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# MACROPRUDENTIAL POLICY: A CASE STUDY FROM A TABLETOP EXERCISE

- In June 2015, a group of Federal Reserve Bank presidents participated in a tabletop exercise designed to assess the value of prudential policy tools in averting or easing financial crises.
- Presented with a hypothetical scenario of overheating financial markets, the participants were asked to consider how effectively various capital-based, liquidity-based, and credit-based tools, as well as stress testing and supervisory guidance, could address the risks inherent in the scenario.
- The group concluded that many prudential tools had limited applicability and could only be implemented with a lag. Tools that could be implemented more quickly, such as stress testing and margins on repo funding, were preferred to others. Surprisingly, monetary policy tools were judged to be an attractive alternative means of promoting financial stability.

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## 1. INTRODUCTION

Since the global financial crisis of 2007-09, policymakers around the world have advocated the use of prudential policy tools to promote financial stability—that is, to reduce risks that could inhibit the financial sector’s ability to intermediate credit (Bernanke 2008; Bank of England 2009; Basel Committee on Banking Supervision 2010; Tarullo 2013). Prudential policy tools are rules or requirements that enhance the safety and soundness of specific firms, sectors, or practices. The use of such prudential policy tools for financial stability purposes is often called macroprudential policy. Academic work on the implementation of macroprudential methods has flourished recently,<sup>1</sup> and even prior to the crisis, some researchers and policymakers argued for a macroprudential approach to financial regulation.<sup>2</sup>

This article describes a “tabletop” inquiry into macroprudential tools that was conducted by members of the Financial

<sup>1</sup> See Brunnermeier et al. (2009); Hanson, Kashyap, and Stein (2011); and Hirtle, Schuermann, and Stiroh (2009).

<sup>2</sup> See the classic contributions by Robinson (1950) and Bach (1949), and more recent work by Crockett (2000) and Borio (2003).

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To view the authors’ disclosure statements, visit [https://www.newyorkfed.org/research/author\\_disclosure/ad\\_epr\\_2016\\_adrian-macroprudential-policy.html](https://www.newyorkfed.org/research/author_disclosure/ad_epr_2016_adrian-macroprudential-policy.html).

Stability Subcommittee of the Conference of Presidents (COP) of the Federal Reserve Banks in June 2015.<sup>3</sup> In the tabletop exercise, Federal Reserve Bank presidents were presented with a plausible, albeit hypothetical, scenario of financial market overheating. They were asked to identify the risks to financial stability present in the scenario, and to review a variety of possible macroprudential and monetary responses to those risks. In exploring the actions and tools available to policymakers, the participants drew conclusions about the advantages and the limitations of the different approaches.

Before describing the hypothetical scenario, the available policy tools, and their transmission mechanism in detail, we define the macroprudential objectives that guided the exercise and the framework used in assessing financial vulnerabilities.

In the tabletop exercise, the primary macroprudential objective is to reduce the occurrence and severity of major financial crises and the possible adverse effects on employment and price stability. The macroprudential objective, because it focuses on economy-wide financial stability, differs from the Federal Reserve's monetary policy objectives of full employment and stable prices and goes beyond its microprudential objective of ensuring the safety and soundness of individual firms. However, the objectives and transmission mechanisms of microprudential, macroprudential, and monetary policies are intertwined, generating the potential for trade-offs among objectives. For example, trade-offs may arise between preemptive macroprudential actions and the cost of financial intermediation, because preemptive macroprudential actions that reduce vulnerabilities may slow economic performance in the short term.<sup>4</sup> Furthermore, the trade-off between macroprudential and microprudential objectives might be more severe in busts than in booms, while the trade-off between macroprudential and monetary policy objectives might be more severe in booms than in busts. Therefore, a secondary objective is to manage such trade-offs—in other words, to mitigate the side effects of macroprudential policy actions through time. Financial system disruptions that macroprudential objectives aim to avoid include fire sales in financial markets, destabilizing runs on banking and quasi-banking institutions, shortages of money-like assets, disruptions in credit availability to the nonfinancial business

<sup>3</sup> The subcommittee is chaired by Eric Rosengren (Federal Reserve Bank of Boston) and includes William Dudley (Federal Reserve Bank of New York), Esther George (Federal Reserve Bank of St. Louis), Loretta Mester (Federal Reserve Bank of Cleveland), and Narayana Kocherlakota (Federal Reserve Bank of Minneapolis).

<sup>4</sup> In the longer term, financial stability and economic growth likely complement each other (Dudley 2011).

sector, spikes in risk premia, disorderly dissolution of systemically important financial institutions, excessive spillovers from disruptions in international funding and currency markets, and disruptions of the payments system.

Our assessment framework of financial vulnerabilities follows Adrian, Covitz, and Liang (2013). The framework is a forward-looking monitoring program designed to identify and track the sources of systemic risk over time and to facilitate the development of policies to promote financial stability. Under this framework, macroprudential tools and actions can be classified according to whether they serve preemptive or resilience goals. The preemptive goal—reducing the occurrence of crises—leans against the financial cycle by limiting the buildup of financial risks to reduce the probability or

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magnitude of a financial bust. The resilience goal—reducing the severity of crises—strengthens the resilience of the financial system to economic downturns and other adverse aggregate shocks. The framework also distinguishes between shocks, which are difficult to prevent, and vulnerabilities that amplify shocks. Such vulnerabilities may arise from excessive increases in asset valuations, leverage, and liquidity and maturity transformation. Nonetheless, the framework monitors vulnerabilities across four sectors of the economy: the non-financial business sector, the household sector, the banking sector, and the nonbank financial sector.

The scenario explored in this exercise provides a path for key macroeconomic and financial variables, which are assumed to be observed through the fourth quarter of 2016, as well as the corresponding projections for the interval from the first quarter of 2017 to the fourth quarter of 2018, which are assumed to reflect staff forecast and market expectations as of the fourth quarter of 2016. The variables are grouped according to their potential to have a significant impact on three types of vulnerabilities—valuation, leverage, and liquidity and maturity transformation—across the four economic sectors noted above (nonfinancial firms, households, banks, and nonbank financial institutions). The assessment of financial vulnerabilities by participants is assumed to take place as of the first quarter of 2017.

The hypothetical scenario features a compression of U.S. term and risk premia through the fourth quarter of 2016—projected to continue thereafter—which keeps financial conditions loose and fuels valuation pressures in U.S. financial markets. The compression of risk premia encourages the issuance of corporate debt and leveraged loans, which boosts leverage in the nonfinancial business sector. In addition, the real price index in the commercial property market rises rapidly. At the same time, the nonbank financial sector, including money market mutual funds, expands in size and provides short-term wholesale funding to the nonfinancial business sector. These developments occur while the Federal Reserve removes the degree of monetary accommodation only gradually in 2015 and 2016, as inflation is assumed to persist at slightly below its target rate and unemployment to persist at the hypothetical scenario-specific non-accelerating inflation rate of unemployment (NAIRU), as discussed in Section 2. As such, the constraint on monetary policy and the looser-than-desired financial conditions boost the rationale for the use of macroprudential tools.

The hypothetical scenario resembles some well-known cases of financial overheating from recent decades that have been documented in the literature, although with some notable differences. First, the scenario bears similarity to the case of New England during the mid-1980s, when rapid growth in regional mortgage lending led to a real estate boom (Federal Deposit Insurance Corporation 1997). Second, the scenario resembles the real estate boom that took place in Sweden from 1989 to 1990, which was fueled by accommodative fiscal policies, rapid growth in lending by banks and mortgage companies, and capital inflows (Englund 1999; Jaffee 1994). However, unlike the cases of New England or Sweden, our scenario places greater emphasis on the increase in nonfinancial business leverage as opposed to bank leverage. It also allows for a greater role for the nonbank financial sector as a provider of short-term funding (rather than mortgage loans, as in Sweden) and highlights constraints on monetary tightening that can keep financial conditions relatively loose. Finally, compared with the U.S. financial crisis in 2008-09, our hypothetical scenario highlights an increase in leverage at nonfinancial firms instead of households and features overheating in commercial property rather than in the residential housing market.

Participants were asked to consider several types of macroprudential tools in pursuing macroprudential objectives under the hypothetical scenario. Capital-based tools

included leverage ratios, countercyclical capital buffers, and sectoral capital requirements. Liquidity-based tools included liquidity and net stable funding requirements. Credit-based tools included loan-to-value (LTV) and debt-to-income (DTI) caps, margin requirements for securities financing transactions, and other restrictions concerning underwriting standards. Stress tests included capital and liquidity stress tests. Supervisory guidance and moral suasion, including speeches and public announcements, were additional tools that participants in the exercise considered. In addition, participants could also use monetary policy tools for macroprudential objectives. We note that the tabletop exercise abstracted from governance issues within the Federal Reserve System, focusing instead on economic mechanisms of alternative tools.

In evaluating the various tools available, tabletop participants found many of the prudential tools less attractive owing to implementation lags and limited scope of application. Among the prudential tools, participants favored

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those deemed to pose fewer implementation challenges—in particular, stress testing, margins on repo funding, and supervisory guidance. Nonetheless, monetary policy came more quickly to the fore as a financial stability tool than might have been expected before the exercise.

The remainder of this article is structured in five sections. Section 2 describes the hypothetical macrofinancial scenario. Sections 3 and 4 provide an overview of prudential and monetary instruments that are available to the Federal Reserve Board and the Federal Open Market Committee (FOMC), respectively, to achieve macroprudential objectives. Section 5 gives a brief description of the transmission channels of the tools. Section 6 presents a summary of the tabletop exercise, and Section 7 summarizes the findings.

TABLE 1

## Summary of Indicators and Risks Highlighted in the Hypothetical Scenario, by Sector

Sector	Risk		
	Asset Valuation	Leverage	Maturity Transformation
Nonfinancial business	Term and credit spreads	Debt-to-GDP	
	Equity valuations	Debt-to-assets	
	Commercial property prices		
Household	Mortgage spreads	Debt-to-GDP	
	Residential property prices	Debt-to-assets	
		GSE lending	
Banking		Debt-to-GDP	High-quality liquid asset share
		Capital ratios	Maturity mismatches
Nonbank financial		Nonbank size	Money market fund risks
			Short-term funding size
			Repo funding backed by bonds
			Bond mutual funds

Notes: The color code represents a suggestive assessment of risks in the hypothetical scenario provided by the authors ahead of the tabletop exercise, and does not necessarily reflect the views that the Conference of Presidents members shared during the exercise, which are summarized in Section 6. Dark green suggests relatively higher risk, and light green suggests relatively lower risk. Medium green indicates moderate risk.

## 2. THE HYPOTHETICAL SCENARIO

The scenario assumes that data are observed through the fourth quarter of 2016. Data for the period from the first quarter of 2017 through the fourth quarter of 2018 are assumed to reflect staff forecasts and market expectations as of the fourth quarter of 2016.<sup>5</sup> The scenario features rapid expansion in U.S. economic activity and gradual removal of monetary accommodation in 2015 and 2016. In this context, a persistent decline in foreign sovereign bond yields and high risk appetite among investors put downward pressure on the U.S. term and risk premia, which keeps financial conditions loose and fuels valuation pressures in U.S. markets. Most notably, valuation pressures emerge in the corporate debt and commercial property markets. The compression of risk premia encourages the issuance of corporate debt and leveraged loans, which boosts leverage in the nonfinancial business

<sup>5</sup> Without loss of generality, the variables in the hypothetical scenario, which are assumed to be observed through the fourth quarter of 2016, do not exhibit the volatility that characterizes actual macroeconomic and financial time series data beyond the last data point available at the time the scenario was built (in other words, the first quarter of 2015 or fourth quarter of 2014 for most variables). The last actual data point was the first quarter of 2015 for Charts 1 through 7 (except for commercial property prices); the fourth quarter of 2014 for Chart 7 (commercial property prices), Charts 9 through 11, and Charts 13 through 20; the third quarter of 2014 for Chart 8; and 2013 for Chart 12 (which uses annual data).

CHART 1  
United States and Foreign Economies:  
Real GDP Growth

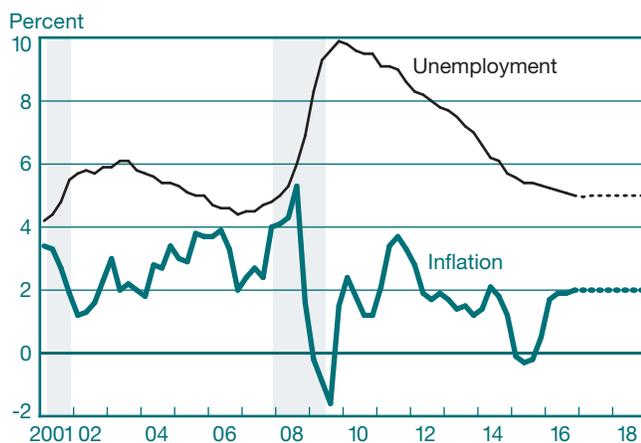


Sources: U.S. Bureau of Economic Analysis; Statistical Office of the European Communities; Cabinet Office of Japan; U.K. Office for National Statistics. All sources accessed through Haver Analytics.

Notes: All data reflect seasonally adjusted annual rates. Foreign growth reflects the average quarterly GDP growth at an annual rate in the euro area, Japan, and the United Kingdom, weighted by the quarterly nominal GDP in U.S. dollars. The extrapolation takes the weighted average of the growth projections for the three economies from the 2015 stress test baseline scenario, with the weights given by the quarterly nominal GDP from the latest quarter available. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

CHART 2

## United States: Unemployment and Inflation



Source: Bureau of Labor Statistics. Source accessed through Haver Analytics.

