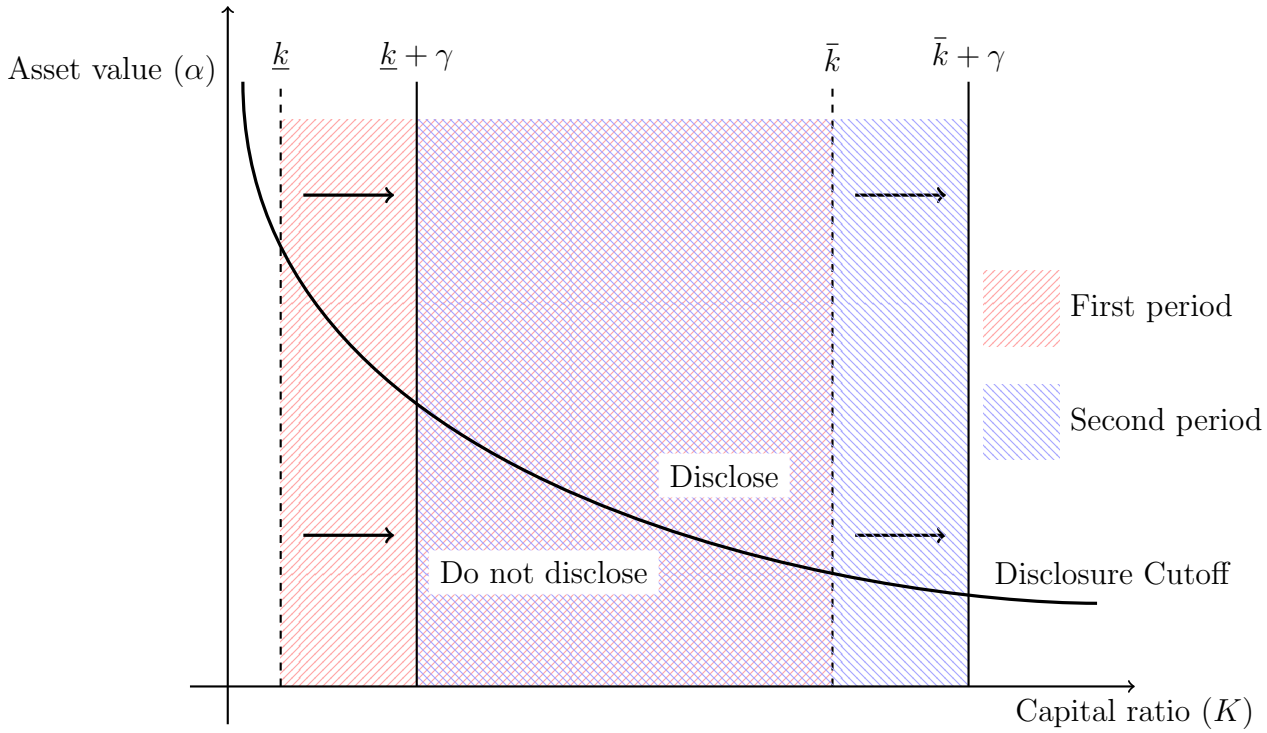
$$\implies A_{\alpha_1,1}(K) = \frac{2}{2-p}[c(K) + (1-p)c(K-\gamma)] \tag{12}$$

We therefore see that $A_{\alpha_1,1}(K) > A_{\alpha_1,2}(K)$, as needed, and given $c(K) \sim [0, C]$, $\gamma \in [0, \min(\underline{k}, 1-\bar{k})]$, that $A_{\alpha_1,1}(K) \leq 1$, as required. □

We see from Proposition 3 that there is successive disclosure in each period. We also see this for asset α_1 if the bank is allowed to disclose fair value in either period. In addition, the convexity of $c(\cdot)$ means banks are less sensitive to capital ratios when making fair value decisions in period 2 when costs are low, but are more sensitive when costs are high. This can be seen in Figure 3. The downward sloping line is the disclosure cutoff. For any asset value (α) above that line, banks choose to report fair value. However, at what level banks make that decision depends on their capital ratio, K. In the range of $\underline{k}$ to $\bar{k}$, the slope of the disclosure cutoff is steep—meaning banks are very sensitive to capital ratios when making fair value reporting decisions. When there is a positive capital shock, or low costs obtain, within the range $\underline{k} + \gamma$ to $\bar{k} + \gamma$, the slope of the disclosure cutoff is not as steep—banks depend less on their capital ratios in making fair value decisions than they did in the first period. This is even more stark if banks have the optionality available to them in α_1. In this

case there is successive disclosure in both assets, and the difference between $A_{\alpha_1,1}(K)$ and $A_{\alpha_2}(K)$ is even larger.

Figure 3: Fair Value Disclosure with Positive Capital Shock



As firms disclose more assets at fair value, fewer assets will remain on balance sheets at historical cost. Stable banks should be more willing to trade off the risks of facing insolvency with the benefits of acquiring assets at fair value, over time. The reason we believe that this relationship should decrease over time is two-fold. First, the uncertainty over the market's outlook decreases following the crisis. Second, the benefit of disclosing fair value decreases over time. With the costs decreasing and the benefits decreasing, there should be less of a correlation between the stability of a bank and its fair value assets because the value of being a particularly stable bank decrease relative to the market, meaning firms will acquire assets and disclose fair value assets more idiosyncratically. This brings us to our second hypothesis.

Hypothesis 2. *The correlation between a bank's fair value reporting ratio and its capital*

ratio is decreasing with macroeconomic stability.

Our hypothesis states that the incentive for a bank with a high capital ratio to disclose or acquire fair value assets will decrease over time with increasing financial sector stability. A bank with a high capital ratio will be more stable, but as the economy improves, and the benefits to disclosure decrease, stability will matter less in the choice of banks to disclose or acquire fair value assets. While fair value disclosure will lead some distressed banks to unload fair valued assets on more stable banks, this effect should also decrease over time, meaning that fair value disclosure should essentially equilibrate more in times of low stress.

