Level 3 Fair Value Measurement and Systemic Risk

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Abstract

Motivated by bank regulators' use of level 3 fair value assets as an indicator for systemic risk, we examine whether level 3 fair value assets contribute to systemic risk buildup via the balance sheet liquidity channel and how financial reporting transparency mitigates the risk buildup. We first document increased loss hoarding for banks with more level 3 assets. We then find that level 3 assets contribute to systemic risk buildup for banks with high repo liabilities but low liquid assets. Importantly, we find additional disclosures of valuation inputs mitigate level 3 assets' contribution to systemic risk. Finally, our results show that banks with security impairment losses reduce repo financing and increase asset sales. Collectively, the evidence suggests that sudden collateral value reductions related to level 3 fair value assets may serve as the origin of a liquidity shock that trickles down the financial system, thereby building up systemic risk. This study contributes to the financial stability and fair value accounting literature by exploring the role of fair value measurement in banks' liquidity management, which is distinct from the regulatory capital channel examined by prior research.

1. Introduction

In response to the 2008-2009 financial crisis, the Dodd-Frank Act requires the Federal Reserve (Fed) to monitor the systemic risk profile of financial institutions. Among many new macro-prudential regulations, the Fed requires U.S. based bank holding companies (BHCs) with total assets greater than $50 billion to file a *Systemic Risk Report* (FR Y-15) starting from 2012.[1] In the Y-15, BHCs are required to report the amount of investment securities subject to level 3 fair value accounting in addition to the amount of adjusted trading and available-for-sale securities.[2] This suggests that, despite the small magnitude of level 3 relative to total assets, regulators consider level 3 fair value measurement an important factor contributing to the accumulation of systemic risk beyond levels 1 and 2.[3] Bank regulators' use of level 3 fair value assets as an indicator of systemic risk is also inconsistent with some prior accounting research contending that fair value accounting is unlikely to induce procyclicality via the regulatory capital channel (Laux and Leuz 2010; Badertscher et al. 2012) and that the managerial inputs in level 3 measurement contain private information and can deviate from the common market inputs attributing to procyclicality (Bhat et al. 2011; Altamuro and Zhang 2013; Mahieux 2021).

On the other hand, the European Systemic Risk Board (ESRB, 2020) argues that managerial discretion in fair value measurements and the inherent lack of transparency may result in inaccurate valuation of financial assets that hinders effective risk monitoring by external parties. In addition, such discretion may allow banks to conceal losses. Loss overhangs will

[1] FR Y-15 was initially required annually but changed to quarterly filings starting from June 2016. The size threshold is modified to $100 billion since 2020. Please see here for detailed FR Y-15 information.
[2] The Basel Committee also includes level 3 fair value assets as an indicator to identify and monitor Global Systemically Important Banks (GSIBs). Please see https://www.bis.org/bcbs/gsib/index.htm for details.
[3] Assets measured with levels 1, 2, and 3 fair values represent 1.4%, 20%, and 0.5% of total assets for our sample banks.

eventually bust when the true loss is revealed after an adverse economic shock. This may cause a significant liquidity shock and potentially a contagion effect, especially for level 3 assets since level 3 fair value measurement is the most opaque compared to levels 1 and 2. In this study, we explore whether level 3 fair value measurement contributes to a systemic risk buildup during a non-stress economic period. We propose that loss overhangs caused by level 3 measurement can serve as the origin of a future liquidity shock, leading to a significant contagion effect through the balance sheet liquidity channel. We further examine whether transparency of level 3 disclosure mitigates this systemic risk buildup.

Banks are subject to liquidity risk due to their role in transforming short-term liabilities into long-term loans. Different from regulatory capital buffers that most banks maintain, banks tend not to maintain a buffer on cash reserves and thus, bank operations can be very sensitive to wholesale short-term funding, which relies on securities as collateral.[4] Since many financial instruments subject to level 3 fair value measurement serve as collateral in short-term borrowing (such as repurchase, or "repo") transactions,[5] and for complex financial instruments, borrowers have significant influence on collateral valuations,[6] level 3 fair value measurement may trigger a liquidity shock when loss hoarding banks concede the large collateral value declines that lenders also observe after economic shocks.

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[4] FDIC requires that "*each bank should establish a policy to maintain cash balances at the minimum levels necessary to meet reserve requirements and customer demands*" to avoid having excess nonearning assets and to minimize exposure to misappropriation. See https://www.fdic.gov/regulations/safety/manual/section3-4.pdf.

[5] Data provided by NY-Fed shows that, although Treasuries and agency-ABS are the main collaterals, non-agency ABS and municipal bonds also serve as collateral in the tri-party repo market. For bilateral repo transactions, Baklanova et al. (2016) provide survey evidence that 9.5% of repo collateral is private label asset-backed securities in 2015. Both municipal bonds and non-agency ABS are common level 2 and level 3 assets. In addition, banks can pledge their Mortgage Servicing Rights (MSR) to raise short-term funding to support their servicing activities, which is almost always classified as level 3 assets during our sample period.

[6] The 2011 Global Master Repurchase Agreement jointly issued by SIFMA and ICMA defines "market value" of the collateral vaguely as "*the price…agreed by the parties having regard to market practice for valuing securities*". Please see Appendix II for an example of how the balance sheet value of MSR reported by the borrower (seller) is used in a repo contract.

When the collateral value of level 3 instruments declines significantly, there are potential contagion effects. First, to ensure borrowers have the ability to repay the principal and interest, short-term fund lenders in repos usually require additional cash payment ("variation margins") when the collateral value declines, which may force liquidity-constrained banks to sell securities if the decline in collateral value is excessive.[7] Further, lenders may simply refuse to roll over the short-term lending with reduced collateral value, adding fire sale pressure if banks need to maintain certain cash levels for operation. A fire sale may cause a decline in the price of the sold security, especially during economic downturns, which further reduces the collateral value for other borrowing banks. This illiquidity spiral would constrain bank liquidity and, in the end, reduce the aggregate funding liquidity (Clerc et al., 2016).

This discussion suggests that opacity of level 3 measurement is the culprit for level 3 assets' contribution to systemic risk buildup during a non-crisis period. Because level 3 disclosure transparency facilitates internal and external monitoring, we expect that additional disclosures about level 3 valuation models and inputs improve the quality of level 3 fair value and reduce the loss hoarding tendency. Instead of recognizing large losses during a downturn, small losses recognized during tranquil economic periods would give rise to smaller liquidity shocks that banks can better manage. As a result, fire sales and the subsequent spillover effect become less likely. Furthermore, since liquidity risk is higher for banks that rely on repo financing and have limited liquid assets, we expect the effect of level 3 disclosure transparency in reducing the systemic risk buildup to be more significant for banks with higher repo liability-to-liquid assets ratios.

[7] Variation margins refer to the additional payments (i.e., [borrowed amount + accrued interest payment] * [1+initial margin] - collateral fair value) borrowers need to make when the collateral value declines.

Using our sample of 3,670 BHC-quarters, representing 263 unique BHCs and ranging from 2010 to 2013,[8] we first validate that level 3 fair value assets positively predict future impairment on investment securities and tail risk measured as *VaR* (value-at-risk) and that these associations decline significantly after the implementation of ASU 2011-04. We use ASU 2011-04 that amends ASU Topic 820 as a shock to level 3 disclosure transparency. ASU 2011-04 requires firms to provide additional qualitative disclosures about the valuation process and quantitative disclosures about level 3 valuation inputs and sensitivities. To the extent that level 2 fair value asset portfolios share commonalities with level 3 asset portfolios in their composition and valuation complexity, and because ASU 2011-04 does not affect level 2 fair value disclosures, we use level 2 assets as the control group to rule out potential confounding time effects or omitted variables. We validate that the positive association between fair value assets and future impairment and *VaR* and the effect of ASU 2011-04 in attenuating this association is significantly higher for level 3 than level 2 assets. This finding is consistent with the notion that, relative to level 2 assets, the incremental discretion and inherent opacity of level 3 assets allows banks to hoard losses and increase tail risk.

Next, we examine the association between level 3 assets and banks' contribution to systemic risk measured as *ΔCoVaR* (i.e., change in Conditional *VaR*) developed by Adrian and Brunnermeier (2016). Since our research interest is how transparency of level 3 fair value measurements mitigates systemic risk buildup, this measure is appropriate because it estimates the extent to which individual banks' tail risk contributes to the value at risk of the banking system before risk realizations in economic downturns. Relative to level 2 assets, we document a

[8] We choose this sample period to have balanced pre- versus post-ASU 2011-04 periods. The short window helps better identify the disclosure effect. Our main findings continue to hold when we expand the sample to 2019.

significantly positive association between level 3 assets and $\Delta CoVaR$ prior to ASU 2011-04 and a significant reduction in this association after ASU 2011-04. This finding is consistent with our expectation that the opacity of level 3 assets contributes to the systemic risk buildup and that level 3 valuation transparency mitigates this contribution. Furthermore, we partition the sample based on the BHC's ratio of repo liabilities to liquid assets (i.e., cash, available-for-sale Treasury securities, and available-for-sale non-MBS agency obligations). We find the association between level 3 assets and $\Delta CoVaR$ and the attenuating effect of ASU 2011-04 to be more significant for banks with higher repo liability-to-liquid asset ratios, supporting the balance sheet liquidity channel.

Because level 2 assets can be different from level 3, and the potential asset composition changes in each level could limit the effectiveness of level 2 assets as the control group, in addition to controlling for asset compositions in our main analyses, we conduct two supplemental analyses to sharpen the identification of the transparency effect. First, we hold the asset classes constant by restricting our analyses to two subsamples: non-agency ABS and derivatives.[9] One major advantage of the ABS subsample, in addition to the asset homogeneity, is that the valuation processes of level 2 and 3 ABS are very similar and that ABS is often used as repo collateral. While derivatives exhibit larger valuation variability than ABS, declines in derivative values often involve margin calls, which exacerbate liquidity constraints. We continue to find the same results for these two subsamples, suggesting that asset heterogeneity or changes in asset compositions through time do not explain our findings.

[9] Non-agency ABS represents 13.8% (25.4%) of our sample BHCs' level 3 (level 2) assets. Derivatives represent 8.9% (3.3%) of our sample BHCs' level 3 (level 2) assets.

Our second analysis relies on the cross-sectional variation in disclosure quality of level 3 measurements. We manually collect level 3 disclosures and classify BHCs into high versus low disclosure quality groups based on whether a bank provides clear quantitative information on level 3 valuation inputs. We find that the attenuation effect of ASU 2011-04 is concentrated in the subsample where BHCs provide more transparent disclosures. This result is consistent with Altamuro and Zhang (2013) who find that only banks that disclose default and prepayment rate assumptions report higher quality level 3 MSR values compared to level 2. We caveat that neither of the two supplemental analyses to sharpen identification of the effect of transparency are perfect, but the two different and orthogonal perspectives corroborate our main analyses.

We conduct several additional tests related to the consequences of impairment losses to further support the liquidity channel. First, we find that banks' impairment losses are associated with reduced repo liabilities, suggestive of the potential adverse impact on bank liquidity due to collateral value decline. Furthermore, banks with impairment losses have a higher tendency to sell investment securities, especially those with higher repo liability-to-liquid asset ratios, consistent with the argument that, when the collateral value declines, fire sales are more likely for banks facing liquidity constraints. Finally, banks' impairment losses are less likely to comove with peers after ASU 2011-04, consistent with the disciplinary role of disclosure transparency.

Although the magnitude of level 3 assets appears small relative to total assets, its economic impact on bank liquidity through collateral value reduction can be significant. 78% of our sample banks engage in repo transactions. Conditional on positive repos, the average ratio of repo liability to cash is 107% for our sample banks. For the 59% of our sample banks with positive level 3 assets, the ratio of level 3 assets to repo liability is 96%. During our non-crisis sample period, impairment losses exist for 21.0% of bank quarters. Conditional on existence of

impairment losses, our model estimate suggests that impairment losses at the tail 1% in distribution reduce repo liabilities by 9.1% for a bank with a median level of repos. This is a potentially significant liquidity shock for banks, especially so for those operating with limited cash reserves.