Notes: Inflation is computed as the four-quarter percentage change in the quarterly average of the consumer price index for all urban consumers (CPI-U). Unemployment reflects the quarterly average of the monthly series for the civilian noninstitutional population, aged sixteen years and over. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

sector. The nonbank financial sector expands and provides short-term wholesale funding to the nonfinancial business sector. Table 1 provides a summary of the indicators used to monitor three types of risks in the hypothetical scenario (valuation pressures, excess leverage, and excess liquidity and maturity transformation) across four sectors in the U.S. economy (nonfinancial businesses, households, banks, and nonbank financial institutions). The table also includes a color-coded assessment of the severity of risks in the hypothetical scenario that was provided to participants ahead of the tabletop exercise.

## 2.1 Hypothetical Macroeconomic Context

In the United States, it is assumed that there is a sustained, rapid expansion in real economic activity, which is fueled in part by the overheating of financial markets. Real GDP grows at 3¼ percent per year (Chart 1), unemployment steadily declines to 5 percent by the end of 2016, and inflation does not exceed 2 percent per year (Chart 2). Beyond 2016, real GDP is forecast to continue rising at a rate of 3¼ percent per year, unemployment to persist at 5 percent, and inflation

to remain at only 2 percent per year. Despite the rapid pace of GDP growth, U.S. inflation is dampened by dollar appreciation and stable energy prices amid slow growth in foreign economies (Chart 1), forces that are expected to persist through 2018. In addition, we assume for the purposes of this scenario that NAIRU is around 5 percent, and that unemployment does not decline below that level as a result of fast productivity growth and rising labor force participation.

In the hypothetical scenario, given the decline in unemployment and pickup in inflation, the FOMC is assumed to start raising the federal funds target rate in the second quarter of 2015 and to increase it to about 1½ percent by the end of 2016 (Chart 3). However, despite rapid GDP growth, the pace of U.S. monetary tightening is assumed to be constrained by unemployment persisting at 5 percent and inflation remaining stable at 2 percent over the forecast horizon. Markets expect the federal funds target rate to rise to only 3 percent by the end of 2018.

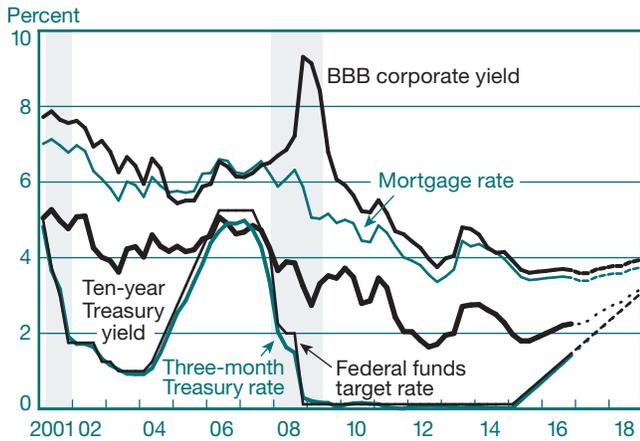
Downside risks to the hypothetical macroeconomic forecast stem from the potential of adverse financial developments, especially in markets where overheating concerns persist. Three key risks are highlighted in the scenario: (1) a severe disruption in the corporate debt market, (2) a sharp reversal in commercial property prices, and (3) a sudden stop in short-term funding, as discussed in Sections 2.2 through 2.5 below. The realization of any of these risks would undermine GDP growth, put downward pressure on inflation, and increase unemployment.<sup>6</sup> In such a case, the relatively low level of the federal funds rate would curtail the Federal Reserve's ability to provide monetary accommodation, and the zero lower bound might again become a binding constraint.

## 2.2 Hypothetical Valuation Pressures

Valuation pressures arise in selected U.S. financial markets, fueled in part by spillovers from the foreign sector and high risk appetite among investors. In particular, sovereign bond yields in the euro area decline and persist at low levels through late 2016, and are expected to remain depressed thereafter (Chart 4). Low foreign yields and high risk appetite trigger portfolio reallocations toward U.S. assets, including Treasury bonds and risky assets. As a result, term premia and risk premia in U.S. markets narrow, especially for riskier assets (Chart 5). The compression

<sup>6</sup> A financial bust would impair real economic activity through the same channels that are at work during the financial boom. In other words, the firms' lost access to funding would curtail investment, increase unemployment, and decrease wage growth and inflation; a decline in commercial property prices would also depress construction.

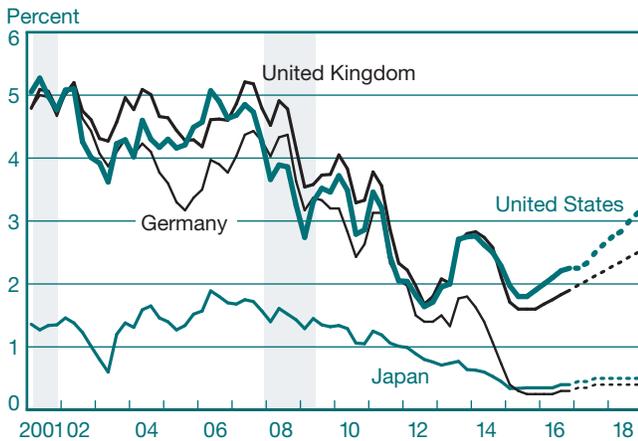
CHART 3  
United States: Borrowing Rates



Sources: Federal Reserve Board, Statistical Release H.15, Selected Interest Rates; Federal Home Loan Mortgage Corporation; Standard and Poor's Global Fixed Income Research. All sources accessed through Haver Analytics.

Notes: Mortgage rate reflects the interest rate of a conventional thirty-year fixed-rate mortgage, expressed as quarterly averages. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

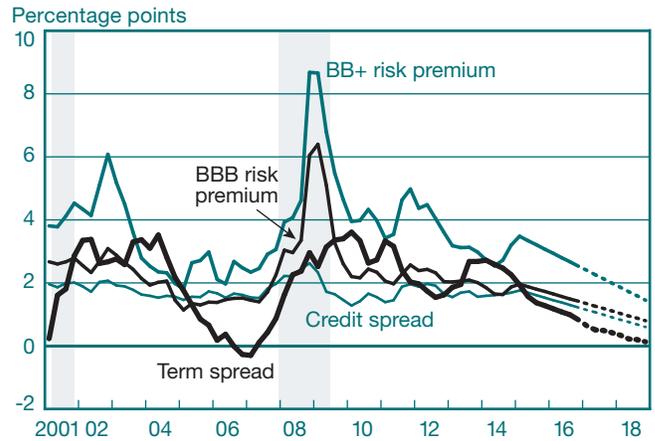
CHART 4  
Select Economies: Ten-Year Sovereign Bond Yields



Sources: U.S. data: Federal Reserve Board. Non-U.S. data: Deutsche Bundesbank; Bank of England; Ministry of Finance of Japan. Sources for non-U.S. data accessed through Haver Analytics and the Federal Reserve Bank of St. Louis Federal Reserve Economic Data (FRED) database.

Notes: All data reflect quarterly averages of government bond yields. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

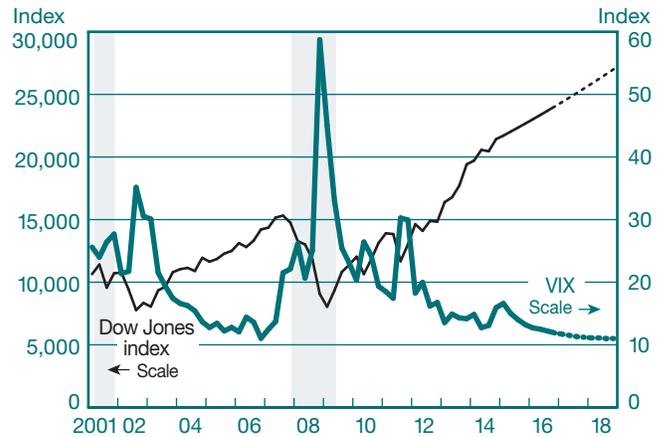
CHART 5  
United States: Interest Rate Spreads



Sources: Federal Reserve Board, Statistical Release H.15, Selected Interest Rates; Federal Home Loan Mortgage Corporation; Standard and Poor's Global Fixed Income Research. All sources accessed through Haver Analytics.

Notes: BB+ risk premium reflects the yield spread between BB+ corporate bonds and ten-year Treasuries. BBB risk premium reflects the yield spread between BBB corporate bonds and ten-year Treasuries. Term spread reflects the difference in yield between ten-year Treasuries and three-month Treasuries. Credit spread reflects the difference between the thirty-year mortgage rate and the ten-year Treasury yield. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

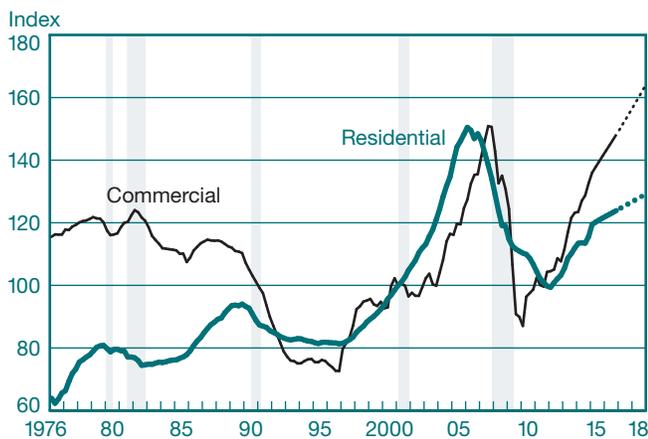
CHART 6  
Stock Market Activity



Sources: Dow Jones; Chicago Board Options Exchange. Sources accessed through Haver Analytics.

Notes: The chart shows the Dow Jones Total Stock Market Index weighted by the float-adjusted market capitalization, obtained as quarterly averages of end-of-period weekly observations. VIX is the Chicago Board Options Exchange (CBOE) Volatility Index. The VIX reflects the quarterly average of weekly observations, with the later data given by the weekly averages of the daily close. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

CHART 7  
Real Property Prices



Sources: CoreLogic; Federal Reserve Board.

Notes: Residential prices reflect CoreLogic's National Home Price Index excluding distressed sales. Commercial prices reflect the Federal Reserve Board's Commercial Real Estate Price Index. All data are seasonally adjusted, deflated by the consumer price index, and normalized to 100 at 2001:Q1. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

of term and risk premia leads to looser-than-desired financial conditions in U.S. markets, despite rising short-term interest rates, providing a rationale for macroprudential policy.

The increased demand for U.S. assets puts upward pressure on U.S. equity prices, dampens stock market volatility (Chart 6), and compresses the equity risk premium. With the Dow Jones Total Stock Market Index rising 6 percent per year through 2016 (and expected to rise at a similar pace thereafter), the equity risk premium is expected to narrow by more than 1 percentage point by the end of 2018.<sup>7</sup>

The compressed risk spreads, looser underwriting standards, and rising demand for commercial mortgage-backed securities (CMBS) fuel growth in commercial mortgage lending. As a result, valuation pressures emerge in the commercial property market, with the price index matching its pre-Lehman Brothers peak in real terms by the end of 2016 and expected to exceed it substantially by the end of 2018 (Chart 7).

<sup>7</sup> With real GDP growing at 3¼ percent per year, inflation persisting at about 2 percent, and the stock market rising at 6 percent per year, the dividend yield declines from 2 to 1.95 percent between early 2015 and late 2018. As such, and with the ten-year Treasury yield rising from about 2 percent to 3.15 percent, the equity risk premium is compressed from 3.33 percent to 2.1 percent during the same interval.

CHART 8  
GSE Lending as a Percentage of Total Outstanding Residential Mortgage Lending



Source: Federal Reserve Board, Financial Accounts of the United States. Source accessed through Haver Analytics.

Notes: GSE is government-sponsored enterprise. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

The share of government-sponsored enterprise (GSE) mortgages increases (Chart 8) because of the GSEs' loosened underwriting standards for prime mortgages and the continued reluctance of banks to engage in nonprime residential mortgage lending. However, in the aggregate, residential mortgage lending increases more slowly than commercial lending, and hence residential property prices rise more slowly than commercial prices, remaining below their pre-Lehman peak (Chart 7).<sup>8</sup>

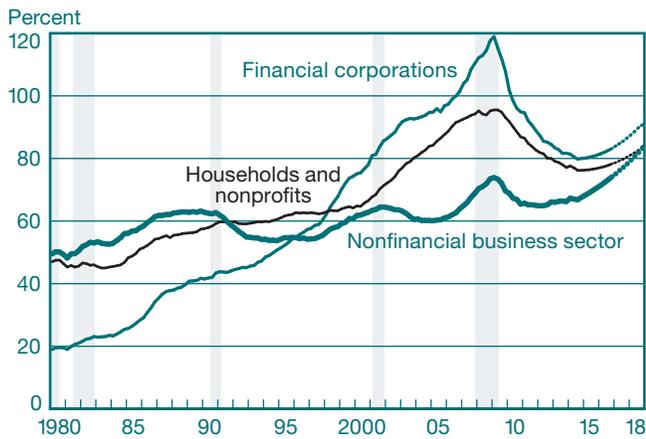
### 2.3 Hypothetical Evolution of Leverage

Leverage in the nonfinancial business sector rises substantially by late 2016 and is projected to increase well above its trend by late 2018, measured as either the debt-to-GDP ratio (Chart 9) or the debt-to-assets ratio (Chart 10). The increase in leverage reflects the issuance of corporate bonds and leveraged loans, especially for riskier firms, which are facilitated by an environment of low risk premia, high risk

<sup>8</sup> In our scenario, commercial property prices rise at about 7 percent per year in nominal terms during 2015-16, and are projected to continue at the same rate through 2018. Residential property prices rise at a rate of 4 percent per year during the same interval.

