Lecture notes on risk management, public policy, and the financial system

Regulatory capital and liquidity standards

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Capital and liquidity standards for banks

- Capital standards and the global financial crisis
- Key components of capital standards
- Credit risk capital
- Market risk capital
- Current state of capital standards

Economics of capital rules

Regulatory stress tests

Regulatory liquidity standards for banks

Money market mutual fund regulation

Pre-crisis evolution of international capital standards

1974 Committee on Banking Regulations and Supervisory Practices set up by G10 governors

1975 The Concordat: Report on the supervision of banks' foreign establishments

1988 Basel Capital Accord (or the Accord)

- First international supervisory agreement
- But statutory implementation only by national authorities

1996 Market Risk Amendment to the Capital Accord

- First use of internal models to compute risk weights

2004 Basel II Revised Framework: model-based credit risk measurement

Post-crisis capital standard revisions

2009 "Basel 2.5": revised market risk, treatment of securitizations

2010–2019 Basel III revisions

- Increase in minimum capital
- Introduction of leverage-based charges
- Introduction of liquidity charges
- Additional requirements for large banks

2013 Fundamental review of the trading book (FRTB): revision of market risk capital rules initiated

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"Basel III Endgame" ongoing US implementation

Objectives of post-crisis capital standard revisions

- Objectives in conflict, and not necessarily met
- Above all: higher minimum required quantity of capital, especially for large banks, to reduce failure probability
- Higher quality, loss absorbency of capital, i.e. capacity to absorb losses without inducing run-like behaviors
- Reduce likelihood of crisis and bailing out or unwinding failing intermediaries
  - Reduce divergence of social and private cost of capital funding
  - Avoid taxpayer cost of bailouts
- Reduce complexity, especially in models used to compute RWA
- Capture previously neglected risks, e.g. securitization, counterparty risk
- Global cooperation
  - Reduce variations across institutions and jurisdictions in how rules interpreted
  - Without prescriptive, detailed prescriptive rules

Quantifying regulatory capital standards

- Standards defined as *minimum ratios*
  - With detailed definitions of numerator (capital) and denominator (assets)
- Numerator is the **quantity of capital:** certain liabilities issued by the bank
  - Distinguished by type or **quality of capital**
  - Recognition of **regulatory capital instruments** other than common equity, raising question of
  - **Loss absorbency:** can losses be imposed on the liability—in crisis or at "point of non-viability"—without jeopardizing financial stability?
    - Concern reflects crisis experience: banks received public support while limiting losses to some regulatory capital instruments
    - Standards set out categories of loss absorbency and criteria for acceptance of a capital instrument into each
- The denominator may be either of

  Risk-weighted assets (RWA), with distinct weighting systems for credit, market, operational risk→**risk-based capital**

  Total balance-sheet assets, adjusted using regulatory definitions→**leverage-based capital**

Loss absorbency hierarchy

Tier 1 or **core capital:** common equity and other "first loss" components

- Intended to cover **going concern** losses firm can survive

Tier 2 or **supplementary capital:** certain subordinated debt, preferred stock, and loan-loss reserves (ALLL account) within limits

- Intended to cover **gone concern** loss, i.e. if firm failing
- Protect taxpayer and most senior liabilities, e.g. deposits, senior unsecured debt

Bail-in-able liabilities includes other forms of longer-term unsecured subordinated debt

- Provides further buffer to enable resolution, esp. large banks

Types of Tier 1 capital

Common equity Tier 1 capital (CET1): most loss-absorbent funding source, includes

- Common equity and retained earnings
- Common equity not a security type
- Calculated in conformity with accounting standards, excludes
  - **Goodwill**, other **intangible assets**
  - **Accumulated other comprehensive income** (AOCI), cumulative mark-to-market gains/losses on securities **available for sale** (AFS)
  - **Deferred Tax Assets** (DTAs) arising from previous losses
- Limits on an *asset*, **mortgage servicing rights** (MSRs)

Additional Tier 1 capital (AT1) includes

- Hybrid securities with equity and debt characteristics
- E.g. **Noncumulative perpetual preferred stock**
- In Europe: **contingent capital**

Scope of risk-based capital

- Minimum capital requirements measured for
  - Credit risk
  - Market risk
  - Counterparty risk
  - Operational risk
- A bank's minimum risk-based capital is the total
  - Simple sum, no diversification benefit

Banking and trading books

- Regulatory distinction that largely aligns with accounting distinctions
- Regulatory arbitrage: same asset may have different impact on required capital depending on how assigned
- Tightening of "boundary" in BCBS' *Fundamental review of the trading book*