This study makes several contributions to the banking and fair value accounting literature. First, most prior studies on fair value accounting and procyclicality examine the 2008-09 crisis period and focus on the mark-to-market fair value. Although level 3 managerial inputs deviating from distressed market prices can reduce the feedback effect during the crisis period (Bhat et al. 2011), what is unclear is whether loss hoarding arising from level 3 discretion facilitates a systemic risk buildup during the normal economic period as argued by ESRB (2020). Our paper fills this void. Furthermore, prior research discussing the implications of fair value accounting on systemic risk focuses on the regulatory capital channel (Khan 2019; Laux and Leuz 2009, 2010, Badertscher et al. 2012). Given the detrimental liquidity crunch during the recent crisis and the under-explored importance of collateral fair valuation in bank wholesale funding to liquidity management in the literature, we focus on the balance sheet liquidity channel. Our results suggest that the opacity in level 3 fair value measurement can serve as an origin of a liquidity shock that has a potential to spill over to the entire financial system depending on banks' liquidity constraints. We also show that improved transparency can mitigate the liquidity shocks due to collateral over-valuation in the first place, thereby mitigating the systemic risk buildup.

This study is also related to fair value reporting transparency, information risk, and systemic risk in general. We go beyond Song et al. (2010) and Riedl and Serafeim (2011), who document that level 3 fair values have lower value relevance and higher information risk relative

to levels 1 and 2, by examining the macro implications of level 3 fair value discretion. Bushman and William (2015) find that banks that delay loan loss recognition are more likely to have higher tail risk and contribute to systemic risk. We differ from their study by examining whether the loss hoarding potential of level 3 fair value measurement contributes to financial instability through collateral over-valuation.

Finally, our study carries important policy implications. Our results support bank regulators' isolation of level 3 fair value assets from the other two levels in Y-15 disclosures when considering the systemic implications, but we also note the importance of disclosure transparency as a mitigating factor. Our findings further contribute to the discussions of continuing improvement of the effectiveness of level 3 fair value disclosures (e.g., ASU 2018-13) by highlighting that improved transparency of level 3 fair value can potentially reduce banks' tail risk and their contribution to systemic risk.

2. Background and Literature Review

2.1 FR Y-15 and Systemic Risk

The 2008-09 financial crisis calls attention to the importance of systemic risk. The systemic risk stems from the contagion and transmission of negative shocks from individual banks to the entire banking system, thereby resulting in a systemic failure in the financial system and real economy (Eijffinger, 2012). Adrian and Brunnermeier (2016) contend that this contagion can arise from direct contractual links and counterparty credit risk, i.e., interconnectedness or through herding by financial institutions (systemic as a herd). Smaga (2014) elaborates that this contagion can occur through interconnectedness, or co-movements due to structural similarities of banks, correlated exposure, or opaque products.

Archarya et al. (2017) further note that regulations before the financial crisis tend to be micro-prudential, limiting individual banks' risk-taking while ignoring the potential spillover of individual banks' tail risk to the entire financial system. Hanson et al. (2011) argue that a macroprudential approach can be characterized as *"an effort to control the social costs associated with excessive balance sheet shrinkage of multiple financial institutions hit with a common shock."* In response to the 2008-09 financial crisis and such criticisms, regulators shifted their emphasis from a micro-prudential to a macroprudential perspective.

Section 165 of the Dodd-Frank Act requires the Federal Reserve to establish enhanced prudential standards for bank holding companies and foreign banking organizations with total consolidated assets of $50 billion or more. Among many new requirements, the Fed requires these large financial institutions to file the FR Y-15 - *Systemic Risk Report* annually with the regulators beginning from 2012. The Fed uses the Y-15 data to monitor the systemic risk profile of these large institutions. In addition, the data collected from the Y-15 is also used to facilitate the implementation of additional capital requirements and to analyze the systemic risk implications of proposed mergers and acquisitions.[10] The Y-15 requires eligible BHCs to report the systemic risk profile on six dimensions: size, interconnectedness, substitutability, complexity, cross-jurisdictional activity, and short-term wholesale funding. Starting from 2016 June 30, eligible BHCs are required to file the Y-15 quarterly. In November 2019, the Fed updated the eligibility to BHCs with consolidated assets of greater than $100 billion.

In Schedule D (Complexity Indicators) of the Y-15, eligible BHCs are required to disclose their notional amount of over-the-counter derivative contracts, trading and available-for-sale securities, and assets valued accounted for based on level 3 fair value measurements. Based

[10] See https://www.federalreserve.gov/apps/reportforms/reporthistory.aspx?sOoYJ+5BzDaRHakir9P9vg==.

on this disclosure requirement, the Fed views that level 3 fair value accounting has an important implication on BHCs' systemic risk profile beyond levels 1 and 2. This view is supported by the European Systemic Risk Board (ESRB, 2020) that contends that managerial discretion and opaque fair value accounting inputs, especially level 3 measurement, may increase systemic risk because this opacity and discretion results in less effective external monitoring and increased loss hoarding.

2.2 Fair Value Accounting

2.2.1 Macro Implications of Fair Value Accounting

Accounting research in banking did not have a macro focus before the financial crisis (Beatty and Liao, 2014). Given that accounting information is critical to market and regulatory discipline and in mitigating financial system instability (Acharya and Ryan, 2016), more debates on the role of accounting information in financial systemic failures arose after the 2008-09 financial crisis. In addition to examining the role of loan loss provision accounting in affecting financial stability through the regulatory capital channel (e.g., Beatty and Liao, 2011), accounting studies also examine the macro implications of fair value accounting via the regulatory capital channel.

Laux and Leuz (2009, 2010) question critics' argument that fair value accounting accelerated the 2008-09 financial crisis due to the capital depleting loss recognition based on the *mark-to-market* mechanism. They argue that fair value accounting is not equivalent to mark-to-market. The majority of bank assets such as loans are not fair valued. Most securities subject to fair valuation are classified as available-for-sale securities with holding gains/losses bypassing regulatory capital calculations. Thus, they conclude that fair value cannot contribute to the financial crisis through the regulatory capital channel. Consistent with this view, Badertscher et al.

(2012) find that other-than-temporary-impairment of available-for-sale and held-to-maturity securities that can deplete regulatory capital is a small fraction of loan loss provisions. Although they find that sales of securities are correlated with the magnitude of impairments, securities sales are not significantly correlated with other components of earnings. In addition, banks with low capital ratios engage in less selling in the crisis. Khan (2019) exploits the adoption of FAS 115 and the change in the regulatory prudential filter that excludes unrealized gains and losses from regulatory capital calculation after the adoption of FAS 115. He finds that systemic risk increases after the adoption of FAS 115 but decreases after the implementation of the prudential filter, suggesting that including volatile fair value adjustments in regulatory bank capital increases systemic risk. Combined with the fact that most banks hold capital buffers beyond minimum levels, prior research suggests that fair value accounting along with the prudential filter is unlikely to contribute to financial instability via regulatory capitals.

In contrast, building on the regulatory capital channel, Bhat et al. (2011) document that changes in bank holding of MBS are positively associated with changes in MBS prices during the 2008-09 crisis, consistent with the feedback effect of mark-to-market accounting. They further examine whether FAS 157-4 reduces this association because FAS 157-4 allows banks to switch to mark-to-model when an asset's market liquidity is low. Their finding of a lower feedback effect post-FAS 157-4 suggests not only that mark-to-market accounting has a potential feedback effect but that *mark-to-model* (i.e., level 3 fair value measurement) can attenuate this feedback effect during the crisis period.

However, regulatory capital is not the only reason for fair value accounting to affect the financial system. For example, Plantin et al. (2008) argue that management may have incentives to fire sell financial assets leading to the feedback effect due to compensation or reputation reasons.

In addition, and more importantly, Adrian and Shin (2010) argue that when balance sheets are marked to market, leverage becomes marked to market and thus procyclical. Specifically, to maintain a target leverage ratio, when securities price become lower, banks may sell securities that may further supress the securities price, thus giving rise to a downward spiral effect. Adrian and Shin (2008) further argue that while the subprime mortgage sector is small relative to the financial system as a whole, the contagion effect through marked-to-market balance sheet and funding liquidity can be amplified many-fold through market price changes. Specifically, they argue that valuation of bank balance sheet determines firm liquidity and solvency. Asset sales due to a liquidity crunch, along with marked-to-market accounting, can spill the liquidity crunch over to the whole financial system. This balance sheet liquidity channel is unexplored in the accounting literature.

While our study also examines the association between systemic risk and fair values, we focus on level 3 fair value measurement, which is called out by the regulators and how level 3 fair value assets contribute to systemic risk through the balance sheet liquidity channel. Since banks typically do not maintain extra cash reserves and collateral valuation has a significant impact on banks' wholesale funding, it is possible that a small collateral valuation reduction can trigger a broader liquidity effect, especially for liquidity-constrained banks. In addition, prior research primarily focuses on the impact of mark-to-market accounting during the crisis period and shows that deviation from common market inputs may reduce the feedback effect when the market price is in distress (Bhat et al. 2011). However, whether level 3 input discretion contributes to a systemic risk buildup during the normal economic period through loss hoarding is unexplored. Furthermore, we examine how transparency mitigates the systemic risk buildup via level 3 measurements, which is also unexplored in prior research.

2.2.2 Level 3 Fair Value Measurements and Disclosure

When requiring eligible BHCs to disclose their level 3 fair value assets in the FR Y-15, the regulators' assumption is that level 3 fair value measurement is more opaque because mark-to-model valuation depends heavily on management's discretionary judgment. Prior literature provides mixed evidence about whether level 3 measurement is more opaque and thereby less informative relative to levels 1 and 2. Song et al. (2010) find that level 3 fair value is less value relevant compared to levels 1 and 2, suggesting that management judgment is less informative of market price relative to mark-to-market accounting.[11] Consistent with Song et al. (2010), Riedl and Serafeim (2011) document that level 3 fair values are associated with higher information risk relative to levels 1 and 2 captured by the market beta. Using insurers' fair value reporting, Hanley et al. (2018) find that insurers are more likely to inflate their level 3 fair values when they use self-estimated inputs and when they classify assets as level 3 while the other insurers' consensus treatment of the asset is level 2. In addition, using financial analysts' forecasts to gauge fair value accounting informativeness, Magnan et al. (2015) find that while level 2 measurement increases analyst forecast accuracy, level 3 measurement increases forecast dispersion.

In contrast, Altamuro and Zhang (2013) examine whether managerial discretion in recognizing fair values for mortgage servicing rights (MSR) is informative. They find that level 3 MSR fair values better reflect the persistence of future cash flows and that level 3 fair values have stronger associations with default risk and prepayment risk than level 2. But this result is concentrated in banks disclosing prepayment and discount rate assumptions. Their findings

[11] Fiechter et al. (2021) further find that value relevance of level 3 remeasurements depends on whether unrealized gains and losses are recognized through net income or OCI. They find that unrealized gains or losses flowing through OCI are less value relevant because they reflect transitory illiquidity discounts when banks have the ability to hold the assets.

suggest that management discretion in level 3 combined with transparent valuation inputs disclosures can generate high-quality level 3 fair values.

To address the opacity associated with level 3 fair value measurement, the FASB issued ASU 2011-04, requiring firms to provide additional disclosures about level 3 fair valuation processes and sensitivities. While prior research has not examined whether such disclosure requirement addresses the opacity around level 3 measurements, Chung et al. (2017) find that firms with more opaque fair value estimates voluntarily provide discussions of the external and independent pricing of fair value estimates and their proper classification according to the FAS 157 hierarchy. They also find that these disclosures are associated with higher market pricing and lower information risk for level 3 estimates, suggesting that level 3 disclosures can mitigate information risk. Their findings are consistent with Guay et al.'s (2016) findings that firms affected by FAS 157 use voluntary disclosure to mitigate the negative effects of complex financial statements on the information environment.

2.3 Securities Sold Under Agreements to Repurchase

2.3.1 Types of Repos and Importance of Repo Valuation

Banks utilize a variety of resources to manage their balance sheet liquidity to satisfy the demand for credit, deposit withdrawals, and operating expenses, among which securities sold under agreements to repurchase (repo) are an important form of short-term borrowing. A repurchase agreement is effectively a collateralized loan, allowing banks to borrow cash using long-term available-for-sale security investments as collateral. The majority of repo transactions mature within one month, although the share of repos maturing between one and three months has been growing since the 2008-09 financial crisis (ICMA, 2019). Most repo transactions also require over-collateralization, i.e., a haircut (margin) that refers to collateral's initial market

value being higher than the borrowed amount. The collateral may be revalued every day before maturity, and a reduction in collateral value would prompt lenders to require borrowers to make additional payments (i.e., variation margins) to ensure the borrowers' ability to pay back. Upon maturity, borrowers "buy back" the underlying security collateral for the principal plus interest (i.e., repo spread).

