

Would Macroprudential Regulation Have Prevented the Last Crisis?

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A key response of official sectors around the world to the financial and economic crises of ten years ago has been the formation of financial stability committees. Such committees now exist in over 40 countries worldwide (Edge and Liang 2017). The remits of these committees are “macroprudential.” Macroprudential policy focuses on potential system-wide risks and amplification mechanisms, complementing the detailed firm-specific risk assessments of microprudential regulators. In addition, it has the explicit objective to ensure that the financial system does not amplify a downturn in the real economy—for example, by being forced to cut back on the supply of credit in a stress (Borio 2003; in this journal, Hanson, Kashyap, and Stein 2011).

This paper asks whether macroprudential authorities, as they have been designed over the past decade, could prevent—or materially dampen—a rerun of the last crisis. To be clear at the outset, macroprudential regulation does not seek to

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eliminate recessions. Instead, it is aimed at ensuring that the financial system does not create shocks that trigger recessions or amplify other shocks to make recessions materially worse. With this in mind, the first part of our paper provides an account of the amplifying factors that made the last crisis so severe. Our diagnosis centers on two overlapping but distinct vulnerabilities: the increase in leverage and short-term funding at financial intermediaries, and the build-up in indebtedness in the household sector. These factors, we argue, can account for around two-thirds to three-quarters of the fall in US GDP that followed the financial crisis. We describe and calibrate the policy interventions required to address these vulnerabilities.

We then contrast how well-equipped two prominent macroprudential regulators are to make these interventions. We argue that the US Financial Stability Oversight Council would likely make little difference were we to experience a rerun of the factors that caused the last crisis. It has no macroprudential levers under its direct control, and not all of its members have mandates to protect financial stability. A macroprudential regulator modeled on the UK's Financial Policy Committee stands a better chance because it has many of the necessary powers. But spotting build-ups in vulnerabilities in real-time is challenging. And given the role played by loosely regulated nonbank financial institutions prior to the last crisis—and the continuing evolution of the financial system—a successful macroprudential intervention would likely require political backing to be nimble in widening the perimeter of regulation to capture such institutions. More generally, such a regulator would have to be fairly aggressive in using its powers. Given the novelty of these powers, there is no clear evidence on whether such forceful interventions would be realistic were risks to escalate again. Our conclusion distills some key challenges and priorities for the development of a successful macroprudential framework.

The test we pose is really not very tough. Today's macroprudential frameworks were created in response to the scenario we are revisiting, whereas the challenges facing macroprudential regulators in the future will likely be new. But while our essay explores how today's macroprudential regimes might respond if vulnerabilities similar to those that caused the last crisis were to reoccur, we also invite readers to use this thought-experiment to consider how macroprudential committees might respond if other “resilience gaps” opened up in the future.

Fault-Lines That Led to the 2008 Financial Crisis

In Aikman, Bridges, Kashyap, and Siegert (2018), we describe the competing factors that contributed to the 2008 financial crisis and discuss the dimensions of their relative contributions. Here we summarize the evidence regarding the two dominant contributors: 1) the fragilities in the financial system associated with excessive leverage and the use of potentially flighty short-term funding; and 2) the unprecedented (by US standards) lending boom to the household sector that began in the mid-2000s. Bernanke (2018) also identifies these two channels to be of primary importance, with particular emphasis on the former.

Table 1

Size and Structure of the Leveraged Financial System

	2001:Q4				2007:Q4			
	Assets (\$bn)	Leverage	Liquid assets	Short-term funding	Assets (\$bn)	Leverage	Liquid assets	Short-term funding
Commercial banks	6,552	11.0	6.6%	26.5%	11,182	9.8	4.6%	33.2%
<i>of which: large institutions</i>	2,291	12.2	6.7%	32.9%	5,422	11.8	4.6%	37.5%
Savings institutions	1,317	11.6	3.0%	18.2%	1,852	9.1	2.3%	22.6%
Broker-dealers	2,376	28	2.4%	57.3%	4,686	45	0.4%	63.4%
Government-sponsored enterprises	1,417	42.3	0.2%		1,677	23.7	0.7%	
Total	11,662				19,397			

Source: Financial Accounts of the United States; Call Reports; FDIC; Adrian, Fleming, Shachar, and Vogt (2017); and Annual Reports of Fannie Mae and Freddie Mac.

Note: “Leverage” is defined as total assets divided by (book) equity. “Liquid assets” refers to the ratio of cash and Treasury securities to total assets. For brokers, “short-term funding” refers to repo funding relative to total assets. For deposit-takers, it refers to (estimated) uninsured domestic deposits and foreign deposits relative to total assets. While deposits are typically short-term liabilities, many types of deposits, including insured deposits in particular, are “behaviorally stable” and were not withdrawn during the crisis (Martin, Puri, and Ufier 2018). “Large commercial banks” are defined as banks with at least \$150 billion in total assets. For 2007, this is adjusted using the Consumer Price Index (\$180 billion). Government-sponsored enterprises include Fannie Mae and Freddie Mac.

Our thesis is that these two factors amplified the initial losses that occurred when house prices fell. The fragilities in the financial system meant that lenders had to cut back lending as they struggled to absorb losses, which led to a credit crunch that reduced investment and employment. As households also struggled to deal with excessive debt, they cut spending, amplifying the downturn further.

Fragilities in the Financial System

Vulnerabilities in the financial system built significantly in the years leading up to the global financial crisis (Brunnermeier 2009; Acharya, Philippon, Richardson, and Roubini 2009; Duffie 2018). As a result, even relatively small losses on financial institutions’ mortgage exposures were sufficient to trigger stability concerns for the entire financial system that ultimately spilled over into the real economy.

Table 1 documents the solvency, liquidity, and funding positions of different classes of US financial institutions at two points prior to the global financial crisis: end-2001, a period when the US economy was recovering from the strains caused by the collapse of the dot-com bubble; and end-2007, the beginning of the financial crisis. The total assets of the institutions we capture here increased from \$12 trillion to almost \$20 trillion between these dates. Clearly, the use of debt finance, or “leverage,” varied significantly across institutions. For the largest commercial banks, leverage changed little in the years leading up to the crisis. Commercial banks did, however, reduce the amount of assets that could easily be sold without price

concessions (liquid assets) and expanded their reliance on short-term funding, which can rapidly disappear during times of stress.

The most extreme vulnerabilities developed for the parts of the financial system that did not take traditional deposits. Consider, for instance, the changes for broker-dealers, a category that includes specialised investment banks and the investment banking subsidiaries of larger banking groups. The assets of these entities increased from 28 to 45 times their equity between 2001 and 2007, meaning that a roughly 2 percent decline in the value of broker-dealers' assets would have been sufficient to wipe out all of their equity. In addition, these firms were traditionally highly reliant on short-term wholesale funding (Rosengren 2014), and became even more so during this period.