Definition of banking and trading books

Banking book: original focus of Basel framework and bulk of RWA in most banks

- Primarily C&I loans and mortgages
- Loans valued at par, but with provisions for default loss through the **allowance for loan and lease losses** (ALLL) account
- Mostly credit risk, but also market, esp. interest-rate risk
- Also includes illiquid and real assets, e.g. unlisted equities, real estate
- Includes assets **held to maturity** (HTM), not marked-to-market but reported at **amortized cost**

Trading book: positions held for liquidity, market-making and proprietary trading

- And hedges of those positions
- Mostly market risk, but some credit and default risk in securities and loans in trading book
- Includes **trading** and **available for sale** (AFS) securities

Credit risk weighted assets

Standard approach: tables of fixed risk weights for assets by type and credit rating

- Use of ratings now excluded by DFA→U.S. applies Organization for Economic Cooperation and Development (OECD) risk classifications for sovereigns

Internal ratings-based (IRB) **approach:** bank computes risk weights

- Applies formula based on single-factor credit risk model using bank-computed inputs
- Generally reduces RWA for banks that qualify

  Foundation IRB: internal estimate of probability of default (PD)
  Advanced IRB: internal estimate of LGD, exposure at the time of default (EAD), maturity of the exposure
- In U.S., obligatory for **Advanced Approaches Banking Organizations:**
  - Large, internationally active banks, $250 billion+ in assets

Classification of sources of market risk

General market risk arising from shocks to broad risk factors

Default risk in trading book

- Including securitizations
- Formerly **specific risk**—"exposures to specific issuers of debt securities or equities," other idiosyncratic sources of risk—phased out following FRTB

Residual and **non-modelable risk**

Standardized and internal models approaches

Standardized approach: "building-block" approach, treats each risk factor—interest rates, equity, foreign exchange, etc.—separately

- There is a **"simplified alternative"** to standardized approach for eligible banks

Internal models approach: initially VaR-based, but moving toward expected shortfall following FRTB

- Banks using internal models must also calculate standardized approach capital for each trading desk as a control

Post-crisis revisions to market risk capital

- Fundamental review of the trading book(FRTB) address
  - Variability in market risk RWA across banks
  - Regulatory arbitrage of trading vs. banking book assignments
  - Understatement of tail risk, liquidity risk
- "Basel 2.5" interim revisions to trading book capital rules published 13Jul2009:

  Stressed Value-at-Risk: $\rightarrow$large increase in trading book capital
  - Computed using historical data from a crisis

  Default risk in the trading book

  Correlation trades: additional capital charge for securitized products
- U.S. adoption (final rule) 07Jun2012
- Revised standards published 14Jan2016 focus on better capture of tail risk:
  - Use of expected shortfall in place of VaR, but at lower confidence level
  - Incorporation of market liquidity risk in minimum required capital

Standardized approach for market risk capital

- Risk factors:

Interest rate risk	Foreign exchange risk
Credit spread risk: non-securitization	Equity risk
Credit spread risk: securitizations	Commodity risk

- Captures linear (**delta**) and nonlinear (**curvature**) sensitivities, sensitivity to implied volatility (**vega**)
- Table of risk weights by type of sensitivity (e.g. delta) risk factor
- Diversification recognized within risk factors via prescribed correlation, but not across risk factors
- **Default Risk Charge** (DRC): exposures risk-weighted by rating
- **Residual Risk Add-On** (RRAO) of 1 or 0.1 percent of gross notional of certain assets
  - Captures less-common but often important sources of risk
  - **Examples** include correlation risk of securitizations, prepayment risk of mortgage-backed securities
- Market risk capital requirement under standardized approach is

$$\text{sensitivities-based capital} + \text{DRC} + \text{RRAO}$$

Internal models approach for market risk capital

global expected shortfall + DRC + stressed capital add-on

Global expected shortfall: a stressed ES

- Includes liquidity adjustment capturing time to liquidate positions
  - 10–250 days, depending on risk factor
- Includes a scenario-based stress component
- Computed by "trading desk"

Default Risk Charge based on a credit portfolio VaR

Stressed capital add-on currently VaR-based, but moving toward expected shortfall following FRTB

- Banks using internal models must also calculate capital based on standardized approach