The repo market can be classified into two main segments, bilateral and tri-party, where bilateral repos have lenders (buyers) and borrowers (sellers) who exchange cash and specific securities. In contrast, tri-party repo transactions are all done through intermediary clearing banks (i.e., Bank of New York Mellon and J.P. Morgan Chase) and the tri-party repo infrastructure is a platform based on general collateral, where the cash lender is willing to receive any securities that fall within a broad asset class based on the security type, credit rating, and maturity. Valuation of tri-party repos is done by the intermediary clearing banks with a focus on the whole class of securities but not on a particular security. On the other hand, since bilateral repos are based on specific securities, participants need to agree on valuation of these securities and monitor the collateral market value closely. Based on information provided in banks' 10-K/Q disclosures, most of our sample banks use bilateral repos to borrower from either the wholesale funding providers such as Federal Home Loan Banks (FHLB) or retail lenders such as bank customers including large depositors.

The definition of "market value" of the collateral in the 2011 Global Master Repurchase Agreement drafted by the International Capital Market Association (ICMA) and the Securities Industry and Financial Markets Association (SIFMA) is rather vague as "*the price…agreed by the parties having regard to market practice for valuing securities*".[12] Therefore, borrowers'

[12] https://www.icmagroup.org/assets/documents/Legal/GMRA-2011/GMRA-2011/GMRA%202011_2011.04.20_formular.pdf

valuation of collaterals becomes an important input in collateral valuation especially in the bilateral market. Information asymmetry or disagreement about collateral value for complex securities could also represent a significant risk especially for repo lenders that have many repos collateralized by a variety of securities from different counterparties. For example, Royal Bank of Canada (RBC) was sued as a repo lender because they marked down the CMBS collateral during the COVID-19 crisis without consulting the borrower or obtaining a price from "*a generally recognized source agreed to*" by both parties. Lenders' concern about the market value of collateral is also evidenced by Gorton and Metrick (2012) who document that, for their sample of bilateral repo transactions, haircuts for low-grade collateral rose significantly to the point of nearly shutting down (50% to 100% haircuts) during 2008-09 due to the uncertainty and asymmetric information about the collateral value.

2.3.2 Use of Repo for Short-term Financing

Repo is a very important type of short-term financing for commercial banks. 78% of our sample banks use repo for short-term funding purposes with the average repo liability representing 2.8% of total assets. Conditional on having any repo liabilities, the average repo liabilities to cash ratio is 107%. Most of our sample banks borrow either from the wholesale or retail bilateral repo market. Federal Home Loan Banks (FHLB) is an important wholesale funding provider,[13] accepting mortgage related collateral including privately issued mortgage-backed securities (MBS), as well as municipal securities, both of which are commonly measured with level 2 or level 3 fair values.[14] Bilateral retail repo transactions are typically between banks and their customers. 61% of our sample banks disclose that a significant fraction of their repo agreements are with customers such as hedge funds, mutual funds, or other security dealers that

[13] 44% of our sample banks with positive repo liabilities disclose that they have repo agreements with FHLB.
[14] https://www.fhlbdm.com/webres/File/member-support/collateral/member-products-policy.pdf

sometimes demand particular securities to satisfy their own delivery needs. For example, Wintrust Financial discloses in their 2010 10-Q report that, in addition to their own liquidity needs, their repo liabilities may arise from customers and brokers' demand for specific securities and that this funding category fluctuates based on customer preference.[15] These securities demanded by the customers tend to be level 2 or 3 assets. Similarly, J.P. Chase Morgan discloses in their 2010 10-K that the purpose of repo agreements are *"for short-term funding and to make securities available to clients for their liquidity purposes*".[16]

Banks and large depositors also engage in repo agreements when uninsured deposits are substantial. UMB Financial Corp discloses that 82.4% of the available-for-sale securities were used as collateral with large depositors such as public entities at the end of 2010.[17] Tompkins Financial, in their 2010 Q1 10-Q filing, also discloses that they view local repo agreements with customers as an alternative to large time deposits and that 87.1% of total securities are pledged or sold under agreements to repurchase.[18] Since large depositors are less likely to be valuation experts of MBS or ABS, borrowing banks potentially have significantly more influence on collateral valuations.

Finally, mortgage servicing rights (MSR), commonly accounted for as level 3 assets, can also be used as repo collateral to fund the operating activities of the MSR division. For example, both Fannie Mae and Freddie Mac allow servicers to pledge MSR in repo agreements as long as the repo is used to fund the acquisition or performance of servicing activities or to provide collateral for a warehouse line of credit (Fannie Mae, 2015). MSR can also be used as collateral in repos not involving Fannie Mae and Freddie Mac. Appendix II provides an example of how

[15] https://www.sec.gov/Archives/edgar/data/1015328/000095012310098510/c60369e10vq.htm#102
[16] https://www.sec.gov/Archives/edgar/data/19617/000095012311019773/y86143e10vk.htm
[17] https://www.sec.gov/Archives/edgar/data/101382/000119312511044739/d10k.htm
[18] https://www.sec.gov/Archives/edgar/data/1005817/000101905610000595/tompkins_1q10.htm#TF007_V1

the borrower/seller's MSR valuation is used to determine the market value of the collateral in such transactions. Specifically, the level 3 MSR fair value on the most recent balance sheet date can be a direct measure of market value in this example.[19] Collectively, the above discussions suggest security investments, including level 3 fair value assets, are important tools for the purpose of liquidity management and borrower fair valuation of complex financial instruments is an important input for bilateral collateral valuation.

3. Hypothesis Development

Although the relative economic magnitude of security investments is smaller than loans, assets subject to levels 2 and 3 fair value measurements are complex and can have significant implications on the stability of the banking industry.[20] Financial instruments such as non-agency ABS, municipal bonds, and derivatives are measured with either level 2 or level 3 fair values. Relative to level 2 fair value measurements, level 3 measurements involve more managerial discretion in its valuation models or input assumptions. While such discretion and deviation from common market inputs might mitigate the feedback effect of fair valuation when the market is in distress (Bhat et al. 2011), bank regulators emphasize that such discretion may allow banks to hoard losses during normal economic periods, contributing to the systemic risk buildup. Specifically, valuation uncertainty of these instruments coupled with management's tendency of over-valuation, hinders effective internal risk management and external risk monitoring.

Loss overhangs prevent banks from addressing smaller liquidity concerns arising from early small loss recognition. As a result, during economic downturns, bank management then

[19] Alternatively, the MSR value can be based on the most recent Market Value Report, which is also typically delivered by the borrowers.

[20] Based on our manually collected data from 2010 to 2013, the main level 3 asset categories relative to total level 3 assets include non-agency ABS (13.8%), derivatives (8.9%), mortgage servicing rights (11.3%), trust preferred securities (9.4%), municipal bonds (11.2%), and loans 6.4%).

needs to address a much larger liquidity hit due to the level 3 collateral value decline, which can be much more difficult and create a contagion effect to the financial system. For example, lenders may require larger variation margins that prompt liquidity constrained banks to fire sell their investment securities for cash. These asset sales, occurring in economic downturns, may require a larger discount and form the feedback effect by suppressing the price of the sold securities class due to marked-to-market or marked-to-model accounting depending on the fair value levels of the sold securities. This then further concerns any lenders using the asset class as collateral, which further suppresses the short-term credit in aggregate. This is referred to as an illiquidity feedback loop. In addition, the high information asymmetry in the valuation process of these complex assets may also lead to higher haircuts in borrowing in the absence of actual impairment in collateral, significantly increasing the costs of liquidity management during economic downturns. This discussion leads to our first hypothesis that level 3 fair value measurements contribute to the systemic risk buildup during normal economic periods to a higher extent than do level 2 assets.

H1: Level 3 fair value assets are more positively associated with banks' contribution to the systemic risk of the overall banking industry than level 2 assets.

To understand the role of opacity in level 3 fair value measurement in deterring external monitoring and giving rise to loss overhangs that result in systemic failures, we next examine whether the association between level 3 fair value assets and banks' contribution to systemic risk depends on financial reporting transparency. Prior research shows that additional disclosures of level 3 fair value inputs improve the quality of level 3 fair values and enhance external monitoring. Since accurate level 3 fair value allows recognition of gradual and small economic losses in financial instruments before economic downturns, loss overhangs are mitigated. These gradual and small losses are likely to give rise to lower liquidity shocks and are easier to manage for banks. As a result, fire sales and subsequent spillover effects also become less likely. Thus,

we expect increased disclosure to mitigate level 3 fair value's contribution to the systemic risk buildup. Hypothesis 2 is as follows.

H2: Higher transparency attenuates the positive association between Level 3 fair value assets and banks' contribution to systemic risk.

Because the decline in asset value reflected in the bust of loss overhangs exhibits a stronger spillover effect for banks that rely on short-term collateral financing with lower balance sheet liquidity, we expect the contribution of level 3 fair value to the systemic risk buildup and the transparency attenuation effect to be stronger for banks with high repo financing relative to liquid assets. H3 is stated as follows.

H3: The positive association between level 3 fair values and systemic risk and the transparency attenuation effect are stronger for banks with high repo liability-to-liquidity assets ratios.

4. Data and Research Design

4.1 Data

Our sample covers publicly traded bank holding companies from 2010 to 2013. Level 1 through 3 fair value information becomes widely available in the Y-9C report from June 2009. Since we are interested in how level 3 assets contribute to systemic risk buildup during normal economic periods and the other-than-temporary impairment loss information is not available from the Y-9C before 2010, our sample starts in 2010, two quarters after the end of the economic recession period. To better identify the impact of improved transparency related to level 3 fair values, our sample period centers around the effective date of ASU 2011-04 (2012 quarter 1) ending in 2013. We obtain other bank financial characteristics from the Y-9C and stock return information from CRSP. After requiring necessary data to construct the systemic risk measure and control variables, our sample consists of 3,670 bank-quarters for 263 unique BHCs. Finally,

we manually collected detailed level 1 through 3 asset composition and quantitative disclosures on level 3 fair valuation inputs from banks' 10-K and 10-Q filings.

4.2 Research Design

4.2.1 Construction of Systemic Risk Measure

Adrian and Brunnermeier (2016) contend that a good systemic risk measure should capture how risk is built up during tranquil period, which realizes during crises. We follow Adrian and Brunnermeier (2016) and use the systemic risk measure *ΔCoVaR* for each bank-quarter. This measure captures the extent to which an individual bank *i* contributes to the downside tail risk of the entire banking sector during quarter *t*. This measure starts with the concept of value-at-risk $(q\% - VaR_{i,t})$, which measures the potential loss in value of an individual bank over a set period for a given confidence interval. For example, a one-week *VaR* for a bank at the 1% confidence interval of –0.20 indicates that there is a 1% likelihood that the return for the bank over the next week will be lower than −20%. The conditional *VaR*, or *CoVaR*, of the banking system is the system wide *VaR* conditional on the outcome for any individual bank. $\Delta CoVaR_{1\%,t}^{system/i}$ is the average of the weekly *CoVaR* of the banking system over time *t* conditional on bank *i* being in distress (i.e., probability threshold of 1% to calculate *VaR*) minus *CoVaR* conditional on bank *i* being at the median state (i.e., probability threshold of 50% to calculate *VaR*). Please see Appendix III for details of *ΔCoVaR* variable construction. We multiply the result by negative 100 so that *ΔCoVaR* is increasing in a bank's contribution to the systemic risk and is expressed as a percent. As explained in Adrian and Brunnermeier (2016), *ΔCoVaR* is a statistical tail dependency measure that does not rely on causality. This measure captures the direct spillover effect via contractual links, the indirect spillover effect due to market-wide externalities, and common exposures of multiple financial institutions to the same

risk factors. To better capture the time-varying nature of ΔCoVaR, we use a rolling 8-year window prior to quarter t to estimate $\Delta CoVaR_{i,t}$ and require at least 104 weeks of information (i.e., 2 years of information). Since our sample period is 2010 through 2013 and we regress the next 4-quarter $\Delta CoVaR$ on current quarter balance sheet information, the rolling window starts in 2002 so that all estimations include the 2008-09 financial crisis period to ensure the effectiveness of 1% quantile regressions.