4 Data

We create a population of U.S. banks using quarterly data covering 2008-2012 from Compustat Bank. The two key empirical variables necessary for testing the hypotheses of Section 3 are the proportion of assets on the balance sheet that are reported at fair value and our measure of bank stability, the Tier-1 capital ratio.[29] We use the total fair valued assets netting adjustments across levels for our calculation because this best represents the true risk exposure embodied in the bank's decision. The Tier-1 capital ratio is a construct of Basel I, and was designed to be a core measure of a bank's stability. Tier-1 capital is essentially the ratio of equity of a bank, or its *cushion*, to the risk-weighted assets (RWA) of that bank. While uncollateralized debt is given a 100% weighting, government debt is given a weighting of 0%, with several asset classes weighted in between. A bank with a high Tier-1 capital ratio would be considered more stable than a bank with a lower Tier-1 capital ratio. For fiscal year 2007, we have only 22 observations for fair value of assets—consistent with limited reporting of fair value.[30] Given the implementation of FAS 157 (and secondarily 159) November 15,

[29]The Tier-1 capital ratio comes directly from Compustat (*CAPR1*) and is calculated as equity capital plus minority interests, less portion of perpetual preferred stock and goodwill, as a percentage of adjusted risk weighted assets. Basel I requires a ratio of 4% or higher.

[30]There were some early adopters of FAS 159 in 2007, which required their simultaneous adoption of FAS 157, and they look similar on observable characteristics to adopters in 2008.

2007, we look at data from 2008-2012, in which more than 500 banks report some assets at fair value in each quarter.

Table 1 displays summary statistics for banks for our sample period. The fraction of assets reported at fair value is recorded for all 10,770 bank-quarter observations, and has an average of 0.179, with considerable variation across banks. Breaking down assets which can be fair valued, this disclosure was required for readily tradable Level 1 assets—0.009 as a non-netted fraction of assets—but Level 2 assets[31] make up a much larger fraction of balance sheets at 0.169, while Level 3 make up a small proportion at 0.005. Note that these values are unweighted, and larger banks typically have more fair valued assets, consistent with a greater amount of asset trading. In the sample, the Tier-1 capital ratio is 0.121, or 12.1%. While the regulatory requirement of Basel I remains at 0.04, there are several bank observations violating this threshold. Return on assets is measured as income before extraordinary items, divided by total assets. It is notably zero on average, which is not surprising given the prevalence of losses over this period. The size of the banks in the sample varies, with average total assets of $18B. Leverage is measured by the ratio of long-term debt divided by total assets, and has an average of 8.5%.

[Table 1 about here.]

Table 2 shows the correlation table for these variables. The fraction of assets reported at fair value is positively correlated with Tier-1 capital ratio, in line with the first hypothesis. Return on assets is positively correlated with Tier-1 capital ratio, meaning that, not surprisingly, more stable banks have higher returns.

[Table 2 about here.]

We illustrate in Figure 4 the quarterly trends for fraction of assets reported at fair value and the Tier-1 capital ratio from the beginning of 2008 through the end of 2012. The fair

[31] This is the case because the largest asset category on a bank's balance sheet is usually "loans and leases," (Huizinga and Laeven [2012]).

value fraction starts at about 16% in 2008 and increases relatively steadily to 20% at the end of 2012. Similarly, the Tier-1 capital ratio grows from 11.6% to 13.8% over the same period. These trends may arise through many different channels beyond the mechanism described in Section 3, including changes in asset prices for fair valued assets and banks' slow accrual for credit losses on non-fair valued loans over the course of the crisis.

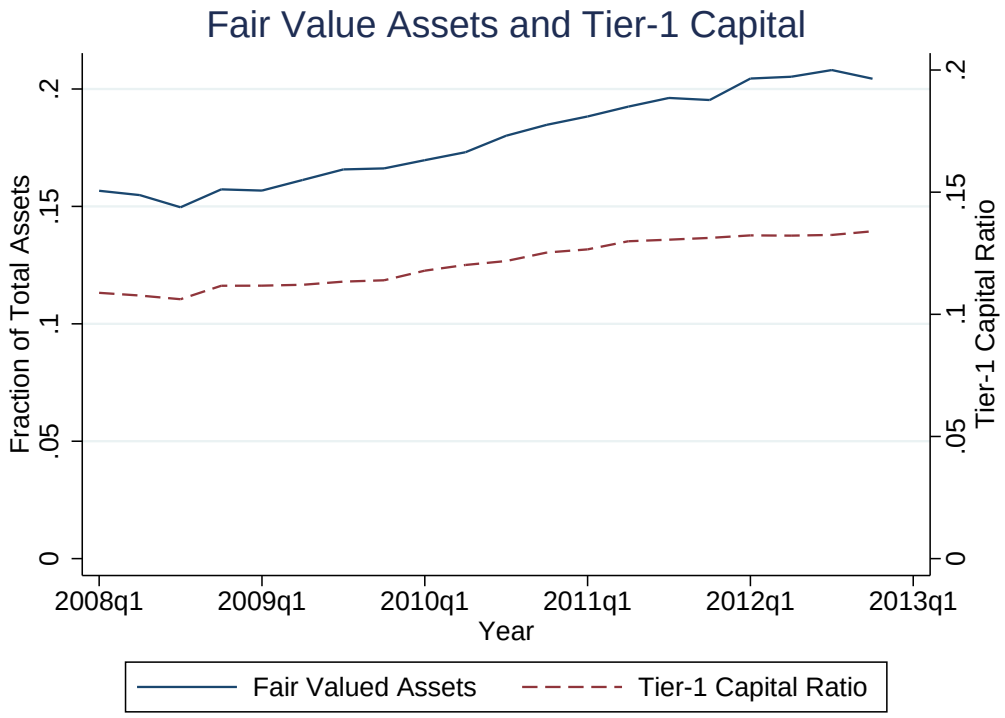


Figure 4: This figure illustrates the quarterly fraction of assets reported at fair value and Tier-1 capital ratio for banks from 2008-2012. We have 10,770 bank-quarter observations in our sample. Fraction of assets reported at fair value is the net assets reported at fair value divided by total assets on the balance sheet. Tier-1 capital ratio was implemented by Basel I as a measure of stability and is calculated as equity capital plus minority interests, less portion of perpetual preferred stock and goodwill, as a percentage of adjusted risk weighted assets.

