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Abstract

Bank capital requirements are based on a mix of market values and book values. We investigate the effects of a policy change that ties regulatory capital to the market value of the "available-for-sale" investment securities portfolio for some banking organizations. Our analysis is based on security-level data on individual bank portfolios matched to bond characteristics. We find little clear evidence that banks respond by reducing the riskiness of their securities portfolios, although there is some evidence of a greater use of derivatives to hedge securities exposures. Instead, banks respond by reclassifying securities to mitigate the effects of the policy change. This shift is most pronounced for securities with high levels of interest rate risk.

Key words: bank, securities, available-for-sale, capital regulation, fair value accounting

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To view the authors' disclosure statements, visit https://www.newyorkfed.org/research/staff_reports/sr851.html.

1. Introduction

Bank capital regulation is often criticized for relying on accrual accounting data which may not reflect the current economic value of bank assets and liabilities (e.g., see Haldane, 2012, and Calomiris and Nissim, 2014). Examining recent events, critics note that regulatory capital ratios for many banks declined only marginally during the 2007-09 financial crisis, despite a collapse in the market value of bank equity, and point to the insolvency of several prominent financial institutions which had apparently healthy capital ratios at the time of their failure. For example, Lehman Brothers had a tier 1 regulatory capital ratio of 11.6% days prior to its bankruptcy, well above the regulatory minimum.[1]

Motivated by these concerns, there has been a trend over time towards greater use of fair value accounting for bank capital regulation, as well as for financial reporting more generally (e.g., Laux and Leuz, 2009). However, we have only an incomplete understanding of how the use of fair values for regulation affects the incentives and behavior of financial institutions. The goal of this paper is to shed light on these issues by studying the effects of a recent policy change which ties regulatory capital directly to the market value of bank securities portfolios.

Specifically, we study the removal of the accumulated other comprehensive income (AOCI) filter for investment securities classified as "available for sale." AOCI is an accounting item which reflects accumulated unrealized changes in the fair value of securities held for investment purposes. Historically, these unrealized gains and losses are not counted towards bank regulatory capital. However, as part of the implementation of the Basel III capital accord, this AOCI filter was removed for a set of the largest US banking organizations.[2,3] For these banks, fluctuations in securities market values now flow through directly to regulatory capital. The filter has been removed according to a step function, with the percentage of AOCI counted towards regulatory capital set at 20% in calendar year 2014, rising by 20% per year until full phase-out of the filter for affected banks in

[1] See e.g. https://economix.blogs.nytimes.com/2010/04/01/capital-requirements-are-not-enough/.

[2] Specifically, the filter was removed for banking organizations subject to the Advanced Approaches Basel regulatory framework, as well as to other banking organizations which elected to include AOCI in capital. See Section 2 for more details.

[3] Although we sometimes refer to the firms we study as "banks" as shorthand, our analysis focuses on consolidated banking organizations at the level of the high-holder bank holding company (BHC), inclusive of nonbank subsidiaries.

2018.

The regulatory capital volatility induced by the removal of the AOCI filter creates a challenge for bank risk management. For example, an article in Risk magazine highlights its impact in the wake of the Brexit vote in the United Kingdom: *"In the first few frantic hours after markets opened on June 24, the primary concern for some treasurers was how their so-called available-for-sale (AFS) portfolio, where liquidity buffers are held, was going to look at the end of the day ... The Brexit vote was the first time treasurers had to manage the impact of AFS volatility on regulatory capital".*[4] The goal of this paper is to study how banks respond to the AOCI filter removal, which effectively means the AFS portfolio is now marked-to-market for regulatory capital purposes.

We examine two main questions. First, does the removal of the AOCI filter lead to lower risk-taking in bank investment securities portfolios? We may expect banks to de-risk because the policy change makes regulatory capital more sensitive to fluctuations in asset values. If banks are averse to this volatility (e.g., because it requires them to hold a larger precautionary equity capital buffer), then a natural response would be to shift to less risk-sensitive securities (e.g., bonds with shorter duration), or to make greater use of derivatives to hedge the portfolio risk. Second, do banks take steps to reclassify securities or otherwise shift the composition of assets in ways which minimize the effect of the removal of the AOCI filter, but do not substantively reduce "fundamental" bank risk?

Our analysis is based on detailed security-level data reported in bank holding companies FR Y-14Q filings, a quarterly regulatory collection which supports the Federal Reserve supervisory stress tests. The data include information on the book and market value of different securities owned, the security type, CUSIP identifier, and the classification of the security (available-for-sale or held-to-maturity). These data are merged by security identifier to information on characteristics such as coupon, duration and credit rating. We also conduct additional analysis and cross-validate our results using publicly available BHC regulatory filings, which report aggregate information about the size and composition of BHC securities portfolios.

We find little clear evidence of a significant reduction in the riskiness of the assets held in the

[4] See https://www.risk.net/derivatives/2463893/brexit-gives-banks-taste-life-without-afs-bond-filters.

securities portfolio in response to the removal of the AOCI filter. We primarily study interest rate risk, which is likely to be the most important source of volatility in asset values given the concentration of agency MBS and Treasury securities, as well as other long-duration bonds, in bank portfolios. Our empirical strategy focuses on examining changes in risk *within* security types with a common risk weight (i.e. considering the average duration of agency MBS or of Treasury securities). This is important to help disentangle the effect of tying capital to the fair value of the securities portfolio from other post-crisis changes in bank regulation. Using data over 2011-2017, we find no evidence that the removal of the AOCI filter leads to lower duration of the agency MBS or Treasury portfolio. We also do not find evidence of a decline in the average yield of either type of securities holdings. Looking across all security types, which we can only do for a shorter period (2015:Q4-2017:Q2), we do find a significant decrease in security duration for AOCI banks, although their total duration risk exposure does not decrease over the same period.

We do find some evidence, however, of increased use of derivatives to hedge securities exposures, based on security-level data on qualifying accounting hedges reported in the FR Y-14Q. The likelihood of hedging a particular bond exposure is between 4 and 16 percentage points higher for banks not subject to the AOCI filter, depending on the specification.

Quantitatively more importantly, we find evidence that treated banks respond by actively reshuffling their portfolios, and in particular classifying risky securities as "held to maturity" (HTM) rather than available for sale (AFS). The use of detailed security-level data allow us to control in a precise way for security characteristics – most finely by including both BHC fixed effects and a vector of CUSIP-by-calendar quarter fixed effects in our specifications. This is an important feature of our analysis, since it allows us to isolate the effects of the accounting classification decision *for a given security* from changes in the composition in investment securities portfolios which was occurring during this period. In these specifications, our preferred point estimates suggest that a security is 20 percentage points more likely to be classified as HTM rather than AFS if owned by a BHC subject to the AOCI rule (measured on a fully phased-in basis), or 38 percentage points measured on a weighted basis. For both agency MBS and Treasury securities, we find that these effects are concentrated among bonds with higher duration.

Although reclassifying securities in this way reduces the volatility of regulatory capital, it does not mitigate the fundamental risks of the assets being held. Given that there are obstacles to selling securities classified as held-to-maturity, such reclassification may in some circumstances even increase risk, to the extent that it reduces the liquidity of the bank's assets during periods of stress. We also find some weak suggestive evidence that banks shift their residential mortgage investments towards investments in whole loans rather than mortgage-backed securities. Again, this may heighten rather than reduce risk, given that whole loans are exposed to credit risk while mortgage bonds are generally in the form of agency securities which have a guarantee against default. However, holding whole loans reduces regulatory capital volatility since such loans are not marked-to-market.

Our results highlight that banks will actively reshuffle the composition of their asset portfolios when an asset has a different regulatory treatment depending on where it is held on the balance sheet. Such reshuffling will mask the effects of changes in regulatory capital measurement, and may have other unintended consequences which affect financial stability.

1.1 Related literature

Our analysis is most closely related to an emerging literature studying the effects of the removal of the AOCI regulatory capital filter. The three most closely related papers we are aware of are Chircop and Novotny-Farkas (2016), Kim et al. (2017) and Hamilton (2018). Chircop and Novotny-Farkas (2016) conduct an event study approach around announcement dates related to the AOCI rule, finding evidence that bank stock returns reacted negatively to news that the rule was becoming more likely to go into effect. This result is consistent with the view that the AOCI rule represented a tightening of regulation for affected banks. Kim et al. (2017) find evidence of a reduction in securities portfolio risk due to the AOCI rule (in contrast to our results). Kim et al. (2017) and Hamilton (2018), like us, find evidence of a shift from AFS to HTM within BHC securities portfolios.

Unlike this set of papers, our analysis is able to more directly measure the types of risks embedded in bank securities portfolios based on the characteristics of individual securities, and control finely for security characteristics when examining shifts in securities classification. This can matter importantly for the empirical analysis. For example Kim et al. (2017) find evidence of a shift to zero-risk-weight securities (consisting of Treasury securities and other direct obligations of the Federal government), which they interpret as a reduction in risk. However, we show that in fact, Treasury securities have among the longest duration of any of the security types held in bank portfolios, and thus have very significant exposure to interest rate risk. Furthermore, measuring interest rate risk directly, we find no evidence that the removal of the AOCI filter was associated with a reduction in duration within asset class. Conversely, these other papers study a number of aspects of bank responses to the removal of the AOCI filter which we do not consider—for example, Kim et al. (2017) study effects of the removal of the AOCI filter on repo market activity and mortgage market lending.

This paper is also related to other research studying the interaction between accounting and regulatory capital rules. For example, Ellul et al. (2015) find evidence from the insurance industry that when capital regulations are based on historical cost accounting, banks engage in "gains trading" by selling securities which have appreciated in value, thereby realizing the gains in fair values on these positions and selectively boosting net income. In fact, discouraging gains trading was a key motivation among banking regulators for removing the AOCI filter in the first place. Although Ellul et al. (2015) study a different research question to us, and focus on insurers rather than banks, their work is quite closely related in the sense that it uses security-level data to study how the interaction of accounting standards and capital rules affects securities holdings and trading by financial institutions.