4.2.2 Model Specification

We estimate equation (1) to examine the association between level 3 fair value assets and banks' contribution to the system-wide risk, and the effect of level 3 disclosure transparency on this association.

$$\Delta CoVaR_{i,t+4} = \beta_0 + \beta_1 \, Level3\ Assets_{i,t} + \beta_2 \, Level2\ Assets_{i,t} + \beta_3 \, ASU*Level3\ Assets_{i,t} + \beta_4 \, ASU*Level2\ Assets_{i,t} + \Pi \, Controls_{i,t} + \varepsilon_{i,t} \quad (1)$$

$\Delta CoVaR_{i,t+4}$ represent bank i's average contribution over the next 4 quarters. All balance sheet items are measured at the end of quarter t. The main test variable *Level3* (*Level2*) *Assets* is measured as the fair value of level 3 (level 2) assets scaled by total assets. We use level 2 assets as the control group because levels 2 and 3 share most commonalities in underlying assets, complexity, and valuation methods, while level 3 is characterized with more discretion and opacity in measurement. Therefore, level 2 assets serve as our control group for us to identify the effect of management discretion and opacity on systemic risk. Following the prediction of H1, we expect the coefficient on *Level3 Assets* to be positive and larger than that on *Level2 Assets*.

To study the effect of level 3 disclosure transparency, we use Accounting Standard Update (ASU) 2011-04 on Fair Value Measurement (Topic 820) to capture the impact of level 3 transparency. This amendment does not change the application of fair value accounting but explicitly requires additional information about level 3 fair valuations. Specifically, banks are

supposed to provide additional information about both the valuation process and the sensitivity of the level 3 fair values to changes in the valuation inputs. Since prior research documents higher quality valuation and reduced information risk of level 3 fair values following additional disclosures (Altamuro and Zhang, 2013; Chung et al., 2017), H2 predicts a declined association between level 3 fair value assets and systemic risk after ASU 2011-04 became effective, suggesting a negative β_3. Because the ASU 2011-04 disclosure requirement applies only to level 3 fair values but not level 2, We expect β_3 to be more negative than β_4.

We control for a battery of variables that prior literature has documented affect systemic risk. First, we control for level 1 fair value assets because security investments in general have been documented to contribute to systemic risk (Adrian and Brunnermeier, 2016) and are included in the complexity section of the FR Y-15. We further control for six additional systemic risk factors following the content of the FR Y-15, including *size, foreign liabilities, foreign claims, notional amount of derivatives, substitutability,* and *interconnectedness*.

Since Y-15 forms are only available for the largest U.S. banks, we construct these risk indicators based on Y-9C disclosures and stock return information for a broader sample. We control for *Size* measured as the log of market equity. Size typically exhibits the highest explanatory power to explain the cross-sectional variation of system risk. We further control for the *notional amount of derivatives* scaled by total assets as another complexity measure. *Foreign liabilities* are measured as the bank's deposits in foreign offices scaled by total assets, while *foreign claims* are measured as the sum of interest-bearing balances in foreign offices, loans to foreign banks, commercial and industrial loans to foreign addresses, and loans to foreign governments and official institutions scaled by total assets. We also control for *substitutability* which we define as the sum of income from fiduciary activities and investment banking,

advisory, and underwriting fees scaled by quarterly income. Finally, we control for *interconnectedness* which we define as the sum of cash balances due from other depository institutions and loans to other financial institutions scaled by total assets. All of the above variables are expected to positively contribute to systemic risk.

Furthermore, we control for banks' leverage (*leverage*), current quarter value-at-risk (*VaR*), the ratio of market capitalization to book equity (*market-to-book ratio*), loans and leases held for sale minus the allowance for loan and lease losses scaled by total assets (*loans net of reserves*), loan components (*C&I Loans*, *consumer loans*, *real estate loans*), betas from the single factor CAPM (*beta*), market-adjusted returns (*market adj. returns*), total intangible assets scaled by total assets (*intangible assets*). We also control for the investment securities composition to address the possibility that we are merely capturing the effect of heterogeneity of investments across banks. In addition, we use the log of the size of the 10K/Q files (*10K/Q readability*) to control for the overall financial reporting readability. Finally, to alleviate concerns that macro environment and innate bank-level characteristics affect our results, we include bank and year-quarter fixed effects in all specifications.

We test H3 by separately estimating model (1) for high versus low reliance on repo financing scaled by liquid assets. Specifically, we calculate this partitioning variable capturing banks' repo financing demand and balance sheet liquidity as the repo-to-liquidity ratio: repo liabilities divided by the sum of cash and liquid AFS investment securities. H3 predicts that the coefficient on *Level3 Assets* (*ASU*Level3 Assets*) in equation (1) is more positive (negative) for banks with high than low repo-to-liquidity ratios.

5. Results Discussions

5.1 Descriptive statistics

Table 1 reports descriptive statistics of the main variables for our sample. The mean (median) value of $\Delta CoVaR_{i,t+4}$ is 2.65 (2.74). This means that if an average (median) bank in our sample moved from its median state to its stress state, it would increase the weekly market VaR by 2.65% (2.74%). The mean (median) value of $VaR_{i,t+4}$ is 11.28 (10.21). This means that for the average (median) bank in our sample there is a 1% likelihood that a weekly return for the bank will be lower than −11.28% (-10.21%). These figures are close to those reported in Adrian and Brunnermeier (2016). Consistent with prior research (Song et al., 2010; Riedl and Serafeim, 2011), a majority of the assets subject to recurring fair valuation are classified as level 2, representing 20.0% of total assets. In contrast, assets subject to level 1 and 3 fair valuations are on average 1.4% and 0.5% of total assets, respectively. Loans make up an average of 62.5% of our sample BHCs' assets. Most banks in our sample do not have foreign claims or foreign liabilities. Similar skewness is observed for substitutability and notional amount of derivatives, whereas the interconnectedness measure which captures inter-bank lending relationships is more normally distributed. Of the investment security types we include, Agency ABS makes up the highest proportion of assets at 10.9%, while government agency obligations (excluding MBS) and municipal debt account for about 3% each.

Table 2 reports Pearson correlations of main variables. As expected, bank size is the most highly correlated variable with $\Delta CoVaR_{t+4}$ ($\rho = 0.61$). The other variables that regulators believe contribute to systemic risk also positively correlate with $\Delta CoVaR_{t+4}$ with correlations ranging from 0.01 to 0.26. This provides comfort that our systemic risk measure (i.e., $\Delta CoVaR$) captures the systemic risk that regulators have in mind. Finally, we find positive correlations between $\Delta CoVaR_{t+4}$ and all three levels of fair value assets. However, the correlation for level 3 ($\rho = 0.25$) is higher than that for level 2 ($\rho = 0.15$) and level 1 ($\rho = 0.17$).

5.2 Validation Analyses

As the first step of our analysis, we validate if level 3 assets are positively associated with future impairment on investment securities, as a proxy for loss hoarding, and tail risk measured as *VaR* (value-at-risk). We use impairment on investment securities as a measure for loss hoarding based on Vyas' (2011) findings that banks' impairment recognition lags relevant price index. We further examine whether these associations decline significantly after the implementation of ASU 2011-04. This validation analysis is critical to establishing the linkage between level 3 valuation discretion and loss hoarding.

These results are presented in Table 3. Column (1) shows that level 3 AFS securities are positively associated with future impairments which provides evidence that banks may be more likely to hoard losses due to discretion allowed by level 3 accounting.[21] This relation declines significantly after the adoption of ASU 2011-04, suggesting that level 3 disclosure transparency has a potential to discipline management in asset valuation and mitigate loss hoarding. Column (2) shows that level 3 assets are positively associated with the bank's tail risk as measured by VaR and this relation declines significantly after the adoption of ASU 2011-04. This finding also supports the notion of level 3 opacity allowing loss hoarding and deterring external monitoring which may lead to inappropriate bank risk taking, resulting in crash risk. In both columns, the effect of level 3 (*ASU*Level 3 AFS or Assets*) on the outcome variables is significantly different than the effect of level 2 (*ASU*Level 2 AFS or Assets*), suggesting that level 3 discretion is distinct from level 2 in affecting loss hoarding and risk taking.

5.3 Main Analyses

[21] To examine whether future impairment is due to reclassifications from other comprehensive income, we analyze the association of impairment and the change in net unrealized gains (losses) on available-for-sale securities. Untabulated results show that there are no statistically and economically significant correlations between impairment and the change in holding loss, suggesting that impairment results are not driven by reclassifications.

We show results supporting H1 and H2 in Table 4. The estimated coefficient for level 3 assets is 0.100 (*p-value = 0.001)*. This finding is consistent with the regulator's concern that level 3 fair value assets contribute to a bank's contribution to the systemic risk of the banking industry. Further, the estimated coefficient on level 2 fair value assets in column (1) is insignificant, and it is also significantly different from the coefficient for level 3 fair value assets. The economic magnitude of the association between level 3 fair value asset and systemic risk suggests a one standard deviation change of level 3 assets positively contributes to 6.9% of a standard deviation change in $\Delta CoVaR_{t+4}$. The estimated coefficient for *ASU*Level 3* assets is -0.125 (*p-value < 0.001)*. This result helps rule out the alternative explanation that the positive association between level 3 assets and $\Delta CoVaR_{t+4}$ is due to the underlying complexity or interconnectedness of the assets and supports the notion that transparent information about the valuation process and managerial level 3 inputs mitigates the systemic risk.[22] We find no evidence of negative changes in the coefficient of the level 2 fair value assets, further ruling out the alternative explanation that the change in coefficient on level 3 assets is driven by changes in how security investment or fair value accounting affects systemic risk in general. Finally, the sum of the estimated coefficients for *Level3 Assets* and *ASU*Level 3* assets is not significantly different from zero suggesting that level 3 assets are not significantly related to systemic risk after ASU 2011-04 became effective.

Table 5 reports the results supporting H3. Column (1)/(2) is the subsample for banks with high/low repo liabilities relative to liquid assets. We find that the coefficient on level 3 assets prior to ASU 2011-04 is only significant in column (1) and the coefficient on level 3 assets is

[22] In untabulated analyses, we estimate a fully interacted model and allow the coefficients on other control variables to change after ASU 2011-04 and find similar results. In addition, we find no systemic reduction in the coefficients of other systemic risk indicator variables, suggesting our results are unlikely driven by an average reduction of the systemic risk and value-at-risk after 2012.

significantly different between columns (1) and (2), suggesting higher valuation concerns of level 3 assets for these higher repo liability-to-liquidity banks lead to higher systemic risk. The impact of disclosure is only significant for banks with high repo liability-to-liquidity ratios. The level 3 coefficients in column (1) are also significantly different from the corresponding level 2 coefficients. These findings suggest that level 3 assets are likely to contribute to systemic risk especially for banks with more balance sheet liquidity concerns, consistent with the liquidity channel.

5.4 Supplemental Analyses

5.4.1 Asset Heterogeneity

Our main design uses a time indicator variable to measure the change in transparency of level 3 fair value measurements. Although we use level 2 fair value assets as the control group, level 2 and level 3 assets might not be comparable, which limits our empirical inference. We perform two supplemental analyses to address this concern. First, we limit the assets in our sample to derivatives and non-agency asset-backed securities, respectively. We choose these two types of assets due to their significant representations in both level 2 and level 3 assets, as well as their significant implications to systemic risk. Non-agency ABS represents 13.8% (25.4%) of level 3 (level 2) assets. Its risk assessment is notoriously complex although the underlying valuation models are similar across different types of ABS. Furthermore, ABS are commonly used as repo collateral, which has implications for financial stability via the balance sheet liquidity channel. Similar to ABS, derivative instruments are also complex and hard to value. Since derivative transactions are often between financial institutions and involve margin calls, the threat of systemic failure is particularly high.

Holding the financial instrument relatively homogenous in these two separate subsamples, we examine whether our main results continue to hold in each subsample and report results in Table 6. We find the association between level 3 assets and systemic risk is particularly strong (*coeff. = 2.407*) for derivatives prior to ASU 2011-04. The coefficient on level 3 non-agency ABS is 0.553 prior to ASU 2011-04, lower than that for derivatives but its economic magnitude is higher than the Table 4 results on overall level 3 assets. Most importantly, the coefficients on *ASU*Level 3 Assets* are significantly negative for both subsamples, whereas little change is observed for level 2 assets. Thus, our Table 6 results further increase our confidence that the decline in the association between level 3 assets and contribution to systemic risk is not driven by asset composition changes.