Much of this short-term funding took the form of repurchase agreements, or "repos." Repos are a form of borrowing in which the broker-dealer sells securities that it holds, receives the value of those securities in cash, and a few days later repurchases the securities at a predetermined price that includes an additional interest payment. The repo liabilities of broker-dealers increased from \$1.4 trillion in 2001 to \$3.0 trillion in 2007.¹ Moreover, an increasing fraction of repos were backed by low-quality securities.

Figure 1 shows the rise in repo funding, along with commercial paper, another form of funding that experienced rapid growth over this period. Traditional commercial paper is short-term debt issued by companies to fund operations. However, by the end of 2006, 60 percent of outstanding commercial paper consisted of so-called "asset-backed commercial paper" that had been issued to fund the purchase of specific securities such as credit card receivables, auto loans, or mortgage-backed securities.

The growth in repos and commercial paper coincided with an increase in the size of money market mutual funds, which purchased much of the repos and commercial paper issued. Regulators allowed money market mutual funds to invest in assets with a weighted average maturity of up to 90 days, but these funds offered investors the ability to withdraw their money at a day's notice. Moreover, money market mutual funds did not have any capital that would shield these short-term investors from losses. In a crisis, investors in money market mutual funds who withdrew their funds first were certain to be fully paid, while later claims might not be fully paid, providing incentives to "run" on the fund.

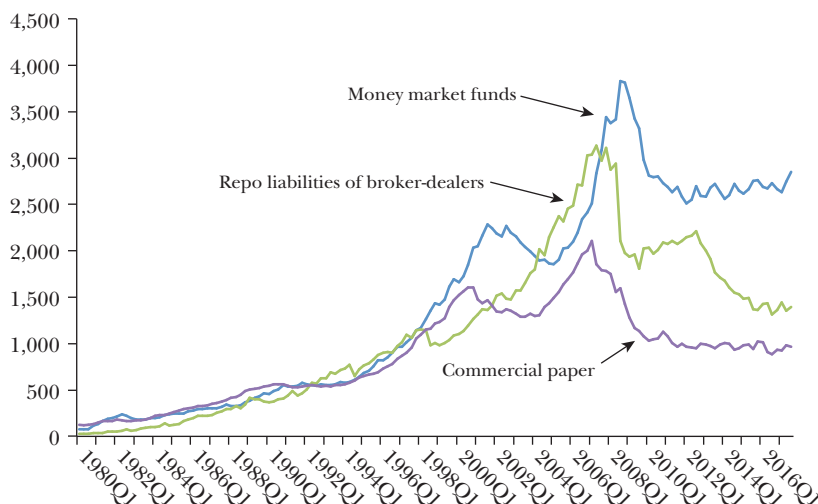
In summary, nonbanks became an increasingly important source of credit for the real economy in the years preceding the crisis: between 2001 and 2007, nonbank financials accounted for over 70 percent of the total growth in home mortgage credit (according to the Financial Accounts of the United States). This growth was accompanied by an increased reliance on debt financing of the nonbank system. Short-term borrowing became more important, with the belief that it could be

¹ Total repo liabilities for all types of institutions recorded in the Financial Accounts of the US data for end-2001 and 2007 were \$2.2 trillion and \$4.8 trillion, respectively. None of these numbers were readily available in the run-up to the crisis, as broker-dealers repo liabilities were only reported on a netted basis (Eichner, Kohn, and Palumbo 2013; Holmquist and Gallin 2014).

Figure 1

Reliance on Short-Term Funding

(\$ billions)



Source: March 2018 release of the Financial Accounts of the United States, based on Adrian, de Fontnouvelle, Yang, and Zlate (2017). The size of money-market funds is measured as outstanding money market fund shares (liabilities) in table L.121. Commercial paper refers to commercial paper (liabilities) issued by any sector (table L.2019), which includes asset-backed commercial paper. Repo liabilities of broker-dealers are based on security repurchase agreements (liabilities) in table L.130.

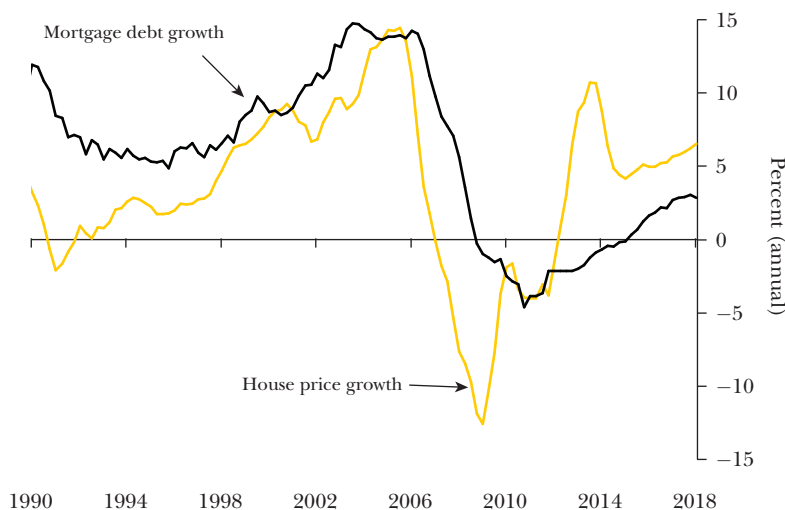
rolled over continually. These observations suggest that macroprudential regulators' arsenals must include tools to affect the overall propensity to rely on debt financing and also affect the maturity of the funding, and macroprudential regulators must have scope to apply these tools both to banks and to nonbanks.

The Build-up in Household Debt

Alongside the pronounced build-up in leverage and short-term funding in the financial system, there was a rapid build-up in debt in the real economy, concentrated in household mortgages. Mortgage debt doubled in the six years before the crisis, and by 2007 reached 72 percent of GDP. Two aspects of this debt build-up are noteworthy and will inform our later macroprudential analysis.

First, the increase in mortgage debt was accompanied by a house price boom, shown in Figure 2. House prices rose by two-thirds in the five years to their peak in early 2006 (according to the S&P Case-Shiller US National Home Price Index), and ongoing rapid house price appreciation was embedded in expectations (Gennaioli and Shleifer 2018). The aggregate loan-to-value ratio on the stock of US housing remained broadly flat during this period, meaning that for each 1 percent increase in house values, homeowners also increased their mortgage debt by around 1 percent. In part, this reflected new homeowners taking out larger mortgages in order to purchase more expensive homes. But in addition, existing homeowners

Figure 2
Mortgage Debt and House Prices
(annual percentage change)



Source: Financial Accounts of the United States and S&P Case-Shiller US National Home Price Index.

also extracted housing equity by taking out additional debt. Mian and Sufi (2011) estimate that existing homeowners borrowed \$0.25 on average for every \$1 increase in home-equity value during the housing boom, enough to account for over half of the increase in debt for homeowners between 2002 and 2006.