Figure 5 illustrates that the variation in fraction of assets reported at fair value is predominantly driven by changes in Level 2 assets quarterly from 2008 through 2012. While Level 1 assets and Level 3 assets stay stagnant or decrease as a portion of the total assets of banks, Level 2 increases over time. Essentially, changes in the fair value fraction are driven predominantly by changes in the amount of Level 2 assets reported.

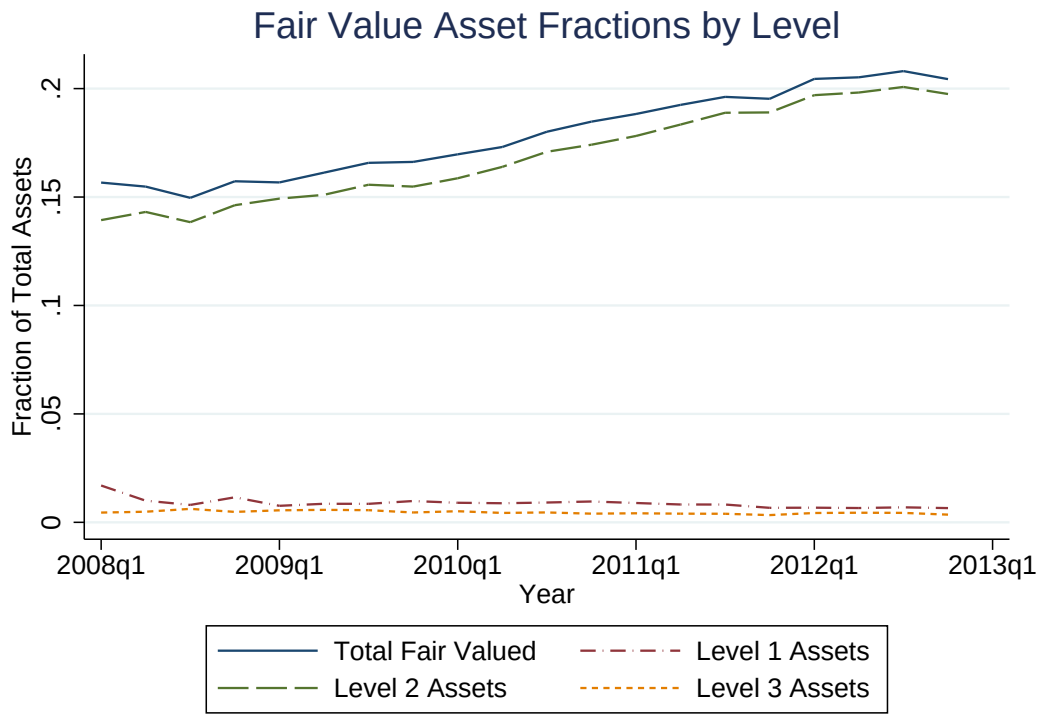


Figure 5: This figure illustrates the quarterly fraction of assets reported at fair value, and Levels 1, 2, and 3 assets for banks from 2008-2012. We have 10,770 bank-quarter observations in our sample. Fraction of assets reported at fair value is the net assets reported at fair value divided by total assets on the balance sheet. Level 1 assets are assets with quotable prices in active markets for identical assets. Level 2 assets use inputs other than quoted prices included in Level 1 for fair value. Level 3 assets use unobservable inputs for fair value reporting.

Our empirical strategy for testing Hypothesis 2 relies upon the evolving macroeconomic features of the economy following the immediate crisis of 2008. We consider three different measures of macroeconomic stability. The first measure is the Federal Reserve Board of Governors survey of senior loan officer lending standards. This survey asks whether officers have tightened lending standards. We take the negative of this measure, so that decreases in tightening over time lead to increases in stability. The second measure we consider is based on VIX, S&P 500 option implied volatility, from the Chicago Board Options Exchange. Again, we use the negative of this volatility so that a decrease in volatility is represented as an increase in stability. Finally we consider an index of house prices, given the centrality

of the housing market to the health of the financial sector and the greater economy during the financial crisis. In this case, we take a rise in the Federal Housing Finance Agency's (FHFA) index based on observed sales prices as an increase in stability. Figure 6 illustrates these three measures at a quarterly frequency 2008-2012. For comparability, the measures are normalized to mean zero, standard deviation one, and are smoothed using the Hodrick-Prescott filter.

