# Level 3 Fair Value Measurement and Systemic Risk

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## Research questions

Does level 3 fair value measurement build up the systemic risk during the non-crisis period? If so, does financial reporting transparency mitigate such buildup?

## Motivation

- **Management discretion of level 3 fair value measurement**

FR Y-15 Instructions: Level 3 fair value measurement inputs reflect the **banking organization's own assumptions** about the assumptions that a market participant would use in pricing an asset (or liability).

European Systemic Risk Board: levels 2 or 3, especially level 3, discretion **gives rise to over-valuation and information asymmetry**, root of spillover and systemic risk.

**Schedule D—Complexity Indicators**

| Notional Amount of Over-the-Counter (OTC) Derivative Contracts (U.S. Dollar Amounts in Thousands) | RISK | Amount | |
|---|---|---|---|
| 1. OTC derivative contracts cleared through a central counterparty | M409 | | 1. |
| 2. OTC derivative contracts settled bilaterally | M410 | | 2. |
| 3. Total notional amount of OTC derivative contracts (sum of items 1 and 2) | M411 | | 3. |

| Trading and Available-for-Sale (AFS) Securities (U.S. Dollar Amounts in Thousands) | RISK | Amount | |
|---|---|---|---|
| 4. Trading securities | M412 | | 4. |
| 5. AFS securities | 1773 | | 5. |
| 6. Total trading and AFS securities (sum of items 4 and 5) | M414 | | 6. |
| 7. Trading and AFS securities that meet the definition of level 1 liquid assets | N510 | | 7. |
| 8. Trading and AFS securities that meet the definition of level 2 liquid assets, with haircuts | N511 | | 8. |
| 9. Total adjusted trading and AFS securities (item 6 minus items 7 and 8) | N255 | | 9. |
| **Level 3 Assets** | | | |
| 10. Assets valued for accounting purposes using Level 3 measurement inputs | G506 | | 10. |

- **Prior accounting research**
  - Fair value accounting is unlikely to induce procyclicality via the regulatory capital channel
  - Level 2 assets use common market inputs for valuation and more likely to contribute to procyclicality
  - Level 3 assets is relatively small to total assets, and further, the managerial discretion in level 3 measurement contain private information and can reduce its contribution to procyclicality.
  - The lack of transparency in level 3 valuation inputs can exacerbate over-valuation and loss hoarding, which leads to significant liquidity shock across the market when there is an adverse event.

Prior research on fair value and procyclicality mainly focus on the regulatory channel and provides mixed evidence. No prior research has examined the role of level 3 fair value in the context of systemic risk.

## Background and Descriptive statistics

- **Fair value measurement regime**

Fair value is aimed to estimate the price at which an asset/liability can be transacted between market participants in an orderly manner. Based on whether a market exists for the asset/liability and how active the market is, assets and liabilities are classified into the following three levels.

- Level 1: quoted prices in active markets
- Level 2: observable inputs other than level 1 inputs
- Level 3: unobservable inputs
- 78% of sample banks use repo for short-term funding.
- Most of the sample banks use bilateral repos to borrow from wholesale funding providers such as FHLB or retail lenders.

Repo collateral
- Treasury, agency MBS (L2)
- ABS (L2 or L3)
- Municipal bonds (L2 or L3)
- Non-agency MBS (L2 or L3)
- MSR (L3)

- **Research setting**

ASU 2011-04 requires entities which develop quantitative unobservable inputs in measuring fair value to disclose these unobservable inputs. (E.g. JP Morgan's 10-K filing)