The evidence in this paper is also related to the broader debate about fair value accounting for financial institutions (e.g., see Laux and Leuz, 2009).[5] We note that the setting we study involves a change in capital regulation which is not due to or accompanied by a corresponding change in accounting standards. All banks are required to account for securities in the same way, both before and after the introduction of the AOCI rule. What has changed is whether or not AOCI is counted

[5]This literature seeks to understand the costs and benefits of fair-value accounting and whether fair-value accounting reduces financial stability and contributes to fire sales, or was a contributing factor in the 2007-09 financial crisis.

towards regulatory capital. However, our results are related for example to research by Barth et al. (1995) which finds that the use of fair value accounting is associated with more volatility in earnings and accounting equity, and more frequent breaches of regulatory capital requirements.

Banks are among the largest investors in fixed income securities, and an additional contribution of our research is to present new stylized facts about the characteristics of bank securities holdings and trends in these investments over time. This paper is thus related to research on why banks hold securities. For instance, Hanson et al. (2015) argue that banks are “patient” fixed income investors willing to hold relatively illiquid but higher yielding assets because of the sticky nature of retail deposits. Hanson and Stein (2015) present evidence from Call report data that banks are yield-oriented investors who invest in long-term securities when the yield curve is steep. These papers highlight other determinants of bank security holdings, which in general we will control for or dummy out (e.g., we will absorb time series variation in the shape of the yield curve by including a vector of time dummies).

Finally, our research is related to the literature on the design of bank capital requirements and the costs and benefits of using accounting values to determine minimum capital requirements. For further discussion see Berger et al. (1995), Calomiris and Nissim (2014) and references therein.

2. Background and Institutional Details

2.1 Securities accounting

Under Financial Accounting Standard (FAS) 115, securities holdings are classified in three categories: “trading” securities that are bought and held principally for the purpose of selling in the near term; “held to maturity” securities consisting of debt securities that the firm has the positive intent and ability to hold until maturity; and “available for sale” securities not captured by either of the above definitions, which the bank may retain for long periods but that may also be sold.[6] Trading securities are accounted for at fair value. Held to maturity securities are accounted for at amortized cost. The accounting treatment of available for sale securities follows an intermediate

[6]For more details, see Financial Accounting Standards Board (2010). Note that this study focuses on securities held for investment purposes and classified as either HTM or AFS, rather than for securities held for trading.

approach, in which unrealized changes in fair value do not affect net income, but contribute to a balance sheet item called accumulated other comprehensive income (AOCI). Changes in the fair value of AFS securities will thus correspondingly lead to changes in book equity.[7]

Accounting standards discourage firms from selling or reclassifying any significant quantity of securities classified as held-to-maturity—in particular, under the "tainting rule", any firm doing so will subsequently be prohibited from classifying any financial asset as held to maturity for a period of two years after the occurrence of the event. Bank regulatory guidance also indicates that sales or reclassifications of securities classified as HTM should be "rare."[8]

2.2 The AOCI filter

In 1995, shortly after FAS 115 became effective, U.S. banking regulators introduced an "AOCI filter", which excluded balances recorded in AOCI from regulatory capital. The apparent motivation for this decision was to reduce instability in regulatory capital. The AOCI filter was subsequently removed under the international Basel III capital framework agreed upon in 2012. The decision to remove the AOCI filter attracted significant comment from banks and industry groups, which argued that the proposed policy change would increase the volatility of regulatory capital, discourage banks from investing in risky fixed-income securities and force banks to maintain higher capital ratios as a buffer against volatility (see for example Clearing House Association, 2011 and American Bankers Association, 2012; see also Kim et al., 2017 for additional discussion and references).

In the final rule issued in July 2013 to implement Basel III in the United States, the AOCI filter on regulatory capital was ultimately removed only for the largest banking organizations subject to the Advanced Approaches Basel regulatory framework (see Board of Governors of the Federal Reserve System, 2013), as well as to any non-advanced approaches firm which elected to include AOCI in capital. The advanced approaches framework applies to large and/or internationally active

[7]Under the accounting standard, firms also record "other than temporary impairments" (OTTI) associated with persistent reductions in the value of AFS or HTM fixed income securities value, generally associated with an adverse credit event related to the obligor. We note that there was an earlier 2009 accounting rule change governing the conditions under which an OTTI should be recognized (e.g., see https://www.occ.treas.gov/news-issuances/bulletins/2009/bulletin-2009-11.html). This change is not directly related to our paper, however, and predates our sample period.

[8]See https://www.occ.treas.gov/publications/publications-by-type/other-publications-reports/baas.pdf.

banking organizations—generally those with at least $250 billion in total consolidated assets or at least $10 billion in total on-balance sheet foreign exposure—and includes the depository subsidiaries of those firms. Non advanced-approaches banks were given a one-time option to elect to opt out of including AOCI in regulatory capital. Almost all firms elected to take up this option. The final rule also phased in removal of the AOCI filter, with the percentage of AOCI counted towards regulatory capital set at 20% in calendar year 2014, rising by 20% per year until full phase in at 100% in 2018.

2.3 Other regulatory changes

The removal of the AOCI filter on investment securities has occurred as part of a broader set of banking regulatory reforms implemented since the 2007-09 financial crisis. Most notably, the United States has (i) switched from Basel I to Basel III capital requirements, including changes in risk-based capital requirements, an increase in the leverage ratio, and the introduction of a supplementary leverage ratio, (ii) implemented supervisory stress testing via the comprehensive capital analysis and review (CCAR) as an additional constraint on capital distributions by large banking organizations, and (iii) introduced liquidity requirements via the liquidity coverage ratio (LCR).

A challenge for empirical research on regulation is therefore to disentangle the effects of individual regulatory changes from one other. In our analysis of portfolio risk and hedging, we address these concerns by focusing on an analysis of changes in risk *within* a class of securities which have the same regulatory capital risk weights and LCR weights. In particular, we examine changes in risk within U.S. Treasury portfolios and within agency MBS portfolios. The introduction of the LCR, or the higher leverage ratio, will induce shifts in investments across security types, but do not directly affect the relative regulatory "cost" of holding a riskier vs less risky bond within a security type (e.g., a long-duration Treasury security rather than a short-duration security—both of which have the same (zero) risk weight and are counted as level 1 assets for purposes of the leverage ratio).[9] Similarly, we also examine the classification of securities as HTM or AFS finely,

[9] The higher leverage ratio, if binding, would induce banks to increase their holdings of assets with high risk weights, compared to otherwise similar banks bound by risk-based capital requirements. Similarly, the LCR induces banks to shift away from asset types which do not qualify as high-quality liquid assets.

generally by including a fixed effect for each security. We also focus our analysis on large bank organizations all of which are subject to enhanced bank supervision and supervisory stress testing, to minimize concerns that these exercises could change bank risk-taking incentives.

3. Sample and Data

Our empirical analysis focuses on large U.S. banking organizations with more than $50 billion in total assets.[10] We focus on this sample because smaller banks are likely to be a less appropriate comparison group relative to the set of advanced approaches firms for which the removal of the AOCI filter was mandatory. Aside from any inherent differences in the business model of smaller banks, since the passage of the Dodd-Frank Act, BHCs larger than $50 billion in assets have been subject to enhanced supervision, including annual supervisory stress tests as part of the comprehensive capital analysis and review (CCAR) conducted by the Federal Reserve. This heightened supervisory oversight may lead to changes in behavior unrelated to the removal of the AOCI filter. This sample also corresponds to the set of firms for which we have security-level data.

3.1 Bank-level summary statistics

Table 1 summarizes the characteristics of our sample of banking organizations based on public FR Y-9C data. The sample period for these summary statistics is 2010:Q1 to 2017:Q4. Securities portfolios are an important asset class for this sample, comprising 17% of total assets for the average bank, and 27% of assets for the bank at the 90th percentile of the distribution. A high fraction of these securities are classified as available-for-sale (AFS), although as we will show, the fraction of securities classified as held-to-maturity (HTM) increases sharply over the sample period.[11]

Table 1 also summarizes the composition of bank investment securities portfolios. The largest

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[10]Nearly all the firms in our sample are commercial bank holding companies (BHCs). In recent quarters the sample also includes a set of intermediate holding companies (IHCs) of large foreign banking organizations, when those IHCs exceed $50 billion in total assets. In this paper we refer to this group of BHCs and IHCs as either banking organizations, or simply banks.

[11]Note that these statistics exclude securities held for trading purposes rather than for investment. Most firms in our sample do not have significant trading portfolios, although these are important for a a few of the largest firms with large investment bank subsidiaries. Securities classified as trading assets are marked-to-market for regulatory capital purposes throughout the sample period.

category, making up nearly half of the overall portfolio on average, is agency mortgage-backed securities (MBS), representing interests in securitized pools of mortgages which are guaranteed against default by Fannie Mae, Freddie Mac or Ginnie Mae. Agency passthrough MBS account for 29% of securities holdings, and agency collateralized mortgage obligations (representing structured bonds backed by agency passthrough pools) make up another 20%. Other significant asset classes include U.S. Treasury securities (10% share), U.S. government agency debt (8%), asset backed securities (7%), municipal and state debt (6%) and foreign debt securities (6%).

The table also presents summary statistics for other bank controls included in our specifications, such as asset size, profitability as measured by return on assets, capitalization as measured by the tier 1 risk-based capital ratio, and balance sheet composition. The table also reports information about the number of banks in the sample.

3.2 Security-level data

The bulk of our empirical analysis is based on CUSIP-level data on the bonds and other securities underlying these aggregated statistics. These security-level data are drawn from Schedule B.1 of the FR Y-14Q, a quarterly regulatory collection which supports the Federal Reserve's supervisory stress tests, and is filed by BHCs with at least $50 billion in consolidated assets. We also make use of a closely related Y-14Q schedule that collects information on which investment securities have qualified accounting hedges ("B.3").[12] The Y-14Q securities data are available from 2010:Q3 onwards, and in this paper draft we use FR Y-14Q data through 2017:Q2 (although the data continue to be collected on an ongoing basis). We also augment our sample with data from an earlier collection of security level data for a smaller number of firms collected by the Federal Reserve Bank of New York starting in 2009:Q2; these earlier data are not part of our main statistical analysis, however.

Figure 1 shows the number of banks reporting securities-level data, distinguishing between those which now include AOCI in regulatory capital and those which do not. Except for one firm, this corresponds to the set of advanced approaches banking organizations. The sample size increases

[12] See https://www.federalreserve.gov/reportforms/forms/FR_Y-14Q20140930_i.pdf for further information on these and other FR Y-14 schedules.

over time. From 2009-11, the securities data are available only for a small number of firms. The sample expands in 2011 to support the introduction of the Comprensive Capital Analysis and Review (CCAR). The sample expands again in 2013, due to the later entry of a set of smaller BHCs into the CCAR.[13] Given the expansion of the number of BHCs which contribute to the security-level sample over time, and the timing of the removal of the AOCI filter, our analysis of the security-level data begins in 2011:Q3.