Computation of expected shortfall for market risk

- Global expected shortfall measured at the 97.5 percent confidence level
  - Liquidity adjustments make time horizon of the ES measure a complex weighted average
  - Under Basel I and 2.5, VaR had been at 99th percentile (equal to 97.5 percent ES under the normal distribution)
    - Normal parametric 0.975 ES $= 1.00492 \times$ 0.99 VaR
  - Instantaneous price shock equivalent to a 10-day move, computed daily
- Analytical models, Monte Carlo and historical simulation can be used
- Calculated daily
  - Using worst 250 days
- Backtesting required
  - Backtesting of ES relies on VaR backtesting
  - Reliant on exceedance counts
- Historical observation period: minimum 1 year of data (or weighted average 6 months)
- Any computational technique and model acceptable

Basel III: risk-based capital

- Higher minimum capital ratios to RWA—both quality and quantity:

  Common equity Tier 1 (includes retained earnings): 2→4.5 percent (by 2015 in U.S.)

  Total Tier 1 capital including AT1→6 percent Tier 1 (by 2015 in U.S.)

  Total capital including Tier 2≥8 percent (unchanged from Basel II)

- Additional capital requirements:
  - Must be met through issuance of CET1
  - Not meeting these requirements→restrictions on capital distributions and discretionary bonuses

  Capital conservation buffer (CCB): additional common equity of 2.5 percent (by 2019 in U.S.)

  Countercyclical buffer of 0–2.5 percent by 2019 for large banks

  G-SIB surcharge of 1–3.5 percent by 2019 for very large banks

- U.S. final rule approved 02Jul2013

Basel III: leverage-based capital

- **Leverage ratio:** minimum capital based on aggregate on- and off-balance sheet exposures
  - Larger of risk-based capital and leverage ratio is the binding minimum
- Basel III standard (January 2014): Tier 1 capital a minimum of 3 percent of **exposure measure** or **adjusted assets**, including
  - On-balance sheet assets
  - Derivative and other off-balance sheet exposures, based on NPV or option value, plus potential future exposure
  - **Securities financing transaction** (SFTs): repo and securities lending; some netting recognized
- Addresses avoidance of capital charges by underestimating RWA
  - Impact of RWA estimate can be measured via **RWA density:** ratio of RWA to adjusted assets
  - But low RWA density may be related to bank's business mix, e.g. large trading book, not RWA manipulation
- For some banks adjusted assets *exceed* balance sheet assets
  - E.g. Deutsche reduces balances-sheet assets with a negative derivatives position

Total Loss Absorbing Capacity

- Rules require G-SIBs to issue certain types of debt
- Intended to address ($\rightarrow$)**Too-Big-To-Fail**

U.S. Supplementary Leverage Ratio

- U.S. has adopted more stringent leverage-based capital rules
- **U.S. leverage ratio** for all FDIC-insured banks prior to crisis:
  - Long embedded in PCA framework
  - Now applies to Standardized Approach banks
  - Tier 1 capital at least 4 percent
  - At least 5 percent for bank to be "well-capitalized"
  - But relative to generally smaller exposure measure that excludes off-balance sheet items
- **Supplementary Leverage Ratio** (SLR): final rule 08Apr2014, implementation by early 2018)
  - Advanced Approach banks: Tier 1 capital at least 3 percent
  - Relative to exposure measure that includes off-balance sheet items
- **Enhanced Supplementary Leverage Ratio** (eSLR)
  - Applies to GSIBs: 2 percent in addition to SLR
  - Insured bank subsidiaries of GSIBs: SLR at least 6 percent to be considered well-capitalized
- Impact of SLR primarily on largest banks, generally conduct large volume of SFTs through dealing subsidiaries

Relation of risk- and leverage-based capital ratios

- Risk-based capital intended to provide a risk-sensitive measure
  - Ideally varies precisely with riskiness of banks' assets and activities
- Leverage-based capital intended to provide a backstop
  - Limits manipulation of risk measures by banks
- Required minimums of different regulatory capital instruments calibrated to achieve this
- If binding, risk-based minimum capital makes lower-risk assets less attractive
- If binding, leverage ratio makes higher-risk assets relatively attractive
  - And disincentivizes lower-risk activities, e.g. repo and bond market intermediation

Summary of post-crisis regulatory minimum capital

Assets	Liabilities
Risk-weighted assets	CET1 $\geq$ 4.5% RWA Tier 1=CET1+AT1 $\geq$ 6% RWA Total risk-based (Tier 1+Tier 2) $\geq$ 8% RWA Capital conservation buffer CET1 2.5% RWA Countercyclical buffer (large banks) CET1 0–2.5% RWA G-SIB surcharge CET1 1–3.5% RWA
	Leverage ratio: Tier 1 $\geq$ 4% exposure (standardized) SLR: $\geq$ 3% exposure (advanced) SLR: $\geq$ 5% exposure (GSIBs)
Adjusted exposure	Non-regulatory capital debt forms

Table shows required ratios for U.S. once current regulation fully implemented by 01Jan2019.