CHART 9

Leverage in the Private Sector: Debt to GDP

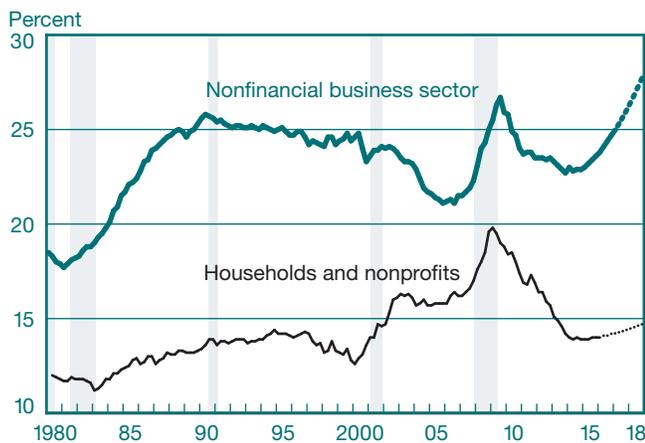


Source: Federal Reserve Board. Source accessed through Haver Analytics.

Notes: Leverage is computed as the ratio of outstanding debt by sector to seasonally adjusted annualized nominal GDP. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

CHART 10

Leverage in the Private Nonfinancial Sector: Debt to Assets

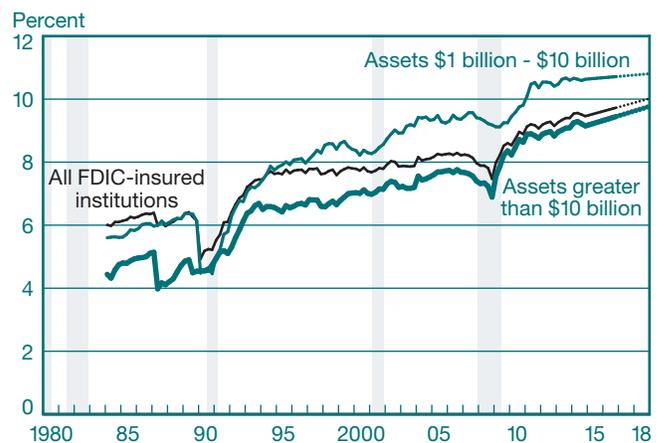


Source: Federal Reserve Board, Financial Accounts of the United States. Source accessed through Haver Analytics.

Note: The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

CHART 11

Bank Leverage: Core Capital to Assets



Source: Federal Deposit Insurance Corporation Banking Statistics. Source accessed through Haver Analytics.

Note: The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

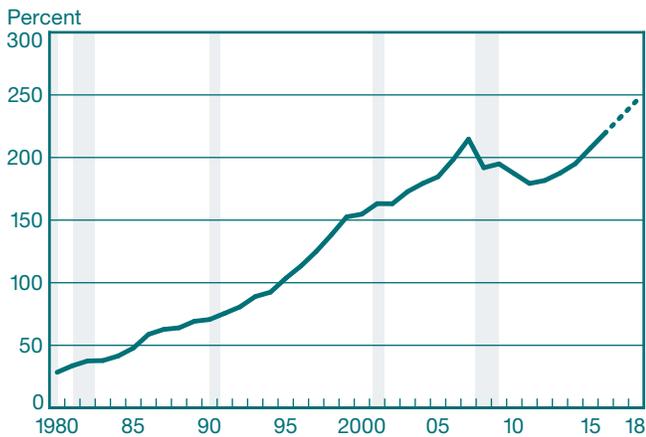
appetite, reach for yield, and a continuation of high demand for collateralized loan obligations (CLOs).

Leverage in the household sector rises more slowly than for nonfinancial firms (Charts 9 and 10), reflecting the reluctance of bank holding companies (BHCs) to ease underwriting standards and the relatively slower growth of residential property lending. Following the fast rise and sharp correction around the 2008 crisis, household leverage remains below its long-term trend as measured by either the debt-to-GDP or the debt-to-assets ratio.

Banks purchase part of the new corporate debt and issue leveraged loans to nonfinancial businesses, increasing their exposure to risk in response to narrower term and credit risk premia. As regulatory capital requirements are phased in, banks raise more capital and strengthen their ratios of core capital to assets further (Chart 11). However, there is concern that the ratios of core capital to risk-weighted assets (not shown) remain flat as banks increase their exposure to risk.

Nonbank financial institutions, such as mutual funds, private equity funds, hedge funds, and other shadow bank intermediaries, increase their market shares of high-risk corporate debt, CLOs, asset-backed securities (ABS), and CMBS. As a result, they grow in size and increase their leverage. As shown in Chart 12, shadow banking liabilities (as a percentage of GDP) rise above pre-crisis levels starting in 2016.

CHART 12  
Shadow Banking Liabilities as a Percentage of GDP



Sources: Federal Reserve Board, *Financial Accounts of the United States*; Adrian and Ashcraft (2012).

Note: The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

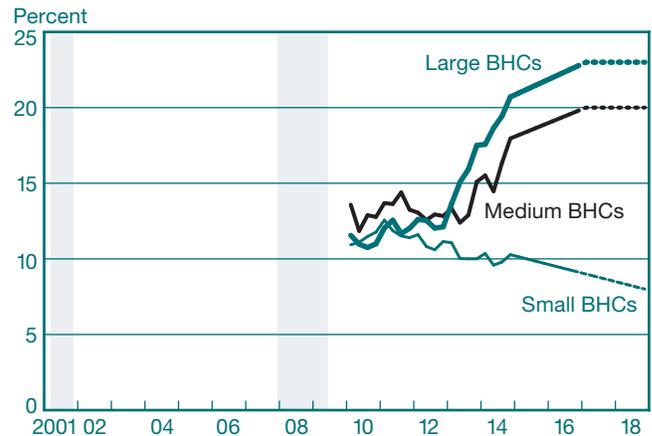
## 2.4 Hypothetical Liquidity and Maturity Transformation

In the scenario, liquidity ratios improve at large and medium-size banks (those with assets above \$250 billion and \$50 billion, respectively), reflecting the phasing in of the Basel III liquidity coverage ratios (LCR) and net stable funding ratios (NSFR). However, small banks are not subject to such regulations and they increase their exposures to long-term corporate debt and commercial mortgage loans. As a result, small banks suffer continued deterioration in the share of high-quality liquid assets (Chart 13) and widening duration gaps between assets and liabilities (Chart 14).

Money market funds (MMFs) grow in size and increase funding to nonfinancial firms, banks, and broker-dealers, leading to an expansion of their size that approaches the pre-crisis peak (Chart 15). Their maturity and liquidity mismatches continue to raise concern.<sup>9</sup> MMF growth stems from a move by households and nonfinancial corporations to reallocate funds from bank deposits to MMFs. In turn, MMFs finance nonfinancial corporations through commercial paper and banks and broker-dealers through repo as well as

<sup>9</sup> Despite the compliance date of October 2016 for new reforms, concerns about the MMFs' maturity and liquidity mismatches persist, since the floating net asset value (NAV) in itself may not entirely eliminate the risk of investor runs, and the prime retail funds are still exempt from the floating NAV.

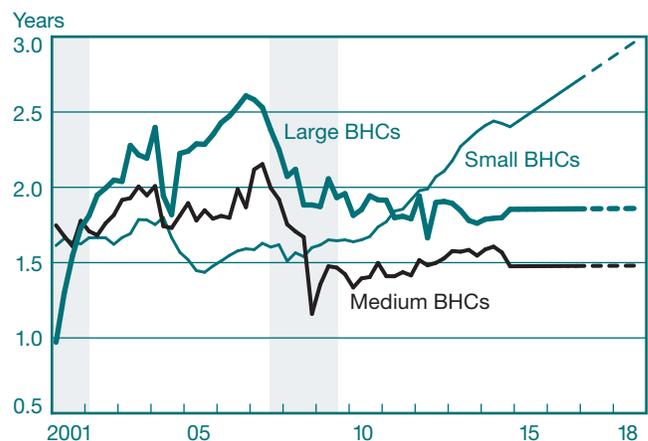
CHART 13  
Liquidity at BHCs: High-Quality Liquid Assets as a Percentage of Total Assets



Sources: Federal Reserve Board, *Consolidated Financial Statements of Bank Holding Companies* (FR Y-9C data) and *Report of Transaction Accounts, Other Deposits, and Vault Cash* (FR-2400).

Notes: BHC is bank holding company. Shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

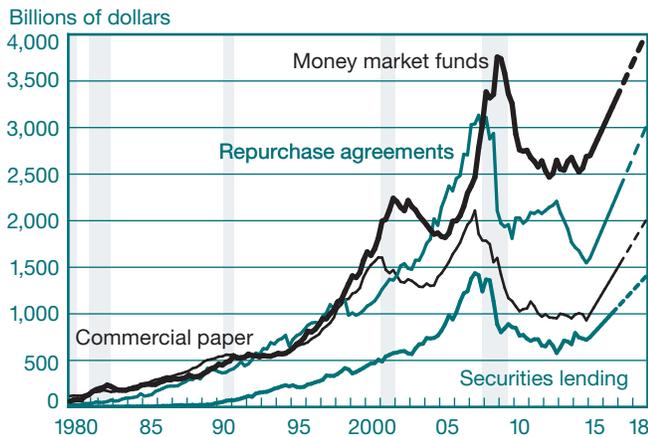
CHART 14  
Maturity Transformation at BHCs: Duration Gap, Assets versus Liabilities



Source: Federal Financial Institutions Examination Council, *Consolidated Reports of Condition and Income*.

Notes: The data through 2014:Q4 include both bank holding companies (BHCs) and commercial banks without a BHC. For commercial banks without a BHC, the bank is treated like a BHC. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

CHART 15  
Short-Term Funding



Source: Federal Reserve Board, Financial Accounts of the United States. Source accessed through Haver Analytics.  
Note: The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

CHART 16  
Share of Corporate Debt and Equities in Repo and Securities Lending by Primary U.S. Government Securities Dealers



Source: Federal Reserve Bank of New York, FR 2004, Government Securities Dealers Reports. Source accessed through Haver Analytics.  
Notes: For periods prior 2013:Q2, the chart shows the share of corporate securities in the total of federal agency and government-sponsored enterprise (GSE) securities, federal agency mortgage-backed securities (MBS), and corporate securities. Starting in 2013:Q2, the chart shows the share of corporate “debt, equities, and other” in the total of U.S. Treasury securities, federal agency and GSE securities, federal agency MBS, corporate debt, equities, and other, for repurchase agreements (repos) and securities lent. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

CHART 17  
Short-Term Funding as a Percentage of GDP



Source: Federal Reserve Board, Financial Accounts of the United States. Source accessed through Haver Analytics.  
Note: The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

securities-lending transactions. Repo transactions increasingly use risky corporate debt as collateral (Chart 16).

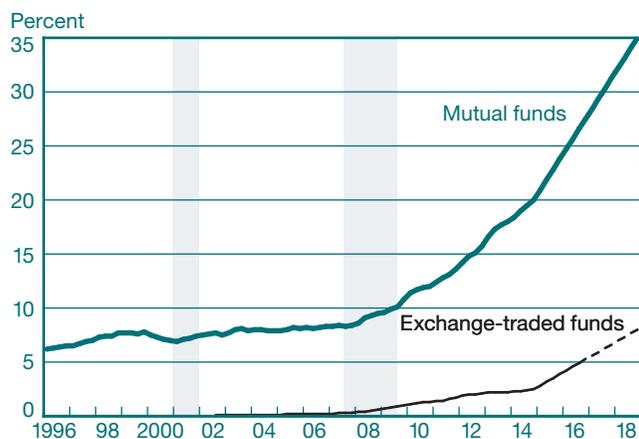
As a result, short-term wholesale funding as a fraction of GDP rises from 28 percent in early 2015 to 35 percent by the end of 2016, though that figure is far below the pre-crisis peak of 57 percent (Chart 17). The rise in short-term funding reflects repo, commercial paper, securities lending, and other forms of money market funding. Short-term funding is expected to rise slightly above 40 percent of GDP by the end of 2018.

Mutual funds and exchange-traded funds increasingly shift their portfolios away from highly liquid Treasury securities and agency debt and toward corporate and sovereign debt, acquiring increasing shares of the total amount outstanding in the market (Chart 18). While the risk of fire sales by banks, broker-dealers, and insurance companies is mitigated as a result of stricter regulations, the greater importance of mutual funds among corporate bond investors generates new sources of risk.<sup>10</sup> Mutual funds are potentially subject to sudden

<sup>10</sup> The Investment Company Act of 1940, enforced by the Securities and Exchange Commission, prohibits open-ended mutual funds from holding more than 15 percent of net assets in illiquid securities. Although the rule aims to limit the mutual funds’ holdings of illiquid corporate debt, in practice the SEC defines “illiquid securities” only broadly—as securities that “may not be sold or disposed of in the ordinary course of business within seven days at approximately the value at which the mutual fund has valued the investment on its books.”

CHART 18

### Mutual Fund and Exchange-Traded Fund Holdings of Corporate and Foreign Bonds as a Percentage of the Total Market Outstanding



Source: Federal Reserve Board, Financial Accounts of the United States. Source accessed through Haver Analytics.

Notes: The total market outstanding is computed as all sectors' liabilities of corporate and foreign bonds held by U.S. residents, available under category L.213 in the Financial Accounts of the United States. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

redemptions that can lower bond liquidity and widen credit spreads, thus leading to a deterioration of financing conditions for corporate borrowers.

## 2.5 Hypothetical Vulnerabilities

As detailed above, the scenario highlights three key risks in financial markets. First, the possibility exists of disruptions in the corporate debt market, such as a corporate default cycle, market overreaction to U.S. monetary policy normalization, or a jump in the pricing of credit risk that could result from a sudden reversal in risk appetite or foreign capital flows.