Second, there were clear signs in the years before the financial crisis that lending standards were being loosened and borrower quality was deteriorating. The Federal Reserve Board's Senior Loan Officer Opinion Survey on Bank Lending Practices reported easing standards between 2004Q1 and 2006Q3. The expansion of credit to the most risky borrowers was particularly pronounced. For example, according to the Federal Reserve's Survey of Consumer Finances, the share of the stock of mortgagors with debt of over four times their income more than doubled between 2001 and 2007 from 6 percent to 13 percent. The number of new subprime mortgages nearly doubled between 2003 and 2005, 80 percent of which were made with short-term "teaser" interest rates (in this journal, Mayer, Pence, and Sherlund 2009). "Near-prime" mortgages also increased rapidly. The private-label securitization market, in which these mortgages were bundled into tranching financial securities and resold, was an important driver of these frothy credit supply conditions (Keys, Mukherjee, Seru, and Vig 2010).

In summary, the years running up to the Great Recession saw an unprecedented surge in US household debt. That boom was accompanied and reinforced by soaring property prices. Aggressive credit supply expansion, compounded by financial innovation, provided the undercurrent for an unsustainable cycle. Household balance sheets became increasingly vulnerable to a shock as more credit was extended to highly indebted households.

Quantifying the Effects of the Credit Crunch and Deleveraging

Extrapolating the 20-year average growth rate from 2007Q4 through 2010Q4 suggests that the level of GDP per capita was 8.5 percent below trend by 2010Q4. How much of this might plausibly be attributed to the credit crunch and the deleveraging by overly indebted households? Estimating precise contributions is challenging. Nonetheless, triangulating across a range of studies, it seems very likely that these factors account for a large part of that gap. In Aikman, Bridges, Kashyap, and Siegert (2018), we provide the details of how we arrive at this conclusion; here, we simply summarize the main points.

A variety of studies, using a variety of methods, find that the fragility of lenders resulted in a credit crunch that had the potential to materially affect real economic activity (for example, Chodorow-Reich 2014; Greenlaw, Hatzius, Kashyap, and Shin 2008; Bassett, Chosak, Driscoll, and Zakrajšek 2014; Guerrieri et al. 2015). Translating the estimates from any one of these studies into an impact on the GDP shortfall requires a number of assumptions. For example, Chodorow-Reich (2014) identifies the impact of the credit crunch on employment in enterprises with less than 1000 employees. For our purposes, this finding needs to be extrapolated to the entire economy and then translated into an impact on GDP. Averaging across our five preferred studies, in Aikman, Bridges, Kashyap, and Siegert (2018), we find that about 35 percent of the 2010 GDP gap can be attributed to the abrupt tightening of credit conditions. That is, around 3 percentage points of the overall GDP shortfall can be explained by the fragilities in the financial system, which meant that the economy was prone to suffering a credit crunch.

There is also convincing evidence that a strong relationship exists between household debt growth in the years preceding economic downturns and the severity of the subsequent downturn (for example, Jordà, Schularick, and Taylor 2013, 2016; Bridges, Jackson, and McGregor 2017; Mian and Sufi 2012; Mian, Sufi, and Verner 2017; Gertler and Gilchrist 2018). Converting the various estimates into an impact on the fall in GDP during the Great Recession is subject to the same basic challenges as with scaling the impact of the credit crunch. In Aikman, Bridges, Kashyap, and Siegert (2018), we average across a number of approaches and find that the household debt boom can account for about one-half of the GDP gap, or just over 4 percentage points of the overall fall in GDP.

Our reading of the existing evidence is therefore that, taken together, these two effects account for around three-quarters of the contraction in output that occurred during the Great Recession. That is, absent the credit crunch and the deleveraging by households, the cumulative fall in GDP growth during the recession would have been three-quarters smaller.

It is obviously an oversimplification to treat the effects of the credit crunch and the household deleveraging channels as if they were clear and distinct events. Rather, there was two-way feedback between these phenomena: tight credit conditions intensified households' need to deleverage, and the reduction in spending by highly indebted households led to an economic contraction that made it harder for all borrowers to service their debts, generating larger losses for banks and other

financial intermediaries. However, disentangling the precise impact of these channels is not material to our argument. Rather, our claim is that each channel had a very substantial bearing on the costs of the crisis. Should we see a rerun of the factors that caused the last crisis, therefore, macroprudential policy would have to address vulnerabilities associated with excessive debt-financing and short-term funding in the financial system, and excessive debt levels in the household sector.

What Could a Macroprudential Regulator Have Done to Address the Build-Up in These Vulnerabilities?

We start this section by asking whether it was possible to spot the vulnerabilities in both the financial system and in household balance sheets documented above in real time. We then consider the policies a macroprudential regulator could introduce in response. In the next section, we discuss the institutional frictions that actual macroprudential regulators would face in implementing such policies in practice.

Identifying the Build-up in Risk in Real Time

Identifying macroprudential policy interventions requires spotting emerging risks and accumulating vulnerabilities prior to a crisis. Identifying the debt build-up in the household sector was relatively straightforward. The Bank for International Settlements was sounding alarms about the risks from credit build-ups in 2004 (for example, Borio and White 2004). The IMF's *Global Financial Stability Report* in April 2005 had a chapter on the state of household balance sheets in advanced economies.

Table 2 summarizes how often some key words associated with building fragilities were mentioned in Federal Open Market Committee (FOMC) transcripts through the 2000s. Again, the build-up in household debt was clearly evident from the early 2000s. The house price bubble was also observed well ahead of the crisis. By its meeting in June 2005, the FOMC was discussing evidence that houses may be up to 20 percent overvalued, leading to the spike in transcript references to “house price,” “bubble,” and words associated with mortgage lending. This assessment turned out to be pretty accurate: by the end of the recession in June 2009, house prices were 13 percent below their June 2005 level, and the peak-to-trough fall during the crisis was 20 percent (based on the Case-Shiller US National Home Price Index). Between the end of the recession in June 2009 and February 2012, house prices fell further, bringing the overall peak-to-trough fall to 26 percent. However, the extent to which the build-up in debt was being concentrated at riskier, heavily indebted borrowers was not being adequately picked up (Eichner, Kohn, and Palumbo 2013). It is striking that the word “subprime” was mentioned 314 times in the FOMC's 2007 transcripts, but only 27 times in all the transcripts from 2000 to 2006. Commercial paper and “securitization” were also rarely mentioned before 2007.