Example: Risk-weighted and adjusted assets

	BAC	MS	DB
Risk-weighted assets			
Credit risk	863 035	151 573	214 753
CVA	57 212	20 011	6 655
Market risk	57 386	83 608	34 684
Operational risk	500 000	115 487	98 102
Total RWA	1 477 633	370 679	354 194
Adjusted assets	2 192 337	828 000	1 444 000
Percent of total RWA			
Credit risk	58.4	40.9	60.6
CVA	3.9	5.4	1.9
Market risk	3.9	22.6	9.8
Operational risk	33.8	31.2	27.7

Sources: quarterly Pillar 3 disclosures, 30Jun2017. BAC: Bank of America Corp.; MS: Morgan Stanley; DB: Deutsche Bank AG. All data based on advanced approach and reflect transition/phase-in rules. Currency amounts: US$ mill. for BAC and MS, € mill. for DB.

Example: Capital and leverage ratios

	BAC	MS	DB
Capital composition			
Common equity tier 1	171 431	61 604	52 634
Additional tier 1	23 391	8 776	8 655
Tier 1 capital	194 822	70 380	61 289
Tier 2 capital	27 849	10 645	6 231
Capital ratios (percent of risk-weighted assets)			
Common equity tier 1	11.6	16.6	14.9
Tier 1 capital	13.2	19.0	17.3
Total capital	15.1	21.9	19.1
Leverage ratio (capital as percent of adjusted assets)			
Tier 1 leverage	8.9	8.5	4.2
Memo: risk-weighted/adjusted assets (%)	67.4	44.8	24.5

A summary of the critiques

Complexity: simpler capital rules would do a better job preventing bank failures

Inaccuracy of standard weights: higher weights do not necessarily apply to riskier assets

- **Example:** Merrill and UBS losses on low-weight subprime AAA

Procyclicality: gains increase and losses diminish capital and some risk weights may rise during downturns, diminishing bank lending

Regulatory arbitrage: the system encourages investment in higher-risk assets within categories with similar risk weights, or redesign of riskier assets to qualify for lower weights

Quantity of required capital criticized as too high and too low

Uniformity and herd behavior: Since the system applies to all banks, banks adopt uniform approaches to risk weighting→uniform investment and business strategies

Incentivizes risk-taking: For example, the leverage ratio penalizes low-risk assets by placing a floor under their risk weights

Excessive complexity of risk-based capital rules

- Basel rules feature complex system of risk weights in calculating minimum required capital
- Risk-weighting of assets doesn't lead to more precise measure of bank's true required capital
  - Risk-based capital has no discernible relationship to likelihood of bank failure during crisis
- Simple leverage ratio outperforms risk-based capital in computing required capital and has predictive power for bank failure during crisis
- Basel rules also feature complex definition (Tier 1) of capital
  - Capital definition based on equity (core Tier 1) has predictive power for bank failure during crisis

Procyclicality of risk-based capital

- **During expansions:** asset prices rise and volatility declines
  - Higher asset values generate surplus capital, intermediaries respond by restoring higher leverage, not by "acquiescing" in stronger balance sheet
  - Declining volatility→declining Value-at-Risk for a given volume of assets→release of risk budgets→increase in position size
- **During downturns:** inverse behavior of prices and volatility
  - Internal model estimates of bank borrowers' default probabilities rise
- Feedback pathways work pro- rather than countercyclically due to guarantees and moral hazard
- Tension between procyclicality and ability of rules to discriminate differences in risk across banks at a point in time
- Mitigation approaches in Basel III: higher minimums, countercyclical buffers, regulatory leverage ratios
  - Leverage ratios less susceptible to procyclicality than risk-based capital requirements

Regulatory arbitrage of capital rules

- Basel II capital standards induced leverage and liquidity transformation before the crisis
  - Obtain a substantial spread over risk-free benchmarks using embedded leverage or underestimate of credit risk
  - Operates together with ($\rightarrow$) implicit guarantees to keep funding cost low
- **Structured credit products** had low or zero risk weight pre-GFC
  - Originate and retain super senior
  - Hedge via CDS to bring risk weight to zero
- **Asset-backed commercial paper** (ABCP) conduit sponsors permitted from 2003 to avoid capital charges:
  - Credit support provided in form of liquidity, not credit guarantees
  - Kept off balance sheet under U.S. GAAP
  - But treated by rating agencies as full guarantees
- Regulatory preference for government debt
  - Zero risk weights for some central government issues
  - Incomplete mitigation under Basel III and later revisions