Table 2 summarizes information from the security-level data regarding the types of securities held, pooling the data from 2011:Q3 to 2017:Q2, where in total about 3.7 million entries were recorded. As in the Y-9C data, by far the largest asset class, both in terms of number of observations and dollar share, are agency mortgage-backed securities (MBS). In terms of number of observations, the next largest asset classes are municipal bonds and corporate bonds, though in terms of dollar value, US Treasury and agency debt as well as (non-US) sovereign bonds are larger. Combined, these five asset classes account for over 86 percent of observations (and 80 percent in terms of dollar value).

For each security, banks are asked to report the security identifier (CUSIP), a description of the security, the USD amount of their exposure (in terms of face value, amortized cost, and market value), the purchase date, the accounting intent—HTM or AFS—and whether any other-than-temporary impairment (OTTI) has been taken.

Based on the CUSIP identifier for each security, we are then able to merge in additional information on the securities from vendor sources, such as the coupon and maturity of debt securities, measures of their interest rate sensitivity (duration), or their credit rating.[14]

While we are limited in our ability to backfill all these variables for the historical data, coverage for most of them is almost complete for the most recent quarters (starting in 2015:Q4). Of particular interest for us as a measure of interest rate risk is the effective duration of different securities, drawn from an industry-leading financial analytics vendor. Table 3 shows that municipal bonds tend to have the highest effective duration, ahead of agency MBS and Treasury and agency bonds. This is

[13]This phase-in provision applied to 11 smaller bank holding companies, which were only required to begin complying with the full requirements of the supervisory stress tests in the 2014 stress testing cycle.

[14]CUSIPs are not available for all observations: about 9% are missing, of which about half are for sovereign bonds.

true even though agency MBS have much longer contractual remaining maturity—but due to the free prepayment option embedded in U.S. fixed-rate mortgages, many homeowners are expected to return their outstanding debt much sooner.

The table also reports a valuation measure, namely the ratio of reported fair value to face value, which again tends to be highest for municipal bonds (though they also feature the largest standard deviations). Coupon rates tend to be highest for corporate bonds and lowest for Treasury/Agency bonds. We are able to observe the fraction of bonds for which there is a qualified accounting hedge. This fraction is close to zero for agency MBS, though more than 10% for corporate bonds, municipal and sovereign bonds.

In the next section, we will study how interest rate risk taking varies across banks subject and not subject to the progressive removal of the AOCI filter. We have more limited coverage of the duration of individual securities prior to 2015:Q4. However, for Treasury securities and agency MBS we are able to impute these durations quite accurately, based on remaining maturity, coupon, and (for agency MBS) origination vintage. Further details are provided in the Internet Appendix.

The Internet Appendix also describes our efforts to verify that aggregated values from the security-level data "roll up" to information reported in BHC FR Y-14Q reports. The appendix documents that the security-level data is comprehensive, in that the summed up values of the security holdings match the Y-9C values closely.

4. Effects on portfolio risk

In this section, we test our first hypothesis, namely that affected banks respond to the phase-in of the AOCI rule by reducing the level of risk in their securities portfolio. In our analysis to date we focus on the level of interest rate risk, that is, the average duration of banks' securities portfolios for individual asset types, as well as overall (pooling across both AFS and HTM securities).

We proceed in two steps. First, we focus on the recent data since 2015:Q4 for which we have duration measures for each of the main security types identified in the previous section, namely agency MBS, Treasury/agency bonds, corporate bonds, municipal bonds, and sovereign bonds. We start by measuring average duration by BHC across all of those assets, and test whether BHCs subject to the removal of the AOCI filter ("AOCI banks") have lower average duration (or risk exposure, defined as duration times face value divided by total assets). We also test whether over the time period for which we have this data there is any de-risking for AOCI banks.

Since the above analysis only covers a relatively short time period after the AOCI rule has already been mostly phased in (2015:Q4 to 2017:Q2), it cannot conclusively be used to examine whether the introduction of the AOCI rule in 2013 had dynamic effects on the riskiness of the affected banks' securities portfolio. To test this, we instead focus on two asset classes for which we can impute duration measures going back to 2011 relatively well, namely US Treasuries and agency MBS. As discussed earlier, looking *within* each of these asset classes also means that we do not need to worry about effects of other concurrent regulatory changes (such as the Liquidity Coverage Ratio or the Supplementary Leverage Ratio) which may have differentially affected different banks' incentive to shift the composition of their portfolios from one asset class to another.

In most of our analyses, the key coefficient of interest is an interaction of an indicator variable that equals one for banks affected by the removal of the AOCI filter ("AOCI banks") interacted with a step function that captures the gradual phase-in of the new rule. This step function is at 0 through the end of 2013, then increases by 0.2 in Q1 of each year (thus reaching 1 in 2018:Q1). This specification assumes that banks adjust gradually to the AOCI filter removal, in proportion with the percentage of AOCI counted towards regulatory capital. If instead banks acted by reducing their portfolio risk or reshuffling securities prior to the phase-in (which is possible given that the rule started being discussed as part of Basel III deliberations in December 2010; see Chircop and Novotny-Farkas 2016 for a timeline), this might bias our estimated coefficients. There could be downward bias if the adjustment took place prior to 2014; however, there could instead be upward bias if most of the adjustment to the AOCI rule took place early in the phase-in period, e.g. in 2014, when our "phase-in" variable only takes a value of 0.2. However, at least when it comes to re-classification of securities from AFS to HTM, we will see later (Figure 3) that there is little evidence of anticipation effects prior to 2014, and that the effects of the new rule have occurred gradually since then.

4.1 Cross-sectional analysis of duration: pooled securities portfolio

First we establish some stylized facts about the level and changes in overall duration. In the first two columns of Table 4, we test whether, since 2015:Q4, banks subject to the removal of the AOCI filter have lower average interest rate risk in their securities portfolio. Specifically we estimate the following regression:

$$\text{Risk}_{b,t} = \alpha + \gamma_t + \beta \cdot \text{AOCI\_bank}_b + \epsilon_{b,t}. \tag{1}$$

where $\text{Risk}_{b,t}$ is interest rate risk of bank b at time t, measured in two ways: (i) as the average duration (weighted by current face value of a security) across the five main asset classes; or (ii) multiplying this duration by the total face value of the securities holdings, divided by the banks' total assets. We call this second measure the "Total Risk Exposure." The regressions also include quarter fixed effects, γ_t.

The table indicates that there are no significant cross-sectional differences in average interest rate risk taking between AOCI banks vs. non-AOCI banks. The average duration is slightly lower, although the total risk exposure is somewhat higher. However, these differences are quantitatively small and the coefficients are not precisely estimated.

In columns (3) and (4), we test whether AOCI banks have been reducing the overall duration of their securities portfolio as the rule is being progressively phased in (i.e. as a greater percentage of AOCI is being included in regulatory capital). To do so, we interact the AOCI bank dummy with time (at quarterly frequency), now including bank fixed effects (α_b):

$$\text{Risk}_{b,t} = \alpha_b + \gamma_t + \delta \cdot \text{AOCI\_bank}_b \times t + \epsilon_{b,t}. \tag{2}$$

The negative coefficient in column (3) indicates that from late 2015 to mid-2017, there is indeed a relative downward trend in average duration in AOCI banks' securities portfolios. The coefficient of -0.09, significant at the 5% level, implies that the affected AOCI banks reduced the average duration at an annual rate of about 10% of the average ($= 4 * 0.09/3.68$). However, as discussed above, this is not a particularly sharp test of the causal effect of the removal of the AOCI filter, since total duration could be affected by a range of regulatory changes during this period—for example a rotational shift into high-quality liquid assets to satisfy the liquidity converage ratio. (The time period studied is also fairly short, and does not include any of the "pre" period before the AOCI rule is announced and implementation begins). Furthermore, in column (4), where we use total risk exposure, the coefficient is close to zero and not statistically significant.

In sum, this initial analysis does not reveal large differences in the absolute level of duration between AOCI and non-AOCI banks. It does show some evidence of a recent reduction in average duration among AOCI banks, although their total duration risk exposure has not been significantly decreasing.

4.2 Duration in Treasury and agency MBS portfolios: longer sample

We now turn to an analysis over a longer sample period of the evolution of interest rate risk exposure for the two most important asset classes in bank securities portfolios, namely agency MBS and Treasury debt. For those asset classes, we are able to extend the sample back to 2011 by imputing duration measures (see Internet Appendix for details of how this is done).[15]

Similar to the previous subsection, we then regress either average duration or total risk exposure in that asset class on the AOCI-bank dummy, but now interacted with our measure of the phase-in of the new rule including AOCI in regulatory capital:

$$\text{Risk}_{b,t} = \alpha_b + \gamma_t + \delta \cdot \text{AOCI\_bank}_b \times \text{phase-in}_t + \epsilon_{b,t}. \tag{3}$$

Table 5 presents the results. As discussed earlier, these results are based on looking *within* each of these asset classes, which have a common risk weight—helping to identify the effect of the removal of the AOCI filter from other regulatory changes during this period.[16] We see that the point estimates of the estimated effects of AOCI on the duration of AOCI banks' MBS and Treasury portfolios is negative, consistent with some risk reduction, but far from statistically significant

[15]Note that for agency MBS we only retain standard pass-through securities, meaning we drop collateralized mortgage obligations and similarly "complex" structured securities for which imputing duration is more challenging. Pass-through MBS account for about 60% of the face value of banks' MBS holdings.

[16]One exception to this general point is that within agency MBS, Ginnie Mae securities are treated differently for the liquidity coverage ratio than agency MBS issued by Fannie Mae and Freddie Mac, suggesting we may wish to consider these two subtypes of agency MBS separately. We plan to address this in the next draft of this paper.

(columns 1 and 3).[17]

We note in contrast that the total risk exposure of AOCI banks to these two asset classes in fact increased, and significantly so for Treasuries. This increase in total exposure to Treasury securities likely reflects the effects of other regulations introduced around the same time—in particular the Liquidity Coverage Ratio (LCR) which required advanced approaches firms to increase their holdings of liquid assets.