Second, to the extent that these shocks hit the commercial mortgage market, they amplify the risk of a sharp correction in commercial property prices. Disruptions to the corporate debt and commercial mortgage markets would affect the real economy directly, as nonfinancial firms lose access to financing and reduce their investment, and also indirectly, as lenders suffer valuation losses and cut lending further. The cost to the real economy increases

with the size of the markets affected and the range of institutions involved (see Charts 19 and 20).<sup>11</sup>

Third, the increased reliance on short-term wholesale funding leaves banks and nonbank financial intermediaries vulnerable to the risk of runs on their short-term liabilities. In particular, as repo funding increasingly uses risky corporate bonds as collateral (Chart 16), disruptions in the long-term corporate bond market would impair short-term funding. Consequently, given the increasing extent of maturity transformation at financial intermediaries, disruptions in short-term funding would have additional negative consequences on the long-term debt markets as well. In particular, owing to increased concentration in illiquid corporate debt, hedge funds and bond mutual funds would become increasingly vulnerable to large redemptions in the event of adverse shocks to the corporate bond market, which would cause fire sales and exacerbate the downward pressure on asset prices.

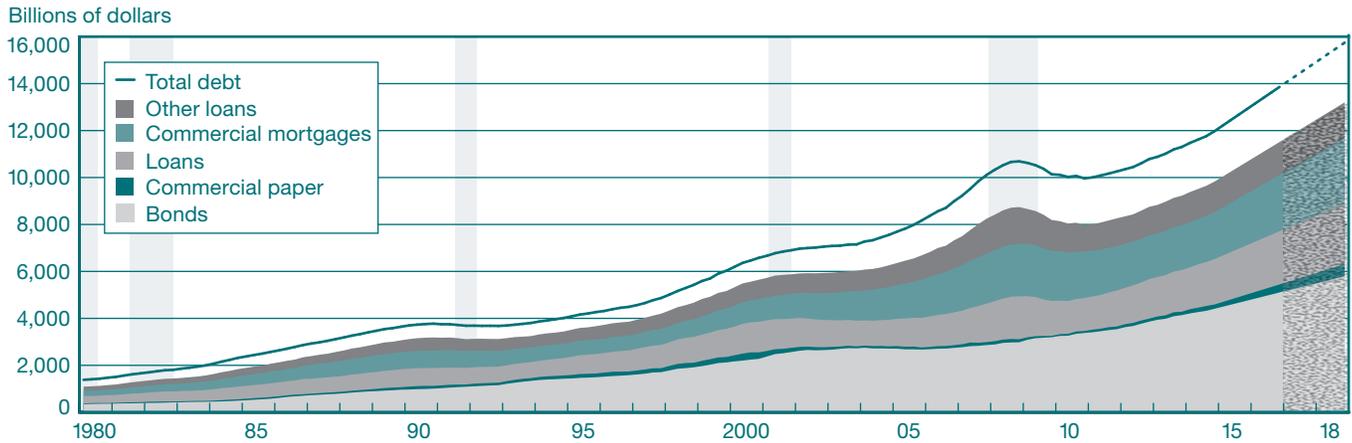
## 3. PRUDENTIAL TOOLS TO ADDRESS FINANCIAL STABILITY RISKS

In this section, we outline the range of regulatory and supervisory tools that the Board of Governors of the Federal Reserve System can potentially use to mitigate the impact of cyclical variations in financial stability risks—those that arise only at certain times during the financial cycle, such as in booms or busts. These variations can result from overheating or the realization of stress scenarios. Note that the utilization of some tools will need to be coordinated with other banking regulators.

There are six broad categories of tools: (1) capital regulation, (2) liquidity regulation, (3) credit regulation, (4) supervisory stress tests, (5) supervisory guidance, and (6) moral suasion. The purpose of the exercise is for COP subcommittee members to gain a better understanding of the practicalities involved in applying macroprudential tools; it is not to opine on which tools would be applicable in the current economic environment.

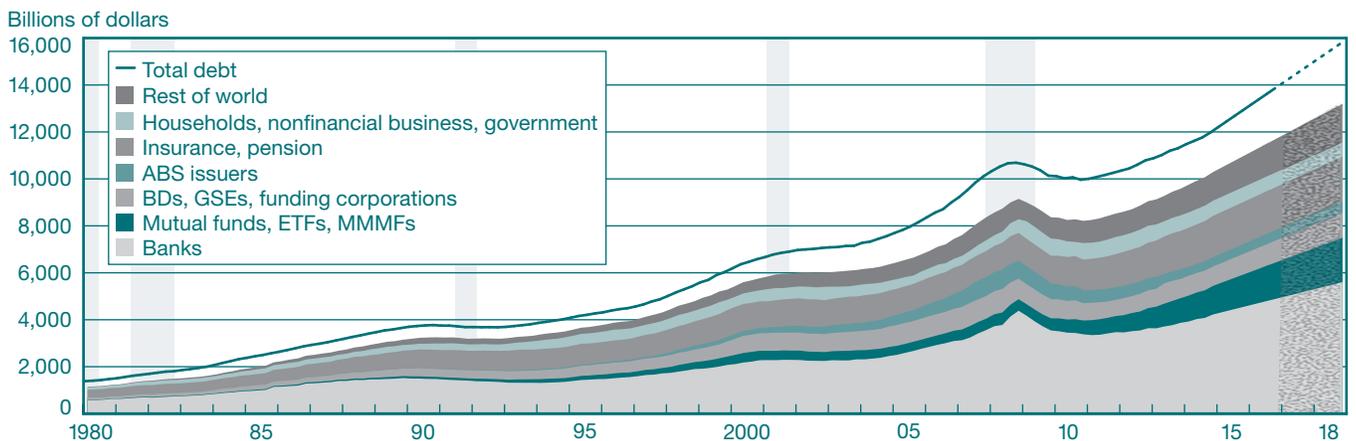
<sup>11</sup> U.S. banks had little exposure to bonds, holding only about 6 percent of the total outstanding in late 2014. By contrast, U.S. shadow banking institutions, U.S. insurance companies, and foreign entities each held about one quarter of the total outstanding. U.S. banks had larger exposures to commercial mortgages, holding 56 percent of the total, while issuers of asset-backed securities, life insurers, and real estate investment trusts held 15, 13, and 8 percent, respectively. Finally, U.S. banks and credit unions held the majority of loans other than mortgages—87 percent of the total. These statistics are based on the Financial Accounts of the United States, published by the Board of Governors of the Federal Reserve System.

CHART 19  
Nonfinancial Business Sector Debt by Instrument



Sources: Federal Reserve Board, Financial Accounts of the United States; authors' calculations. Financial Accounts accessed through Haver Analytics.  
Note: The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

CHART 20  
Nonfinancial Business Sector Debt by Holder



Sources: Federal Reserve Board, Financial Accounts of the United States; authors' calculations. Financial Accounts accessed through Haver Analytics.  
Notes: ABS is asset-backed securities. BD is broker-dealer. GSE is government-sponsored enterprise. ETF is exchange-traded fund. MMMF is money market mutual fund. The shaded areas indicate periods designated recessions by the National Bureau of Economic Research.

We describe each tool, its scope of application, whether it applies to downturn or overheating scenarios (or both), and its associated implementation challenges or limitations. Several broad themes emerge across the tools considered in the exercise:

- Prudential tools can be used to build resilience against shocks, in addition to “leaning against”

emerging risks to financial stability.<sup>12</sup> This is an advantage over monetary policy, which would address financial stability concerns only by “leaning against the wind.”

<sup>12</sup> For example, capital regulation can be used to build resilience, as the capital buffer serves to absorb unexpected losses at individual firms. To the extent that increased capital requirements discourage lending activity in the affected sector(s), capital regulation can also be used to “lean against the wind.”

- Many (though not all) tools can be used to target specific exposures. This ability to target exposures is a potential advantage relative to monetary policy tools in cases where policymakers are concerned only about a specific sector.
- Most of the tools are subject to a lag between the time policymakers decide to apply the tool and the time the tool actually becomes effective. In many instances, this lag may arise as a result of administrative processes.
- Several tools are more effective in the run-up to a crisis or recession than they are during the crisis or recession.<sup>13</sup> This characteristic proved relevant during the exercise because the scenario under consideration involved overheating.
- Many tools are subject to limitations in their scope of application, with most applying only to banking organizations rather than to the full range of entities engaged in financial intermediation.

The set of prudential tools together with their limitations is further outlined in Table 2.

### 3.1 Capital Regulation

#### *Leverage Ratios*<sup>14</sup>

The Federal Reserve Board's minimum leverage ratios require banking organizations to hold at least a minimum amount of capital relative to their exposures. The U.S. regulatory capital rules include two leverage ratios: the leverage ratio and the supplementary leverage ratio (SLR).

- The leverage ratio applies to all banking organizations subject to the Federal Reserve Board's regulatory capital rules.<sup>15</sup> It is measured as tier 1 capital divided by average total consolidated assets.<sup>16</sup> The minimum leverage ratio requirement is 4 percent.<sup>17</sup>
- The SLR is effective January 1, 2018, and will apply only to banks deemed "advanced approaches banking

<sup>13</sup> As we shall note, countercyclical capital buffers, loan-to-value ratios, margins, and supervisory guidance would apply in a downturn only under specific circumstances.

<sup>14</sup> See 12 CFR 217.10.

<sup>15</sup> It generally does not apply to bank holding companies or savings and loan holding companies with less than \$1 billion in total consolidated assets.

<sup>16</sup> Tier 1 capital is a key regulatory measure of banks' capital, consisting primarily of common stock, noncumulative perpetual preferred stock, and retained earnings.

<sup>17</sup> All insured depository institutions are required to meet a 5 percent tier 1 leverage ratio requirement to be considered "well capitalized" under the Prompt Corrective Action (PCA) framework. The PCA framework is intended to ensure that problems at the insured depository institutions are addressed promptly and at the least cost to the FDIC's

organizations.<sup>18</sup> It will be measured as tier 1 capital divided by total leverage exposure, which equals the daily average total consolidated assets plus certain off-balance-sheet exposures. The minimum SLR requirement will be 3 percent.

- In addition, effective January 1, 2018, there will be an enhanced SLR requirement applicable to U.S. top-tier bank holding companies identified as globally systemically important banking organizations (G-SIBs). The enhanced requirement consists of a 2 percent leverage buffer above the minimum SLR requirement, for a total of 5 percent.<sup>19</sup>

Minimum leverage requirements may be used as a countercyclical tool in downturn or overheating scenarios in accordance with applicable administrative processes. For example, U.S. banking agencies have issued public notices in times of anticipated unusual and temporary asset growth (such as an influx of deposits that increased average total assets in the lead-up to the Year 2000 problem, or Y2K, and in the period following the terrorist attacks of September 11, 2001) that acknowledged the potential for declines in banking organizations' leverage ratios.<sup>20</sup> In addition, under the enhanced SLR, banking organizations' capital levels may fall below the leverage buffer amount without breaching the 3 percent regulatory minimum requirements, allowing banking organizations to continue lending activities during times of stress, albeit subject to restrictions on distributions and discretionary bonus payments.

*Limitations and other considerations.* Leverage ratios do not differentiate across exposure types—in other words, the same capital requirement generally applies to all assets. In addition, as noted above, the SLR standard only applies to a subset of the largest banking organizations. Moreover, any public notice that acknowledges temporary asset growth

#### *Footnote 17 (continued)*

Depositor Insurance Fund. Insured depository institutions that fail to meet the capital measures under the PCA framework are subject to increasingly strict limits on their activities, including their ability to make capital distributions, pay management fees, grow their balance sheets, and take other actions.

<sup>18</sup> Advanced approaches banking organizations are those with at least \$250 billion in total consolidated assets or at least \$10 billion in consolidated on-balance-sheet foreign exposures.

<sup>19</sup> Organizations that maintain an SLR of 5 percent or less are subject to restrictions on distributions and certain discretionary bonus payments (though not in the form of a PCA requirement, because BHCs are not subject to PCA requirements). Insured depository institutions of G-SIBs are required to meet a 6 percent SLR in order to be considered "well capitalized" under the PCA framework.

<sup>20</sup> Given that such declines had the potential to result in consequences for the banks under PCA, banking organizations were encouraged to inform the banking agencies if capital ratios fell and to discuss options to address any temporary breach of capital ratio minimum requirements.

TABLE 2

## Prudential Tools to Address Cyclical Changes in Financial Conditions

Prudential Tool Categories	Tools	Risks Addressed <sup>a</sup>	Applicable Scenarios		Can Target Specific Exposures?	Applicable Banks/BHCs	Requires Interagency Agreement?	Considerations <sup>b</sup>
			Boom	Bust				
Capital regulation	Leverage ratios	Lev	X	X	No	Minimum leverage ratio (LR) to all, supplementary leverage ratio (SLR) to advanced approaches <sup>c</sup>	Yes	Assume SLR is effective by the fourth quarter of 2016 for the purposes of the tabletop exercise.
	Countercyclical buffers (CCyB)	Val, Lev	X	X <sup>d</sup>	No	\$250 billion or more in assets <sup>e</sup>	Yes	Increases are effective twelve months after announcement, sooner in emergencies; decreases are effective immediately.
	Sectoral risk weights	Val, Lev	X	X	Yes	All	Yes	
Liquidity regulation	Liquidity coverage ratio (LCR)	Liq	X	X <sup>f</sup>	No	\$50 billion or more in assets <sup>g</sup>	Yes	
	Net stable funding ratio (NSFR) <sup>h</sup>	Liq	X	X	No	TBD	Yes	
Credit regulation	Loan-to-value ratio (LTV)	Val, Lev	X		Yes	All	Yes	LTVs have been implemented through guidance that can be changed more expeditiously.
	Margins	Val, Lev	X		Yes	All and nonbanks	No	Implement using the Federal Reserve's authority under the Securities Exchange Act of 1934.
Supervisory stress test	Comprehensive Capital Analysis and Review (CCAR)	Val, Lev	X	X	Yes	BHCs with \$50 billion or more in assets	No	Annual frequency creates challenges. Targeting specific exposures requires preannouncing and/or repeating the scenario.
	Comprehensive Liquidity Assessment and Review (CLAR)	Liq	X	X	Yes	BHCs in LISCC portfolio <sup>i</sup>	No	Potential delayed impact owing to CLAR messages being delivered annually.
Supervisory guidance		Val, Lev, Liq	X	X	Yes	All	No	
Moral suasion		Val, Lev, Liq	X	X	Yes	All	No	

<sup>a</sup>The risks are valuation (val), leverage (lev), and maturity and liquidity (liq).