Regulatory arbitrage: the euro area "doom loop"

- **Doom** or **diabolic loop:**
  - Sovereign perceived creditworthiness deteriorates
  - Banks balance sheets weaken, ↑perceived likelihood of bailouts
  - Sovereign perceived creditworthiness worsens
- Regulatory privilege for sovereign debt
  - Basel rules for standard approach banks: zero risk weight for local sovereign debt denominated in domestic currency
  - IRB banks in EU can apply zero weight to EU government debt, exempt from large exposure limits
- Experience: no losses for private creditors following Greece et al. debt crisis
- Marked **home bias** of Eurozone banks: high concentration of domestic debt in sovereign portfolios
- Insensitivity to risk an impediment to introduction of euro area-wide "safe asset"
  - E.g. **sovereign bond-backed securities** (SBBS): securitization of euro-area central government issues

Quantity of capital

- High minimum required capital criticized on grounds it constrains lending
- Current Basel and U.S. requirement remain well below historical ratios

Origin and purpose of regulatory stress tests

- Stress testing originates as private, single-firm risk management techniques
- Primarily a microprudential supervisory tool for assess bank's condition:
  - Supports capital standards by estimating capital ratios under stress
  - Firms' internal capital planning a mechanism for imposing supervisory data collection, modeling capabilities on regulated firms
  - Affects firms' distribution plans (dividends, share repurchases)
- But evolving into key macroprudential tool
  - Application to largest banks
  - Forward-looking, centered on projections of future events
  - Results generally highly publicized, intended to promote financial stability by strengthening confidence
  - But no explicit systemic-risk component, e.g. interactions between firms
- Has become key measure through high public visibility and impact
  - When results generally positive, supports public confidence in banks and in regulatory mechanism
  - Semi-public nature of tests may compromise credibility

Evolution of stress tests during crisis

- Began as ad-hoc measures during crisis, now annual exercises
- **Supervisory Capital Assessment Program** (SCAP) of 2009 surprisingly effective in reassuring markets
- **Comprehensive Capital Analysis and Review** (CCAR), 2011–date,
- **Dodd-Frank stress testing** (DFAST): SIFIs (including nonbanks) and BHCs with consolidated assets $\geq$ \$50 bill.
- Similar efforts by European regulators have met more skepticism: ECB, EBU, Single Supervisor, Single Resolution Mechanism, Asset Quality Review (AQR)
- Stress tests to be conducted in future on non-bank SIFIs under Dodd-Frank
  - But stress tests need to be adapted, current framework and scenarios not appropriate for non-bank SIFIs
- Credibility is crucial
  - SCAP in 2009 credible, contribution to turn in markets
  - Europe 2010: lack of detail in disclosure, sovereign debt in banking book excluded

Planning horizon of stress tests

- Multi-year horizon rather than measuring results of a ne-time shock
- Identify uses and sources of capital over the planning horizon
  - P&L results under "benchmark" and "adverse" macroeconomic scenarios
  - Capital ratios, capital-raising and dividend-payout plans
- Stress scenarios set by Fed, but only broad outlines, not details of scenarios, are made known to regulated institutions and public
  - Opacity increases compliance costs, introduces potential for arbitrariness in results
  - Full transparency would increase risk of procyclicality due to correlated risks, and potential for regulatory arbitrage

In- and outflows of capital under the stress tests

- Regulated entity computes results acc. accounting rules
- Estimate **after-tax net income** (or losses) each quarter in the scenario
  - **Pre-provision net revenue** (PPNR): NII plus other income (e.g. fees) less other expenses (e.g. legal costs)
  - Subtract **provisions** (realized and estimated future loan losses), mark-to-market or **other-than-temporary impairment** (OTTI) losses on securities, and taxes
- Measure capital impact under entity's **baseline capital plan**
  - Net income distributed to shareholders or added to capital
  - Net income but not capital plan computed under stress (e.g. no unplanned dividend cuts in response to losses)
  - How do shareholder and regulatory capital change in the scenario? Does regulated entity still have enough?