4.3 MBS and Treasury yields

As an alternative measure of risk-taking, and to complement to the above analysis on duration, we examine differential trends in the average yield on Treasury securities and MBS, measured as the annualized ratio of interest income to the book value of securities held. These can be measured directly using FR Y-9C data. Securities with higher yields will in general be exposed to greater risk. This will be in the form of interest rate risk in the case of Treasury securities and interest rate risk and prepayment risk in the case of agency MBS. For other types of securities such as corporate bonds, yields will also reflect credit risk and liquidity risk.[18] We note however that there are also limitations of examining yield as a measure of risk—for example it will be misleading in the case of zero coupon bonds (such as principal-only collateralized mortgage obligations).

Results are shown in Table 6. Conditioning on entity and time fixed effects, as in our earlier specifications (and in specifications (2), (4) and (6), a set of bank characteristics), we find a negative point estimate on the coefficient on AOCI bank × phase-in, implying that banks including AOCI in capital are on average shifting towards less risky securities. The effect is 22-59 basis points for Treasury securities and 2-17bp for MBS. However, none of these coefficients are close to statistically significant.

[17] The point estimate in column (3) is large in magnitude, but very imprecisely estimated, due to some large idiosyncratic movements at a small number of firms. The timing of these idiosyncratic movements also does not align particularly well with the phase-in of the new rule.

[18] For our security-level data we find that yield is significantly positively correlated with duration, as expected.

4.4 Hedging

An alternative margin for firms to reduce their exposure to the risks of their securities portfolio is to use derivatives to hedge—for example using interest rate swaps to reduce the interest rate risk associated with Treasury securities. We study the effect of the AOCI rule on hedging behavior using data on qualified accounting hedges available since 2015:Q3.

We now estimate a security-level regression where the dependent variable is equal to 1 if investment security i held by BHC b at time t has an accounting hedge in place at that point in time, or zero otherwise. The right-hand-side variable of interest is a dummy for AOCI banks interacted with the phase-in of the new rule including AOCI in regulatory capital:

$$\text{Hedge}_{i,b,t} = \alpha_i + \alpha_t + \alpha_b + \delta \cdot \text{AOCI\_bank}_i \times \text{phase-in}_t + \epsilon_{i,b,t}. \tag{4}$$

Each specification at least controls for CUSIP, quarter, and banking entity fixed effects (α_i, α_t, α_b). Thus, identification is coming from differences in hedging behavior by different banks for the same security. In the more restrictive specifications, we instead control for CUSIP-by-quarter fixed effects, $\alpha_{i,t}$ and CUSIP-by-BHC fixed effects $\alpha_{i,b}$. This significantly reduces the sample size, but controls even more finely for security characteristics (since we are just comparing differences in hedging behavior for a given security at a given point in time). Table 7 reports six regressions; the first three equal-weight each record in the Y-14 data, the second three weight them by face value of the securities.

We do find evidence of increased use of derivatives to hedge securities exposures, based on security-level data on qualifying accounting hedges reported in the FR Y-14Q. The estimates imply that the likelihood of hedging a particular bond exposure is between 4 and 16 percentage points higher for a bank which fully includes AOCI in regulatory capital, depending on the specification. The larger estimates come from the specifications including CUSIP-by-quarter fixed effects, as well as the specifications weighted by bond face value.[19] These coefficients are quite large relative to

[19]The reason why the weighted estimates are larger is likely a composition effect–there are a large number of distinct agency MBS in the sample, and agency MBS are much less likely to involve a qualified accounting hedge, because they are exposed to idiosyncratic prepayment risk which cannot be easily hedged.

the sample average of the likelihood of a hedge, which is 5-6 percent for the weighted regressions and 2 percent for the unweighted regressions. Some caution should be exercised in extrapolating the magnitude of the largest estimates to the entire sample, since they are based only on the subset of securities which are held by multiple banks and for which there is cross-sectional variation in hedging behavior at a given point in time. The hedging data are also available over only a short time period which does not include the period prior to the phase-in of the AOCI rule.

5. Risk shuffling

We now examine other margins of adjustment in response to tying bank capital to the market value of the AFS securities portfolio via the removal of the AOCI filter. In particular we examine whether firms classify a greater proportion of securities as "held to maturity." Since HTM securities are measured at historic cost for all firms, classifying securities in this way provides a mechanism for banks to mitigate the impact of the removal of the AOCI filter without reducing the level of risk or income on their securities portfolio.

5.1 Held to maturity: Portfolio-level results

Before turning to our regression analysis, Figure 3 plots the share of securities classified as held-to-maturity, splitting the bank sample by whether they are subject to the removal of the AOCI filter or not. We see a parallel increase in the fraction of HTM for both groups during 2012 and 2013 — however the trend sharply diverges from the start of 2014 onwards, once the AOCI rule begins coming into effect. From then onwards there is a continued upward trend in the HTM share for "AOCI banks" including AOCI in regulatory capital, but in contrast the ratio is flat for the non-AOCI bank group.

This graphical evidence supports the argument that the AOCI rule induces substitution by banks into HTM, partially insulating regulatory capital from the volatility associated with movements in security fair value. The shape of this differential trend (which appears in 2014 and rises fairly linearly thereafter) also supports our choice to specify the "post" period in terms of the percentage of AOCI counted towards regulatory capital.

Closely related to this graphical evidence, we now estimate the following bank-level panel regression model using Y-9C data:

$$\%\text{HTM}_{b,t} = \alpha_b + \gamma_t + \delta \cdot \text{AOCI\_bank}_b \times \text{phase-in}_t + \Gamma \cdot \mathbf{X}_{b,t} + \epsilon_{b,t}. \tag{5}$$

The dependent variable "% HTM" is defined as the percentage of investment securities for BHC b at time t which are classified as HTM (between 0 and 100). The key right-hand-side variable of interest is AOCI bank × phase-in, which measures the fraction of AOCI counted towards regulatory capital for the BHC. All our specifications include BHC fixed effects and time fixed effects by quarter. This ensures that our estimates are identified only based on within-firm variation in the composition of the securities portfolio as the AOCI filter is progressively removed over time. We then estimate various different specifications controlling for other combinations of BHC characteristics, $\mathbf{X}_{b,t}$. Results are shown in Table 8. Standard errors are clustered by BHC.

Consistent with the graphical evidence, the results suggest that AOCI banks classify a greater percentage of their investment securities portfolios as held-to-maturity as the AOCI rule is phased in. The interpretation of the coefficient is that the full removal of the filter increases the share of securities held as HTM by 17 to 20 percentage points, depending on the specification. The estimated coefficient of interest is not very sensitive to the the inclusion or exclusion of BHC characteristics (perhaps unsurprisingly given that we already include BHC fixed effects).

Our results here are consistent with other concurrent work on the AOCI filter, in particular Kim et al. (2017) and Hamilton (2018), which also finds a shift in securities portfolio composition towards HTM among banks subject to the new rule. However, a limitation of our analysis so far is that with Y-9C data, we are not able to control in a fine way for the characteristics of the securities held, which may also be changing as the AOCI filter is removed, or be evolving for other reasons during this sample period (e.g., the introduction of the liquidity coverage ratio). To address this limitation, we turn to an analysis based on security-level Y-14Q data.

5.2 Held to maturity: Security-level results

We now estimate a security-level regression where the dependent variable is equal to 1 if investment security i held by BHC b at time t is classifed as HTM at that point in time, or zero if classified as AFS. As before, the key right-hand-side variable of interest is a dummy for AOCI banks interacted with the phase-in of the new rule:

$$\text{HTM}_{i,b,t} = \alpha_i + \alpha_t + \alpha_b + \delta \cdot \text{AOCI\_bank}_i \times \text{phase-in}_t + \epsilon_{i,b,t}. \quad (6)$$

As in the earlier security-level hedging regressions, we always control at least for CUSIP, quarter, and BHC fixed effects (α_i, α_t, α_b). In the more restrictive specifications, we instead control for CUSIP-by-quarter fixed effects, $\alpha_{i,t}$ and CUSIP-by-BHC fixed effects $\alpha_{i,b}$. Table 9 reports six regressions; the first three equal-weight each record in the Y-14 data, the second three weight them by face value of the securities.

Columns (1) and (4) test whether the Y-9C results above were somehow driven by different banks holding different securities that are more or less "suitable" for HTM status. Columns (2) and (5) add CUSIP-by-quarter fixed effects, meaning that we look *within* the same security in the same quarter and test whether AOCI banks became more likely to classify the security as HTM as the AOCI phase-in progresses. Columns (3) and (6) further add CUSIP-by-BHC fixed effects, in order to test whether AOCI banks disproportionately change the intent of a fixed CUSIP in their portfolio from AFS to HTM over the course of the phase-in.

We see that the coefficient on the AOCI dummy interacted with the phase-in measure is positive in all columns, meaning that banks subject to the removal of the AOCI filter become disproportionately more likely to hold a fixed CUSIP as HTM as the rule phase-in progresses. They are largest in columns (2) and (5), which look within CUSIP-quarter.[20] Thus, the shift to HTM holds even when just comparing the same security held by different BHCs at the same point in time. If anything, the weighted coefficient in column (5) of 0.34 is actually *larger* than the portfolio-level results from Table 8.

[20]Using CUSIP×Quarter fixed effects reduces the number of observations by more than half, since only CUSIPs that are held by more than one bank in a given quarter are included in the regression.

In columns (3) and (6), which additionally control for CUSIP-by-BHC fixed effects, coefficients are positive (meaning there is some re-classification of fixed securities occurring), but not nearly as large as in the immediately prior two columns. This means that most of the trend towards HTM shares comes from the "extensive margin" (securities being added to portfolio or sold from it), rather than the reclassification of securities already held in the portfolio. As in the earlier columns, results are larger when observations are value-weighted.

5.3 Are longer-duration securities classified as HTM?

Our results suggest that advanced approaches BHCs have "shielded" their portfolios against the removal of the AOCI filter by classifying a larger portion of their portfolios as HTM, declaring their intent to hold these securities until maturity and thereby avoiding the requirement to mark-to-market for regulatory capital purposes.

Next, we present results on which types of securities are classified as HTM, and in particular, whether BHCs have particularly (re)classified securities with longer durations. The value of long-duration securities is more sensitive to movements in the term structure of interest rates, and they would therefore which be likely to generate more volatility in regulatory capital if marked-to-market.