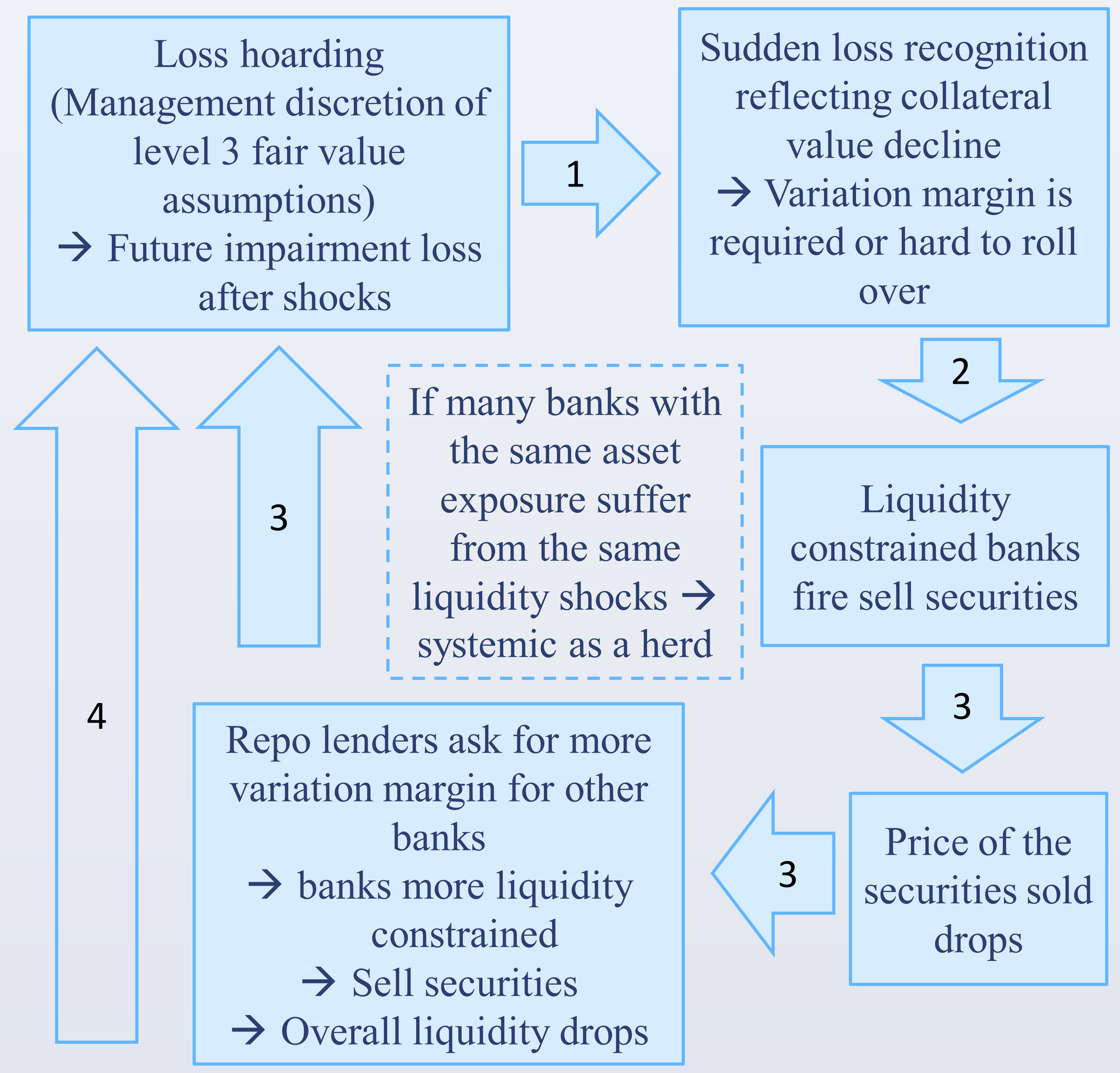
**Level 3 inputs[(a)]**

December 31, 2012 (in millions, except for ratios and basis points)

| Product/Instrument | Fair value | Principal valuation technique | Unobservable inputs | Range of input values | Weighted average |
|---|---|---|---|---|---|
| Residential mortgage-backed securities and loans | $ 9,836 | Discounted cash flows | Yield | 4 % - 20% | 7% |
| | | | Prepayment speed | 0 % - 40% | 6% |
| | | | Conditional default rate | 0 % - 100% | 10% |
| | | | Loss severity | 0 % - 95% | 15% |

## Framework & Evidences

- **Loss hoarding – Impairment - Liquidity Shock Loop**




Disclosure may discipline discretion and loss hoarding. Truthful valuation can reflect early small losses and have a smaller shock to liquidity.