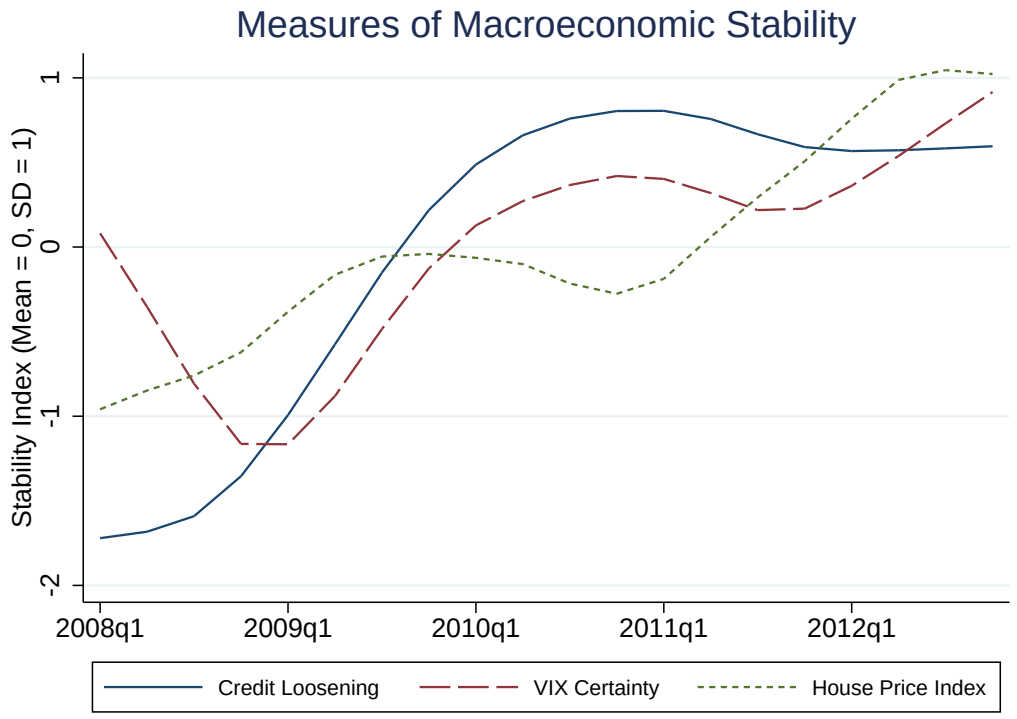


Figure 6: This figure illustrates quarterly data on three measures of macroeconomic stability from 2008-2012. Credit loosening is the negative of the net percentage of domestic senior loan officers tightening standards for commercial and industrial loans for medium and large borrowers. VIX certainty is the negative of the implied volatility of options trading on the Chicago Board Options Exchange. House Price Index comes from FHFA and is based on observed sales prices. All three measures are normalized to have mean zero and standard deviation one, and are smoothed using the Hodrick-Prescott filter to deal with seasonality.

All of these measures are increasing from 2008 to 2012 and are related to stability of the financial sector. The choice over measures of macroeconomic stability, especially in a time of crisis, involves significant discretion. Rather than picking a particular measure, or a composite measure, we instead focus on the general tendency of macroeconomic stability

over the sample period. Because the market is clearly becoming more stable, we are agnostic about this choice and focus on a linear time trend rather than deliberating over the efficacy of one measure over another.[32]

5 Empirical Strategy and Results

In this section, we describe our empirical methods and the specifications we use to investigate the testable implications of our theoretical model. The object we describe is the fraction fair value ($FracFair$), and we define this as the fraction of assets on a bank's balance sheet which are reported at fair value, following the variety of standards discussed in Section 2.[33] This number is reported for the Compustat Bank universe of banks, and it includes fair valued assets across all three valuation methodologies. We use this number, rather than specific Level 1, 2, and 3 assets, because fraction fair value is netted for exposure,[34] meaning it represents the true exposure to fair value that a bank may face. The relationship we outline is that between fraction fair value, and the Tier-1 capital ratio ($T1C$).

$$FracFair_{i,t} = \alpha + \beta \text{ T1C}_{i,t} + \lambda X_{i,t} + \delta_i + \varphi \text{ Time}_t + \epsilon_{i,t} \tag{13}$$

5.1 Testing Hypothesis 1

Table 3 presents the results of our tests of the first hypothesis; in each specification, standard errors are clustered at the bank level. To start, the first column simply uses the bivariate relationship between our variables of interest, yielding a coefficient of 0.741 (standard error: 0.117), which is significant at the 1% level. This means that banks with a higher Tier-1 capital ratio do indeed report a larger fraction of their assets at fair value. In particular, a

[32] As a robustness check, in Section 5.3, we replace the linear time trend with a composite of the raw measures.

[33] $FracFair$ is the ratio of Compustat items $TFVAQ$ and AT.

[34] Banks present their derivatives assets and liabilities, and repurchase agreements assets and liabilities covered by master netting agreements net on the balance sheet under FIN 39 and FIN 41.

one percentage point increase in the Tier-1 capital ratio is associated with a 0.741 percentage point increase in the fraction of assets reported at fair value.

In column (2), we add a quarterly trend to the empirical model.[35] This allows us to control for myriad changing aggregate factors, such as government policy and changes in risk preferences. Not surprisingly, given the increase in fair value over time seen in Table 4, the trend itself enters the regression positively and significantly. The coefficient of interest is slightly smaller at 0.662 (se: 0.125) but is still strongly significant. This specification addresses the particular concern that assets that were previously reported at fair value are simply increasing in value over time, so that no active disclosure decision is being made by banks subsequent to 2008. Since capital ratios were likewise increasing over time, this mechanical effect could, in principle, be driving our results. However, the similar coefficient obtained after controlling for this variation implies that this is not the case.

[Table 3 about here.]

Our next step is to control for other explanatory variables that can help explain how the fair value fraction varies across banks and through time. Column (3) illustrates the coefficient on the capital ratio after including a broad set of controls – it increases slightly to 0.715 (se: 0.128) and remains strongly significant. This is somewhat unexpected given that the controls we include are correlated with the capital ratio, and might also be related to differences in fair value-related balance sheet risk, the key cost of fair value in our theoretical model.

We next look at the coefficients on the control variables themselves. The logarithm of total assets was included as a measure of bank size, and enters the regression positively and significantly, which is not surprising since larger banks might also be expected to exhibit less sensitivity to adverse shocks, at least as far as insolvency is concerned. Similarly, return on assets and Tobin's q both enter positively and significantly, which is consistent with higher

[35] Very similar results obtain when controlling for time effects using separate year-quarter dummies, rather than a linear trend.

current performance and market expectations of future performance indicating better ability to weather future volatility or liquidity shocks.

Of particular interest is the effect of including the debt ratio as a regressor. First of all, this means that the coefficient on the Tier-1 capital ratio is now estimated conditional on the debt ratio. Hence the variation used to identify this coefficient comes only from the riskiness of assets, as codified by the Basel regulations, rather than also including the effects of leverage, as in columns (1) and (2). For the debt ratio coefficient itself, there are several mechanisms potentially at play. The direct effect of higher leverage on susceptibility to future shocks would seem to suggest a negative coefficient. However, the debt ratio also embodies the market's perception of the creditworthiness of the bank in the sense that, all else equal, a high debt ratio implies that lenders have been happy to lend to the bank. These two effects point in opposite directions, and in fact, the positive coefficient seen in column (3) suggests that the second dominates.