Before turning to regression results, we present some descriptive graphical evidence. Figure 2 shows that AOCI banks tend to hold longer duration securities as HTM. Pooling the five main asst classes identified earlier, we first sort securities into (value-weighted) duration quintiles (by quarter in 2016 and 2017), and then for each quintile calculate the share of holdings that are held as HTM, separately for AOCI banks and non-AOCI banks (pooling firms within each group).

The figure shows that AOCI banks tend to hold more of their securities portfolio as held-to-maturity (as seen above) and that this is true especially for longer duration securities. Both AOCI and non-AOCI banks tend to hold the lowest duration assets primarily as AFS, but from quintile 2 onward the HTM share increases less for non-AOCI banks than for AOCI banks.

We next investigate more formally if this pattern has strengthened over the period of the phase-in of the new AOCI rule. Table 10 estimates security-level regressions for whether a security is classified as HTM, of the same form as in equation (6) above, except that we also include a triple interaction term for AOCI bank × phase-in × above-median duration. The coefficient on this variable measures whether the trend towards HTM is more pronounced for bonds with longer duration.[21] We include CUSIP×quarter and bank fixed effects, as in columns (2) and (5) of Table 9.

The triple interaction term is positive, at least marginally statistically significant, and also quantitatively large (it is generally at least as large as the single interaction on AOCI bank × phase-in). Consistent with the graphical evidence, this suggests that the trend towards HTM is heavily concentrated in bonds with a high level of interest rate risk.

5.4 Which banks? Which security types?

Augmenting this evidence, in Table 11 we present additional evidence about which types of firms and security types experience a more pronounced trend towards HTM. We note that the power of some of these regressions is relatively low, in part due to the fact that we adopt a conservative assumption of clustering standard errors by BHC.

Columns (1) and (2) present results interacting the variable of interest with security types. The coefficients are largest for agency MBS and Treasury/agency securities, although the coefficients are also positive for municipal bonds and sovereign bonds.

Columns (3) and (4) interact the AOCI bank × phase-in variable with an interaction term for whether the BHC's capital ratio is below median. Perhaps surprisingly, we find no evidence that reclassification is more pronounced among firms with low capital ratios; if anything the opposite is true. There are a number of limitations here, however; for example we consider only one type of minimum capital requirement and do not consider the role of stress tests in determining firms' "headroom" relative to minimum capital requirements. These preliminary results should correspondingly be treated cautiously.

Finally, columns (5) and (6) interact AOCI bank × phase-in with a dummy for whether the firm has an above-median sized investment securities portfolio, as a percent of total assets. One might imagine that firms with very large securities portfolios may have particularly strong incentives to reclassify securities, given the volatility induced by the removal of the AOCI filter. Directionally,

[21] The regression also includes all single interaction terms or partials them out by the inclusion of the relevant fixed effects.

we find that this is the case, although the statistical significance of the estimated coefficient is weak.

5.5 Loans versus securities

Another margin available to banks to mitigate the effect of the AOCI filter removal is to hold fixed income assets in the form of whole loans instead of securities. We examine this margin in the context of BHC mortgage portfolios. This seems like a natural setting, since it is extremely common for BHCs originate mortgages and then switch them to MBS through the agency MBS market (often these resulting MBS are still retained on balance sheet, as shown by the high overall share of agency MBS in BHC securities portfolios).

We investigate this question using FR Y-9C data, using a panel regression model similar in structure to Table 8. The dependent variable is "mortgage share" which is defined as the ratio of residential mortgage assets as a percentage of residential mortgages and mortgage backed securities owned by BHC b at time t.

Results are shown in Table 12. As before, our regressions control for both time and BHC fixed effects, and the key coefficient of interest is on the interaction term AOCI bank $\times$ phase-in. This coefficient is consistently positive, with a coefficient of about 0.1. This point estimate implies that the fraction of mortgage investments held in the form of whole loans rather than securities increases by about 10 percentage points under the full phase-in of the staggered removal of the AOCI filter. However, the coefficient is at most marginally statistically significant.

6. Conclusions

Using detailed security-level data, we present new evidence on the effects of measuring regulatory capital using market values rather than book values. We find only limited evidence that banks respond to the policy change by reducing risk, although there is some evidence that the removal of the AOCI filter induces banks to hedge more actively. Instead, banks reclassify securities to shield their portfolios from the effects of the removal of the AOCI filter, particularly for securities with high levels of interest rate risk. There is also some weak evidence of a shift towards holding whole loans, which are not marked to market.

Reclassifying long-duration securities as "held-to-maturity" dampens the volatility of measured regulatory capital, but does not in itself reduce the fundamental risk (e.g., interest rate risk or prepayment risk) of the assets held by BHCs. In fact on some dimensions they may increase risk, for example by making it more difficult for banking organizations to liquidate securities holdings during periods of stress. Our results highlight the potentially unanticipated effects of treating assets differently for regulatory purposes depending on where they are held on the balance sheets of financial institutions.

References

American Bankers Association (2012): "Treatment of unrealized gains and losses under the Basel III capital framework," *Comment letter*.

Barth, M. E., W. R. Landsman, and J. M. Wahlen (1995): "Fair value accounting: Effects on banks' earnings volatility, regulatory capital, and value of contractual cash flows," *Journal of Banking and Finance*, 19, 577 – 605, the Role of Capital in Financial Institutions.

Berger, A. N., R. J. Herring, and G. P. Szego (1995): "The role of capital in financial institutions," *Journal of Banking and Finance*, 19, 393 – 430, the Role of Capital in Financial Institutions.

Board of Governors of the Federal Reserve System (2013): "Federal Reserve Board approves final rule to help ensure banks maintain strong capital positions," *Comment letter*.

Calomiris, C. W. and D. Nissim (2014): "Crisis-related shifts in the market valuation of banking activities," *Journal of Financial Intermediation*, 23, 400 – 435.

Chircop, J. and Z. Novotny-Farkas (2016): "The economic consequences of extending the use of fair value accounting in regulatory capital calculations," *Journal of Accounting and Economics*, 62, 183 – 203, conference papers 2015.

Clearing House Association (2011): "Treatment of Unrealized Gains and Losses Under the Basel III Capital Framework," *Comment letter*.

Ellul, A., C. Jotikasthira, C. T. Lundblad, and Y. Wang (2015): "Is Historical Cost Accounting a Panacea? Market Stress, Incentive Distortions, and Gains Trading," *The Journal of Finance*, 70, 2489–2538.

Financial Accounting Standards Board (2010): "Statement of Financial Accounting Standards No. 115: Accounting for Certain Investments in Debt and Equity Securities," *Original Announcement As Amended*.

Haldane, A. (2012): "The Dog and the Frisbee," *Speech at the Federal Reserve Bank of Kansas City economic policy symposium on 'The Changing Policy Landscape'*.

Hamilton, D. (2018): "Fear of (Capital) Commitment: Strategic Accounting Classifications and the Consequences for Fixed Income Dealer Inventories," *SSRN Working Paper*.

Hanson, S., A. Shleifer, J. C. Stein, and R. W. Vishny (2015): "Banks as patient fixed-income investors," *Journal of Financial Economics*, 117, 449–469.

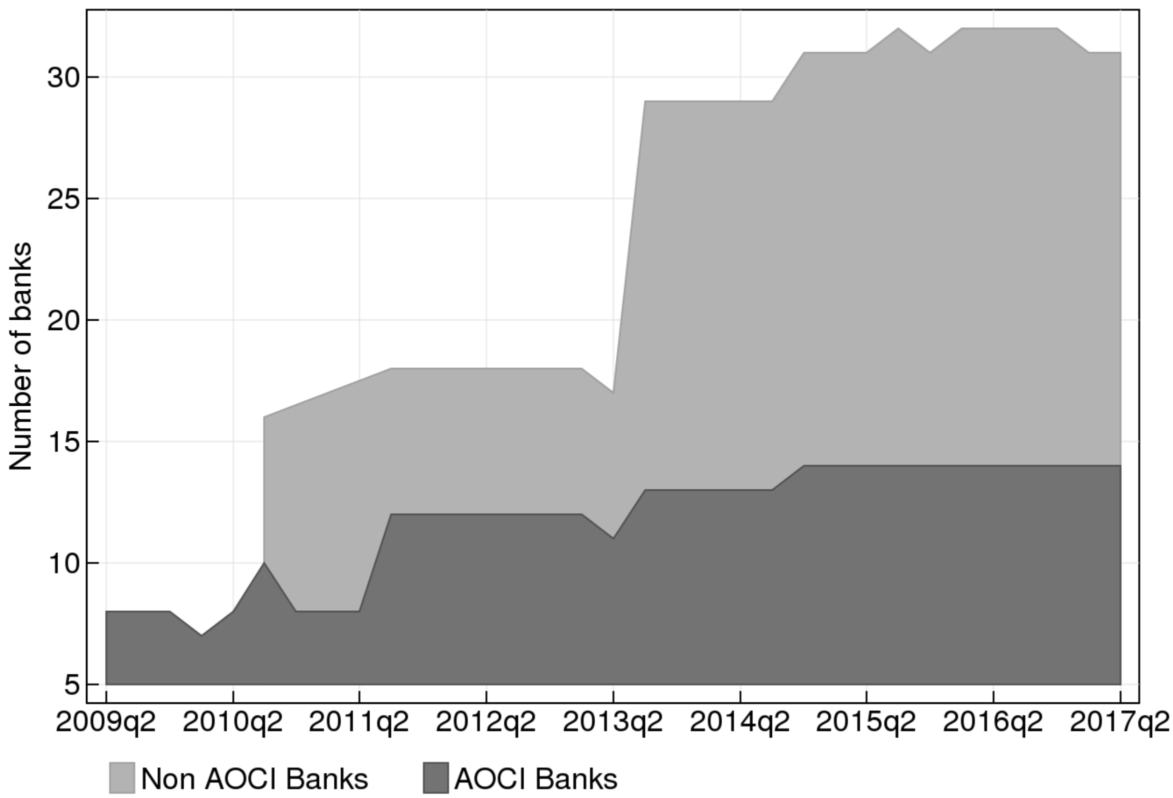
Hanson, S. G. and J. C. Stein (2015): "Monetary policy and long-term real rates," *Journal of Financial Economics*, 115, 429 – 448.

Kim, S., S. Kim, and S. G. Ryan (2017): "Economic Consequences of the AOCI Filter Removal for Advanced Approaches Banks," *SSRN Working Paper*.