More broadly, policymakers did not understand the effects that a sharp fall in house prices would have on the financial system. This lack of resilience might have been identified via stress tests—since the crisis, such tests have become a key

Table 2

Financial Stability Terms Appearing in Discussions of the Federal Open Market Committee

	2001	2002	2003	2004	2005	2006	2007
<i>General</i>							
“Financial stability”	0	1	2	9	5	9	13
<i>Financial System:</i>							
“Bank”	502	429	449	302	284	309	1,024
“Capital”/“Leverage”	454	308	340	208	183	177	402
“Shadow”/“Broker”/“Money market”	17	21	40	10	17	28	59
“Fund”/“Liquid”/“Repo”	1,226	962	1,150	1,058	932	1,110	1,779
“Commercial paper”/“Securitization”	23	22	15	3	14	2	133
<i>Housing Market</i>							
“House price”	2	23	4	41	160	85	83
“Bubble”	6	15	14	19	114	4	8
“Loan”/“Lend”/“Debt”/“Credit”/“Borrow”	413	442	452	269	409	251	1,563
“Mortgage”	84	100	96	67	176	118	481
“Subprime”	0	3	1	0	8	15	314
“LTV”/“Heloc”/“Teaser”/“Alt-A”	2	1	1	0	40	0	45

Note: For each year, transcripts of the eight FOMC meetings and any Conference Calls were searched. All transcripts available here: https://www.federalreserve.gov/monetarypolicy/fomc_historical_year.htm. A simple count of all words containing the stem words listed in the table above was conducted.

component of macroprudential regulators’ toolkits. Hirtle, Kovner, Vickery, and Bhanot (2016) demonstrate that a top-down stress test based on a macroeconomic scenario like the one that played out in 2007–08 would have predicted a significant capital shortfall in the US banking system as early as 2004. But even with a severe stress test, it would have been difficult to understand the fragility of funding flows across the system prior to the crisis, which led to fragilities in the nonbank sector and amplified the macroeconomic downturn. To reveal the full extent of the vulnerabilities that existed, stress tests would have had to cover the entire financial system: broker-dealers; commercial paper, repo, and derivative markets; specialized investment vehicles (SIVs); and other conduits. Building a complete map of funding interconnections between these markets and entities is challenging even today.

Thus, while some warning signs were clearly present in the lead-up to the crisis, we are cautious about the ability of macroprudential regulators to understand the nature of systemic financial risks as they emerge in real time. One implication is that policymakers should seek to develop systematic frameworks within which to monitor emerging risks and their potential implications for macroeconomic tail events.² Another implication is that we should be humble (see also Tarullo 2014). The fact that even in hindsight we believe it would have been hard to diagnose fully the risks in the run-up to the crisis suggests that macroprudential policy frameworks

² Analysis of “GDP-at-risk” and its link to financial indicators is one promising avenue here—see for example Adrian, Boyarchenko, and Giannone (2016), IMF (2018b), and Aikman et al. (2018).

should be calibrated with some built-in “slack” to account for the inherent difficulty of risk assessment, particularly in real time.

Tools and Actions to Reduce Leverage

How much additional capital would US banks have needed to be resilient given the extent of the credit bubble that was building in this period? For a sense of the necessary scale, consider the government capital support that occurred at the height of the crisis via the Troubled Asset Relief Program (TARP). Under this scheme, the US Treasury invested \$200 billion in the preferred stock of 15 large US banks to enhance market confidence in the banking system and to increase its capacity to lend.³ While establishing cause and effect is difficult, there is evidence that this intervention led to dramatic improvements in how market participants viewed the solvency of the US banking system. For example, the interest rate spreads for banks’ unsecured borrowing—often measured by looking at the difference between the three-month interbank borrowing rate and the risk-free Treasury bill yield—fell sharply almost immediately after the TARP was announced on October 14, 2008.

One means by which the authorities could increase system-wide levels of capital in the banking system in response to an emerging “resilience gap” is through a macroprudential tool called the countercyclical capital buffer (CCyB). The CCyB allows regulators to increase capital requirements according to the aggregate risk environment. What level of the countercyclical capital buffer would have delivered a level of resilience equivalent to the TARP injections? The countercyclical capital buffer is typically expressed as a percentage of a firm’s assets, weighted by the riskiness. It is then adjusted by a “domestic lending conversion factor,” which accounts for the fact that large banks operate across international boundaries. An estimate of the necessary countercyclical capital buffer rate is hence:

Required countercyclical capital buffer

$$= \frac{\$200 \text{ billion}}{\text{Risk-weighted assets}} * \text{Domestic lending conversion factor}$$

As of 2005, the 15 TARP recipients on which we focus had total risk-weighted assets of approximately \$8.4 trillion—the denominator of the expression above.⁴ The average “domestic lending conversion factor” was around 75 percent (Avraham, Selvaggi, and Vickery 2012). That is, because large US banks have substantial global assets,

³ The 15 bank holding companies and broker-dealers that received the largest injections in the Troubled Asset Relief Program (TARP) were Citigroup, Bank of America, JP Morgan Chase, Wells Fargo, Goldman Sachs, Morgan Stanley, PNC Financial Services Group, U.S. Bancorp, SunTrust, Capital One Financial, Regions Financial Corporation, Fifth Third Bancorp, BB&T, Bank of New York Mellon, and Key Corp. The estimates we report in the text do not include capital provided by this program to other, smaller banks.

⁴ This number is estimated using published accounts and an average risk-weight of 67.5 percent (based on the New York Fed Quarterly Trends for Consolidated U.S. Banking Organizations). This total includes the assets of firms that did not themselves receive TARP assistance, but that in the course of 2008 were acquired by one of the 15 TARP-recipients on which we focus. These acquired firms include Countrywide Financial, Merrill Lynch, Wachovia, Bear Stearns, Washington Mutual, and National City Corp.

Table 3

Countercyclical Capital Buffer Rate (CCyB) That Would Have Been Necessary to Avoid the Troubled Asset Relief Program

<i>Calculation</i>			
Baseline: Replacing bail-outs			
Total capital injections			\$198bn
Total risk-weighted assets (RWAs)			\$8,409bn
Bailout in percent of RWAs	\$198bn/\$8,409bn		2.4%
Domestic assets in percent of total assets			76%
Required CCyB rate	2.4%/76%		3.1%
Variant 1: Replacing bail-outs and private sector capital raising			
Additional private sector capital raising			\$70bn
Required CCyB rate	$3.1\% \times (\$198\text{bn} + \$70\text{bn})/\$198\text{bn}$		4.2%
Variant 2: Replacing bail-outs, and supporting additional lending			
Additional RWAs if credit growth had continued along pre-crisis trend			\$1,050bn
Assumed stressed target capital ratio			10%
Additional capital to support credit growth	$\$1,050\text{bn} \times 10\%$		\$105bn
Required CCyB rate	$3.1\% + \$105\text{bn}/(\$8,409\text{bn} \times 76\%)$		4.7%

Source: US Treasury, Published Accounts; New York Fed Quarterly Trends for Consolidated US Banking Organizations; Financial Accounts of the United States; Avraham et al. (2012).