A similar conceptual framework is helpful to understand how the cash ratio affects the fair value fraction. On one hand, more cash provides a buffer for future liquidity shocks; on the other, high levels of cash imply either an absence of future investment opportunities or the fact that lenders' perceptions of the bank are poor enough to cause them to purposely hold more cash on their balance sheets. The coefficient on the cash ratio is in fact negative, which is suggestive evidence for the second mechanism.

The last pair of controls are the ratio of net cash flow from investing activities to total assets and a dummy variable for any merger activity. We include these for several reasons. First, the changes in assets picked up by these measures reflects greater opportunity to make fair value decisions.[36] Additionally, endogenously higher asset turnover for more stable banks is another channel through which bank stability can affect the measured fair value fraction. Since banks which have invested a great deal in long-term assets will have negative net cash flows from investing, the negative coefficient is consistent with this story. Banks with more

[36]Controlling for the change in assets directly yields similar results.

asset acquisitions do more fair value, but this effect seems to be essentially independent of the relationship between the capital ratio and fair value, at least conditional on the whole set of controls. The negative sign on the merger variable could come from the fact that acquired banks during this time period were more likely to have low quality assets, directly leading to lower prevalence of initial fair value reporting at the time of asset acquisition.

Column (4) of Table 3 adds bank fixed effects to strip out time invariant unobservable variables at the level of the individual bank. This yields a much smaller coefficient of 0.179 (se: 0.083), which is significant at the 5% level. This difference is not surprising, given that the fixed effects transform this coefficient into a within bank estimator. Hence, rather than coming from *levels* of the fair value fraction, identification in this case comes from *changes* in this fraction and in the capital ratio over time for each bank. The reduction in the magnitude of the coefficient tells us that some unobserved fixed effect is correlated with both the fair value fraction and the capital ratio. This could arise through our hypothesized mechanism, or through other unobserved bank characteristics—to be conservative, in this specification, our goal is to test Hypothesis 1 without using such variation. The big increase in the R^2 suggests that a much of the variation in the fair value fraction is explained by the fixed effects. Fixed effects would capture differences in business models across banks. These differences could be mechanically related to balance sheet composition and the extent of fair value reporting. Specifically, for most traditional banks, available-for-sale securities make up the bulk of fair valued assets, while larger, trading-oriented banks, naturally have many more fair valued assets, such as from trading securities and other financial instruments.

This specification also helps to address one of our main identification concerns—that there is a correlation between the (unobserved) quality of a bank's assets and its capital ratio, which would yield similar results to what we find. To the extent that any such relationship stays roughly constant over time, which is not unreasonable given the limited asset turnover in this time period, its effect will be removed by the fixed effects. Given the positive and significant coefficient we obtain, it remains clear that healthier banks, as measured by the

capital ratio, disclose more of their assets at fair value.

Banks' adoption of accounting policies related to fair value also play a role in describing the tradeoff faced by banks when deciding on fair value reporting for their assets. In particular, use of the fair value option for liabilities (FVOL) decreases the incremental volatility impact of reporting assets at fair value, if there is offsetting risk exposure—one of the avowed goals of standard setters in formulating FAS 159. Because of well known measurement issues in capturing accounting choices from Compustat, in our main specifications we do not include a variable describing takeup of FVOL. Fortunately, given the limited variation in time surrounding adoption, any variation in fair value accounting induced by FVOL should be effectively soaked up by bank fixed effects.[37]

For several reasons, we are not particularly concerned about reverse causality undermining our interpretation of these regressions. First of all, Guthrie et al. [2011] find a negligible impact of positive transition adjustments associated with the adoption of FAS 159 on banks' leverage and capital ratios. Similarly, Badertscher et al. [2011] show that fair value losses had only small effects on bank capital. In addition, the test of hypothesis 2 in the following section addresses this issue directly—as long as the fair value choice involves predominantly writedowns in asset values, as appears to be the case during this time period, a decreasing correlation of the fair value fraction and the capital ratio cannot be explained by a mechanical reverse causality.

5.2 Testing Hypothesis 2

In testing our second hypothesis, we are interested in how the effect of the capital ratio on the fraction fair value varies over time. Hence, we augment equation (13) with an interaction

[37]In unreported tests, we measure FVOL adoption using a dummy variable for the presence of any fair-valued liabilities, which is equal to unity for about 31% of bank quarters in the sample. Including this measure in our regressions does not change the effect of the capital ratio, nor does the measure itself attain statistical significance. This is to be expected, given that fair valued liabilities relative to total assets are only 0.2%, against 17.9% for fair valued assets.

term, allowing this effect to vary linearly with time, as follows:

$$FracFair_{i,t} = \alpha + \beta_1 \text{ T1C}_{i,t} + \beta_2 \text{ Time} \times \text{T1C}_{i,t} + \lambda X_{i,t} + \delta_i + \varphi \text{ Time}_t + \epsilon_{i,t} \qquad (14)$$

Hypothesis 2 predicts $\beta_2 < 0$, so that the effect of the capital ratio is declining over time, as the financial crisis resolves and so disclosure costs fall. Essentially, the specification in the previous subsection picks up the average level of this effect; here, β_1 estimates the effect in the first quarter of 2008, at the start of our sample, and then β_2 illustrates how this changes over time. If the effect is really diminishing, the initial effect should also be higher than the average effects shown in Table 3.

Table 4 presents the initial effect in the first row, and the time interaction in the second row. The baseline results are in column (1). The initial effect is large, with almost a one percentage point increase in the fair value fraction for a one percentage point increase in the capital ratio in the first quarter of 2008. The second row presents that this effect changes by -0.025 percentage points (standard error 0.012) per quarter, which is just as predicted by Hypothesis 2. Another way of thinking about the change in the effect is that, for this specification, ten percent of the effect goes away each year. The effect of the quarterly trend itself is positive and significant, as before. Essentially, Tier-1 capital ratios are increasing over time, leading to more fair value, but the incremental increase in fair value for an increase in the capital ratio is diminishing over time.

[Table 4 about here.]