5.4.2 Level 3 Disclosure Quality

To further strengthen our inference on transparency, we conduct a difference-in-differences analysis based on the quality of disclosure of level 3 measurements post ASU 2011-04. We expect the effect of ASU 2011-04 in lowering the systemic risk to be stronger for banks with more informative disclosure that allows for external monitoring. Specifically, we manually collect bank 10-Q and 10-K filings after ASU 2011-04 to capture their quantitative disclosures quality. Prior to ASU 2011-04, banks usually only list their main financial instruments with fair value levels in their financial statement footnotes without additional discussions of valuation methods. After ASU 2011-04, banks are required to expand their qualitative disclosures and provide the valuation inputs and sensitivity analyses except when they hire an external appraiser to value the financial instruments.

During our hand collection process, we find cross-sectional variation in disclosed content after ASU 2011-04 from no disclosure at all to detailed point estimates of all valuation inputs for

all level 3 financial instruments. While the quality of the disclosure is subjective, we employ an indicator variable to capture high versus low disclosure quality. We choose an indicator variable rather than a continuous measure because of the polarization of banks' disclosure choices. About three quarters of banks with positive level 3 securities either fully disclose the valuation assumption and inputs for all instruments, or do not disclose any assumptions, which supports a simple high versus low quality measure. Specifically, *high quality* is equal to 1 if a bank reports at least one valuation assumption that can be matched to any of its level 3 instruments, otherwise it is equal to zero.

Table 7 reports that level 3 fair value assets contribute to loss hoarding, tail risk and systemic risk in both low and high disclosure quality subsamples prior to ASU 2011-04, and this contribution declines more for banks with high-quality level 3 valuation disclosure post ASU 2011-04. Panel A1(A2) reports results for loss hoarding, proxied by future impairment of investment securities without (with) matching.[23] Panel A1 and A2 show that there is no significant difference of the positive association between Level 3 AFS and future investment securities impairment across high- and low-disclosure banks, but the decline in the association post ASU 2011-04 is significantly larger high-disclosure banks. Panel B1(B2) reports results for tail risk, proxied by *VaR* without (with) matching. Panel B1(B2) show that that there is no significant difference of the positive association between level 3 assets and tail risk across high- and low-disclosure banks, but the decline in the association post ASU 2011-04 is significantly

[23] For future impairment, we match each high disclosure bank-quarter with a low disclosure bank-quarter on size, repo-to-liquid asset and level 3 available-for-sale assets tercile (with replacement). We require matched banks to have level 3 available-for-sale assets within 1.5% of each other. If there are multiple potential matches, the one with the smallest difference in level 3 assets is retained. We use the same matching scheme for VaR and ΔCoVaR analyses except using level 3 assets, instead of level 3 AFS assets. Level 3 available-for-sale assets are used in the impairment test because the independent variables are level 3 available-for-sale securities. Matching on level 3 available-for-sale securities also results in a relatively smaller matched sample. After matching, the normalized differences for all variables are below the 0.25 threshold specified in Imbens and Wooldridge (2009), suggesting that specification sensitivity is less of a concern.

larger high-disclosure banks. Panel C1(C2) reports results for systemic risk, proxied by *ΔCoVaR* without (with) matching. Both panels show that there is no significant difference in the positive association between level 3 assets and tail risk across high- and low-disclosure banks and the matched sample shows that the decline in the positive association is significantly larger for high-disclosure banks. Collectively, Tables 6 and 7 present results corroborating the importance of level 3 disclosure transparency in deterring loss hoarding, lowering tail risk and reducing banks' contribution to systemic risk associated with level 3 discretion.

5.4.3 Mechanism Analyses

We perform additional analyses to further corroborate our inferences by validating the potential mechanisms through which level 3 discretion may contribute to systemic risk. We first investigate whether impairment results in lower repo borrowing. Based on our discussion above, if impairment leads to creditors' refusal to roll over or additional margin requirements by repo lenders that result in fire sale of investments and concern repo lenders, we are likely to observe a reduction in repo borrowing. In Panel A of Table 8, we find results consistent with this expectation. In our non-crisis sample period, the 99th percentile of positive *Impairment*, 1.332%, indicates a decrease in *Repo* of 1.332*0.127=0.169 percentage points. The sample median of *Repo* is 1.86 percentage points, which means that a 99th percentile impairment loss is associated with a 0.169/1.86=9.1% decrease in repo liabilities. To further corroborate the fire sale mechanism, we investigate whether banks are more likely to sell investment securities when they impair investment securities. In column (1) of Panel B, we find that banks impairing investment securities are more likely to sell investments. We then investigate whether such sales are more likely when banks have higher repo borrowing needs relative to liquid assets. In columns (2) and (3), we find that while impairment is associated with asset sales for both subsamples, the

coefficient on impairment is significantly higher for the subsample with higher repo liabilities-to-liquidity ratios. Finally, Table 9 presents the impairment and security sales co-movement results. If loss hoarding associated with level 3 discretion is strong, and the market conditions deteriorates as banks are forced to sell assets, we expect that an individual bank's impairment (security sales) is likely to occur simultaneously with other banks' impairment (security sales), i.e., impairment (security sales) co-movement. Consistent with this expectation, Panel A (B) of Table 9 show that there is a significant positive association between bank's impairment (security sales) and the banking sector's average impairment (security sales). Further, Panel A (B) column (1) and column (2) show that there is a significant decline in the impairment (security sales) co-movement post ASU 2011-04, suggesting that level 3 valuation disclosure may mitigate loss hoarding and impairment (security sales) co-movement. Collectively, these findings strengthen the inference that level 3 discretion contributes to systemic risk through the fire sale mechanism.

6. Conclusions

Motivated by regulators requiring systemically important large BHCs to disclose level 3 fair valued assets as an indicator for systemic risk, we examine the association between level 3 fair value accounting and systemic risk buildup and whether additional disclosures of level 3 assets mitigate this association. Regulators contend that management discretion and the inherent opacity of level 3 accounting allow management to hoard losses and disenables external monitoring of bank risk-taking. When excessive losses are recognized in economic downturns, concerns over collateral value and valuation uncertainty in the short-term wholesale funding market may lead to asset sales or even fire sales that can spread losses and reduce aggregate liquidity in the whole financial system.

Consistent with these arguments, we find that BHCs with more level 3 assets contribute more to the systemic risk of the banking system. In addition, we find this positive association declines after ASU 2011-04 is adopted. We do not find the same decline in systemic risk associated with level 2 assets after ASU 2011-04. Further, we document that this finding is more significant when BHCs' repo liability-to-liquidity ratio is above the sample median. To sharpen inferences of the transparency effect, we find similar main results in two subsamples of more homogenous asset compositions, i.e., non-agency ABS's and derivatives. In addition, we find that the decrease in systemic risk after ASU 2011-04 is concentrated in the subsample where the level 3 disclosure quality is higher. Finally, we document findings supportive of the mechanisms via which level 3 accounting is associated with higher systemic risk.

Our findings make contributions to both the banking and fair value accounting literatures and carry important policy implications. Prior research on the procyclicality and fair value accounting has mostly focused on the impact of mark-to-market (i.e., levels 1 and 2) while our focus is on the opacity and discretion arising from mark-to-model level 3 accounting. We also extend prior banking research on systemic risk by documenting that accounting standards that improve level 3 disclosures have an important macro consequence.

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Appendix I – Variable Definitions (in alphabetical order)

$\Delta CoVaR_{t+4}$	CoVaR is the estimate of the value at risk (VaR) of the entire banking system conditional on the value at risk (VaR) at an individual bank. ΔCoVaR is the change in the VaR of the banking system conditional on bank *i* being in distress (probability threshold of 1% to calculate VaR) versus bank *i* being at the median state (probability threshold of 50% to calculate VaR) all expressed in units of weekly returns and multiplied by –100. $\Delta CoVaR_{t+4}$ is the average ΔCoVaR over quarters *t+1* to *t+4* (see Adrian and Brunnermeier 2016 for more detailed discussions on the measurement of ΔCoVaR)
10K/Q Readability	The log of the size of the complete 10K/Q files of the bank holding company. [SEC Analytics Suite by WRDS: FSIZE; winsorized at the 1st and 99th percentiles]
ABS	The fair value of AFS and trading ABS [Y9C: (BHCKC027 + BCHKF643 + BCHKF644 + BCHKF645 + BCHKF646 + BCHKF647 + BCHKF 648)/bhck2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Agency MBS	The fair value of AFS and trading agency MBS [Y9C: (BHCKg303 + BHCKG307 + BHCKG315 + BHCKG319 + BHCKK145 + BHCKK153 + BHCKG379 + BHCKG380 + BHCKK197)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
ASU	An indicator variable that is equal to 1 during and after 2012, otherwise it is equal to 0.
Beta	The beta from single factor CAPM using daily stock return. [CRSP; winsorized at the 1st and 99th percentiles.]
C&I Loans	The sum of commercial and industrial loans scaled by total loans and lease. [Y9C: (BHCK1763+BHCK1764)/BHCK2122; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Consumer Loans	The sum of all loans to individuals for personal expenditures scaled by total loans and lease. [Y9C: (BHCKB538+BHCKB539+BHCKK137+BHCKK207)/BHCK2122; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Equity	The fair value of AFS and trading investments in mutual funds and other equity securities. [Y9C: (BHCKA511 + BHCKF652 + BHCKf653)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.

Foreign Claims	The sum of interest-bearing balances in foreign offices, Edge and Agreement subsidiaries, and IBFs, loans to foreign banks, commercial and industrial loans to foreign addresses, and loans to foreign governments and official institutions scaled by total assets. [Y9C: (BHCK0397 + BHCK1296 + BHCK1764 + BHCK2081)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Foreign Liabilities	Deposits in foreign offices, Edge and Agreement subsidiaries, and IBFs scaled by total assets. [Y9C: (BHFN6631 + BHFN6636)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Future Impairment	The sum of other than temporary impairment losses on held-to-maturity and available-for-sale debt securities recognized in earnings over the next 12 quarters divided by the total amortized cost of available-for-sale assets. [Y9C: $(\sum_{t=1}^{12}(OTTI_{i,t}))$ / (BHCK1772+BHCK1754) where *OTTI* is the quarterly version of BHCKJ321; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
High Quality	An indicator variable that is equal to 1 if a bank reports a matching valuation assumption for any of their level 3 recurring assets, otherwise it is equal to 0 [This information is collected from the fair value disclosures within the notes to financial statements section of the 10-K].
Impairment	Other than temporary impairment losses on held-to-maturity and available-for-sale debt securities recognized in earnings divided by the total amortized cost of available-for-sale and held-to-maturity securities at the beginning of the quarter. [Y9C: OTTI/(BHCK1772+BHCK1754) where OTTI is the quarterly version of BHCKJ321]. Expressed as a percent.
Industry Impairment Average	The sum of all banks' other than temporary impairment losses on held-to-maturity and available-for-sale debt securities recognized in earnings divided by the sum of all banks' total amortized cost of available-for-sale and held-to-maturity securities at the beginning of the quarter. [Y9C: $(\sum OTTI)$ / $(\sum \text{BHCK1772} + \text{BHCK1754})$ where OTTI is the quarterly version of BHCKJ321]. Expressed as a percent.
Industry Security Sales Average	The sum of all banks' proceeds from the sale of available-for-sale securities divided by the sum of all banks' book total amortized cost of available-for-sale securities at the beginning of the quarter. [The proceeds from the sale of available-for-sale securities are collected from bank holding companies' 10K/Q. Excluding the largest 10 banks by the book value of total assets (BHCK2170).]
Intangible Assets	Total intangible assets scaled by assets. [Y9C: (BHCK3163 + BHCK0426)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.