<sup>b</sup>Most of the tools in this table are subject to a lag between the time policymakers decide to apply the tool and the time the tool becomes effective. In many instances, this lag may arise from administrative processes.

<sup>c</sup>Does not apply to bank holding companies with pro forma consolidated assets of less than \$1 billion that meet several criteria. SLR applies to banks with \$250 billion or more in assets or \$10 billion or more in foreign exposures and enhanced SLR applies to U.S. top-tier holding companies identified as globally systemically important banking organizations (G-SIBs).

<sup>d</sup>The CCyB can be applied in downturn scenarios only if it has previously been activated to a nonzero level.

<sup>e</sup>Also applies to banks with \$10 billion or more in foreign exposures.

<sup>f</sup>Supervisors have discretion in determining the timeframe for remediating an LCR shortfall. For the purposes of the tabletop exercise, assume that the NSFR rule allows similar discretion.

<sup>g</sup>LCR applies to banks with \$250 billion or more in assets or \$10 billion or more in foreign exposures. Modified LCR applies to banks with \$50 billion or more in assets.

<sup>h</sup>For purposes of the tabletop exercise, assume that the NSFR is implemented similarly to the LCR in the United States and is effective by the fourth quarter of 2016.

<sup>i</sup>See [www.federalreserve.gov/bankinfo/large-institution-supervision.htm](http://www.federalreserve.gov/bankinfo/large-institution-supervision.htm) for a list of firms in the Large Institution Supervision Coordinating Committee (LISCC) portfolio.

resulting from exogenous factors that might adversely affect banking organizations' minimum leverage ratios would require timely interagency agreement, which would need to be balanced against concerns that a poorly timed message might signal a potential crisis.

### *Countercyclical Capital Buffer*<sup>21</sup>

As part of Basel III regulatory reform, banking organizations are required to hold a capital conservation buffer (CCB) in an amount greater than 2.5 percent of total risk-weighted assets (RWAs). The CCB is composed of common equity tier 1 capital, and is in addition to the minimum risk-based capital requirements. The capital conservation buffer may be expanded, up to an additional 2.5 percent of total RWAs for a maximum buffer of 5 percent, for advanced approaches banking organizations (defined above). The additional CCB (above 2.5 percent) is referred to as the countercyclical capital buffer (CCyB). The CCyB amount in the U.S. rule is currently 0 percent.<sup>22</sup> When a banking organization does not maintain its CCB (plus any relevant CCyB), it is subject to dividend and discretionary bonus payment restrictions.

The U.S. banking agencies can adjust the buffer from 0 percent to 2.5 percent based on a range of macroeconomic, financial, and supervisory information indicating an increase in systemic risk.<sup>23</sup> Increases to the CCyB would be effective twelve months from the date of announcement or earlier if the agencies articulate the reasons why an earlier effective date is needed. Decreases to the CCyB would be effective on the day following the announcement of the final determination. Unless extended, the CCyB would return to 0 percent twelve months after the effective date.

Given that the CCyB could be activated prior to a period of stress, it could require banking organizations to raise capital when capital is relatively cheap and the system is not under stress. In addition to serving the prudential objective of achieving better capitalized banking organizations, the CCyB might further restrain the buildup of financial system vulnerabilities by influencing the amount and terms of

<sup>21</sup> See 12 CFR 217.11.

<sup>22</sup> Under the reciprocity agreement reached by the United States and other member countries at the Basel Committee, a U.S. banking organization's CCyB amount can be affected by the setting of the CCyB in all jurisdictions where it maintains private sector credit exposures.

<sup>23</sup> Such information includes the ratio of credit to GDP, a variety of asset prices, other factors indicative of relative credit and liquidity expansion or contraction, funding spreads, credit condition surveys, indexes based on credit default swap spreads, options-implied volatility, and measures of systemic risk.

credit conditions. Likewise, the CCyB could allow capital requirements to decrease in a stress period or enable banking organizations to withstand greater losses than if they did not have a buffer before their solvency is called into question. Thus, the CCyB can be applied to both downturn and overheating scenarios, although it can only be applied in downturn scenarios after the CCyB has been activated.

*Limitations and other considerations.* The CCyB does not differentiate across exposure types. While it could be activated and de-activated based on vulnerabilities identified for specific exposures, the CCyB would be applied at the overall bank level, and not at the targeted exposure level. In addition, there is a twelve-month lag for any increase in the CCyB to become effective (with the possibility of exceptions). Finally, adjustments to the CCyB will be based on a determination made jointly by the banking agencies. Because the CCyB amount would be linked to the condition of the overall U.S. financial system and not the characteristics of an individual banking organization, the banking agencies expect that the CCyB amount would be the same at the depository institution and BHC level.

### *Sectoral Risk Weights*

Apart from the Basel III-based CCyB, countries such as the United Kingdom, Switzerland, and Israel have utilized sectoral capital requirements, which apply additional capital requirements on exposures to specific sectors judged to pose a risk to the system. Sectoral risk weights might also be used to reduce capital requirements on safer sectors during a downturn.

*Limitations and other considerations.* Sectoral risk weights could be applied to both downturn and overheating scenarios in accordance with applicable administrative processes. The weights could differentiate across exposure types. However, banking organizations may choose to meet the additional capital requirements for the targeted sector by reducing other exposures in other sectors.

## 3.2 Liquidity Regulation

### *Liquidity Coverage Ratio*<sup>24</sup>

The liquidity coverage ratio (LCR) requires that banking organizations hold a minimum amount of unencumbered high-quality liquid assets (the numerator of the ratio) to withstand net cash outflows (the denominator) over a

<sup>24</sup> See 12 CFR 249.

thirty-day stress period characterized by simultaneous idiosyncratic and marketwide shocks.

Beginning in January 2017,<sup>25</sup> banking organizations with assets equal to or greater than \$250 billion or with foreign exposure equal to or greater than \$10 billion must meet a 100 percent LCR on a daily basis.<sup>26</sup> Banking organizations with assets between \$50 billion and \$250 billion with foreign exposure less than \$10 billion will be subject to a modified LCR, which will be measured monthly.

The U.S. LCR requires banking organizations that are subject to daily compliance and that fall below the minimum threshold for a period of three consecutive business days to promptly submit a remediation plan to their primary regulator. The rule does not impose a fixed requirement on BHCs that are subject to monthly U.S. LCR compliance, but rather allows for supervisory discretion when determining if a remediation plan is necessary. In both cases, the rule does not mandate a specific timeframe for returning to full compliance. The allowance for supervisory discretion in determining the timeframe for remediating an LCR shortfall should enable banking organizations to appropriately utilize their liquidity resources during a period of stress, mitigating the effects of idiosyncratic and marketwide shocks.

*Limitations and other considerations.* The LCR could be applied to downturn scenarios, via supervisory discretion, and to overheating scenarios in accordance with applicable administrative processes. The LCR does not differentiate exposure types and only applies to a subset of banking organizations, as described earlier. Banking organizations may be reluctant to draw down their high-quality liquid assets buffer, particularly in an idiosyncratic stress event that does not immediately affect other market participants, if the usage of these resources could be perceived as a negative signal. In addition, there will be need for coordination across U.S. banking agencies in determining the response to an LCR breach as well as assessing the appropriate timeframe for returning to compliance.

### *Net Stable Funding Ratio*<sup>27</sup>

The net stable funding ratio (NSFR) measures a banking organization's sources of stable funding relative to its on- and off-balance-sheet exposures, weighted by factors

<sup>25</sup> January 2017 marks the end of the LCR phase-in period, which began in January 2015 for banking organizations subject to the full LCR, and in January 2016 for banks subject to the modified LCR.

<sup>26</sup> All subsidiaries of these institutions that are insured depositories with assets greater than or equal to \$10 billion are also independently subject to the U.S. LCR requirement.

<sup>27</sup> See <http://www.bis.org/bcb/publ/d295.htm>.

reflective of the exposures' inherent liquidity characteristics. The Basel III NSFR was finalized in October 2014. The U.S. regulatory agencies have not yet issued a domestic rule to implement the NSFR.

The Basel NSFR standard does not contain any prescriptive measures regarding enforcement of an NSFR breach or remediation of a shortfall. If the U.S. agencies implement an approach similar to the LCR, banking organizations may be able to fall below the NSFR threshold during periods of stress or credit contraction, when market funding is scarcest.

*Limitations and other considerations.* The NSFR does not differentiate across exposure types. The flexibility of U.S. policymakers to allow for and respond to temporary NSFR shortfalls will not be known until the U.S. NSFR rule is finalized; any flexibility likely will require coordination across the banking agencies. In addition, the NSFR, like the LCR, may only apply to a subset of banking organizations.

## 3.3 Credit-Related Tools

### *Caps on Loan-to-Value Ratios*

Credit-related tools are another macroprudential approach being used in countries such as Canada, Norway, and Korea. These tools include caps on loan-to-value (LTV) ratios, which restrict credit based on the value of the underlying collateral and hence dampen demand for a specific lending activity. These tools can increase the resilience of the banking system by decreasing both the probability of default and losses, given default.<sup>28</sup>

The U.S. banking agencies have the authority to issue rules applicable to insured depository institutions' real-estate-related lending activity. The U.S. banking agencies have issued supervisory guidance on prudent underwriting practices that includes maximums for LTV ratios that vary by real estate loan type, derived at the time of loan origination. The Federal Reserve Board could amend the guidance to increase the LTV standards. In addition, the Federal Reserve Board's regulatory capital rules incentivize banks to have prudent underwriting standards by differentiating capital requirements among exposures based on whether or not they were underwritten in compliance with the guidance.<sup>29</sup> Under

<sup>28</sup> Credit-related tools also include caps on debt-to-income (DTI) ratios, which are similar in many aspects to the caps on LTV ratios. The caps on DTI ratios can restrict certain types of loans based on the borrower's income. Hence, lower DTI caps can reduce banks' exposure to certain assets, thus addressing overheating concerns in specific sectors and enhancing banks' resilience to shocks.

<sup>29</sup> See 12 CFR 217.32.

the regulatory capital rules, the Federal Reserve Board could increase the capital that must be held against exposures that were not underwritten in compliance with the guidance.

*Limitations and other considerations.* Lower LTV ratios can be attained during overheating scenarios by tightening the caps. However, this tool would likely not be effective in downturn scenarios. While the LTV caps could be relaxed to increase credit demand, banking organizations might steer away from such loans in downturn scenarios. Therefore, supervisors generally would be relaxing a nonbinding constraint. LTV ratio caps can differentiate exposure types based on the type of collateral. Another limitation of the caps on LTV ratios is that they will only impact a subset of lenders and, therefore, may not substantially affect lending activity in a particular segment of the U.S. economy as long as banking organizations hold only a small portion of newly originated mortgages.

### *Margin Requirements for Securities Financing Transactions*

Setting minimum initial and variation margins for securities financing transactions can constrain excess leverage in the financial system and dampen demand for the assets being financed.<sup>30</sup> Margin requirements can vary based on credit conditions; the minimum requirement can be increased in an overheating scenario to reduce the leverage available to borrowers, and it can be reduced in a time of stress to lower the pressure on borrowers to post additional margin or face fire sale risk.

Under the Securities Exchange Act of 1934, the Federal Reserve Board has the authority to set initial and variation margin requirements for financing that is collateralized by securities extended by broker-dealers, banks, and other nonbank lenders. Although the Federal Reserve Board used this tool between 1934 and 1974 to adjust the initial margin requirements for the equity markets and thus limit excess leverage used by investors, it has not used the tool since.

The Federal Reserve Board could consider using this authority to set and change the minimum initial and variation margin requirements for securities financing transactions, such as reverse repurchase agreements, across the financial system. The minimum margin requirements could be based on what the Financial Stability Board has recommended, as described in the section below. However, its authority under the Securities Exchange Act of 1934 to impose minimum margin requirements for securities financing transactions

<sup>30</sup> Variation margin is part of the margin agreement between clients and brokers that varies as a function of market conditions.

is limited in certain ways. The statute does not include the authority to impose minimum margin requirements for credit extended on U.S. government and agency securities by all lenders (whether broker-dealers, banks, or nonbank lenders).

The Financial Stability Board has recently finalized a framework of minimum haircuts on non-centrally cleared securities financing transactions in which financing against collateral other than government securities is provided to entities other than banks and broker-dealers.<sup>31</sup> In addition, non-centrally cleared securities financing transactions performed in any operations with central banks are also outside the scope of application.

Securities financing transactions provided by regulated or unregulated lenders to unregulated borrowers (such as hedge funds) will be within the scope of the Financial Stability Board framework to limit the buildup of excessive leverage outside the banking system and maintain a level playing field between regulated and unregulated securities financing lenders. Financing provided to banks and broker-dealers subject to adequate capital and liquidity regulation on a consolidated basis is excluded because applying numerical haircut floors to these transactions may duplicate existing regulations.