Next, in column (2), we add the same set of control variables as in Table 3. Just as before, the effect size increases, to -0.037 (se: 0.012), and is still statistically significant and goes in the direction predicted by Hypothesis 2. The effects of the control variables themselves are similar to the previous table, though now log total assets and Tobin's q are no longer statistically significant. Bank fixed effects are added to the model in column (3), and both the initial effect of the capital ratio and the change in effect over time are smaller though

still statistically significant (at the 1% and 5% level, respectively). The fall in the initial effect is not surprising, given the strong persistence in these two key variables.

In column (4), a time interaction is included for each of the seven control variables to allow the effects of the other covariates to vary over time as well. Without these interactions, any change in these effects might be picked up by the capital ratio-time interaction, leading to spurious conclusions.[38] We can see that the effect size actually increases to -0.029 (se: 0.011). Note that for space reasons, the table does not report the coefficients on these extra interaction terms; however, a comparison across columns (3) and (4) indirectly reveals how these effects change over the sample. The two striking differences from this comparison involve the effects of return on assets and Tobin's q, both of which are evidently decreasing over time—this explains the fact that their respective average effects are close to zero, while the initial effect, as seen in column (4) is significantly positive. Clearly, the effect must be falling over time to generate such a pattern. These two observations fit into the intuition explained in Section 3. As the financial crisis eases, even less successful banks can afford the inherent costs of disclosure in order to be compensated for their, perhaps few, high quality assets.

5.3 Robustness

In this section, we investigate a number of alternative specifications in order to see whether the results discussed above are robust. The first row of Table 5 reproduces the baseline results from our tests of the two hypotheses generated by the theoretical model in Section 3. The first column is the coefficient on the Tier-1 capital ratio from the final specification of Table 3, which includes the quarterly time trend, full set of control variables and bank fixed effects. We call this coefficient 'Mean T1C' in the table since it reflects the average effect of the Tier-1 capital ratio on the fair value fraction during our sample period. The

[38]This strategy also deals directly with the effects of differentially time-varying factors across banks. For example, capital infusions from the federal government's TARP program obviously varied over time and by the size of the bank

remaining two columns are the coefficient on the capital ratio and the effect interacted with the time trend, and come from the main specification testing the second hypothesis in Table 4, including the time trend, controls and bank fixed effects. We call these 'Initial T1C' and 'Quarter * T1C'.

[Table 5 about here.]

One concern we address in this table is the extent to which initial adoption of FAS 159 could be driving some of our results, particularly since the specifics of this rule made it easier for banks to adjust their fair value decision in the first quarter of 2008 than in later periods.[39] In row (2), we drop the first quarter of 2008, when the vast majority of banks' adopted FAS 157 and FAS 159. As an additional check, in row (3), we drop all of 2008 in case of slower initial takeup than would be expected given the wording of FAS 159. This yields a somewhat smaller average effect of the capital ratio but the pattern of results matches that of the baseline very closely. In particular, the test of hypothesis 2 is not really affected by these alternative specifications. Likewise, these results address the related concern that changes in asset valuation methodologies imposed by FAS 157 could be driving our results.[40]

In row (4), we restrict our calculation of the fair value fraction to include only Level 2 and 3 assets in the numerator, both because of the significant degree of managerial discretion inherent in the calculation of their values, and because the remaining category, Level 1, had already to be disclosed under FAS 133, as codified in FAS 157. The results are almost identical to the baseline, which is reassuring but not surprising since, as seen in Figure 5, the vast majority of fair value assets are of the 'mark-to-model' type.

Since the fair value fraction is indeed a fraction, it is necessarily restricted to the unit interval. Given the histogram of this ratio, the bound at zero appears to be a potentially relevant constraint. Hence, we implement a Tobit model, which accounts for this lower limit.

[39]Note that opportunistic adoption behavior and subsequent reversal following public opposition from the SEC and Center for Audit Quality, studied in Henry [2009], had run its course by the start of 2008, and so does not affect our analysis.

[40]For example, it could have been the case that less stable banks were taking more liberties with their pre-157 valuations, and so responded to the standardization by reporting less assets at fair value.

The results, in row (5), are very similar to the baseline, indicating that the vanilla ordinary least squares approach used for the rest of our results is not an important simplification.[41]

In row (6), we experiment with dropping banks with substantial asset growth or decline, quarter over quarter, in case these bank quarters are disproportionately affecting our results. Specifically, we drop bank quarters with growth in the top or bottom one percent of the distribution. This slightly weakens the average effect of the capital ratio on the fair value fraction but leaves the initial level and trend of this effect quite similar.

The next robustness check, in row (7), involves subtracting the effect of changes in value on fair valued assets from the calculation of the fair value fraction. After this correction, the ratio does not reflect current period changes in the value of fair value assets. The results are essentially unchanged—this is because the effect on earnings is a relatively small quantity, on the order of a tenth of one percent of fair value assets. Even cumulating these effects over all periods, so that all subsequent value changes are ignored, does not change the results.

In row (8) we use a balanced panel, constructing our estimation sample using only banks which were reporting during all quarters from the first quarter of 2008 to the final quarter of 2012. This yields a sample of 6,500 bank-quarters from 325 banks over 20 quarters. The much smaller sample size mostly reflects a great deal of bank failure during this period. Of course, this induces serious survivorship bias, so that we do not use this sample for our baseline. The mean effect of the capital ratio on the fair value fraction is actually larger in this case. The change over time is slightly smaller in magnitude at -.020, which combined with the larger standard error expected in this smaller sample, is not statistically significant. The result changing in this direction is not unexpected since the banks most sensitive to adverse shocks, and so to decreases in the probability of such shocks as the financial crisis started to resolve, are the most likely to leave the sample before the end of 2012, either by failing or being acquired. This would explain a similar initial effect, at the start of 2008, but a somewhat reduced sensitivity to changing reporting costs over time.

[41] Using a Tobit procedure to additionally account for the upper limit at one yields identical results—this is not surprising given that few banks are anywhere near this limit.