Interconnectedness	The sum of cash balances due from other depository institutions and loans to both depository and nondepository financial institutions scaled by total assets. [Y9C: (BHCK0081 + BHCK0395 + BHCK1292 + BHCKJ454)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 1 AFS Securities	Level 1 AFS securities with readily determinable fair values not held for trading measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG475/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 1 Assets	Level 1 assets measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG504/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 1 Derivative Assets	Level 1 derivative assets measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG494/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 2 AFS Securities	Level 2 AFS securities with readily determinable fair values not held for trading measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG476/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 2 Assets	Level 2 assets measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG505/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 2 Derivative Assets	Level 2 derivative assets measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG495/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 2 Non-Agency ABS	Level 2 non-agency abs measured at fair value on a recurring basis scaled by total assets. [10-K & Y9C: The numerator is taken from the fair value table within the notes to financial statements section of the 10-Q, while the denominator is BHCK2170 from the Y9C; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 3 AFS Securities	Level 3 AFS securities with readily determinable fair values not held for trading measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG477/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 3 Assets	Level 3 assets measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG506/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.

Level 3 Derivative Assets	Level 3 derivative assets measured at fair value on a recurring basis scaled by total assets. [Y9C: BHCKG496/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Level 3 Non-Agency ABS	Level 3 non-agency abs measured at fair value on a recurring basis scaled by total assets. [10-K & Y9C: The numerator is taken from the fair value table within the notes to financial statements section of the 10-Q, while the denominator is BHCK2170 from the Y9C; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Leverage	The ratio of total liabilities to total assets. [Y9C: BHCK2948/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Loans net of Reserves	Total loans and leases held for sale minus the allowance for loan and lease losses scaled by total assets. [Y9C: (BHCK2122-BHCK3123)/BHCK2170; winsorized at the 1st and 99th percentiles; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Market Adj. Returns	Quarterly buy-and-hold market adjusted return. [CRSP: $((\prod_{t=1}^{k}(1 + ret_{i,t})) - 1)$ - $((\prod_{t=1}^{k}(1 + vwret_t)) - 1)$ where k is the number of trading days in a quarter; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Market-to-Book Ratio	The ratio of market capitalization to book equity. [CRSP and Y9C: (PRC*SHROUT) BHCK3210; winsorized at the 1st and 99th percentiles]
Muni	The fair value of AFS and trading Securities issued by states and political subdivisions in the U.S. [Y9C: (BHCK8499 + BHCM3533)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Non-Agency MBS	The fair value of AFS and trading non-agency MBS [Y9C: (BHCKG311 + BHCKG323 + BHCKK149 + BHCKK157 + BHCKG381 + BHCKk198)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Notional Derivatives	The sum of total notional gross amount of derivative contracts held for trading and held for purposes other than trading scaled by total assets. [Y9C: (BHCKA126 + BHCKA127 + BHCK8723 + BHCK8724 + BHCK8725 + BHCK8726 + BHCK8727 + BHCK8728)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Real Estate Loans	The total loans secured by real estate scaled by total loans and lease. [BHCK1410/BHCK2122; winsorized at the 1st and 99th percentiles]. Expressed as a percent.

Repo	Securities sold under agreements to repurchase scaled by either total assets or liquid assets, depending on the specification. [Y9C: (BHCKB995/BHCK2170) or ((BHCKB995/(BHCK0010 + BHCK1287 + BHCK1293 + BHCK1298); winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Sale	An indicator variable that is equal to 1 if a bank realizes net gains or losses from sales of held-to-maturity and available-for-sale securities during a quarter. Otherwise, it is equal to 0. [Y9C: 1 if (BHCK3196 + BHCK3521 + OTTI) ≠ 0, and 0 otherwise. BHCK3196 and BHCK3521 are adjusted to be quarterly rather than year-to-date].
Security Sales	The proceeds from the sale of available-for-sale securities scaled by the bank's amortized cost of available-for-sale securities at the beginning of the quarter. [The proceeds from the sale of available-for-sale securities are collected from bank holding companies' 10K/Q.]
SFP	The fair value of AFS and trading other debt securities [Y9C: (BHCKG339 + BHCKG343 + BHCKG347 + BHCKG383 + BHCKG384 + BHCKG385)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
Size	The log of market capitalization. [CRSP: $\log(PRC_{i,t}*SHROUT_{i,t})$; winsorized at the 1st and 99th percentiles].
Substitutability	The sum of income from fiduciary activities and Investment banking, advisory, and underwriting fees and commissions scaled by quarterly income. [Y9C: (BHCK4070 + BHCKc888)/(BHCK4107 + BHCK4079) where the values in the denominator are adjusted to be quarterly rather than year-to-date; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
USG	The fair value of AFS and trading U.S. government agency obligations. [Y9C: (BHCK1293 + BHCK1298 + BHCM3532)/BHCK2170; winsorized at the 1st and 99th percentiles]. Expressed as a percent.
VaR_{t+4}	VaR is the average weekly maximum loss in market value during the quarter for an individual bank at the 1% confidence level. It is expressed as a percent and is increasing in the loss by multiplying by –100. This is calculated using quantile regressions of weekly stock returns on macroeconomic factors as in Adrian and Brunnermeier (2016). VaR_{t+4} is the average VaR over quarters *t+1* to *t+4*.

Appendix II: Master Repurchase Agreement between PNMAC GMSR ISSUER TRUST ("Buyer" lender) and PENNYMAC LOAN SERVICES, LLC ("Seller" borrower)

"Market Value Percentage" means, (a) for any purpose (other than for purposes of determining the value of the Borrowing Base, which shall be determined pursuant to clause (b) below), as of any date of determination, the lesser of (i) the fair value percentage of the MSR determined by PLS as of the most recent date of determination or (ii) the middle of the range of the fair value percentage of the MSR from the most recently delivered Market Value Report; and (b) for purposes of determining the value of the Borrowing Base from time to time, as of any date of determination, the least of (i) ***the value of the MSR used to prepare PLS's most recent balance sheet, as determined by PLS as of such date of determination in accordance with GAAP***, (ii) the product of (A) the middle of the range of the fair value percentage of the MSR from the most recently delivered Market Value Report and (B) 115%; or (iii) the product of (A) the average of the middle of the range of the fair value percentage of the MSR from the three (3) most recently delivered Market Value Reports and (B) 110%.

Source: https://www.sec.gov/Archives/edgar/data/1568669/000110465916163239/a16-21271_2ex10d3.htm

Appendix III: CoVaR Estimation

This appendix explains how we estimate ΔCoVaR using quantile regressions. ΔCoVaR measures the Value-at-Risk (VaR) for the banking industry conditional on an individual bank's VaR. A bank's q%-VaR is defined as the bank's loss at q% confidence interval. To estimate each bank's VaR, we use model (A1), to run regressions of banks' weekly returns on a set of seven weekly state variables, noted by M. X_t^i is the weekly return for bank i in week t.

$$X_t^i = \alpha^i + \gamma_t^i M_{t-1} + \epsilon_t^i \qquad \text{(A1)}$$

Using A1, we run the 1%-quantile and 50%-quantile regressions of banks' weekly returns, to estimate bank specific VaR at 1% (in distress) and 50% (in the median state), respectively. The estimated coefficients $\hat{\alpha}_{1\%}^i$, $\hat{\gamma}_{1\%}^i$, $\hat{\alpha}_{50\%}^i$, $\hat{\gamma}_{50\%}^i$ capture how a bank's VaR changes depending on the macro-economic states.

To estimate the impact of each bank's loss in distress on the banking system's loss, we use model (A2), 1%-quantile regression of the banking industry weekly return $X_t^{system|i}$ on the state variables, M, and the individual banks' weekly return. $\beta^{system|i}$ captures the impact of bank i on the banking industry.

$$X_t^{system|i} = \alpha^{system|i} + \gamma^{system|i} M_{t-1} + \beta^{system|i} X_t^i + \epsilon_t^{system|i} \qquad \text{(A2)}$$

Then we calculate the VaR and ΔCoVaR for bank i in week t using the predicted values from the above regressions A1 and A2, $VaR_{1\%,t}^i = \hat{\alpha}_{1\%}^i + \hat{\gamma}_{1\%}^i M_{t-1}$, $VaR_{50\%,t}^i = \hat{\alpha}_{50\%}^i + \hat{\gamma}_{50\%}^i M_{t-1}$, and $\Delta CoVaR_{1\%,t} = \hat{\beta}_{1\%}^{system|i}(VaR_{1\%,t}^i - VaR_{50\%,t}^i)$. $VaR_{1\%,t}^i - VaR_{50\%,t}^i$ measures the loss of bank i in week t if it moves from the median state to in distress. $\Delta CoVaR_{1\%,t}$ measures the loss of the banking system in week t conditional on bank i moving from the median state to in distress.

To allow for intertemporal variation of estimated coefficients ($\hat{\alpha}^i_{1\%}$, $\hat{\gamma}^i_{1\%}$, $\hat{\alpha}^i_{50\%}$, $\hat{\gamma}^i_{50\%}$, and $\hat{\beta}^{system|i}_{1\%}$) in model A1 and A2, we estimate the above regressions over an eight-year rolling window for each bank-quarter.[24] For example, we calculate the bank's ΔCoVaR in 2010Q2 using the coefficient estimates based on sample period from 2002Q2 to 2010Q2.

[24] We require at least 104 weekly observations in each eight-year rolling window for estimation.

Table 1: Descriptive Statistics

VARIABLES	(1) N	(2) Mean	(3) SD	(4) 10^{th} Pctl	(5) Median	(6) 90^{th} Pctl
ΔCoVaR	3,670	2.653	1.778	0.173	2.744	4.923
VaR	3,670	11.283	4.302	6.966	10.208	16.899
Future Impairment	3,670	0.109	0.457	0.000	0.000	0.236
Level 3 Assets	3,670	0.488	1.099	0.000	0.029	1.512
Level 2 Assets	3,670	20.040	14.490	5.066	17.762	34.178
Level 1 Assets	3,670	1.384	3.903	0.000	0.051	3.739
Size	3,670	12.588	2.003	10.350	12.292	15.131
Leverage	3,670	89.612	2.582	86.582	89.783	92.487
Market-to-Book Ratio	3,670	0.956	0.471	0.383	0.921	1.535
C&I Loans	3,670	15.668	10.420	5.776	13.295	28.475
Consumer Loans	3,670	4.337	7.911	0.101	1.502	13.458
Real Estate Loans	3,670	73.153	17.897	49.712	77.869	89.999
Beta	3,670	0.894	0.653	-0.021	0.980	1.670
Market Adj. Returns	3,670	0.876	15.581	-15.094	-0.305	17.786
Loans net of Reserves	3,670	62.495	12.945	47.220	64.098	75.957
Intangible Assets	3,670	1.544	1.699	0.000	0.920	3.989
Interconnectedness	3,670	6.025	4.495	1.846	4.748	12.075
Substitutability	3,670	8.529	17.160	0.000	2.779	20.594
Notional Derivatives	3,670	64.783	387.576	0.000	1.428	26.233
Foreign Claims	3,670	0.357	1.558	0.000	0.000	0.316
Foreign Liabilities	3,670	0.798	3.949	0.000	0.000	0.667
Equity	3,670	0.227	0.820	0.000	0.040	0.404
USG	3,670	3.026	3.842	0.000	1.663	8.057
Muni	3,670	3.064	3.662	0.000	1.780	8.504
Agency MBS	3,670	10.934	7.683	1.769	9.846	20.968
Non-Agency MBS	3,670	0.425	0.895	0.000	0.000	1.478
ABS	3,670	0.196	0.705	0.000	0.000	0.559
SFP	3,670	0.070	0.228	0.000	0.000	0.171
10K/Q Readability	3,670	16.010	1.260	14.121	16.239	17.444

Notes: This table presents descriptive statistics for the variables used in the main analyses. All variables are defined in the Appendix.