*Limitations and other considerations.* Regulators can apply margin requirements to overheating scenarios by raising the minimum margin requirements. However, this tool would likely not be effective in stress scenarios for the same reason that the LTV cap would not be effective in such scenarios. Regulators can also differentiate exposure types based on the type of collateral. However, for margin requirements to be effective, coordinated responses from other jurisdictions are needed (both for introducing the initial margin requirements and for subsequent adjusting). Otherwise, borrowers might circumvent the minimum margin requirements if they are able to borrow from an overseas market in a manner not subject to the scope of the margin requirements. The Federal Reserve Board will need to issue a notice of proposed rulemaking to impose margin requirements.

## 3.4 Supervisory Stress Tests

### *CCAR*<sup>32</sup>

The Federal Reserve Board's annual Comprehensive Capital Analysis and Review (CCAR) applies to bank holding

<sup>31</sup> See [http://www.financialstabilityboard.org/wp-content/uploads/SFT\\_haircuts\\_framework.pdf](http://www.financialstabilityboard.org/wp-content/uploads/SFT_haircuts_framework.pdf).

<sup>32</sup> See 12. CFR 225.8.

companies with assets of \$50 billion or more.<sup>33</sup> It includes both a qualitative review of a banking organization's capital planning process and a quantitative assessment of the banking organization's ability to maintain capital ratios above the required minimums under stressful scenarios. The Federal Reserve Board can object to a bank's capital plan and capital distributions for qualitative reasons, quantitative reasons, or both. The scenarios and outcomes are disclosed to the public.

When identified vulnerabilities rise to prominence in the months before CCAR scenarios are issued, the Federal Reserve Board could adapt the supervisory scenarios to stress these vulnerabilities in a timely fashion. If the Federal Reserve Board preannounced supervisory scenarios targeting specific exposures before the stress test "as of date" (in other words, before December 31) and also signaled that those scenarios would be repeated for future CCAR cycles until the concerns are addressed, then banks (especially those whose capital ratios under the scenario fall below the required minimums) might be motivated to adjust their holdings accordingly over time.<sup>34</sup>

*Limitations and other considerations.* CCAR could be applied as a macroprudential tool in both downturn and overheating scenarios. It can also differentiate exposure types based on the design of stressed scenarios. As noted above, CCAR applies only to a subset of banking organizations and is an annual exercise, making it less timely than other tools. When identified macrofinancial vulnerabilities occur between two annual CCAR cycles, the Capital Plan Rule, which governs CCAR, allows the Federal Reserve Board to require a single banking organization, a subset of banking organizations, or all banking organizations to resubmit their capital plans. Resubmission is required if the Federal Reserve Board determines that changes in financial markets or the macroeconomic outlook that could have a material impact on the BHC's risk profile and financial condition require the use of updated scenarios.<sup>35</sup> In addition, certain vulnerabilities, such as the origination of loans destined to be sold to nonbanks, may be difficult to stress through a macroeconomic or market scenario, requiring a change to the stress test framework.

<sup>33</sup> In addition, intermediate holding companies of foreign banking organizations will become subject to the capital plan rule starting in 2017.

<sup>34</sup> If the Federal Reserve Board did not signal that the scenarios would be repeated in future CCAR cycles, then the impact might be limited because banks could understate stress outcomes by temporarily exiting those exposures and buying them back after the "as of date."

<sup>35</sup> The Board could require banks to resubmit capital plans within thirty calendar days of certain events, including changes in financial markets or the macroeconomic outlook that could have a material impact on a bank's risk profile or financial condition that would require the use of updated scenarios.

## CLAR

The Federal Reserve Board's annual supervisory Comprehensive Liquidity Assessment and Review (CLAR) exercise aims to improve banking organizations' liquidity resilience by assessing the adequacy of each firm's liquidity position in light of the firm's own risks and by evaluating the strength of the firm's liquidity risk management.<sup>36</sup> CLAR involves evaluation of a banking organization's liquidity positions through a range of supervisory liquidity analyses such as funding concentrations, longer funding horizons, and limits on short-term wholesale funding. It also involves the evaluation of each firm's own internal stress tests, such as the firm's assumptions regarding liquidity needs for its prime brokerage services and derivatives trading in stress scenarios.

The qualitative and quantitative review of stress testing and liquidity management and measurement practices can influence a banking organization's internal view of its ability to withstand shocks, and consequently its decision making around taking liquidity risks and reserving against these risks.

*Limitations and other considerations.* CLAR could be applied as a macroprudential tool in both downturn and overheating scenarios. It can also differentiate exposure types based on the scope of supervisory analysis and review. CLAR is under the sole purview of the Federal Reserve Board.

CLAR applies to a subset of banking organizations that are in the Federal Reserve's Large Institution Supervision Coordinating Committee (LISCC) portfolio.<sup>37</sup> In addition, although CLAR is structured as a continuous monitoring process over the year, supervisory evaluations are delivered annually, and thus delays may arise between supervisory assessments and banking organizations' reactions or implementation. Finally, supervisory stress scenarios and outcomes from CLAR are not currently disclosed to the public because they are deemed "confidential supervisory information." Therefore, modifications to this supervisory approach may have a limited impact on market expectations because the market will not know what changes are introduced by the Federal Reserve Board in a given CLAR.

## 3.5 Supervisory Guidance

The Federal Reserve Board and other bank regulators can address potential risks arising from a particular activity by

<sup>36</sup> These objectives reflect the enhanced prudential requirements of Section 165 of the Dodd-Frank Act.

<sup>37</sup> See [www.federalreserve.gov/bankinforeg/large-institution-supervision.htm](http://www.federalreserve.gov/bankinforeg/large-institution-supervision.htm) for a current list of firms in the LISCC portfolio.

issuing supervisory guidance. Supervisory guidance can be effective in establishing expectations for banks and banking organizations related to governance, risk management and measurement, stress testing, valuation, and disclosure. For example, the U.S. banking agencies issued SR 13-3, “Inter-agency Guidance on Leveraged Lending,” to address concerns over the deterioration of underwriting practices.<sup>38</sup>

*Limitations and other considerations.* Supervisory guidance could be applied to overheating scenarios. It could be applied to downturn scenarios to the extent that supervisors find it appropriate to clarify their expectations. Supervisory guidance can differentiate across exposure types by targeting a specific activity. The Federal Reserve Board can issue guidance that applies solely to BHCs without interagency coordination but would need the agreement of the other U.S. banking agencies to issue guidance that is more broadly applicable. Although it can be more expeditious to issue guidance than to issue a notice of rulemaking, doing so in coordination with other bank regulatory agencies can still take time.

### 3.6 Moral Suasion

Federal Reserve policymakers could appeal to banks to address risks arising from a particular activity. This approach could also be used to influence other market participants. Moral suasion might take the form of public speeches or interviews by senior policymakers, discussions with the executives of supervised banks, and industry-wide meetings involving all market participants. For example, the Federal Reserve Board played a key role in organizing meetings between Long-Term Capital Management L.P. and a consortium of fourteen large bank and nonbank financial institutions that ultimately resolved the troubled hedge fund in 1998 (see Greenspan [1998]).

*Limitations and other considerations.* This approach can be implemented quickly. In addition, it can be applied to both downturn and overheating scenarios and can differentiate exposure types by targeting a specific activity. The Federal Reserve Board can seek to influence nonbank market participants but cannot require them to make changes.

<sup>38</sup> SR 13-3 requires a bank that purchases leveraged loans to apply the same standards of prudence, credit assessment techniques, and in-house limits that would apply if the bank originated the loans; sets expectation on underwriting and risk management standards for leveraged loans; encourages originating institutions to be mindful of the reputational risk associated with poorly underwritten leveraged transactions; and requires the banks to conduct periodic stress testing.

## 4. MONETARY POLICY TOOLS TO ADDRESS FINANCIAL STABILITY RISKS

This section outlines the range of monetary policy tools that the Federal Reserve can potentially use to mitigate the risks to financial stability arising from either the overheating of financial markets or the realization of adverse outcomes in the hypothetical scenario.

For the purpose of financial stability objectives in the tabletop exercise, monetary policy tools can be classified into five broad categories: (1) tools targeting interest rates, (2) forward guidance, (3) reserve requirements, (4) discount window lending, and (5) tools used for reserves management and securities lending. The tools in each of these categories and their main characteristics are outlined in Table 3. The remainder of this section presents the tools and discusses their potential to address risks to financial stability, their applicability during boom and bust scenarios, their potential to affect specific markets and institutions, and the challenges or limitations in their implementation.

Several broad themes emerge from our review of monetary policy tools. These themes highlight both the advantages and the limitations of deploying monetary policy tools to achieve financial stability objectives:

- In general, monetary policy tools can lean against risks to financial stability arising from valuation pressures, excessive leverage, and liquidity and maturity transformation.
- Monetary policy tools can be implemented quickly once the policy decision is made—an advantage not shared by macroprudential tools, which frequently involve implementation lags.
- Most monetary policy tools apply symmetrically during booms and busts. (The discount window and emergency lending facilities are exceptions, because they help mostly during busts.)
- Monetary policy tools have a broad reach; they can affect financial conditions in both the banking and non-banking financial sectors.
- However, monetary policy tools are blunt: Unlike many macroprudential tools, they cannot target specific asset classes. (A possible exception is threshold-based forward guidance.)
- Using monetary policy tools to address risks to financial stability could lead to conflicts between policy objectives; for example, monetary tightening may reduce the risks of overheating in specific sectors at the cost of slowing economic growth more broadly.

TABLE 3

## Monetary Policy Tools

Monetary Policy Tool Categories <sup>a</sup>	Tools	Risks Addressed <sup>b</sup>	Applicable Scenarios		Target Specific Exposures?	Applicable Institutions	Considerations
			Boom	Bust			
Targeting the federal funds rate	IOER, ON RRP, outright purchases/sales of Treasury securities	Val, Lev, Liq	X	X	No	IOER is with depository institutions; ON RRP are with primary dealers, money market funds, and GSEs; outright purchases/sales are with primary dealers; the federal funds rate applies to all	Implementation is immediate for most tools described in this table.
Targeting long-term interest rates	Outright purchases/sales of Treasury securities, agency debt, agency MBS (for example, LSAPs)	Val, Lev, Liq	X	X	No	Outright purchases/sales are with primary dealers; long-term rates apply to all	Buy (sell) long-term assets to reduce (increase) long-term interest rates.
	Extending/contracting the maturity profile of Fed balance sheet (for example, MEP)	Val, Lev, Liq	X	X	No	Outright purchases/sales are with primary dealers; the yield curve applies to all	Increase (reduce) the maturity profile to lower (raise) the slope of the yield curve of the underlying securities.
Forward guidance	Public statements and releases	Val, Lev	X	X	Yes	All	Signal the intended path of monetary policy conditional on macrofinancial variables.
Reserve requirements	Reserve ratios	Val, Lev, Liq	X	X	No	Depository institutions	The Federal Reserve Banks have paid interest on required and excess reserves since October 2008.
Discount window lending	Discount window rate, collateral requirements	Val, Lev, Liq		X	No	Depository institutions	Provides liquidity to depository institutions against collateral, considering the market value of the underlying asset minus a haircut.
Securities lending	Regular securities lending	Liq	X	X	No	Primary dealers	The Fed offers securities lending to ensure smooth clearing of Treasury and agency securities.
Reserves management	Repos	Liq	X	X	No	Primary dealers	The Fed uses repos to fulfill reserve needs deemed transitory.
	Term Deposit Facility	Liq	X	X	No	Depository institutions	The Fed offers term deposits to manage the quantity of reserves held by depository institutions, particularly to support monetary tightening.

Note: IOER is interest on excess reserves; ON RRP are overnight reverse repos; GSEs are government-sponsored enterprises; MBS are mortgage-backed securities; LSAP is large-scale asset purchase; MEP is maturity extension program.

<sup>a</sup>See Board of Governors of the Federal Reserve System, Monetary Policy Tools, <http://www.federalreserve.gov/monetarypolicy/policytools.htm>.

<sup>b</sup>The risks are valuation (val), leverage (lev), and maturity and liquidity (liq).

## 4.1 Tools Targeting Interest Rates

The Federal Reserve can choose from a mix of tools, with the selection depending on the type of interest rate targeted:

- *To bring the federal funds rate (the interest rate at which depository institutions trade reserves with each other overnight) into line with the target set by the FOMC, the Federal Reserve engages in permanent open market operations (OMOs). That is, the Federal Reserve purchases (or sells) Treasury securities to inject reserves into (or drain reserves from) the market, and thus to lower (or raise) the federal funds rate. In recent years, the Federal Reserve has also used the interest on excess reserves (IOER) and the overnight reverse repo (ON RRP) facility to help control the federal funds rate. Each of these tools is discussed below.*
- *To influence longer-term interest rates, the Federal Reserve can also trade longer-term securities, such as agency debt, agency mortgage-backed securities (MBS), and longer-term Treasury securities.<sup>39</sup>*
- *To influence term premia, the Federal Reserve engages in simultaneous but opposite transactions with short-term and long-term securities, thus affecting the slope of the yield curve of the underlying asset.<sup>40</sup>*

The permanent OMOs consist of outright purchases (or sales) of securities by the Federal Reserve in pursuit of longer-term goals, such as increasing (or decreasing) the amount of reserves available to banks. Under Section 14 of the Federal Reserve Act, the Federal Reserve has the authority to purchase or sell a range of assets that include Treasury securities, agency debt, and agency MBS—transactions that result in changes in the size of the Federal Reserve balance sheet and the supply of reserve

<sup>39</sup> After the federal funds target rate was effectively reduced to the zero lower bound in late 2008 (in other words, a target range between zero and 25 basis points), the Federal Reserve implemented three large-scale asset purchase (LSAP) programs between December 2008 and October 2014 by purchasing longer-term securities (agency debt, agency MBS, and Treasury securities), with the goal of putting downward pressure on longer-term interest rates. For a summary of LSAPs, see [http://www.federalreserve.gov/monetarypolicy/bst\\_openmarketops.htm](http://www.federalreserve.gov/monetarypolicy/bst_openmarketops.htm). Although the purchases were discontinued in October 2014, the Federal Reserve still purchases MBS under a policy in which principal payments from its holdings of agency debt and agency MBS are reinvested in agency MBS.