We have documented evidence consistent with macroeconomic stability reducing the effect of the Tier-1 capital ratio on disclosing fair value. Rather than debate the relative merits of one measure of stability over another, we use a time trend and time interaction with the capital ratio to measure the effects decreasing volatility have on the decision to disclose fair value. However, this may be a faulty abstraction, so we combine three measures of macroeconomic stability in our analysis in place of the time parameter, in row (9). The three measures we use are credit loosening, VIX certainty, and house price index. Credit loosening is from the Federal Reserve Board of Governors survey of senior loan officer lending standards. We take the negative of this measure, so it increases with stability. VIX certainty is the negative of VIX, or the S&P 500 option implied volatility, from Chicago Board Options Exchange, so an it also increases with stability. Finally, our house price measure comes from the Federal Housing Finance Agency's index of observed sales prices, which rises with improvement in real estate. For comparability across specifications, these three measures are normalized to mean zero, standard deviation one, averaged, and then fit to the range of the time parameter, and remain *un-smoothed* for seasonality (unlike their depiction in Figure 6). It is clear that replacing time with our stability term shifts mean effects up and initial effects down (with proportional change to the interaction term), but leaves our results qualitatively the same.

6 Conclusion

In this paper, we develop a model of costly disclosure to describe the tradeoff faced by banks when deciding whether or not to report an asset at fair value. From the model, we derive two testable hypotheses involving the tension between the benefits and the costs of reporting fair value. The first is that banks which are more stable, with higher capital ratios, will report more assets at fair value, given lower costs of incremental volatility. The second is that the role of the capital ratio in driving fair value reporting decisions should decline as macroeconomic stability increases. We find support for both implications of our

model using quarterly U.S. banking data from the beginning of 2008 through the end of 2012. These results are robust to liquidity, size, leverage, performance, and merger activity controls, as well as bank fixed effects to mitigate heterogeneity in bank business models and a variety of alternative econometric specifications. Our results shed light on the process underlying banks' discretionary use of fair value accounting and so can contribute both to the formulation of optimal accounting standards and to the debate over the role of fair value accounting in the financial crisis.

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Table 1: Summary Statistics for Quarterly 2008-2012

This table shows summary statistics using quarterly data for banks from Compustat Bank in our sample from 2008-2012. We report the fraction of assets reported at fair value, the fraction (non-netted) of assets at Level 1, 2, and 3, the Tier-1 capital ratio, ROA, Assets, and Debt Ratio. We have data for 10,770 bank-quarter observations. We find that the fraction of assets reported at fair value has a mean of 0.18. We also find that Level 2 assets are in much larger proportion than either Level 1 or Level 3. Tier-1 capital ratios are calculated as equity capital plus minority interests, less portion of perpetual preferred stock and goodwill, as a percentage of adjusted risk weighted assets, and are roughly 0.12. ROA is on average 0 over this period—as one might expect post crisis. Banks have an average size of $18B in assets, although there is a large variance. The debt ratio is variable, but has a mean of 0.085.

Variable	Mean	SD	Min	Max
Fraction Fair Value	0.179	0.110	0.000	0.973
Level 1 Fraction	0.009	0.029	0.000	0.536
Level 2 Fraction	0.169	0.119	0.000	1.349
Level 3 Fraction	0.005	0.016	0.000	0.578
Tier-1 Capital	0.121	0.038	0.032	0.267
Total Assets (Billions)	17.876	143.758	0.045	2364
Return on Assets	-0.000	0.005	-0.029	0.006
Tobin's q	0.981	0.048	0.879	1.134
Debt Ratio	0.119	0.079	0.000	0.371
Cash Ratio	0.061	0.050	0.007	0.272
Investing CF Ratio	-0.005	0.029	-0.097	0.082

Table 2: Summary Correlations for Quarterly 2008-2012

This table illustrates summary correlations using quarterly data for banks from Compustat Bank in our sample from 2008-2012. We have data for 10,770 bank-quarter observations. We look at fraction fair value, or the fraction of assets a bank reports at fair value. We also look at Tier-1 capital ratio, as required by Basel I. ROA is included as a measure of bank performance. Log total assets is the measure of size for banks, and the debt ratio measures leverage.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Fraction Fair Value	1.00								
(2) Tier-1 Capital	0.26	1.00							
(3) Log Total Assets	0.13	-0.06	1.00						
(4) Return on Assets	0.16	0.29	0.05	1.00					
(5) Tobin's q	0.13	0.03	0.16	0.21	1.00				
(6) Debt Ratio	0.09	-0.23	0.26	-0.04	0.06	1.00			
(7) Cash Ratio	-0.08	0.13	-0.04	-0.12	-0.05	-0.31	1.00		
(8) Investing CF Ratio	-0.12	-0.08	0.00	-0.16	-0.14	-0.01	0.16	1.00	
(9) Any Merger	0.01	0.04	0.27	0.07	0.07	-0.02	0.04	0.06	1.00

Table 3: Bank Choice of Fair Value

This table illustrates results for a regression of fraction fair value assets on Tier-1 capital ratio for banks from 2008-2012 using quarterly data and 10,770 bank-quarter observations. In specification (1), we regress fraction fair value on Tier-1 capital ratio and find a significant positive correlation. In specification (2) we add a control for variation over time, and find a statistically significant increase for banks in our sample. We employ controls in specification (3) to explore alternative explanations for the prevalence, variation, and increases over time in fraction fair value. We control for log assets, ROA, debt ratio, cash ratio, investing cash flow ratio, and merger activity. In specification (4), we use fixed effects to account for unobservable time-invariant bank characteristics. Tier-1 capital ratio is equity of a bank divided by the risk-weighted assets of that bank, as determined by Basel I. Log assets and ROA follow standard definitions. Debt ratio is long term debt and short term debt divided by total assets. Cash ratio is total cash divided by total assets. Investing cash flow ratio is the net cash flow for investing divided by total assets. Any merger is a dummy variable with value one if the bank engaged in merger activity.