Table 2: Correlations

Variables	$\Delta CoVaR_{t+4}$	VaR_{t+4}	Future Impairment	Level 3 Assets	Level 2 Assets
$\Delta CoVaR_{t+4}$	1.00				
VaR_{t+4}	-0.19***	1.00			
Future Impairment	0.08***	0.07***	1.00		
Level 3 Assets	0.25***	0.06***	0.20***	1.00	
Level 2 Assets	0.15***	-0.09***	-0.08***	0.33***	1.00
Level 1 Assets	0.17***	-0.07***	0.01	0.24***	0.08***
Size	0.61***	-0.34***	0.07***	0.39***	0.28***
Leverage	-0.29***	0.29***	-0.05***	0.05***	-0.07***
Market-to-book Ratio	0.25***	-0.39***	-0.08***	0.02	0.04***
C&I Loans	0.18***	-0.18***	0.01	0.07***	0.03**
Consumer Loans	0.13***	-0.08***	-0.02	0.16***	0.09***
Real Estate Loans	-0.33***	0.23***	0.01	-0.35***	-0.29***
Beta	0.47***	-0.05***	0.01	0.16***	0.10***
Market Adj. Returns	-0.04**	-0.07***	0.01	0.00	0.01
Loans net of Reserves	-0.24***	0.22***	0.02***	-0.036***	-0.64***
Intangible Assets	0.41***	-0.24***	0.06***	0.13***	0.01
Interconnectedness	0.01	0.15***	0.11***	0.06***	-0.14***
Substitutability	0.25***	-0.18***	-0.04***	0.24***	0.23***
Notional Derivatives	0.25***	-0.02	0.02	0.45***	0.63***
Foreign Claims	0.23***	-0.08***	0.03	0.28***	0.28***
Foreign Liabilities	0.20***	-0.06***	0.06***	0.27***	0.31***
Equity	0.22***	-0.07***	0.02	0.43***	0.39***
USG	-0.14***	-0.04**	-0.02	-0.01	0.17***
Muni	-0.10***	-0.17***	-0.11***	-0.13***	0.30***
Agency MBS	0.09***	-0.02	-0.10***	0.02	0.47***
Non-Agency MBS	0.11***	-0.07***	0.08***	0.24***	0.20***
ABS	0.12***	-0.04***	-0.01	0.27***	0.18***
SFP	0.12***	-0.02	0.29***	0.36***	0.18***
10K/Q Readability	0.12***	-0.22***	-0.04***	0.16***	0.15***

Notes: This table presents correlation coefficients between the main variables of interest (ΔCoVaR, VaR, Future Impairment, Level 3 Assets, and Level 2 Assets) and all other variables used in the main analysis. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in the Appendix.

Table 3: The associations between level 3 assets, transparency, future impairment, and VaR.

VARIABLES	(1) Future Impairment	(2) VaR_{t+4}
Level 3 AFS	**0.149****	
	(0.035)	
Level 2 AFS	**-0.008**	
	(0.114)	
ASU*Level 3 AFS	**-0.131****	
	(0.017)	
ASU*Level 2 AFS	**0.007****	
	(0.015)	
Level 1 AFS	-0.008	
	(0.104)	
Level 3 Assets		**0.250****
		(0.020)
Level 2 Assets		**-0.011**
		(0.220)
ASU*Level 3 Assets		**-0.276*****
		(0.003)
ASU*Level 2 Assets		**0.005**
		(0.461)
Level 1 Assets		-0.012
		(0.544)
Size	-0.011	-0.145
	(0.860)	(0.780)
VaR	0.002	
	(0.460)	
Leverage	-0.013	0.079
	(0.225)	(0.186)
Market-to-book Ratio	0.043	-0.394
	(0.480)	(0.469)
C&I Loans	0.000	0.042
	(0.910)	(0.112)
Consumer Loans	0.003	0.033*
	(0.205)	(0.093)
Real Estate Loans	-0.002	0.039*
	(0.580)	(0.030)
Beta	0.001	0.056
	(0.949)	(0.489)
Market Adj. Returns	-0.000	0.002
	(0.348)	(0.188)
Loans net of Reserves	-0.000	-0.023
	(0.962)	(0.213)
Intangible Assets	-0.015	-0.214
	(0.779)	(0.284)
Interconnectedness	-0.004	-0.009
	(0.354)	(0.681)
Substitutability	0.001	-0.004

	(0.411)	(0.187)
Notional Derivatives	-0.000***	0.001
	(0.001)	(0.553)
Foreign Claims	-0.012	-0.219**
	(0.591)	(0.030)
Foreign Liabilities	0.013	0.111
	(0.411)	(0.301)
Equity	0.001	-0.070
	(0.957)	(0.552)
USG	0.007	0.013
	(0.358)	(0.703)
Muni	-0.003	-0.110**
	(0.556)	(0.016)
Agency MBS	0.003	0.011
	(0.625)	(0.589)
Non-Agency MBS	0.096***	-0.130
	(0.001)	(0.242)
ABS	0.001	-0.076
	(0.951)	(0.694)
SFP	0.036	0.231
	(0.563)	(0.639)
10K/Q Readability	-0.005	0.095
	(0.830)	(0.227)
P-value of difference between level 2 & level 3	.028	.016
P-value of difference between ASU*level 2 & ASU*level 3	.013	.003
Observations	3,670	3,670
Adjusted R-squared	0.706	0.924
FIRM FE	YES	YES
QTR FE	YES	YES

Notes: This table presents the results of estimating modified versions of equations (1). Column (1) presents the results using forward *Future Impairment* as the dependent variable. The independent variables of interest in Column (1) are *Level 3 AFS, Level 2 AFS,* and their interactions with *ASU. Level 3(2) AFS* is equal to the amount of level 3(2) AFS measured at fair value on a recurring basis scaled by total assets. Column (2) presents the results using *VaR* as the dependent variable. The independent variable of interest in column (2) are *Level 3 Assets, Level 2 Assets,* and their interactions with *ASU. Level 3(2) Assets* is equal to the amount of level 3(2) assets measured at fair value on a recurring basis scaled by total assets. All variables are defined in the Appendix. Both columns include firm and quarter fixed effects. The numbers in parentheses are p-values. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4: The association between level 3 assets, transparency, and ΔCoVaR

VARIABLES	$\Delta CoVaR_{t+4}$	
	Coeff	*p-value*
Level 3 Assets	**0.100*** **	***(0.001)***
Level 2 Assets	**0.000**	***(0.940)***
ASU*Level 3 Assets	**-0.125*** **	***(0.000)***
ASU*Level 2 Assets	**0.002**	***(0.431)***
Level 1 Assets	-0.010	*(0.220)*
Size	0.256**	*(0.034)*
VaR	0.018***	*(0.005)*
Leverage	-0.020	*(0.317)*
Market-to-book Ratio	-0.406***	*(0.002)*
C&I Loans	0.017**	*(0.034)*
Consumer Loans	-0.000	*(0.975)*
Real Estate Loans	0.014**	*(0.024)*
Beta	0.070***	*(0.001)*
Market Adj. Returns	-0.001	*(0.164)*
Loans net of Reserves	0.005	*(0.486)*
Intangible Assets	0.019	*(0.710)*
Interconnectedness	0.005	*(0.486)*
Substitutability	-0.001	*(0.303)*
Notional Derivatives	0.000	*(0.651)*
Foreign Claims	-0.059*	*(0.100)*
Foreign Liabilities	-0.024	*(0.478)*
Equity	-0.006	*(0.899)*
USG	0.003	*(0.816)*
Muni	0.026	*(0.155)*
Agency MBS	-0.006	*(0.539)*
Non-Agency MBS	-0.005	*(0.900)*
ABS	0.025	*(0.700)*
SFP	0.072	*(0.904)*
10K/Q Readability	0.084***	*(0.001)*
P-value of difference between level 2 & level 3	.0016	
P-value of difference between ASU*level 2 & ASU*level 3	.0002	
Observations	3,791	
Adjusted R-squared	0.938	
FIRM FE	YES	
QTR FE	YES	

Notes: This table presents the results of estimating equation (1) where *ΔCoVaR* is the dependent variable. The independent variables of interest are *Level 3 Assets, Level 2 Assets,* and their interactions with *ASU. Level 3(2) Assets* is equal to the amount of level 3(2) assets measured at fair value on a recurring basis scaled by total assets. All variables are defined in the Appendix. This specification includes firm and quarter fixed effects. The numbers in parentheses are p-values. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Cross-sectional effects on the association between level 3 assets, transparency, and ΔCoVaR

	High Repo	Low Repo
	(1)	(2)
VARIABLES	$\Delta CoVaR_{t+4}$	$\Delta CoVaR_{t+4}$
Level 3 Assets	0.132***	0.020
	(0.001)	(0.653)
Level 2 Assets	-0.001	-0.001
	(0.703)	(0.945)
ASU*Level 3 Assets	-0.127***	-0.057
	(0.000)	(0.223)
ASU*Level 2 Assets	0.002	0.007
	(0.511)	(0.198)
Level 1 Assets	-0.004	-0.014
	(0.795)	(0.474)
Additional Controls	Yes	Yes
P-value of difference between level 2 & level 3	0.001	0.649
P-value of difference between ASU*level 2 & ASU*level 3	0.001	0.189
P-value of difference between level 3 (across subsamples)$^{+}$	0.046	
P-value of difference between ASU*level 3 (across subsamples)$^{+}$	0.089	
Observations	1,833	1,819
Adjusted R-squared	0.949	0.933
FIRM FE	YES	YES
QTR FE	YES	YES

Notes: Table 5 presents the results of separately estimating equation (1) for low versus high repo banks. Column (1) presents the results for high repo banks using ΔCoVaR as the dependent variable, while column (2) presents the results for low repo banks using ΔCoVaR as the dependent variable. *High* and *Low Repo* are indicator variables where *High Repo* is equal to 1(0) if a bank's repo liabilities (scaled by liquid assets) is higher (lower) than the median repo liabilities. The independent variables of interest are *Level 3 Assets, Level 2 Assets,* and their interactions with *ASU. Level 3(2) Assets* is equal to the amount of level 3(2) assets measured at fair value on a recurring basis scaled by total assets. All variables are defined in the Appendix. $^{+}$represents one-tailed p-value. Both columns include firm and quarter fixed effects. The numbers in parentheses are p-values. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6: The association between level 3 derivative assets, level 3 non-agency ABS, transparency, and ΔCoVaR

VARIABLES	(1) $\Delta CoVaR_{t+4}$	(2) $\Delta CoVaR_{t+4}$
Level 3 Derivatives	2.407***	
	(0.000)	
Level 2 Derivatives	-0.018**	
	(0.039)	
ASU*Level 3 Derivatives	-1.549*	
	(0.060)	
ASU*Level 2 Derivatives	0.020*	
	(0.083)	
Level 1 Derivatives	-0.965	
	(0.109)	
Level 3 Non-Agency ABS		0.553***
		(0.001)
Level 2 Non-Agency ABS		-0.007
		(0.270)
ASU*Level 3 Non-Agency ABS		-0.582***
		(0.000)
ASU*Level 2 Non-Agency ABS		0.004
		(0.485)
Level 1 Assets		-0.011
		(0.190)
Additional Controls	Yes	Yes
P-value of difference between level 2 & level 3	0.001	0.001
P-value of difference between ASU*level 2 & ASU*level 3	0.060	0.001
Observations	3,670	3,258
Adjusted R-squared	0.939	0.935
FIRM FE	YES	YES
QTR FE	YES	YES

Notes: This table presents the results of separately estimating two amended versions of equation (1). Column (1) and (2) both have ΔCoVaR as the dependent variable. The independent variables of interest are *Level 3 Derivatives, Level 2 Derivatives,* and their interactions with ASU in column (1) and *Level 3 Non-Agency ABS, Level 2 Non-Agency ABS,* and their interactions with ASU in column (2). *Level 3 Derivatives (Level 2 Derivatives)* is equal to the amount of level 3 (level 2) derivatives measured at fair value on a recurring basis scaled by total assets. *Level 3 Non-Agency ABS (Level 2 Non-Agency ABS)* is equal to the amount of level 3 (level 2) non-agency ABS measured at fair value on a recurring basis scaled by total assets. All variables are defined in the Appendix. Both columns include firm and quarter fixed effects. The numbers in parentheses are p-values. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: The cross-sectional effect of disclosure on the association between level 3 assets and impairment, VaR, and ΔCoVaR

Panel A1: High versus Low Disclosure Quality Subsample Analysis - Impairment

	High Quality		Low Quality
	(1)		(2)
VARIABLES	Impairment		Impairment
Level 3 AFS	0.145*		0.115
	(0.077)		(0.142)
Level 2 AFS	-0.001		-0.000
	(0.442)		(0.0.959)
ASU*Level 3 AFS	-0.136***		-0.012
	(0.005)		(0.882)
ASU*Level 2 AFS	0.005		0.002
	(0.144)		(0.350)
Level 1 AFS	-0.008		0.003
	(0.496)		(0.602)
Additional Controls	Yes		Yes
P-value of difference between level 2 & level 3	0.075		0.132
P-value of difference between ASU*level 2 & ASU*level 3	0.005		0.857
P-value of difference between level 3 (across subsamples)		0.781	
P-value of difference between ASU*level 3 (across subsamples)+		0.093	
Observations	1024		966
Adjusted R-squared	0.825		0.817
FIRM FE	YES		YES
QTR FE	YES		YES