FDIC and central bank liquidity standards for banks

- Liquidity risk a longstanding element of bank supervision, e.g. (→)CAMELS ratings
- Central banks have long used **reserve requirements** to control money supply
  - Reserve requirements also serve to protect banks against losses due to sudden deposit withdrawal

Basel liquidity standards

- Motivation: prevent runs on wholesale funding sources, such as 2008 "run on repo"
- Two key measures are essentially liquidity stress test results with different time horizons

  Liquidity Coverage Ratio (LCR)
  - Requires **High-Quality Liquid Assets** (HQLA) to cover cash outflows over 30 day stress scenario
  - Economics: requires liquid assets in excess of "runable" liabilities

  Net Stable Funding Ratio (NSFR)
  - Requires amount of stable funding to cover 1 year of extended stress
  - Economics: requires stable funding (liabilities) in excess of illiquid assets
- Apply to large banks only ($\geq$\$50 bill. assets)
  - More stringent rules apply to largest banks

Liquidity Coverage Ratio: metric and motivation

- Banks compare stock of HQLA they hold to estimate of net outflows in 30-day stress environment
- When fully implemented, rule will require

$$\frac{\text{stock of HQLA}}{\text{net cash outflows over the next 30 days}} \geq 100\%$$

- Denominator represents total net cash outflows in a short-term liquidity crisis
- Numerator represents liquid assets immediately available to cover the net outflow
- LCR $\geq 100\% \Leftrightarrow$ firm has sufficient liquid assets to survive severe cash outflow lasting 30 days
- Focus on tenuousness of short-term funding

Estimating outflows and inflows for LCR

Outflows: sources of potential liquidity drain within 30 calendar days

Maturing funding: deposits, short-term funding secured by illiquid assets or unsecured

Collateral calls due to credit deterioration, counterparties demanding fullest security within agreements

Commitments and lines of credit drawn in anticipation of lender distress

Calculated by applying stress **run-off rates** to liabilities and off-balance sheet items maturing or callable within 30 days

- **Example:** repo run-off rate between 0 and 100 percent depending on collateral quality

Unsecured wholesale funding assumed to have high run-off rate

- Trade-off: banks can rely more on wholesale funding if operating deposits high

Inflows: largely interest receivable and loan repayments from performing borrowers

- Insurance: includes policy premiums due over next 30 days

Estimating net outflows for LCR

- **Total net cash outflows:** outflows minus inflows
- Offsetting impact of inflows capped at 75 percent of outflows

$$\text{total net outflows} = \text{outflows} - \min(\text{inflows}, 0.75 \times \text{outflows})$$

- Prevents denominator of LCR from becoming small or negative even if estimated outflows very large

Treatment of deposits in LCR

- Deposits are sight obligations, but differ widely in assumed "stickiness" and stress run-off rates
- **Operating deposits:** used by depositors for day-to-day business and to support transactions
  - Retail as well as non-financial and financial-firms
  - Assumed to have low run-off rate, esp. insured retail deposits
  - Retail deposits treated as long-term debt, although par-redeemable on demand→compliance with LCR does not immunize bank from runs
- **Nonoperating deposits:** used primarily as investments or liquidity reserve rather than to support transactions
  - More run-prone than operating deposits
  - Shouldn't be used to fund long-term assets such as C&I loans
  - Assumed to have high run-off→LCR renders them less attractive to banks
- Technology, esp. mobile banking, makes deposits less sticky (e.g. (→)SVB failures)

Definition of High-Quality Liquid Assets

- Numerator of LCR: HQLA must "cover" the net outflow
- Weighted average of values of assets deemed liquid under the rule

  Level 1 assets: not subjected to haircut, includes
  - Cash
  - U.S. and sovereign bonds with zero Basel risk weight
  - Central bank excess reserves

  Level 2 assets: capped at 40 percent of HQLA
  - Thus capping Level 2 at $\frac{2}{3}$ of Level 1 assets in HQLA

  Level 2a: subject to 15 percent haircut, includes,
  - "Highest-rated" corporate bonds—down to AA-
  - Sovereigns with non-zero but relatively low Basel risk weights

  Level 2b: subject to higher haircuts, includes
  - Lower-rated investment-grade corporates
  - Residential mortgage bonds
  - Non-financial common equity

Liquidity Coverage Ratio example

- Denominator of LCR: bank estimates for 30 day stress scenario
  - Estimated outflows of funding and commitments \$200 bill.
  - Estimated inflows of interest and repayments \$160 bill.
  - Offset from inflows capped at 0.75×200 $\Rightarrow$net outflow \$50 bill.

$$200 - \min(160, 0.75 \times 200) = 50$$

- Numerator of LCR: bank has
  - Level 1 assets \$30 bill.
  - Level 2a assets \$40 bill.
    - Subject to 15 percent haircut, contribution to HQLA \$34 bill.