Laux, C. and C. Leuz (2009): "The crisis of fair-value accounting: Making sense of the recent debate," *Accounting, Organizations and Society*, 34, 826 – 834.

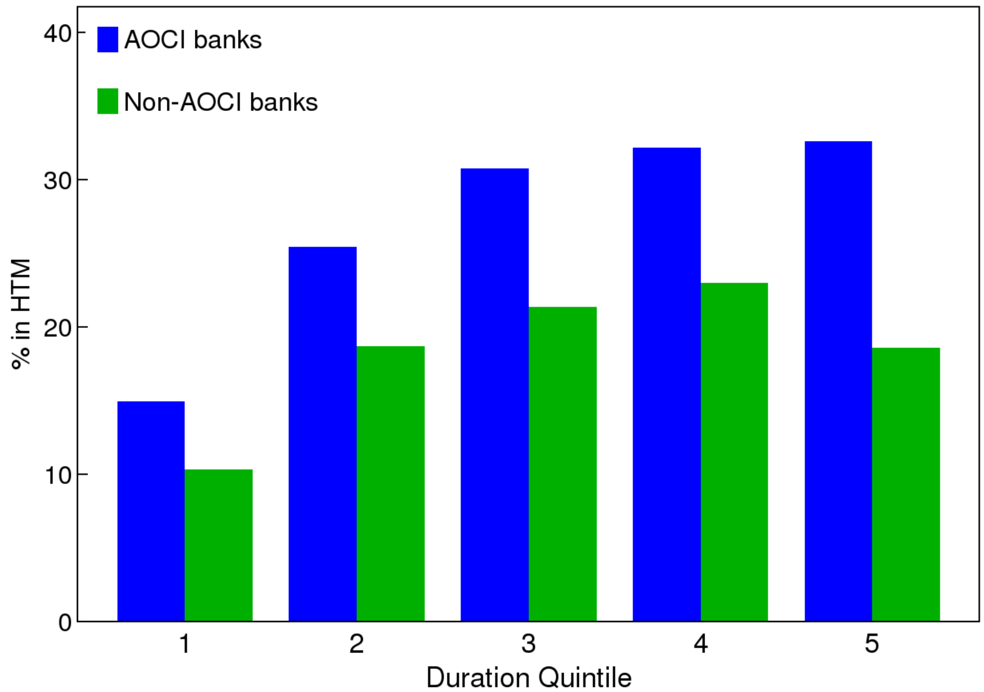
Figures and Tables

Figure 1. Number of banking organizations in security-level sample over time



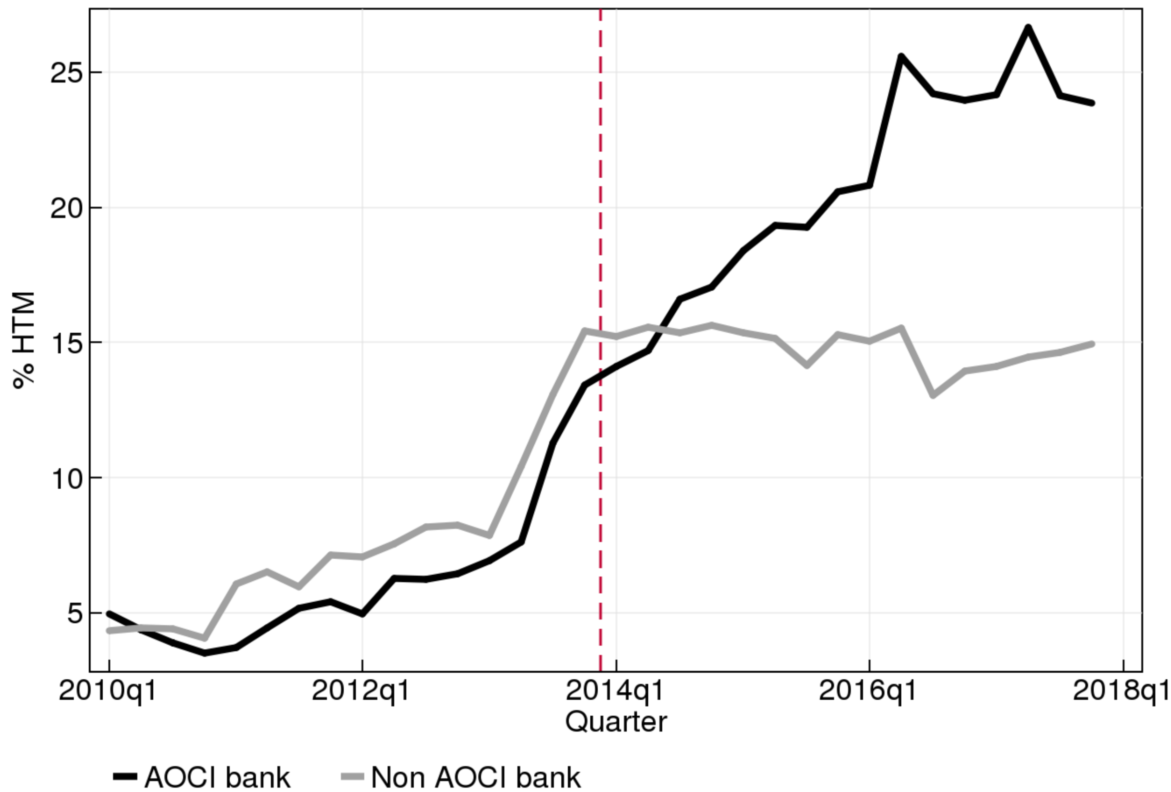
Note: Figure plots the number of banking organizations for which security level data are available at each point in time during sample period. "AOCI bank" refers to banking organizations which now include AOCI in regulatory capital. FR Y-14Q data sample does not include a number of intermediate holding companies (IHCs) which only recently began filing the FR Y-14Q schedule.

Figure 2. Percent of securities classified as held-to-maturity, 2016-17, by security duration and AOCI treatment



Note: FR Y-14Q sample from 2016:Q1 to 2017:Q2 of agency MBS, Treasury securities and other US government obligations, municipal and sovereign bonds. See text for data construction. "AOCI bank" refers to the set of banking organizations which now include AOCI in regulatory capital.

Figure 3. Percentage of investment securities classified as held-to-maturity



Note: Source is FR Y-9C. Data sample is the set of banking firms included in summary statistics in Table 1 (see Internet Appendix for full list). "AOCI bank" refers to the set of banking organizations which now include AOCI in regulatory capital. The transition to including AOCI in regulatory capital begins in 2014:Q1.

Table 1. Summary statistics: FR Y-9C data sample

	mean	sd	p10	p50	p90
Total Assets	411.66	620.51	60.72	150.04	1,488.06
Total Risk-Weighted Assets	253.18	362.80	48.69	100.98	991.61
Investment Securities					
Available for sale, % assets	14.98	9.16	5.11	13.97	24.01
Held to maturity, % assets	1.72	2.72	0.00	0.47	5.37
Total investment securities, % assets	16.70	10.20	5.29	15.45	27.00
Composition of securities, % of total					
US Treasury Securities	10.79	17.82	0.01	2.53	33.87
US Government Agency Obligations	7.71	11.74	0.00	2.15	25.51
US State and Municipal Debt	6.35	11.65	0.03	2.84	14.84
Agency Pass-through MBS	29.07	24.21	2.81	24.76	66.47
Agency CMOs	19.57	21.31	0.00	13.97	47.14
Non-agency MBS	5.78	7.31	0.00	2.63	18.52
Asset Backed Securities	7.44	8.87	0.00	4.20	22.62
Other Domestic Debt Securities	3.42	5.01	0.00	1.64	7.90
Foreign Debt Securities	6.20	9.66	0.00	0.97	20.92
Equity Securities and Mutual Funds	3.34	9.93	0.04	0.75	6.53
Bank Characteristics, % Total Assets					
Residential Family Real Estate	13.44	8.97	0.02	14.00	25.17
Commercial Real Estate	9.40	8.76	0.10	8.85	20.79
Credit Cards	5.15	13.41	0.00	0.44	8.54
Other Consumer Loans	6.20	6.64	0.20	4.57	14.03
Other Loans	19.36	9.89	6.61	19.03	32.66
Trading Assets	5.03	9.26	0.01	0.90	16.18
Fed Funds Sold & Sec Purch to Resell	4.76	9.67	0.00	0.24	17.18
Total Investment Securities	16.70	10.20	5.29	15.45	27.00
Other Real Estate Owned	0.14	0.16	0.00	0.09	0.33
Fixed Assets, Assets	0.85	0.46	0.30	0.76	1.62
Inv in Unconsolidated Subsidiaries	0.36	0.56	0.00	0.19	0.93
Inv in RE Ventures	0.14	0.26	0.00	0.00	0.44
Intangible Assets	3.39	2.43	0.64	3.16	6.92
Total Deposits	60	21	24	69	80
Public [yes=1]	0.7599	0.4275	0.00	1.00	1.00
Foreign [yes=1]	0.2401	0.4275	0.00	0.00	1.00
Tier 1 risk-based capital ratio (%)	12.83	2.99	10.37	12.45	16.31
Return on assets (annualized, %)	0.84	1.17	0.13	0.83	1.60
Number of Firms	42				
Number of Firms Including AOCI in reg. capital	19				
Total Number of Observations	1101				

Note: Sample period is 2010:Q1 to 2017:Q4. Summary statistics based on FR Y-9C data, based on commercial BHCs and IHCs with assets exceeding $50bn subject to supervisory stress testing. See Internet Appendix for full list of banking organizations in sample.

Table 2. Shares of different asset classes in FR Y-14Q securities data, 2011:Q3-2017:Q2.