Panel A2: High versus Low Disclosure Quality Matched-Sample Analysis - Impairment

	High Quality		Low Quality
	(1)		(2)
VARIABLES	Impairment		Impairment
Level 3 AFS	0.233**		0.058
	(0.044)		(0.120)
Level 2 AFS	-0.007		-0.009
	(0.204)		(0.248)
ASU*Level 3 AFS	-0.220***		-0.074**
	(0.000)		(0.012)
ASU*Level 2 AFS	0.003		0.003**
	(0.356)		(0.012)
Level 1 AFS	-0.008		-0.012
	(0.390)		(0.152)
Additional Controls	Yes		Yes
P-value of difference between level 2 & level 3	0.040		0.059
P-value of difference between ASU*level 2 & ASU*level 3	<0.001		0.009
P-value of difference between level 3 (across subsamples)		0.144	
P-value of difference between ASU*level 3 (across subsamples)$^{+}$		0.006	
Observations	570		570
Adjusted R-squared	0.798		0.920
FIRM FE	YES		YES
QTR FE	YES		YES

Notes: Table 7 Panel A1 presents the results of separately estimating equation (1) for firms with some valuation disclosures versus those with no valuation disclosures. Column (1) presents the results for banks with some valuation disclosures (i.e., *High Quality*) using impairment as the dependent variable, while column (2) presents the results for banks with no valuation disclosures (i.e., *Low Quality*) using impairment as the dependent variable. Panel A2 presents the results of matching high quality disclosure banks with low quality disclosure banks (with replacement) on size, repo liability, level 3 available-for-sale securities terciles. Both columns include firm and quarter fixed effects. The numbers in parentheses are p-values. $^{+}$ represents one-tailed p-value. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel B1: High versus Low Disclosure Quality Subsample Analysis - VaR

	High Quality	Low Quality
	(1)	(2)
VARIABLES	VaR_{t+4}	VaR_{t+4}
Level 3 Assets	0.265***	0.165
	(0.007)	(0.412)
Level 2 Assets	-0.025	0.051
	(0.202)	(0.112)
ASU*Level 3 Assets	-0.317***	0.092
	(0.007)	(0.454)
ASU*Level 2 Assets	-0.000	0.001
	(0.993)	(0.967)
Level 1 Assets	0.000	0.084**
	(0.991)	(0.013)
Additional Controls	Yes	Yes
P-value of difference between level 2 & level 3	0.005	0.585
P-value of difference between ASU*level 2 & ASU*level 3	0.008	0.497
P-value of difference between level 3 (across subsamples)	0.241	
P-value of difference between ASU*level 3 (across subsamples)$^{+}$	0.002	
Observations	1024	966
Adjusted R-squared	0.950	0.950
FIRM FE	YES	YES
QTR FE	YES	YES

Panel B2: High versus Low Disclosure Quality Matched-Sample Analysis - VaR

	High Quality	Low Quality
	(1)	(2)
VARIABLES	VaR_{t+4}	VaR_{t+4}
Level 3 Assets	0.203*	0.035
	(0.098)	(0.840)
Level 2 Assets	0.005	0.080
	(0.776)	(0.185)
ASU*Level 3 Assets	-0.499***	0.236*
	(0.001)	(0.098)
ASU*Level 2 Assets	0.006	-0.031*
	(0.580)	(0.051)
Level 1 Assets	0.066**	0.130*
	(0.032)	(0.075)
Additional Controls	Yes	Yes
P-value of difference between level 2 & level 3	0.128	0.814
P-value of difference between ASU*level 2 & ASU*level 3	0.001	0.081
P-value of difference between level 3 (across subsamples)	0.422	
P-value of difference between ASU*level 3 (across subsamples)$^{+}$	<0.001	
Observations	725	725
Adjusted R-squared	0.954	0.956
FIRM FE	YES	YES
QTR FE	YES	YES

Notes: Table 7 Panel B1 presents the results of separately estimating equation (1) for firms with some valuation disclosures versus those with no valuation disclosures. Column (1) presents the results for banks with some valuation disclosures (i.e., *High Quality*) using VaR as the dependent variable, while column (2) presents the results for banks with no valuation disclosures (i.e., *Low Quality*) using VaR as the dependent variable. Panel B2 presents the results of matching high quality disclosure banks with low quality disclosure banks (with replacement) on size and level 3 assets, and repo liability terciles. Both columns include firm and quarter fixed effects. The numbers in parentheses are p-values. $^{+}$ represents one-tailed p-value. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel C1: High versus Low Disclosure Quality Subsample Analysis - ΔCoVaR

	High Quality		Low Quality
	(1)		(2)
VARIABLES	$\Delta CoVaR_{t+4}$		$\Delta CoVaR_{t+4}$
Level 3 Assets	0.091***		0.132**
	(0.000)		(0.040)
Level 2 Assets	0.008		0.043**
	(0.442)		(0.015)
ASU*Level 3 Assets	-0.115***		-0.046
	(0.008)		(0.194)
ASU*Level 2 Assets	0.002		0.003
	(0.497)		(0.503)
Level 1 Assets	0.011		0.026
	(0.576)		(0.211)
Additional Controls	Yes		Yes
P-value of difference between level 2 & level 3	0.0011		0.1260
P-value of difference between ASU*level 2 & ASU*level 3	0.0083		0.2045
P-value of difference between level 3 (across subsamples)		0.536	
P-value of difference between ASU*level 3 (across subsamples)+		0.101	
Observations	983		764
Adjusted R-squared	0.946		0.950
FIRM FE	YES		YES
QTR FE	YES		YES

Panel C2: High versus Low Disclosure Quality Matched-Sample Analysis - ΔCoVaR

	High Quality	Low Quality
	(1)	(2)
VARIABLES	$\Delta CoVaR_{t+4}$	$\Delta CoVaR_{t+4}$
Level 3 Assets	0.075	0.092
	(0.110)	(0.276)
Level 2 Assets	0.007	0.075***
	(0.496)	(0.000)
ASU*Level 3 Assets	-0.206***	-0.050
	(0.002)	(0.366)
ASU*Level 2 Assets	0.007*	-0.004
	(0.065)	(0.372)
Level 1 Assets	0.021	0.100***
	(0.334)	(0.000)
Additional Controls	Yes	Yes
P-value of difference between level 2 & level 3	0.159	0.846
P-value of difference between ASU*level 2 & ASU*level 3	0.002	0.427
P-value of difference between level 3 (across subsamples)	0.857	
P-value of difference between ASU*level 3 (across subsamples)$^{+}$	0.034	
Observations	725	725
Adjusted R-squared	0.949	0.966
FIRM FE	YES	YES
QTR FE	YES	YES

Notes: Table 7 Panel C1 presents the results of separately estimating equation (1) for firms with some valuation disclosures versus those with no valuation disclosures. Column (1) presents the results for banks with some valuation disclosures (i.e., *High Quality*) using ΔCoVaR as the dependent variable, while column (2) presents the results for banks with no valuation disclosures (i.e., *Low Quality*) using ΔCoVaR as the dependent variable. Panel C2 presents the results of matching high quality disclosure banks with low quality disclosure banks (with replacement) on size, level 3 assets, and repo liability terciles. Both columns include firm and quarter fixed effects. The numbers in parentheses are p-values. $^{+}$ represents one-tailed p-value. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8: The association between impairment and repo liabilities or security sales

Panel A: Repo liabilities

VARIABLES	(1) Repo
Impairment	-0.127***
	(0.003)
Size	0.181
	(0.146)
Market Adj. Returns	-0.015
	(0.302)
Additional Controls	Yes
Observations	3,783
Adjusted R-squared	0.931
FIRM FE	YES
QTR FE	YES

Notes: This panel presents the results of regressing repo liabilities (scaled by total liabilities) on *Impairment* and control variables. The independent variable of interest is *Impairment* which is defined as the amount of other than temporary impairments of held-to-maturity and available-for-sale securities during a quarter divided by beginning of quarter total available-for-sale and held-to-maturity securities. All variables are defined in the Appendix. This specification includes firm and quarter fixed effects. The numbers in parentheses are p-values. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel B: Security Sales

		High Repo	Low Repo
	(1)	(2)	(3)
VARIABLES	Sale	Sale	Sale
Impairment	0.050**	0.190**	0.048**
	(0.031)	(0.047)	(0.036)
Size	-0.011	-0.086	0.007
	(0.684)	(0.142)	(0.007)
Market Adj. Returns	-0.007	-0.011*	-0.002
	(0.104)	(0.081)	(0.730)
Additional Controls	Yes	Yes	Yes
P-value of difference between impairment (across subsamples)$^{+}$		.076	
Observations	3,783	1,879	1,886
Adjusted R-squared	0.356	0.337	0.360
FIRM FE	YES	YES	YES
QTR FE	YES	YES	YES

Notes: This panel presents the results of regressing a *Sale* indicator on *Impairment* and other control variables. The dependent variable, *Sale,* is an indicator variable that is equal to 1 if a bank realizes net gains or losses from sales of held-to-maturity and available-for-sale securities during a quarter. The independent variable of interest is *Impairment* which is defined as the amount of other than temporary impairments of held-to-maturity and available-for-sale securities during a quarter divided by beginning of quarter total available-for-sale and held-to-maturity securities. Column (1) presents the sample wide results. Column (2) and (3) present the results when separately estimating the regression for high versus low repo banks, respectively. *High* and *Low Repo* are indicator variables where *High Repo* is equal to 1(0) if a bank's repo liabilities (scaled by liquid assets) are higher (lower) than the median repo liabilities. All variables are defined in the Appendix. $^{+}$represents one-tailed p-value. All columns include firm and quarter fixed effects. The numbers in parentheses are p-values. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Comovement between bank impairment, security sales and the industry average

Panel A: Impairment co-movement

	Pre-ASU	Post-ASU
	(1)	(2)
VARIABLES	Impairment	Impairment
Industry Impairment Average	1.584**	0.893**
	(0.011)	(0.008)
Size	-0.000	0.000
	(0.936)	(0.447)
Market Adj. Returns	-0.000	0.000
	(0.117)	(0.497)
Additional Controls	Yes	Yes
P-value of difference between impairment (across subsamples)$^{+}$	.084	
Observations	1,909	1,747
Adjusted R-squared	0.562	0.302
FIRM FE	YES	YES
QTR FE	NO	NO

Notes: Table 9 Panel A panel presents the results of regressing *Impairment* on *Industry Impairment Average* and other control variables. The dependent variable, *Impairment,* is the current quarter impairment (BHCKJ321) scaled by the book value of held-to-maturity and available-for-sale securities. The independent variable of interest is *Industry Impairment Average* which is defined as the value-weighted amount of other than temporary impairments of held-to-maturity and available-for-sale securities during a quarter divided by beginning of quarter total available-for-sale and held-to-maturity securities. Column (1) presents the pre-ASU sample results. Column (2) presents the post-ASU sample results. All variables are defined in the Appendix. $^{+}$represents one-tailed p-value. All columns include firm fixed effects. The numbers in parentheses are p-values. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel B: Security sales co-movement

	Pre-ASU	Post-ASU
	(1)	(2)
VARIABLES	Security Sales	Security Sales
Industry Security Sales Average	1.220***	0.852***
	(0.000)	(0.000)
Size	-0.035	0.109
	(0.338)	(0.150)
Market Adj. Returns	-0.000	-0.000
	(0.210)	(0.322)
Additional Controls	Yes	Yes
P-value of difference between impairment (across subsamples)$^{+}$	.005	
Observations	1,852	1,682
Adjusted R-squared	0.252	0.358
FIRM FE	YES	YES
QTR FE	NO	NO

Notes: Table 9 Panel B panel presents the results of regressing *Security Sales* on *Industry Security Sales Average* and other control variables. The dependent variable, *Security Sales,* is the proceeds from sale of available-for-sale securities divided by the book value of available-for-sale securities. The independent variable of interest is *Industry Security Sales Average* which is defined as the value-weighted amount of the proceeds from sale of available-for-sale securities divided by beginning of quarter total available-for-sale securities. Column (1) presents the pre-ASU sample results. Column (2) presents the post-ASU sample results. All variables are defined in the Appendix. $^{+}$represents one-tailed p-value. All columns include firm fixed effects. The numbers in parentheses are p-values. Standard errors are clustered by firm. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.