$$0.85 \times 40 = 34$$

    - Limited to 40 percent of total HQLA

$$\frac{x}{30 + x} = 0.4 \quad \Rightarrow \quad x = \frac{2}{3} \times 30 = 20,$$

      with x the eligible portion of Level 2 assets
- LCR is 100 percent, exactly meeting minimum threshold:

$$\frac{\text{stock of HQLA}}{\text{net cash outflows}} = \frac{30 + 20}{50} = 1.0$$

Net Stable Funding Ratio

- When fully implemented, rule will require

$$\text{NSFR} = \frac{\text{available stable funding}}{\text{required stable funding}} \geq 100\%$$

- Focus on appropriate funding of assets
- Intended to discourage short-term wholesale funding, limit maturity mismatch
- Requires that assets with longer maturities and/or lower market liquidity be financed with longer-term or "sticky" short-term funding
- **Required stable funding** is a weighted average of assets
  - Zero weight: cash, short-term securities, matched-book reverse repo
- **Available stable funding** is a weighted average of liabilities
  - 100 percent: Tier 1 and 2 capital instruments, e.g. equity
  - High weight: sticky retail deposits as well as those of small businesses
  - Zero weight: short-term wholesale funding by a broker-dealer

Implementation of Basel liquidity standards

- LCR:
  - Basel Committee standard issued 07Jan2013
  - U.S. more stringent, implementation in final rule 03Sep2014, compliance deadline 2017
- NSFR:
  - Basel Committee standard issued 31Oct2014
  - U.S. more stringent, proposed rule 03Sep2014, anticipated compliance deadline 2018

Market impact of new liquidity standards

- "Matched books" of repo lending and borrowing more expensive
  - Repo generally on balance sheet from accounting standpoint
  - Netting generally limited to same counterparty, settlement platform, settlement date
- Increase demand for T-bills, TDF deposits
- U.S.: do not apply to FBOs

Regulatory changes and collateral shortage

- Regulatory changes
  - Clearing mandates (but clearing→increase in netting, possible offset)
  - Basel liquidity ratio
  - **Financial repression**: reduction in yield resulting from increased demand imposed by regulation
- Responses include **collateral swaps**, swap lower- for higher-quality collateral for a fee
- Restraints on rehypothecation leads to ↓supply of collateral
- For European banks in particular, additional pressure from **encumbrance** of assets
  - Assets pledged or otherwise committed→subordination of remaining debt
  - **Covered bonds**: bonds secured by specific assets, usually mortgage loans
  - **Long Term Refinancing Operations** (LTROs): European Central bank program provides 3-year loans against eligible collateral

Money market mutual funds before the crisis

- Issue shares redeemable at par on demand
  - No material liquidity reserve, bank charter, access to lender of last resort, deposit insurance
  - Explicit or implicit guarantee by sponsor
  - Implicit government guarantee
- Vulnerable to runs
  - Type of open-end investment company (i.e. mutual fund)$\rightarrow$issues redeemable shares
  - But with stable NAV under Rule 2a-7, shares redeemable at fixed \$1.00 rather than market-adjusted net asset value$\equiv$par redemption

Money funds during the global financial crisis

- Perception of public-sector backstop strengthened by
  - U.S. Treasury's 2008–09 **Temporary Guarantee Program**
  - →Federal Reserve emergency lending facilities supporting MMMF's: MMIFF, AMLF, CPFF
- But decline, then stagnation in volume
  - Reduction in total MMMF assets of about 25 percent from pre-crisis peak
  - Shift from prime to government-only funds
  - Shift from commercial paper to repos in asset mix
- U.S. MMMFs: no provision for share cancellation (**reverse distribution mechanism** or RDM) if rates negative