Note: For variant 2, we assume that banks balance sheets had grown by 7 percent rather than 1 percent per year over two consecutive years. This is in line with the difference in the commercial bank credit growth rate between the 20 years before the crisis and the crisis (Q4 2007 to Q4 2009).

an increase in the US countercyclical capital buffer rate will not pass through one-for-one into their capital requirements. Using these parameters and the calculations in Table 3, we estimate that a countercyclical capital buffer of 3 percent would have provided an equivalent level of resilience as the \$200 billion TARP injection. Had a countercyclical capital buffer of 3 percent been built-up in the run-up to the crisis, it would have, in effect, brought the capital raising that ultimately proved necessary forward in time, substituting public provision of capital for private sector resources.

The approach above does not account for the capital that banks raised privately after the results of the stress tests through the Supervisory Capital Assessment Program were published in May 2009. Banks had six months to raise any required capital in private markets, with an explicit backstop option to obtain capital from the US Treasury if necessary. The banks in our sample raised approximately \$70 billion of capital in order to meet these requirements and did not turn to additional government funding. If this \$70 billion is added to the \$200 billion of TARP, our thought experiment suggests a countercyclical capital buffer of around 4.2 percent would have been required to bring forward the public and private capital raising that occurred during the heights of the crisis.

While TARP significantly reduced stress in the banking system, it was not fully sufficient to restart the provision of credit to the economy.⁵ Thus, a second

⁵ Chavaz and Rose (forthcoming) show that the effect of TARP on the provision of mortgage credit differed across regional markets and that TARP recipients reduced mortgage lending in the average county.

sensitivity check is to estimate what size of the countercyclical capital buffer would have allowed banks to continue lending in line with historical credit growth rates. As shown by the calculations in Table 3, a countercyclical capital buffer of 4.7 percent would have ensured that banks would have had sufficient capital to avoid applying for TARP and to continue growing their balance sheets in line with the long-run average growth rate.

Given its profitability in the years preceding the crisis, the banking system had ample capacity to meet increases in the countercyclical capital buffer rate of this magnitude through a combination of new issuance of equity and additional retentions. Hirtle (2016) finds that between 2005 and the collapse of Lehman Brothers in 2008, dividend payments of large bank holding companies amounted to \$162 billion, and total share buy-backs amounted to an additional \$131 billion. Indeed, dividend payments and share buy-backs amounted to \$49 billion and \$18 billion, respectively, between mid-2007 and the failure of Lehman in September 2008. By mid-2007, New Century Financial Corporation, a leading subprime mortgage lender, had already failed, and Bear Stearns and BNP Paribas had started halting redemptions on a number of their investment funds.

Finally, we note that among the 15 institutions that we consider are some broker-dealers. These institutions were not subject to standard prudential requirements.⁶ As a first step, a macroprudential authority would have needed to bring these firms inside the regulatory perimeter. As illustrated in Table 1, bringing all US broker-dealers to the same capital standards that commercial banks had in 2007 would already have added a substantial amount of capital to the system.

Tools and Actions to Reduce Funding Mismatches

During the financial crisis, the Federal Reserve set up a number of new liquidity facilities (Fleming 2012).⁷ These facilities, which were phased out within a few years of the end of the crisis, provided around \$1.5 trillion of short-term liquidity to the financial system, an amount equivalent to 9 percent of commercial banks' and broker-dealers' assets. We posit that requiring firms to replace \$1.5 trillion of their short-term funding with longer-term debt would have reduced liquidity outflows in the crisis in a way that would have avoided a need for extraordinary central bank liquidity facilities. This is likely to be an overestimate of the scale of appropriate policy intervention because some public provision of liquidity in a crisis is likely to be efficient (Holmström and Tirole 1998).

⁶ In 2004, the Securities and Exchange had created the voluntary "Consolidated Supervised Entities" program to regulate large investment bank holding companies. However, this regime was primarily intended to satisfy foreign regulators (Financial Crisis Inquiry Commission 2011). It was generally seen as being insufficiently robust and was terminated following the failure of Lehman Brothers in 2008.

⁷ The facilities included the Discount Window Funding, the Term Auction Facility, the Primary Dealer Credit Facility, the Term Securities Lending Facility, the Term Asset-Backed Securities Loan Facility, the Commercial Paper Funding Facility, and the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility.

As a method of reducing the risks that entail when banks fund long-term, illiquid assets with short-term funding, the Basel Committee on Banking Supervision proposed a “net stable funding ratio” standard that took effect in 2018 (for an overview see, <https://www.bis.org/fsi/fsisummaries/nsfr.pdf>). Data provided in Lallour and Mio (2016) suggest that prior to the crisis, applying the net stable funding ratio to 12 of the largest US banking and investment banking groups at a consolidated level would have led to an increase in long-term funding of \$1.4 trillion by end-2007.⁸

What impact might such an intervention have on the real economy? While a \$1.5 trillion increase in the supply of long-term debt would probably affect equilibrium yields, we think such an intervention would increase firms’ average funding costs by less than 10 basis points. Conservative estimates suggest this in turn might increase lending spreads by less than 20 basis points, reducing the level of GDP by less than 0.2 percent.⁹

Tools and Actions to Reduce Build-Up in Household Debt

Higher capital and liquidity requirements might also reduce household debt growth and house prices by increasing the cost of credit for borrowers. However, the impact of implementing such measures in a boom may be small (for evidence, see Bahaj, Bridges, Malherbe, and O’Neill 2016). Thus, a macroprudential regulator determined to reduce a rapid build-up in household debt might wish to take additional actions.

Here, we consider the potential impact on the household debt boom of imposing loan-to-income limits and accompanying affordability criteria on new mortgages. Adelino, Schoar, and Severino (2016) document the widespread nature of the household credit boom: mortgage originations—and subsequent delinquencies—increased across the income distribution and across credit scores. By constraining unsustainable borrowing choices across the spectrum, macroprudential loan-to-income limits and affordability tests would therefore have helped to reduce the build-up of household debt vulnerabilities in the run-up to the crisis. We focus on these potential interventions rather than minimum down payment (“loan-to-value”) restrictions because the impact of the latter may have been limited by the twin nature of the household debt and house price booms. As discussed above, the aggregate loan-to-value ratio on the stock of US housing remained broadly flat

⁸ The estimates in Lallour and Mio (2016) are based on end-2006 balance sheet data. To make them comparable to the size of the Fed’s liquidity interventions, we scaled them up to reflect the average growth of the relevant groups’ balance sheets between 2006 and 2007.

⁹ The estimate of 10 basis points is based on the conservative assumption of a 100 basis point difference between the spreads on short-term funding and long-term (five-year) debt. To put this into context, the average difference between the cost of repo funding and five-year corporate bond spreads in 2006 was around 70 basis points. The estimated impact on lending spreads is based on the assumption that the increase in funding costs is fully passed on to borrowers by increasing spreads on loans (which represented about 50 percent of total assets), and that financial institutions’ cost of equity remains the same despite the more stable funding base. Given that around 10 percent of banks’ liabilities had to be replaced by long-term debt, this translates into an increase in lending spreads of 20 basis points. The impact of higher lending spreads on GDP is estimated based on multipliers in Firestone, Lorenc, and Ranish (2017).