- **Validation**

Level 3 assets is associated with future impairment and the bank's future tail risk, measured in VaR. Such association is not longer significant economically or statistically after the transparency rule.

| VARIABLES | Future Impairment |
|---|---|
| Level 3 AFS | 0.149** |
| Level 2 AFS | -0.008 |
| ASU*Level 3 AFS | -0.131** |
| ASU*Level 2 AFS | 0.007** |
| Level 1 AFS | -0.008 |
| Observations | 3,670 |
| Adj. R-squared | 0.706 |

| VARIABLES | $VaR_{t+4}$ |
|---|---|
| Level 3 Assets | 0.250** |
| Level 2 Assets | -0.011 |
| ASU*Level 3 Assets | -0.276*** |
| ASU*Level 2 Assets | 0.005 |
| Level 1 Assets | -0.012 |
| Observations | 3,670 |
| Adj. R-squared | 0.924 |

- **1: Impairment → repo borrowing ↓**

First, we show that impairment is associated with a reduction in repo borrowing. In our non-crisis sample period, a 99th percentile impairment loss is associated with a **9.1%** decrease in repo liabilities for a bank with a median repo size.

| VARIABLES | Repo |
|---|---|
| Impairment | -0.127*** |
| Observations | 3783 |
| Adj. R-squared | 0.931 |

**Notes for all tables in this poster:**

1. $^{+}$ one-side test (across-sample)
2. Significance level: * p<0.1, ** p<0.05, *** p<0.01
3. All regressions include firm and year fixed effects, except for impairment/security sale co-movement results, which does not have year fixed effect.
4. Control variables are not listed.

- **2: Liquidity constrained → fire sell securities**

Then, we show that liquidity constrained banks are more affected and sell more securities as impairment occurs. Liquidity is measured using repo to liquid asset ratio.

| SAMPLES | Whole sample | High Repo/liquid assets | Low Repo/liquid assets |
|---|---|---|---|
| VARIABLES | Security Sale | Security Sale | Security Sale |
| Impairment | 0.050** | 0.190*** | 0.048** |
| Impairment $^{+}$ | | p-value = 0.076 | |
| Observations | | 1,879 | 1,886 |
| Adj. R-squared | | 0.337 | 0.360 |

- **3: Impairment co-movement and security sales co-movement**

Next, we show evidence that multiple banks take the impairment and sell securities simultaneously (co-movement), and these co-movements dropped significantly after the transparency rule of level 3 fair value measurement.

| SAMPLES / VARIABLES | Pre-ASU Impairment | Post-ASU Impairment |
|---|---|---|
| Impairment Average | 1.584*** | 0.893** |
| Impairment $^{+}$ | p-value = 0.084 | |
| Observations | 1,909 | 1,747 |
| Adj. R-squared | 0.562 | 0.302 |

| SAMPLES / VARIABLES | Pre-ASU Security Sales | Post-ASU Security Sales |
|---|---|---|
| Security Sales Average | 1.220*** | 0.852*** |
| Impairment $^{+}$ | p-value = 0.005 | |
| Observations | 1,852 | 1,682 |
| Adj. R-squared | 0.252 | 0.358 |

- **4: Disclosure mitigates loss hoarding and future impairment**

Then, we show that disclosure of level 3 fair value assumptions mitigate the loss hoarding and impairment.