Asset Class	Observations (000s)	Dollar Share (%)	Obs. Share (%)
AGENCY MBS	2078	46.41	59.16
US TREASURIES & AGENCIES	106	15.43	3.01
SOVEREIGN BOND	152	8.27	4.34
MUNICIPAL BOND	533	6.53	15.18
CLO	33	3.37	0.94
CORPORATE BOND	234	3.37	6.67
CMBS	69	3.30	1.98
FOREIGN RMBS	34	3.16	0.97
DOMESTIC NON-AGENCY RMBS	104	2.73	2.95
STUDENT LOAN ABS	28	1.93	0.81
CREDIT CARD ABS	10	1.05	0.28
COVERED BOND	7	1.03	0.19
AUTO ABS	15	0.95	0.42
OTHER ABS (EXCL HEL ABS)	15	0.88	0.44
OTHER	9	0.50	0.25
MUTUAL FUND	24	0.42	0.67
AUCTION RATE SECURITIES	35	0.41	0.99
CDO	5	0.15	0.13
PREFERRED STOCK (EQUITY)	7	0.09	0.19
COMMON STOCK (EQUITY)	15	0.03	0.44
Total	3705	100	100

Table 3. Descriptive statistics (mean and standard deviation) of key bond characteristics across main asset classes, 2015:Q4-2017:Q2.

	Agency MBS	Corporate	Municipal	Sovereign	US Treasury/ Agency	Total
Effective Duration (years)	3.95	3.26	7.29	2.69	4.06	4.07
	(1.90)	(2.49)	(3.68)	(2.59)	(2.44)	(2.44)
Remaining Maturity (years)	24.15	4.82	17.79	3.26	4.88	17.14
	(7.15)	(5.54)	(8.54)	(3.27)	(4.30)	(11.16)
Fair Value / Face Value	1.03	1.02	1.06	1.03	1.00	1.03
	(0.04)	(0.08)	(0.13)	(0.08)	(0.06)	(0.06)
Coupon (%, annual)	2.45	3.39	2.78	2.19	1.52	2.25
	(1.48)	(2.14)	(2.28)	(2.30)	(0.80)	(1.59)
Hedge (%)	0.01	0.23	0.16	0.17	0.12	0.07
	(0.11)	(0.42)	(0.37)	(0.38)	(0.32)	(0.25)

Table 4. Average duration and total interest rate risk exposure, main asset classes, by regulatory treatment of AOCI

	(1) Duration	(2) Total Risk Exposure	(3) Duration	(4) Total Risk Exposure
AOCI bank	-0.03	0.07		
	(0.34)	(0.09)		
AOCI bank × time			-0.09**	-0.01
			(0.04)	(0.01)
Quarter FE	Yes	Yes	Yes	Yes
BHC FE	No	No	Yes	Yes
Mean Y	3.68	0.57	3.68	0.57
St.Dev.(Y)	1.02	0.25	1.02	0.25
R2 (within)	0.00	0.02	0.09	0.02
Observations	221	218	221	218

Note: Dependent variable is either weighted average duration or total risk exposure (duration scaled by firm size). "AOCI bank" is a dummy equal to 1 for banking organizations which now include AOCI in regulatory capital. 'Time" is a time trend measured in quarters. Sample period is 2015:Q4-2017:Q2. Standard errors clustered by banking organization. *** means $p < 0.01$; ** means $p < 0.05$; * means $p < 0.10$.

Table 5. Duration and interest rate risk exposure by regulatory treatment of AOCI: Agency MBS and Treasury securities

	(1) MBS Duration	(2) MBS Tot Risk Exposure	(3) Tsy Duration	(4) Tsy Tot Risk Exposure
AOCI bank × phase-in	-0.09	0.04	-1.09	0.11***
	(0.22)	(0.04)	(1.32)	(0.04)
Quarter FE	Yes	Yes	Yes	Yes
BHC FE	Yes	Yes	Yes	Yes
Mean Y	3.25	0.14	3.58	0.07
R2 (within)	0.00	0.01	0.01	0.10
Observations	636	619	599	582

Note: Dependent variable is either weighted average duration or total risk exposure (duration scaled by firm size). "AOCI bank" is a dummy equal to 1 for firms which now include AOCI in regulatory capital. "Phase-in" is a variable between 0 and 1 measuring the percent of AOCI included in regulatory capital for for AOCI banks in the relevant quarter. Sample period is 2011:Q3-2017:Q2. Standard errors clustered by banking organization. *** means $p < 0.01$; ** means $p < 0.05$; * means $p < 0.10$.

Table 6. Security yields and regulatory treatment of AOCI

	(1)	(2)	(3)	(4)	(5)	(6)
	Treasury yield		MBS yield		Other security yield	
AOCI bank × phase-in	-0.22 (0.54)	-0.59 (0.48)	-0.17 (0.47)	-0.02 (0.52)	-0.30 (0.48)	0.08 (0.62)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Entity FE	Yes	Yes	Yes	Yes	Yes	Yes
Stress test	Yes	Yes	Yes	Yes	Yes	Yes
Asset size	No	Yes	No	Yes	No	Yes
Controls	No	Max	No	Max	No	Max
R2	0.03	0.09	0.24	0.30	0.05	0.10
Observations	1101	1101	1101	1101	1101	1101

Note: Dependent variable is the book yield for the security type in question for bank b at time t, measured as annualized interest income as a percentage of accounting book value for investment securities, constructed using FR Y-9C data. "AOCI bank" is a dummy equal to 1 for firms which now include AOCI in regulatory capital. "Phase-in" is a variable between 0 and 1 measuring the percent of AOCI included in regulatory capital for AOCI banks in quarter t. Sample period is 2010:Q1-2017:Q4. Specifications where asset size = "yes" include log(assets). Specifications where controls = "max" include all bank characteristics summarized in Table 1. Standard errors clustered by banking organization. *** means p < 0.01; ** means p < 0.05; * means p < 0.10.

Table 7. Hedging

	(1)	(2)	(3)	(4)	(5)	(6)
AOCI bank × phase-in	0.04*	0.09***	0.07**	0.11***	0.16**	0.08*
	(0.02)	(0.03)	(0.03)	(0.03)	(0.07)	(0.04)
Weights	-	-	-	Face value	Face v.	Face v.
CUSIP FE	Yes	No	No	Yes	No	No
Quarter FE	Yes	No	No	Yes	No	No
CUSIP × Quarter FE	No	Yes	Yes	No	Yes	Yes
BHC FE	Yes	Yes	No	Yes	Yes	No
CUSIP × BHC FE	No	No	Yes	No	No	Yes
Mean Y	0.02	0.02	0.02	0.05	0.06	0.06
R2 (within)	0.00	0.00	0.00	0.00	0.00	0.00
Observations	1211542	535702	533685	1211542	535702	533685

Note: Dependent variable equals 1 if security i held by banking firm b at time t has a qualified accounting hedge, and 0 otherwise. Security-level analysis based on FR Y-14Q data. "AOCI" is a dummy equal to 1 for firms which switched to including AOCI in regulatory capital. firms which now include AOCI in regulatory capital. "Phase-in" is a variable between 0 and 1 measuring the percent of AOCI included in regulatory capital for for AOCI banks in quarter t. Controls include CUSIP (security identifier) fixed effects, time fixed effects, and interactions as shown in the table. Sample period is 2015:Q3-2017:Q2. Standard errors clustered by banking organization. *** means $p < 0.01$; ** means $p < 0.05$; * means $p < 0.10$.

Table 8. Held-to-maturity, percent of total investment securities portfolio

	(1)	(2)	(3)	(4)	(5)
	% of investment securities classified as held-to-maturity				
AOCI bank × phase-in	19.58***	19.60***	19.37***	18.91***	16.98***
	(5.743)	(5.694)	(5.483)	(5.244)	(4.889)
Observations	1064	1064	1064	1064	1064
R^2	0.439	0.439	0.451	0.475	0.491
Time FE	Yes	Yes	Yes	Yes	Yes
Entity FE	Yes	Yes	Yes	Yes	Yes
Stress test	No	Yes	Yes	Yes	Yes
Asset size	No	No	Yes	Yes	Yes
Controls	No	No	No	Yes	Max

Notes: Dependent variable is defined as the face value of held to maturity securities measured as a percentage of total investment securities (held to maturity plus available for sale securities) for bank b at time t, constructed using FR Y-9C data. "AOCI bank" is a dummy equal to 1 for firms which now include AOCI in regulatory capital. "Phase-in" is a variable between 0 and 1 measuring the percent of AOCI included in regulatory capital for AOCI banks in quarter t. Sample period is 2010:Q1-2017:Q4. Specifications where asset size = "yes" include log(assets). Specifications where controls = "max" include all bank characteristics summarized in Table 1. Standard errors clustered by banking organization. *** means p < 0.01; ** means p < 0.05; * means p < 0.10.

Table 9. Held-to-maturity and regulatory treatment of AOCI: security-level analysis

	(1)	(2)	(3)	(4)	(5)	(6)
AOCI bank × phase-in	0.06***	0.19***	0.03***	0.15***	0.34***	0.09***
	(0.01)	(0.04)	(0.01)	(0.03)	(0.07)	(0.03)
Weights	-	-	-	Face value	Face v.	Face v.
CUSIP FE	Yes	No	No	Yes	No	No
Quarter FE	Yes	No	No	Yes	No	No
CUSIP × Quarter FE	No	Yes	Yes	No	Yes	Yes
BHC FE	Yes	Yes	No	Yes	Yes	No
CUSIP × BHC FE	No	No	Yes	No	No	Yes
Mean Y	0.10	0.10	0.10	0.18	0.21	0.21
R2 (within)	0.00	0.00	0.00	0.00	0.01	0.00
Observations	3215332	1387355	1383412	3215332	1387355	1383412

Note: Dependent variable equals 1 if security i held by banking firm b at time t is classified as HTM, and equals zero if classified as AFS. Security-level analysis based on FR Y-14Q data. Controls include CUSIP (security identifier) fixed effects, time fixed effects, and interactions as shown in the table. Standard errors clustered by banking organization. *** means p < 0.01; ** means p < 0.05; * means p < 0.10.

Table 10. Held-to-maturity and regulatory treatment of AOCI: by effective duration

	(1) MBS	(2) MBS	(3) Tsy	(4) Tsy
AOCI bank × phase-in	0.12**	0.30***	0.09	0.02
	(0.06)	(0.09)	(0.12)	(0.11)
AOCI bank × phase-in	0.20**	0.22*	0.27*	0.29*
× above-median duration	(0.08)	(0.12)	(0.15)	(0.15)
Weight	-	Face v.	-	Face v.
CUSIP × Quarter FE	Yes	Yes	Yes	Yes
BHC FE	Yes	Yes	Yes	Yes
Mean Y	0.12	0.34	0.21	0.17
R2 (within)	0.00	0.01	0.01	0.01
Observations	695357	695357	47666	47666

Note: Dependent variable equals 1 if security i held by banking firm b at time t is classified as HTM, and equals zero if classified as AFS. Security-level analysis based on FR Y-14Q data. Effective duration measures the sensitivity of security value to a given change in interest rates. Controls include CUSIP (security identifier) fixed effects, time fixed effects, and interactions as shown in the table. Standard errors clustered by banking organization. *** means $p < 0.01$; ** means $p < 0.05$; * means $p < 0.10$.