Table 4

Impact of Different Loan-to-Income Limits on Gross Mortgage Lending for Owner-Occupier House Purchase (First Lien Loans Only)

	Loans granted (number, millions)	Number of loans (millions) impacted by loan-to-income limit of:				Loans granted (value, \$ billions)	Impact on value (\$ billions) of mortgages originated assuming all impacted loans reduced in size:			
		2x	3x	4x	5x		2x	3x	4x	5x
2003	4.1	2.9	1.3	0.4	0.1	755.8	189.6	59.0	16.1	6.0
2004	4.6	3.2	1.5	0.5	0.1	906.6	245.8	81.9	21.7	6.1
2005	4.8	3.4	1.6	0.5	0.1	1,031.5	288.6	95.8	23.7	6.0
2006	4.2	2.9	1.4	0.4	0.1	939.5	245.9	75.0	18.7	6.0
2007	3.4	2.4	1.2	0.4	0.1	755.9	204.4	67.8	17.7	4.8
Cumulative total:										
2003–2007	21.1	14.8	7.0	2.2	0.6	4,389	1,174	379	98	29

Source: Home Mortgage Disclosure Act (HMDA) data.

Note: The left panel identifies the *number* of mortgage originations for owner-occupier house purchase that would have been affected by loan-to-income limits set at the levels labelled. The right panels give the *value* reduction in gross lending that would have resulted if all those affected mortgages were reduced in size such that they just met the listed loan-to-income limit.

in the run-up to the crisis, whereas household debt rose sharply relative to income. Adelino, Schoar, and Severino (2017) also document the relatively stable distribution of combined loan-to-value ratios *at origination* between 2001 and 2007.¹⁰

As a simple illustration, consider how loan-to-income limits would have affected loan-level mortgage originations for owner-occupier house purchases in the run-up to the crisis.¹¹ For example, a loan-to-income limit of four times income applied from 2003 to 2007 would have meant that 2.2 million of the 21 million mortgages originated would have had to be reduced in size (see Table 4). Assuming all of these affected loans were still originated at the largest size possible given the limit, this intervention would have left the mortgage stock on the eve of the crisis around \$100 billion or about 1 percent lower than the \$10.6 trillion observed.

However, this naive experiment is likely to understate significantly the effect of loan-to-income limits on the mortgage stock. First, the data sample excludes second lien or “piggyback” mortgages, whereas well-designed loan-to-income limits would take into account the *combined* value of first and additional loans. To the extent that these additional loans pushed households’ overall indebtedness above the loan-to-income limit, some would have been curtailed. This could have had a material

¹⁰ Mayer, Pence, and Sherlund (2009) document an increase in the median combined loan-to-value ratio for *non-prime* purchase loans between 2003 and 2007. We argue below that income and affordability limits would have been effective in moderating the boom in non-prime mortgage lending.

¹¹ With thanks to Matthieu Chavaz for assistance, we use annual data resulting from the 1975 Home Mortgage Disclosure Act (HMDA), which covers the vast majority of mortgages originated. From this dataset, we analyse first lien mortgages for house purchase by owner-occupiers where both loan size and income is reported.

effect: the total flow of second lien mortgage originations from 2003 to 2007 was over \$200 billion. Second, this experiment focuses only on owner-occupier house purchase loans, with no impact assumed on investor loans or refinancing, both of which were important features of the household credit boom. Third, our calculation assumes that all affected borrowers still receive a loan and at the largest size possible given the limit—in reality, some borrowers would likely be shifted further below the limit and some might be excluded altogether. As an upper bound of the impact, if all originations constrained by a loan-to-income limit of four times income were excluded altogether—rather than just reduced in size—the impact on gross lending would rise from around \$100 billion to \$620 billion.

Borrowers at the riskier end of the spectrum that could either not certify their income or that had particularly stretched affordability characteristics would have perhaps been the most likely to have been excluded altogether. We can attempt to quantify these considerations. Between 2003 and mid-2007, about half of non-prime mortgage originations for house purchase had low or no documentation of income, assets, or both (Mayer, Pence, and Sherlund 2009). That amounted to around 1.7 million loans or 8 percent of the total captured in Table 4 over the same period.¹² These loans performed significantly worse than those with full documentation—by 2008 serious delinquencies on low or no documentation subprime loans had risen to 25 percent (Mayer, Pence, and Sherlund 2009). Many of these loans would likely have been curtailed by a loan-to-income limit, given the requirement that some actual documentation of income is provided in order to implement a loan-to-income policy. To give a sense of scale, had all of these loans been excluded by a loan-to-income policy between 2003 and mid-2007, lending could have been reduced by around \$360 billion (next to last line of Table 5).¹³

As a complement to loan-to-income limits, a macroprudential authority aiming to enhance the resilience of household sector balance sheets could also recommend the introduction of affordability tests, which require lenders to assess borrowers' capacity to service debts in different circumstances (as discussed in Bank of England 2017). Evidence from the Survey of Consumer Finances suggests that by 2007, 20 percent of the total stock of mortgagors had debt service burdens of over 40 percent of their income—a situation that might reasonably have been flagged by an affordability test. The impact of such tests on the rapid growth in non-prime mortgage borrowing could have been significant. For example, 76 percent of subprime mortgages for house purchase between 2003 and mid-2007 were short-term hybrid

¹² The Mayer, Pence, and Sherlund (2009) sample is based on data from First American Loan Performance. These data capture the vast majority of securitized, non-prime (that is subprime or near-prime “Alt-A”) first lien mortgage originations. The sample covers a total of 9.7 million originations, including investor loans and refinances. For comparability with Table 4, we focus on the subsample of about 3.4 million loans to owner-occupiers for house purchase. When comparing to Table 4, this subsample underestimates the total share of non-prime loans, since it does not capture mortgages retained by the lender rather than securitized.

¹³ This assumes low- or no-documentation loans had a proportionate share in the total value of originations in Table 4.

Table 5

Potential Impact of a 4× Loan-to-Income Limit and Accompanying Affordability Test on Household Debt Boom

Mortgage debt stock	
Total mortgage debt stock (2007) ^a	\$10,638bn
Gross flow of new mortgages (for owner-occupier house purchase)	
Total value of loans granted (2003 to 2007) ^b	\$4,389bn
Direct impact of 4× loan-to-income limit (2003 to 2007)^b	
Lower-bound estimate: all loans still originated at maximum size within limit:	- \$98bn
Upper-bound estimate: all loans with loan-to-income > 4× excluded altogether:	- \$622bn
Potential upper-bound impacts on non-prime lending (2003 to 2007)^c	
If income requirement excluded all low- or no-documentation subprime loans	- \$359bn
If affordability test excluded all non-prime originations on teaser rates	- \$366bn

^a Financial accounts of the United States.