The two tables on the right show that banks with a high-quality disclosure of level 3 assumptions also have a larger decrease in the association between level 3 assets and future impairment and tail risks.

| SAMPLES | High Quality | Low Quality |
|---|---|---|
| VARIABLES | Future Impairment | Future Impairment |
| Level 3 AFS | 0.145* | 0.115 |
| Level 2 AFS | -0.001 | -0.000 |
| ASU*Level 3 AFS | -0.136*** | -0.012 |
| ASU*Level 2 AFS | 0.005 | 0.002 |
| Level 1 AFS | -0.008 | 0.003 |
| Level 3 $^{+}$ | p-value = 0.781 | |
| ASU*Level 3 $^{+}$ | p-value = 0.093 | |
| Observations | 1,024 | 966 |
| Adj. R-squared | 0.825 | 0.817 |

| SAMPLES | High Quality | Low Quality |
|---|---|---|
| VARIABLES | $VaR_{t+4}$ | $VaR_{t+4}$ |
| Level 3 Assets | 0.265*** | 0.165 |
| Level 2 Assets | -0.025 | 0.051 |
| ASU*Level 3 Assets | -0.317*** | 0.092 |
| ASU*Level 2 Assets | -0.000 | 0.001 |
| Level 1 Assets | 0.000 | 0.084** |
| Level 3 $^{+}$ | p-value = 0.241 | |
| ASU*Level 3 $^{+}$ | p-value = 0.002 | |
| Observations | 1,024 | 966 |
| Adj. R-squared | 0.950 | 0.950 |

- **Finally, we provide evidence that level 3 fair value measurement contributes to systemic risks.**

| VARIABLES | $\Delta CoVaR_{t+4}$ |
|---|---|
| Level 3 Assets | 0.100*** |
| Level 2 Assets | 0.000 |
| ASU*Level 3 Assets | -0.125*** |
| ASU*Level 2 Assets | 0.002 |
| Level 1 Assets | -0.010 |
| Observations | 3,791 |
| Adj. R-squared | 0.938 |

Level 3 fair value measurement's contribution to systemic risks concentrates among liquidity constrained banks

| SAMPLES | High Repo/liquid assets | Low Repo/liquid assets |
|---|---|---|
| VARIABLES | $\Delta CoVaR_{t+4}$ | $\Delta CoVaR_{t+4}$ |
| Level 3 Assets | 0.132*** | 0.020 |
| Level 2 Assets | -0.001 | -0.001 |
| ASU*Level 3 Assets | -0.127*** | -0.057 |
| ASU*Level 2 Assets | 0.002 | 0.007 |
| Level 1 Assets | -0.004 | -0.014 |
| Level 3 $^{+}$ | p-value = 0.046 | |
| ASU*Level 3 $^{+}$ | p-value = 0.089 | |
| Observations | 1,833 | 1,819 |
| Adj. R-squared | 0.949 | 0.933 |

Disclosure of level 3 valuation assumptions help mitigate such contributions to systemic risks.

| SAMPLES | High Quality | Low Quality |
|---|---|---|
| VARIABLES | $\Delta CoVaR_{t+4}$ | $\Delta CoVaR_{t+4}$ |
| Level 3 Assets | 0.091*** | 0.132*** |
| Level 2 Assets | 0.008 | 0.043** |
| ASU*Level 3 Assets | -0.115*** | -0.046 |
| ASU*Level 2 Assets | 0.002 | 0.003 |
| Level 1 Assets | 0.011 | 0.026 |
| Level 3 $^{+}$ | p-value = 0.536 | |
| ASU*Level 3 $^{+}$ | p-value = 0.101 | |
| Observations | 983 | 764 |
| Adj. R-squared | 0.946 | 0.950 |

## Conclusions

We find a positive association between Level 3 and systemic risk buildup when level 3 accounting is opaque

1. This is not observed for level 2 assets
2. This finding association declines after ASU 2011-04 that requires more disclosure on level 3 valuation
3. The same decline is concentrated for banks with liquidity concerns
4. Same finding after holding the asset category constant.

## Contact

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Latest: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4180600

## Terminology and Variable Definition

- ΔCoVaR: conditional value-at-risk
- ABS: asset-backed securities
- AFS: available-for-sale securities, scaled by total assets
- ASU: An indicator variable, 1 for 2012/2013 and 0 for 2010/2011.
- MSR: mortgage servicing rights
- repo: securities sold under agreements to repurchase scaled by total assets
- VaR: value-at-risk