<sup>40</sup> For instance, under the maturity extension program (MEP) from late 2011 to the end of 2012, the Federal Reserve extended the average maturity of its holdings of Treasury securities in order to decrease longer-term interest rates, by purchasing securities with remaining maturities of six years to thirty years and selling an equal par amount of securities with remaining maturities of three years or less. For details on the MEP, see <http://www.federalreserve.gov/newsevents/press/monetary/20110921a.htm> and [http://www.newyorkfed.org/markets/opolicy/operating\\_policy\\_110921.html](http://www.newyorkfed.org/markets/opolicy/operating_policy_110921.html).

balances.<sup>41</sup> The permanent OMOs follow decisions by the FOMC and are implemented by the Trading Desk at the Federal Reserve Bank of New York, which trades with qualified primary dealers.

In addition to using permanent OMOs, the Federal Reserve has deployed the IOER rate and the ON RRP facility to help manage the federal funds rate and maintain it within the target range.<sup>42</sup> By setting the IOER rate, the Federal Reserve can influence the federal funds rate, since depository institutions (DIs) have little incentive to lend to each other at rates below the IOER.<sup>43</sup> However, the IOER has not served as a hard floor for the federal funds rate, since institutions other than DIs can also lend in the federal funds market, but are not eligible to receive IOER. Such institutions—including government-sponsored enterprises (GSEs), primary dealers, and money market mutual funds—have tended to lend to DIs at rates below the IOER. Therefore, the Federal Reserve has used the ON RRP facility, to which the aforementioned institutions are eligible counterparties, as a supplementary policy tool to influence the federal funds rate. Since the ON RRP offering rate is the maximum interest rate that the Federal Reserve agrees to pay on the counterparties' reverse repos (arrangements in which the Federal Reserve sells securities and repurchases them the next day), the counterparties have little incentive to lend in the federal funds market at below the ON RRP rate. As a result, the IOER and ON RRP rates have served as the top and bottom of the target range of the federal funds rate.

Overall, the tools targeting interest rates can serve financial stability goals in a number of ways. For instance, monetary tightening can curb valuation pressures and excess leverage by limiting credit growth (for example, either by restraining credit demand through the interest rate channel, or by reducing credit supply through the bank lending and bank capital channels).<sup>44</sup> Monetary tightening can also enhance liquidity by increasing the amount of liquid assets (other than cash) available in the market

<sup>41</sup> Agency debt refers to the debt of government-sponsored enterprises such as Fannie Mae, Freddie Mac, and Ginnie Mae. Agency MBS refers to MBS guaranteed by the aforementioned government-sponsored enterprises.

<sup>42</sup> See <https://www.federalreserve.gov/monetarypolicy/reqresbalances.htm> and <https://www.federalreserve.gov/monetarypolicy/overnight-reverse-repurchase-agreements.htm>.

<sup>43</sup> Since October 2008, the Federal Reserve has paid IOER on the reserve balances that depository institutions hold at Federal Reserve Banks in excess of the minimum required, in addition to interest on required reserves.

<sup>44</sup> The transmission channels of monetary policy are explained in the next section. Transmission channels include the interest rate channel, the balance sheet channel, the bank lending channel, the bank capital channel, and the risk-taking channel.

as the Federal Reserve sells liquid Treasury securities, and can reduce the incentive for risk taking by increasing the yields of safe assets. These tools can be applied immediately, can work during booms and busts, and can affect financial conditions in sectors that macroprudential tools generally cannot reach, such as the nonbank financial sector. However, targeting interest rates cannot address concerns related to specific sectors (for example, selling Treasury securities tightens financial conditions throughout the economy, not only in targeted sectors with overheating concerns). Finally, targeting interest rates for financial stability may lead to conflicts among policy objectives (for example, they may curb the growth in commercial real estate prices and corporate leverage, but at the cost of dampening inflation pressures even more and pushing unemployment above the hypothetical scenario-specific NAIRU).

## 4.2 Forward Guidance

With the federal funds rate at the zero lower bound, the Federal Reserve has increasingly used forward guidance to signal the future path of monetary policy as a way to affect longer-term interest rates. Since December 2008, FOMC press releases have included language suggesting that the federal funds target rate would remain exceptionally low “for some time,” “for an extended period,” at least until a specific date, or at least as long as unemployment and inflation do not breach certain thresholds (“threshold-based forward guidance”). Announcing that the federal funds rate would remain low for longer than previously anticipated may provide monetary stimulus by reducing long-run interest rates (see Del Negro, Giannoni, and Patterson [2015]; Harrison, Körber, and Waldron [2015]; McKay, Nakamura, and Steinsson [2015]).

In principle, a form of threshold-based forward guidance could be deployed for financial stability purposes. For example, the Federal Reserve might signal a future increase in the federal funds rate (monetary tightening) unless specific financial variables return to desirable parameters by a certain date (such as if the rate of growth of commercial property prices were to fall below 5 percent per annum within six months). Such forward guidance could condition monetary tightening on the evolution of financial variables in specific sectors, which in turn would prompt investors to reduce their exposures to those sectors. As such, forward guidance could

potentially have a more targeted effect than other types of monetary policy tools.

## 4.3 Required Reserves

Reserve requirements represent funds that depository institutions must hold in deposits at the Federal Reserve against certain types of liabilities. The Federal Reserve has the authority to set the minimum ratio of liabilities for which depository institutions must hold required reserves at the Federal Reserve, and also the interest rate that the depository institutions receive (since October 2008) for the required reserves and excess reserves held at the Federal Reserve. Although the required reserves apply only to depository institutions, the tool affects the total supply of credit in the economy, and thus it can address risks to financial stability arising from excess valuation, leverage, and liquidity and maturity transformation (in other words, reserves in Federal Reserve deposits constitute liquid assets). The tool has the same advantages and limitations as the tools targeting interest rates.

## 4.4 Discount Window Lending

Through discount window lending, the Federal Reserve provides funding to individual depository institutions in times of need. By providing funds to banks in need during bad times, the tool can help arrest a fall in asset prices (preventing fire sales) and can offset a sudden stop in banks’ external funding (allowing banks to roll over their debt). The Federal Reserve has the authority to decide the discount window interest rate, the collateral that banks must post to obtain such funding, and also the haircut that applies to the market value of the collateral to determine the amount of the loan. Thus, the tool differs from other monetary policy tools by being more targeted to the banking sector and by serving financial stability objectives mostly during busts.

## 4.5 Reserves Management and Securities Lending

The Federal Reserve can conduct temporary OMOs to address transitory market needs for reserve balances and

securities held on its balance sheet. Since temporary OMOs address transitory liquidity needs, they are not the primary tool to address financial stability concerns related to valuation pressures or excess leverage.<sup>45</sup> However, temporary OMOs can address risks arising from liquidity and maturity mismatches, because they affect the supply of short-term funding and the liquidity of underlying collateral securities. There are three main types of temporary OMOs: (1) securities lending serves to address market pressures and smooth the clearing of specific securities, such as Treasury securities or agency debt; (2) repos and reverse repos, equivalent to collateralized lending or borrowing, are used by the Federal Reserve to temporarily inject reserves into or drain reserves from the market; and (3) interest-bearing term deposits via the Term Deposit Facility are used to drain reserve balances from the banking system, and thus to control the short-term interest rate.

## 5. TRANSMISSION CHANNELS OF MACROPRUDENTIAL AND MONETARY POLICIES

This section provides a brief overview of macroprudential transmission mechanisms as laid out in the Committee on the Global Financial System's report "Operationalizing the Selection and Application of Macroprudential Instruments" (CGFS 2012), and an overview of monetary policy transmission as laid out in the committee's report "Regulatory Change and Monetary Policy" (CGFS 2015).<sup>46</sup>

### 5.1 Transmission Mechanisms for Capital-Based Macroprudential Instruments

Raising capital requirements serves both goals of macroprudential policy—resilience and preemption. It enhances

<sup>45</sup> As an exception, the Federal Reserve has used the ON RRP facility to help control the federal funds rate since September 2014. The FOMC has stated that it will use the facility only to the extent necessary and will phase it out when it is no longer needed to control the funds rate.

<sup>46</sup> For empirical evidence on the effectiveness of macroprudential tools in foreign economies, see Akinci and Olmstead-Rumsey (2015), CGFS (2012), and International Monetary Fund (2012).

the resilience of the banking system in a direct fashion, because the additional capital buffers enable banks to weather losses of a greater magnitude before their solvency is called into question, thus reducing the severity of disruptions to the supply of credit and other financial intermediation services during crises.

Raising capital requirements serves the goal of preemption by moderating the credit cycle. Banks have four broad options to respond to a shortfall in capital: (1) increase lending spreads, (2) decrease dividends and bonuses, (3) issue new capital, and (4) reduce asset holdings. The first three options may negatively affect credit demand, because lending spreads obviously increase in the first case and they are likely to increase in the second and third cases; higher lending spreads are a common response to increased funding costs, as implied by both a reduction in dividends and the issuance of new equity. The fourth option leads to a reduction in credit supply, because banks may respond to tighter macroprudential instruments by rationing the overall quantity of credit.

The impact on credit conditions of tightening sectoral capital requirements is similar to the tightening of general capital requirements, although more targeted. Thus, higher sectoral capital requirements increase the relative cost for banks of lending to the specified sector, providing sharper incentives to reduce activity there. Furthermore, banks with exposure to sectors singled out by regulators as particularly risky may find it hard to raise external equity, which increases the pressure on them to build up capital through retained earnings or by reducing the supply of credit. In either case, the measure has a more targeted effect on credit cycles and asset prices in specific sectors.

Tighter prudential requirements could be subject to leakages or regulatory arbitrage. The tightening of a capital-based instrument may be ineffective if banks reduce voluntary buffers. Through regulatory arbitrage, some of the reduction in bank credit is expected to be taken up by nonbank intermediaries or internationally active banks that are not subject to the increased requirement. Furthermore, large borrowers in developed markets may be able to replace bank credit with the issuance of bonds and similar instruments.

## 5.2 Transmission Mechanisms for Macroprudential Capital Stress Tests

Macroprudential capital stress tests are conducted through the use of a stress scenario. This scenario is fed into a model to forecast banks' income and thus determine net profits. The projected profits and losses, in turn, determine expected bank capital in the stress scenario. To the extent that a bank's capital ratios under the scenario fall below the required minimums, the test can be considered "binding" and the bank will have to adjust its capital plan by reducing payouts in order to build capital. The stress test will be more or less binding over time depending on the interaction of two channels: changes in bank portfolios and changes in the stress scenario. The latter channel could be considered a form of tightening regulatory capital requirements, as specific assets on banks' portfolios become subject to more or less pessimistic assumptions under the stress scenario. In this case, stress tests would have a similar transmission mechanism to the capital-based instruments discussed in the previous section.

Conceptually, stress tests can be tailored to address various sources of systemic risk. For example, asset prices in specific sectors—such as residential or commercial real estate—can increase rapidly in buoyant times and present a common source of downside risk. To reflect such "salient risks," the scenario can be tailored to assume sharp declines in real estate prices, leading to higher capital needs for banks with exposures to the targeted sectors (in other words, the resilience goal).<sup>47</sup> If the scenario is repeated over time, the stress test may even prompt banks to proactively reduce exposure to the targeted sectors (the preemptive goal).

<sup>47</sup> See the Federal Reserve's "Policy Statement on the Scenario Design Framework for Stress Testing," available at <http://www.federalreserve.gov/bankinforeg/bcreg20131107a1.pdf>. This document introduces the concept of salient risks, which are "specific risks to the economic and financial outlook that are especially salient but will feature minimally in the scenario if the Board were only to use approaches that looked to past recessions or relied on historical relationships between variables." The document notes that "There are some important instances when it will be appropriate to augment the recession approach with salient risks. For example, if an asset price were especially elevated and thus potentially vulnerable to an abrupt and potentially destabilizing decline, it would be appropriate to include such a decline in the scenario even if such a large drop were not typical in a severe recession."

## 5.3 Transmission Mechanisms for Liquidity-Based Macroprudential Instruments

Raising liquidity requirements serves both the preemptive and resilience objectives of macroprudential policy. It serves the preemptive objective through its impact on the credit cycle or expectations, which, in turn, may lead to a tightening of banks' risk management standards. It also serves the resilience objective by enhancing the ability of banks to weather periods of liquidity stress more easily, because it forces them to retain liquid assets whose prices remain stable during fire sales and to become less reliant on fragile short-term funding.

Banks will tend to respond to a rise in generic liquidity requirements by adjusting the profile of their assets and liabilities, using one or more of the following broad options: (1) replace short-term with long-term funding, (2) replace unsecured with secured funding, (3) replace illiquid with liquid assets, (4) shorten maturities of the loan book, and (5) decrease (illiquid) asset holdings that require stable funding. On the one hand, replacing short-term with longer-term funding or shifting from unsecured to secured funding will tend to increase funding costs. Replacing illiquid with liquid assets or shortening the average maturity of the loan book, on the other hand, will tend to reduce banks' earnings. All these cases might lead to an increase in lending spreads or a lowering of profits, which in turn would result in a higher price of loans and thus reduced credit flow. Banks can also reduce holdings of asset classes that require stable funding, which would result in reduced credit supply. In either case, tighter liquidity requirements could decrease the overall volume of credit in the economy, with illiquid lending likely to be most affected.