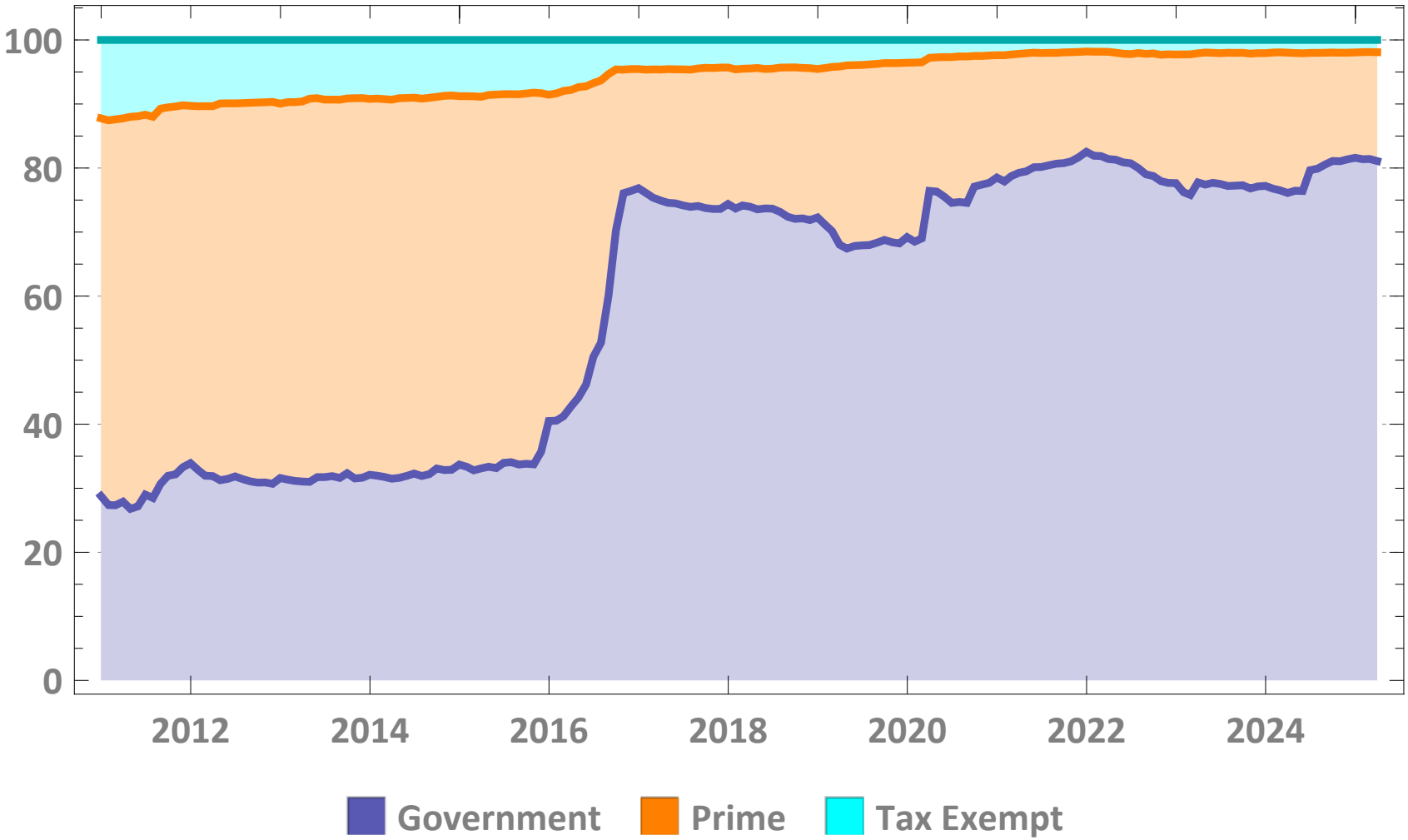
Money market fund reform

- Amendments to SEC Rule 2a-7 adopted 23Jul2014, compliance by 14Oct2016
- **Stable net asset value** (NAV) permitted for two fund types:
  - By assets: **government** MMMF, has 99.5% of assets in government securities and repo
  - By investor type: **retail** MMMF, owned by "natural persons"
- **Floating NAV:** daily share prices to be based on mark-to-market value rather than amortized cost for remaining fund types:
  - By assets: **prime** (corporate securities) and **municipal/tax-exempt**
  - By investor type: **institutional** MMMFs (all non-retail)
- **Liquidity fees and redemption gates:** if "liquid assets" (SEC definition) of any non-government MMMF drop below
  - 30% of total: MMMF *may* impose 2% fee on and temporary suspension of redemptions
  - 10% of total: MMMF *must* impose 1% fee on redemptions
- Additional reporting requirements, including stress-testing results
- RDM permitted for stable NAV funds

Money market funds after reform

- Reform intended to preclude runs on MMMFs and eliminate need for implicit guarantee
- Rapid increase in volume
- Shift of asset composition, ownership and type
  - By assets: now predominantly publicly-issued debt and Federal Reserve liabilities (ON RRP)
  - By type: government MMMF share rises
- Form of financial repression: regulatory structure incentivizes investment in governmnet debt
- Non-retail ownership share rises inflation, rising rates from 2021

Government and prime money funds 2010–2025



Shares of money market mutual fund types in total fund assets, percent, month-end, Dec. 2010 to Mar. 2025. *Source*: U.S. Securities and Exchange Commission, Division of Investment Management, Money Market Fund Statistics.