Table 11. Held-to-maturity and regulatory treatment of AOCI: by asset class and bank characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)
AOCI bank × phase-in	0.25***	0.47***				
× Agency MBS	(0.06)	(0.09)				
AOCI bank × phase-in	-0.04	-0.28***				
× Corporate Bond	(0.04)	(0.09)				
AOCI bank × phase-in	0.12*	0.25				
× Municipal Bond	(0.07)	(0.18)				
AOCI bank × phase-in	-0.06	-0.28**				
× Sovereign Bond	(0.05)	(0.13)				
AOCI bank × phase-in	0.20**	0.16				
× Treasury/Agency	(0.09)	(0.14)				
AOCI bank × phase-in			0.29***	0.39**	0.15***	0.24***
			(0.06)	(0.15)	(0.03)	(0.07)
AOCI bank ×			0.02	-0.08		
Below-median Tier 1 Capital			(0.05)	(0.12)		
AOCI bank × phase-in			-0.15**	-0.07		
× Below-med. Tier 1 Cap.			(0.06)	(0.18)		
AOCI bank ×					0.03	-0.04
Above-median Securities Portfolio					(0.05)	(0.10)
AOCI bank × phase-in					0.14*	0.26
× Above-med. Sec. Portfolio					(0.07)	(0.21)
Weights	-	Face v.	-	Face v.	-	Face v.
CUSIP × Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
BHC FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean Y	0.11	0.23	0.10	0.21	0.10	0.21
R2 (within)	0.01	0.01	0.01	0.01	0.01	0.01
Observations	1190573	1190573	1377444	1377444	1377444	1377444

Standard errors clustered by BHC.

Note: Dependent variable equals 1 if security i held by banking firm b at time t is classified as HTM, and equals zero if classified as AFS. Security-level analysis based on FR Y-14Q data. Controls include CUSIP (security identifier) fixed effects, time fixed effects, and interactions as shown in the table. Standard errors clustered by banking organization. *** means $p < 0.01$; ** means $p < 0.05$; * means $p < 0.10$.

Table 12. Substitution between MBS and whole mortgages

	(1)	(2)	(3)	(4)	(5)
AOCI bank × phase-in	0.12	0.09	0.10	0.10	0.13*
	(0.08)	(0.07)	(0.08)	(0.08)	(0.07)
Time FE	Yes	Yes	Yes	Yes	Yes
Entity FE	Yes	Yes	Yes	Yes	Yes
Stress test	No	Yes	Yes	Yes	Yes
Asset size	No	No	Yes	Yes	Yes
Controls	No	No	No	Yes	Max
R2	0.07	0.08	0.09	0.09	0.34
Observations	1079	1079	1079	1079	1079

Notes: Dependent variable is defined as the book value of mortgages held in portfolio as whole loans (measured as a percentage of mortgages plus available-for-sale MBS) for bank b at time t, constructed using FR Y-9C data. "AOCI bank" is a dummy equal to 1 for firms which now include AOCI in regulatory capital. "Phase-in" is a variable between 0 and 1 measuring the percent of AOCI included in regulatory capital for AOCI banks in quarter t. Sample period is 2010:Q1-2017:Q4. Specifications where asset size = "yes" include log(assets). Specifications where controls = "max" include all bank characteristics summarized in Table 1. Standard errors clustered by banking organization. *** means $p < 0.01$; ** means $p < 0.05$; * means $p < 0.10$.

Internet Appendix for
"Regulation and Risk Shuffling in Bank Securities Portfolios"

Andreas Fuster and James Vickery

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A. BHCs in sample

Table A.1. List of BHCs in data sample: 2010-2017

Name	First	Last	RSSDID	AOCI	Y14Q
BANCWEST CORP	2010q1	2016q1	1025608	0	0
ZIONS BC	2010q1	2017q4	1027004	0	1
DEUTSCHE BK TR CORP	2012q1	2016q2	1032473	1	0
CIT GROUP	2010q1	2017q4	1036967	0	1
M&T BK CORP	2010q1	2017q4	1037003	0	1
JPMORGAN CHASE & CO	2010q1	2017q4	1039502	1	1
KEYCORP	2010q1	2017q4	1068025	0	1
HUNTINGTON BSHRS	2010q1	2017q4	1068191	0	1
PNC FNCL SVC GROUP	2010q1	2017q4	1069778	1	1
FIFTH THIRD BC	2010q1	2017q4	1070345	0	1
BANK OF AMER CORP	2010q1	2017q4	1073757	1	1
BB&T CORP	2010q1	2017q4	1074156	0	1
BBVA COMPASS BSHRS	2010q1	2017q4	1078529	0	1
STATE STREET CORP	2010q1	2017q4	1111435	1	1
U S BC	2010q1	2017q4	1119794	1	1
WELLS FARGO & CO	2010q1	2017q4	1120754	1	1
SUNTRUST BK	2010q1	2017q4	1131787	0	1
CITIZENS FNCL GRP	2010q1	2017q4	1132449	0	1
NORTHERN TR CORP	2010q1	2017q4	1199611	1	1
COMERICA	2010q1	2017q4	1199844	0	1
BMO FNCL CORP	2010q1	2017q4	1245415	0	1
TD BK US HC	2010q1	2015q2	1249196	1	0
AMERICAN EXPRESS CO	2010q1	2017q4	1275216	1	1
MUFG AMERS HOLDS CORP	2010q1	2017q4	1378434	0	1
ALLY FNCL	2010q1	2017q4	1562859	0	1
CREDIT SUISSE HOLD USA	2016q3	2017q4	1574834	1	0
BNP PARIBAS USA	2016q3	2017q4	1575569	0	0
CITIGROUP	2010q1	2017q4	1951350	1	1
MORGAN STANLEY	2010q1	2017q4	2162966	1	1
CAPITAL ONE FC	2010q1	2017q4	2277860	1	1
GOLDMAN SACHS GROUP THE	2010q1	2017q4	2380443	1	1
RBC USA HOLDCO CORP	2015q4	2017q4	3226762	0	0
HSBC N AMER HOLDS	2010q1	2017q4	3232316	1	1
REGIONS FC	2010q1	2017q4	3242838	0	1
BANK OF NY MELLON CORP	2010q1	2017q4	3587146	1	1
TD GRP US HOLDS LLC	2015q3	2017q4	3606542	1	1
DISCOVER FS	2010q1	2017q4	3846375	0	1
SANTANDER HOLDS USA	2012q1	2017q4	3981856	0	1
SYNCHRONY FNCL	2015q4	2017q4	4504654	0	0
UBS AMERS HOLD LLC	2016q3	2017q4	4846998	0	0
BARCLAYS US LLC	2016q3	2017q4	5006575	1	0

B. Imputation of Duration for Agency MBS

From the fourth quarter of 2015, historical duration for each agency MBS is calculated at each point in time using the pricing engine from a leading industry financial analytics vendor. Prior to this date, duration for passthrough securities is imputed based on option-adjusted duration (OAD) data available at the cohort level (Agency, Term, Vintage, Coupon). The available cohorts cover about half of all the securities held in bank portfolios. Duration for remaining securities is imputed based on security characteristics drawn from eMBS. Specifically we estimate the following equation:

$$\text{OAD}_{i,t} = \alpha + f(\text{Moneyness}_{i,t}, \text{RemainingMaturity}_{i,t}) + \Gamma \cdot \mathbf{X}_{i,t} + \delta \cdot \text{YCslope}_t + \epsilon_{i,t}. \tag{7}$$

$\text{OAD}_{i,t}$ is the option-adjusted duration of security i measured at time t. $f(\text{Moneyness}_{i,t}, \text{RemainingMaturity}_{i,t})$ contains a cubic function of a pool's "moneyness" at t and a quadratic function of its remaining maturity at t, where all terms are also interacted with one another to allow for sufficient flexibility. Moneyness is the difference between a pools weighted average coupon and the current mortgage rate (either 30-year or 15-year, depending on security original maturity).[1] This proxies for the underlying borrowers' incentive to refinance, which is a key determinant of the option-adjusted duration. The same is true for the remaining maturity, which of course is mechanically related to duration, but also in that it affects the responsiveness to refinancing incentives (pools that have been in-the-money for a long time are typically "burned out" and do not prepay quickly).

$\mathbf{X}_{i,t}$ contains other key pool characteristics that affect a pool's effective duration: the original maturity (10, 15, 20, or 30 years); the pool factor (meaning what fraction of the original balance is still outstanding); the most recent prepayment speed ("CPR"), winsorized at 0.4 (meaning that at an annualized rate, 40% or more of borrowers prepay); and the security's ratio of fair value to face value in the Y-14 submission. Finally, we also include the slope of the Treasury yield curve at time t (YCslope_t), taken as the difference between the 10-year and the 2-year yields, as a proxy for the expected evolution of market interest rates (which in turn will affect future prepayments).

[1] We winsorize moneyness at +4 and include a dummy for whether a pool's value was winsorized.

The securities in the regression are weighted by their outstanding balance. The R^2 from this regression is 0.82, suggesting a good in-sample fit. We have also verified that for the securities/quarters where we also have the CUSIP-level duration from the vendor directly, the correlation between our imputed durations and those from the vendor is high (0.78).

C. Reconciliation of FR Y-14 and FR Y-9C Data

To check the completeness and accuracy of our draw of the FR Y-14Q data, we aggregate the FR Y-14Q data by BHC x quarter x purpose (AFS or HTM), and compare aggregate securities values to the corresponding FR Y-9C reported values for the same BHC and quarter.

Tabulating a comparison of the two values, we find that in nearly all cases, the aggregate of the Y-14 data matches the Y-9C either exactly or very closely. Splitting the sample before and after 2015:Q1 reveals the data quality has improved over time, although the security-level data reconciles well in both subperiods. Using all data, and constructing a scatter plot of the aggregated Y-14 security face value as a % of total BHC assets against the Y-9C value (measured as a ratio of total assets on the same basis), nearly all values lie close to the 45 degree line, and the R-squared of a regression of one value on the other is 0.992.