## 5.4 Transmission Mechanisms for Credit-Related Macroprudential Instruments

Credit-related macroprudential instruments strengthen the ability of the banking system to weather a crisis (the resilience goal) by reducing both the probability of default (PD) and the loss-given-default (LGD) of loans. First, by restricting the amount that can be borrowed against the given value of a property or collateral, caps on LTV ratios and margin requirements on security financing transactions reduce leverage and, in doing so, reduce the PD. Second, caps on LTV ratios and margin requirements enable lenders to recover

higher portions of their loans in the event that collateral values decline, which reduces the LGD. In addition, because higher margins reduce borrowers' reliance on short-term funding, margins lower the risk of fire sales that borrowers would conduct—and the resulting losses—in the event that short-term funding becomes difficult to roll over.

Tighter LTV and DTI ratio caps can also restrict the quantity of credit to specific sectors (the preemption goal) by limiting the funding available for certain borrowers. For instance, by restricting the amount of mortgage lending, the measures may also reduce home purchases and increase savings. In principle, house prices will tend to ease, an outcome that in turn reduces households' ability to obtain credit and withdraw equity more generally. Margin requirements could also serve the preemption goal. For example, they might limit the amount of short-term funding that borrowers use to finance assets in certain sectors, such as CMBS and ABS.

There are at least three distinct channels through which leakages can occur. First, there may be leakages to the unregulated sector and foreign banks. Second, arbitrage through nonmortgage (unsecured) top-up loans is a possibility. Uncollateralized top-up loans (such as those from real estate companies) could also facilitate home ownership if LTV ratio caps are overly restrictive when creditworthiness is assessed on a broader range of indicators. Third, if households are constrained by asset-side macroprudential instruments, the structure of the housing market could evolve in ways counteracting the intended effect (for example, through the emergence of part-purchase, part-rent models of home ownership).

## 5.5 Transmission Mechanisms of Monetary Policy

*Interest Rate Channel:* The interest rate channel of monetary policy refers to the impact of changes in short-term interest rates set by the central bank on longer-term borrowing rates, through expectations about the future path of policy. Longer-term rates affect output by influencing savings and investment decisions. Changes in central bank policy rates will also affect broader financial conditions. For instance, certain contracts, such as floating-rate mortgages and some corporate bonds, link rates faced by firms and households to short-term benchmark rates, giving rise to a direct transmission of short-term rates to long-term borrowers' cost of funding.

*Balance Sheet Channel:* The other channels of policy transmission focus on the role played by banks and other intermediaries in the financial system. One important role of

financial intermediaries is to overcome frictions within financial markets that arise from information asymmetries and incomplete contracts. As a way of mitigating these frictions, some loans to firms and households are secured by assets, or are otherwise dependent on borrower attributes such as cash flow, liquid assets, or net worth. As a result of these frictions, a “financial accelerator” effect arises, whereby adverse economic shocks lower collateral values and further worsen economic activity, thus leading to excessive tightening of credit conditions in bad times. To break this cycle, monetary policy may curb the deterioration in collateral values by reducing interest rates. The potency of the balance sheet channel depends upon the extent to which borrowers are dependent on collateralized credit.

*Bank Lending Channel:* The bank lending channel operates primarily through the impact of monetary policy on the supply of reserve balances available to banks, which in turn affects banks' cost of funding. For instance, during monetary tightening, banks' cost of funds increases, since the different forms of bank funding are imperfect substitutes and accessing alternative sources of funding may require higher costs (such as replacing regular deposits with certificates of deposit). In turn, changes in the cost of funding impact the supply of loanable funds from banks. Even if changes in the stance of monetary policy do not affect the supply of reserves, the bank lending channel can impact the supply of credit by changing the amount of relatively cheap deposit funding that banks receive. For borrowers that have limited access to capital markets and therefore cannot readily substitute between bank loans and other forms of credit, the bank lending channel reinforces the interest rate channel.

*Bank Capital Channel:* The bank capital channel refers to the impact of monetary policy on banks' net worth. Tighter monetary policy may reduce the value of bank assets by reducing the capacity of borrowers to repay bank loans and by lowering the value of assets pledged as collateral on those loans. The change in net worth in turn impacts banks' willingness to supply credit.

*Risk-Taking Channel:* Monetary policy affects incentives for risk taking and, therefore, the risk premia component of interest rates. A protracted period of easier monetary policy can increase the amount of risk that intermediaries are prepared to tolerate through a “reach for yield” process, and also through the impact of interest rates on asset valuation, income, and cash flows, which can affect banks' measurements of risk. However, threshold-based forward guidance—whereby the FOMC announces that it will tighten monetary policy unless the growth of asset prices declines below a certain threshold—could limit the impact of low interest rates on asset prices.

The specific mechanisms through which the risk-taking channel operates include the pricing of risk; leverage; maturity and liquidity transformation; and interconnect- edness and complexity. These mechanisms in turn operate across different sectors:

- In financial asset markets, monetary policy affects financial conditions not only through the risk-free term structure but also through risk premia. Monetary tightening generates negative stock returns through increases in risk premia, while the easing of monetary policy tends to reduce risk premia on corporate bonds owing to increased risk taking by financial institutions.
- In the banking sector, looser monetary policy increases banks' incentive to use short-term funding while increasing the share of risky assets and potentially loosening underwriting standards. To the extent that banks try to maintain a relatively stable leverage ratio over the cycle, and that risk-weighted assets drop when asset prices boom, banks will tilt their balance sheets toward riskier assets.
- In the nonbank financial sector, the same forces are at work as in the banking sector, but to a greater degree. The nonbank financial system is less constrained by regulation, leading to a greater transmission of mon- etary policy to financial conditions through a larger degree of endogenous risk taking. Such increased risk taking may be evident in higher leverage and greater maturity and liquidity transformation.

## 6. SUMMARY OF THE TABLETOP EXERCISE

The five members of the Financial Stability Subcom- mittee of the Conference of Presidents (henceforth "committee members") shared their views on the key risks to financial stability under the scenario and potential options to address these risks. These options included monetary policy as well as the set of macroprudential tools presented in Section 3.

### 6.1 Risks to Financial Stability

Committee members discussed which factors they believed posed the most immediate risks to financial stability in the scenario. Most stated that financial conditions are too loose relative to the macroeconomic conditions in the scenario, despite the monetary tightening that occurs in the scenario.

In particular, both risk and term premia under the scenario are very narrow. Members also cited the risk of hitting the

*Among the macroprudential tools that were considered, stress testing, margins on repo funding, and supervisory guidance were preferred over capital-based, liquidity-based, or credit-based macroprudential tools.*

zero lower bound again in the event of a crisis, given the relatively low target federal funds rate under the scenario. A sharp reversal in the pricing of risk would disrupt the corporate debt market, with potentially adverse conse- quences for the real economy.

Committee members also noted that commercial real estate (CRE) prices are elevated in the scenario and that a sharp decline would have adverse consequences at the macroeconomic level. The adverse consequences would result mainly from losses in the financial system, since CRE represents a large share of banks' collateral, and only to a lesser extent from a slowdown in con- struction investment, which makes a relatively small contribution to GDP growth. Committee members also noted that, depending on the nature of the CRE investments being made, actions aimed at CRE val- uation could be unpopular.

Members expressed concern that under the scenario, reliance on short-term wholesale funding (STWF) provided by nonbank financial institutions is high. Although some institutions providing short-term wholesale funding are affiliated with bank holding companies (broker-dealers, for example), a considerable portion of STWF providers are not subject to Federal Reserve supervision. As a result, it would be difficult to directly address this concern.

Maturity mismatches at small banks are high in the scenario, because the banks' investments in illiquid CRE are funded by short-term liabilities. Some com- mittee members argued that the risk of runs is low for individual banks, since their deposits are insured. However, others argued that to the extent that these institutions are exposed to similar risks, a more pro- nounced decline in CRE prices could trigger broader runs on these banks as a group, which could pose a threat to financial stability.

## 6.2 Potential Actions to Address Risks to Financial Stability

Committee members discussed a range of monetary and macroprudential actions that may be appropriate responses to the risks to financial stability identified in the hypothetical scenario.

Some members favored the use of macroprudential tools, while others favored monetary policy actions. Among the macroprudential tools that were considered, stress testing, margins on repo funding, and supervisory guidance were preferred over capital-based, liquidity-based, or credit-based macroprudential tools. This preference was expressed in light of the implementation challenges associated with the latter group of tools (including implementation lags, coordination among regulatory bodies, and limited scope of application, as discussed below).

All committee members mentioned the possibility of using a tailored stress test as a macroprudential tool, where the stress test scenario could potentially include a component aimed at the nonfinancial business sector. In the context of the tabletop exercise, one member specifically raised the possibility of an adverse scenario that assumes a sharp decline in CRE prices and a run on short-term wholesale funding.<sup>48</sup> Stress test implementation options discussed included preannouncing and repeating the supervisory scenario over time as ways to alter banks' portfolio decisions, applying the existing CCAR exercise outside of its usual annual cycle, and implementing some form of stress test to cover smaller banks.

The committee also discussed using margin requirements for repo funding based on the authority granted to the Federal Reserve Board under the Securities Exchange Act of 1934. The Federal Reserve Board used this tool by changing margin requirements for the equities market between 1934 and 1974, but it has not used it since then. There was also some hesitation regarding this approach, because it would represent a significant expansion in the scope of Federal Reserve Board influence over financial markets.

Most committee members also envisioned the continued use of supervisory guidance and discussions with industry participants, as well as public statements. In the context of the hypothetical scenario, they discussed new guidance to tighten underwriting standards in CRE lending. Several advocated beginning with “soft” macroprudential tools such as supervisory guidance before considering other tools such as stress testing or margin requirements. Other members

<sup>48</sup> The suggestion was for a decline in CRE prices greater than that which was incorporated in the 2015 CCAR stress scenario.

seemed to prioritize stress testing and margin requirements ahead of supervisory guidance. Although these members did not specify a reason for the prioritization of stress testing and margin requirements, they may have perceived guidance as being less binding than the other tools.

In considering the various macroprudential tools, committee members identified several concerns that could potentially make the use of these tools less attractive. One concern was that many of the tools require coordination among different regulators in order to be effective, and that achieving such coordination would slow the implementation process. Another concern was that many of the tools have additional implementation lags, which may be explicit or may arise from administrative processes.<sup>49</sup> Committee members also pointed

*In light of . . . concerns regarding macroprudential tools, some members favored monetary policy . . . to address risks in the hypothetical scenario; others advocated beginning with the macroprudential tools but using monetary policy at a later date if macroprudential actions were not effective.*

to the limited scope of application of some macroprudential tools (for example, those that apply only to regulated banking organizations). Broadly speaking, the various implementation lags cited during the exercise steered committee members away from many macroprudential tools and toward monetary policy, as well as toward those macroprudential tools (such as tailored stress tests) that could be implemented more expeditiously.

In light of these concerns regarding macroprudential tools, some members favored monetary policy over macroprudential tools to address risks in the hypothetical scenario; others advocated beginning with the macroprudential tools but using monetary policy at a later date if macroprudential actions were not effective. Some also suggested that implementation of macroprudential tools could be accompanied by a public signal on the possibility of deploying monetary policy at some future date, thus leveraging the expectations channel of monetary policy.

<sup>49</sup> For an example of explicit lags, see the earlier discussion regarding CCyB implementation.

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## 7. CONCLUSION

This article examines a macroprudential tabletop exercise that was conducted by members of the Financial Stability Subcommittee of the Conference of Presidents of the Federal Reserve in June 2015. The tabletop exercise presented participants with a plausible, albeit hypothetical, macrofinancial scenario that would lend itself to macroprudential considerations. The scenario featured a compression of U.S. term and risk premia through the fourth quarter of 2016—projected to continue thereafter—which keeps financial conditions loose and fuels valuation pressures in U.S. financial markets. The compression of risk premia also encourages the issuance of corporate debt and leveraged loans, which boosts leverage in the nonfinancial business sector. In addition, valuation pressures also arise in the commercial property market. At the same time, the nonbank financial sector, including money market mutual funds, expands in size and provides short-term wholesale funding to the nonfinancial business sector. These developments occur while the Federal Reserve is assumed to gradually tighten monetary policy in 2015 and 2016, as inflation is assumed to persist at its target rate and unemployment to persist at the hypothetical scenario-specific NAIRU. Consequently, monetary policy is constrained from tightening further, and the looser-than-desired financial conditions give rise to a rationale for macroprudential tools.

Committee members shared their thoughts about the most immediate risks to financial stability present in the hypothetical scenario, viewing financial conditions as being too loose relative to the macroeconomic conditions, despite the monetary tightening. Committee

members also noted that commercial real estate prices were elevated in the hypothetical scenario, and that a sharp decline would have adverse consequences at the macroeconomic level. Members expressed concern regarding the reliance on short-term wholesale funding provided by nonbank financial institutions in the scenario. Maturity mismatches at small banks were also judged to be high in the hypothetical scenario, because the banks' investments in illiquid commercial real estate were funded by short-term liabilities.

Committee members discussed a range of monetary and macroprudential actions that may be appropriate responses to the financial stability risks identified in the hypothetical scenario, recognizing that the purpose of the discussion was not to opine on which tools (if any) would be applicable in the current economic environment. Of the full range of tools considered, many of the prudential tools were found to be less attractive owing to implementation lags and limited scope of application. The prudential tools most favored by participants were those deemed to pose fewer implementation challenges, in particular stress testing, margins on repo funding, and supervisory guidance. Nonetheless, monetary policy came more quickly to the fore as a financial stability tool than might have been thought before the exercise.

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### **Editor's note:**

*This article has been updated since its initial publication on the Bank's website in March 2016. The updates primarily affect Section 4 and Table 3; the article's conclusions remain the same.*

—February 2017

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