^b Home Mortgage Disclosure Act (HMDA) data; gross flow of first lien owner-occupier purchase loans. Impact estimates do not include potential reduction in second lien loans, investor loans, or loans for refinance.

^c Number of non-prime first lien owner-occupier purchase loans estimated based on Mayer et al. (2009) and share in total value of loans assumed to be a proportionate. Exclusions for low- or no-documentation loans and teaser-rate loans would have overlapped; taken together these borrowers accounted for about \$580bn of lending from 2003 to 2007.

loans with initial “teaser” rates, which were low introductory interest rates that would last for the first year or two of the mortgage (Mayer, Pence, and Sherlund 2009). By 2008, serious delinquency rates on these loans exceeded 30 percent. An affordability test that required mortgagors to demonstrate resilience to an interest rate stress up front would likely have curtailed non-prime lending on teaser rates significantly. If the test had prevented these loans altogether, it could have reduced mortgage lending by around \$370 billion (last line of Table 5).

Taken together, actions to restrict the borrowing of those that either could not certify their income or had stretched affordability characteristics would likely have materially dampened the surge in non-prime lending prior to the crisis. As Table 5 shows, we are left with a wide range of possible effects, but it seems plausible that combining loan-to-income and affordability rules would have moderated the scale of the household debt boom in the run-up to the crisis.

The macroeconomic benefit of any limits would incorporate the fact that they would have targeted the most highly indebted borrowers. Bunn and Rostom (2015), Andersen, Duus, and Jenson (2016), and Fagereng and Halvorsen (2016) show a correlation between pre-crisis household leverage and subsequent negative consumption responses. Although these studies do not demonstrate causality, they suggest that limiting leverage of the most highly indebted households could have a stronger aggregate effect on spending in a downturn than reducing debt uniformly across households. Targeted macroprudential interventions of this kind could therefore have been particularly effective in dampening the macroeconomic fallout from the crisis.

Table 6

Survey Data on Usage of Macroprudential Tools

	Use of bank-focused tools <i>(positive countercyclical capital buffer, forward-looking provisions, caps on credit growth)</i>	Use of household-focused tools <i>(loan-to-income or debt-service-to-income limits)</i>	Both
All advanced economies (18)	44% of countries	33% of countries	22% of countries
Advanced economies with financial stability committee with formal powers (5)	60% of countries	40% of countries	40% of countries
Other advanced economies (13)	38% of countries	31% of countries	15% of countries

Note: We consider the 19 advanced economies covered in Edge and Liang (2017), minus South Korea, for which no data on tool usage is available. Numbers are based on country classification in Edge and Liang (2017) and survey responses on tool usage in IMF (2018a) that consider tools in use at the date of the survey. “Formal powers” refers to powers to act unilaterally or to issue “comply-or-explain” recommendations. Results for the United Kingdom have been adjusted to account for measures that had been agreed but were not yet binding at the date of the survey.

Could the Macroprudential Frameworks Set Up Since the Crisis Implement Such Policies?

Of the 58 countries surveyed in Edge and Liang (2017) that have created macroprudential frameworks since the crisis, 41 have set up multi-agency financial stability committees. Perhaps surprisingly, only 11 of these have formal powers, including either direct controls over macroprudential policy tools or the right to issue “comply or explain” recommendations to which other authorities are formally obliged to respond. The remaining cases rely on the voluntary cooperation of other regulators to achieve their policy aims.¹⁴

There is tentative evidence that financial stability committees with formal powers are more likely to act than government agencies exposed to short-term political pressures. Table 6, for instance, presents evidence from a sample of 18 advanced economies that 60 percent of countries with high-powered financial stability committees have taken bank-focused policy actions; this compares to 38 percent for countries where financial stability policy requires interagency cooperation. Similarly, countries with high-powered financial stability committees are also more likely to have used household-focused macroprudential tools. While the sample is small and causation is likely to run both ways, this evidence suggests that institutional frameworks do matter for mitigating biases towards inaction in the application of macroprudential policies.

If we line up the multi-agency financial stability committees in order of the powers at their direct disposal, two cases stand out at opposite ends of the spectrum. The UK Financial Policy Committee has a wide-ranging toolkit to achieve its

¹⁴ Forbes (2018) provides a detailed summary of some of the macroprudential measures that different countries have put in place after the crisis.

mandate to protect and enhance the resilience of the UK financial system. At the other end of the spectrum, the US Financial Stability Oversight Council has few powers under its direct control. In this section, we compare and contrast these polar cases, and assess what they could do if faced with a rerun of the factors that led to the last financial crisis.

The US Financial Stability Oversight Council

The Financial Stability Oversight Council was set up in 2010 as part of the Dodd–Frank Act, and its ten voting members include the heads of existing regulatory agencies, including the Federal Reserve, Federal Deposit Insurance Corporation, Securities Exchange Commission, alongside the Secretary of the Treasury and one independent member with insurance expertise. It also has five non-voting members, including the Director of the Office of Financial Research, who serve in an advisory capacity. It is chaired by the Secretary of the Treasury, and most decisions are taken by majority rule.

Its overall mandate is to identify and respond to risks to US financial stability that could arise from the distress or failure of large, interconnected bank holding companies or nonbank financial companies. It is also charged with promoting market discipline by removing expectations that investors will be shielded from losses by the government. It is designed to facilitate information sharing between relevant regulatory agencies. Its only binding tool is the power to designate nonbank financial institutions deemed to be systemically important for enhanced supervision, a decision that has to be backed by two-thirds of the voting members. It has no other macroprudential powers. For other policy interventions, the Financial Stability Oversight Council can only issue recommendations to other regulators, not all of whom have an explicit financial stability objective (Kohn 2014).

We argue that the Financial Stability Oversight Council in its current form does not have sufficient powers to ensure financial stability in the face of a credit boom. The Council's track record to date supports this pessimistic assessment. First, consider the efforts to reform money market mutual funds. The runs on the Reserve Primary Fund in September 2008, followed by large outflows from money market mutual funds in general, revealed the fundamental vulnerability of these institutions to runs (Squam Lake Group 2011). Four years later in November 2012, the Financial Stability Oversight Council (unanimously) suggested three options for reform: making the shares in money market mutual funds have a floating rather than fixed value; mandating a 1 percent capital requirement along with a requirement that large withdrawals could be delayed; or mandating a 3 percent capital requirement that might be combined with other options. All of these actions would have reduced incentives to run a fund before it was no longer able to redeem shares at their face value.