	(1)	(2)	(3)	(4)
Tier-1 Capital	0.741***	0.662***	0.715***	0.179**
	(0.117)	(0.125)	(0.127)	(0.083)
Quarterly Trend		0.002***	0.004***	0.004***
		(0.000)	(0.000)	(0.000)
Log Total Assets			0.007***	0.015
			(0.003)	(0.016)
Return on Assets			0.338	0.021
			(0.323)	(0.163)
Tobin's q			0.228***	0.051
			(0.072)	(0.040)
Debt Ratio			0.215***	0.115**
			(0.063)	(0.045)
Cash Ratio			-0.156**	-0.235***
			(0.073)	(0.033)
Investing CF Ratio			-0.318***	-0.191***
			(0.065)	(0.025)
Any Merger			-0.019**	-0.012***
			(0.008)	(0.003)
Fixed Effects	No	No	No	Yes
Adj. R-Squared	0.066	0.078	0.153	0.838
N	10,770	10,770	10,770	10,770

Table 4: Bank Choice of Fair Value Over Time

This table presents results for a regression of fraction fair value assets on Tier-1 capital ratio while taking into account the diminishing effect of Tier-1 capital ratio over time, for banks from 2008-2012 using quarterly data and 10,770 bank-quarter observations. In specification (1), we regress fraction fair value on Tier-1 capital ratio, an interaction between quarter and Tier-1 capital ratio, and a quarterly trend. We find that while effects for Tier-1 capital ratio and quarterly trend remain positive and statistically significant, that the effect of Tier-1 capital ratio is statistically significantly decreasing over time. We employ controls in specification (2) to explore alternative explanations for the prevalence, variation, and increases over time in fraction fair value. We control for log assets, ROA, debt ratio, cash ratio, investing cash flow ratio, and possible mergers. In specification (3), we use fixed effects account for unobservable time-invariant bank characteristics. Specification (4) adds year interactions for all controls. Tier-1 capital ratio is equity of a bank divided by the risk-weighted assets of that bank, as determined by Basel I. Log assets and ROA follow standard definitions. Debt ratio is long term debt and short term debt divided by total assets. Cash ratio is total cash divided by total assets. Investing cash flow ratio is the net cash flow for investing divided by total assets. Any merger is a dummy variable with value 1 if the bank engaged in merger activity.

	(1)	(2)	(3)	(4)
Tier-1 Capital	0.923***	1.115***	0.457***	0.539***
	(0.180)	(0.179)	(0.122)	(0.134)
Quarter * Tier-1 Capital	-0.025**	-0.037***	-0.025**	-0.029***
	(0.012)	(0.012)	(0.010)	(0.011)
Quarterly Trend	0.005***	0.008***	0.007***	0.019***
	(0.002)	(0.002)	(0.001)	(0.005)
Log Total Assets		0.008***	0.019	0.028*
		(0.003)	(0.015)	(0.015)
Return on Assets		0.186	-0.003	0.656**
		(0.322)	(0.156)	(0.318)
Tobin's q		0.229***	0.065	0.143***
		(0.072)	(0.040)	(0.050)
Debt Ratio		0.219***	0.133***	0.188***
		(0.064)	(0.044)	(0.050)
Cash Ratio		-0.162**	-0.246***	-0.309***
		(0.073)	(0.032)	(0.071)
Investing CF Ratio		-0.322***	-0.194***	-0.155***
		(0.065)	(0.025)	(0.053)
Any Merger		-0.019**	-0.012***	0.020***
		(0.008)	(0.003)	(0.007)
Fixed Effects	No	No	Yes	Yes
Time Interactions	No	No	No	Yes
Adj. R-Squared	0.080	0.158	0.840	0.844
N	10,770	10,770	10,770	10,770

Table 5: Robustness and Varied Specifications

This table illustrates results for various specifications regressing fraction fair value assets on Tier-1 capital ratio. Mean T1C reports the average effect of Tier-1 capital ratio on fair value assets while controlling for a quarterly trend, log assets, ROA, debt ratio, cash ratio, net investing cash flow ratio, and a dummy for mergers with fixed effect. Initial T1C and Quarter * T1C report the coefficients for Tier-1 capital ratio in 2008Q1 and the quarter-Tier-1 capital interaction, respectively in a regression with the same controls. (1) **Baseline** specification is as presented in Table 3, column 4, and Table 4, column 3. (2) Drop 2008, Q1 drops data from initial election in quarter 1 of 2008. (3) Drop 2008 drops all data from 2008, the initial election year. (4) Only level 2 and 3 assets uses level 2 and 3 assets only, divided by total assets. (5) Tobit restricts the model to positive values (avoiding the OLS bounding problem). (6) Drop top & bottom 1% growth drops bank-quarter observations in the top and bottom 1% of growth levels, avoiding excessive mergers. (7) Fair value adjustment subtracts the effect of changes in value on fair valued assets from the calculation of the fair value fraction. (8) Balanced panel—banks must be in sample for all 20 quarters. (9) Stability measure uses an average of three measures of stability—credit loosening, VIX certainty, and house price index—in place of the time trend and time interaction.

	Mean T1C	Initial T1C	Quarter * T1C
(1) **Baseline**	**0.179****	**0.457*****	**-0.025****
N=10,770	(0.083)	(0.122)	(0.010)
(2) Drop 2008Q1	0.173**	0.477***	-0.026**
N=10,297	(0.085)	(0.130)	(0.010)
(3) Drop 2008	0.153*	0.493***	-0.026**
N=8,761	(0.088)	(0.157)	(0.012)
(4) Only level 2 and 3 assets	0.146*	0.428***	-0.025**
N=10,770	(0.085)	(0.120)	(0.010)
(5) Tobit	0.177**	0.456***	-0.025**
N=10,770	(0.081)	(0.117)	(0.010)
(6) Drop top & bottom 1% growth	0.141	0.422***	-0.025**
N=10,576	(0.088)	(0.122)	(0.010)
(7) Fair value adjustment	0.180**	0.457***	-0.025**
N=10,770	(0.083)	(0.122)	(0.010)
(8) Balanced panel	0.271**	0.497***	-0.020
N=6,500	(0.114)	(0.164)	(0.014)
(9) Stability measure	0.281***	0.387***	-0.018**
N=10,770	(0.083)	(0.093)	(0.009)