Following heavy resistance, including criticisms that money market mutual funds were outside of the FSOC's remit, no final recommendation was issued (Cochran, Freeman, and Clark 2015). The Securities and Exchange Commission, as primary regulator for money market mutual funds, rejected the idea of capital requirements and ultimately passed a floating value option (on a 3 to 2 vote) that only applied to a subset of money market mutual funds. This took effect in October 2016.

A second case involves the long-running debate over attempts to reform US housing finance. There has been bipartisan political support for using government-sponsored enterprises like Fannie Mae and Freddie Mac to support the housing market, with some emphasis on making housing more affordable for lower-income borrowers (Rajan 2010). However, Alan Greenspan (2005), while Fed Chair and at the peak of his influence on public policy, repeatedly testified in favor of restraining the ability of government-sponsored enterprises to purchase private-label mortgage-backed securities on financial stability grounds, but to no avail. After the crisis, the Dodd–Frank Act did ban certain types of mortgages, such as interest-only mortgages or those with negative amortization. But it left the question of minimum down-payment restrictions to a group of six regulators involved in housing, which ultimately opted against introducing such a requirement. While risks in the housing market have significantly declined since the crisis, average loan-to-value ratios on mortgages are not lower than they were in the early 2000s. Furthermore, no US regulator has the ability to impose loan-to-income requirements, even if the Financial Stability Oversight Council wished to recommend this action.

Problems associated with lack of power of the Financial Stability Oversight Council would be mitigated if other authorities had the tools and incentives to act. For example, maintaining the stability of the financial system and containing the systemic risk that may arise in financial markets has long been central to the mission of the Federal Reserve (Kohn 2006). The Fed has a recognized set of powers including: conducting annual stress tests for large bank holding companies and the nonbank financial companies it supervises; setting countercyclical capital buffers for bank holding companies; imposing liquidity requirements on the largest and most complex financial institutions; and setting minimum margin requirements.

But the Fed's powers are limited. For example, the Dodd–Frank Act curtailed the Fed's ability to provide emergency lending to nonbanks. Moreover, the Fed lacks authority over many parts of the financial system and has no tools that can be used to tackle household debt vulnerabilities. A June 2015 “war game” exercise conducted by four Reserve Bank presidents concluded that the Fed had insufficient macroprudential powers to address a build-up in risks that resembled the earlier financial crisis (Adrian, de Fournouville, Yang, and Zlate 2017). Also, Fed officials have cast doubt on whether its mandate permits it to use monetary policy to act against a build-up in financial stability risks.

The UK Financial Policy Committee

The UK Financial Policy Committee was established in 2013. It has twelve voting members: the Governor of the Bank of England, four Deputy Governors, the Executive Director for Financial Stability, the head of the UK Financial Conduct Authority, and five independent external members. A representative of the Treasury attends the meetings as a non-voting member. Most of the Governors of the Bank of England also sit on the UK's monetary policy and microprudential policy committees, which facilitates policy coordination. The large external membership, and the fact that decisions are taken primarily by consensus, means that external members have a strong voice.

The Financial Policy Committee is the most muscular macroprudential regulator in the world. It unilaterally sets the countercyclical capital buffer for all banks, building societies, and large investment firms operating in the United Kingdom, along with a countercyclical leverage buffer for large banks. Despite more than 70 countries reporting that they have put a countercyclical capital buffer framework in place, the UK Financial Policy Committee is one of only around 10 to have implemented it at positive rates to date and the only country to have released it in response to risks crystallizing. The Financial Policy Committee can also vary risk weights by sector for certain types of risk. It can impose limits on household borrowing via loan-to-income and loan-to-value restrictions. It advises on the scenarios used in the annual stress tests of the largest UK banking groups. It has successfully petitioned the government for additional powers. It can issue “comply or explain” recommendations to other regulators. In the past, it has made 18 recommendations to other regulators, all of which have been implemented. Finally, it makes an annual assessment on whether the perimeters of prudential regulation are drawn appropriately.

These powers are accompanied by a strong accountability framework. All members of the Financial Policy Committee are personally accountable to Parliament and typically provide testimony at least once a year. These testimonies follow the release of a biannual Financial Stability Report, which is increasingly designed to reach a wide audience to enhance public accountability.

If confronted by a rerun of the events leading to the financial crisis, the Financial Policy Committee would have the direct power to increase the resilience of the banking system by raising capital requirements via the countercyclical capital buffer rate, sectoral capital requirements, and countercyclical leverage buffers. While it does not have powers to direct changes in banks’ liquidity or funding requirements, it could issue comply-or-explain recommendations to the microprudential regulator to implement such changes. It seems plausible to us that, faced with evidence of mounting vulnerabilities throughout the early-to-mid 2000s, the Financial Policy Committee would have commissioned a stress test of the largest UK banking groups that would have assumed severe falls in house prices. Such an exercise might not have uncovered all the channels via which losses eventually transpired (for example, we doubt it would have been feasible to understand the full extent of losses that materialised on the seemingly very safe “AAA” tranches of collateralized debt obligations backed by mortgage securities¹⁵). Nevertheless, such tests would have exposed the fragile solvency and liquidity position of the largest banking groups (including their broker-dealer subsidiaries) at this point—thus signalling the need for higher capital and liquidity standards.

¹⁵That said, a paper written prior to the collapse in valuations of the senior AAA tranches of collateralized debt obligations argued that these assets were significantly overvalued given the likely states of the economy when defaults might occur—that is, given the systematic nature of the risks being borne by investors (Coval, Jurek, and Stafford 2009).

In addition, a regulator modeled on the Financial Policy Committee could have used its annual assessment to recommend changes to the regulatory perimeter to include other parts of the financial system like stand-alone broker-dealers that were not part of wider banking groups. Finally, the Financial Policy Committee could have guarded against vulnerabilities associated with household indebtedness by limiting the extension of certain mortgages with high loan-to-income ratios. Indeed, a loan-to-income limit and accompanying affordability test, similar to those considered above, was put in place by the Financial Policy Committee in 2014.

Conclusion

Could macroprudential policy frameworks have prevented the last crisis? Perhaps. There would have been challenges in spotting and responding to build-ups of risk in real time. But our analysis suggests that a macroprudential regime with a suitably strong mandate, coupled with powers to adjust financial system leverage and maturity/liquidity transformation and to limit household sector indebtedness, could have significantly ameliorated the macroeconomic fall-out from the collapse of the real estate bubble.

Are today's macroprudential regimes sufficiently well-equipped to do this? The US Financial Stability Oversight Council is not. The circumscribed structure of the Financial Stability Oversight Council reflects a political choice to limit the remit of financial regulation and, notably, to limit its ability to respond to financial sector developments outside the commercial banking system. While this may be deemed politically desirable, it would severely restrict the ability of US regulators to prevent a rerun of the crisis in the future. A macroprudential regulator modeled on the UK Financial Policy Committee would have the necessary mandate and powers, including in relation to household indebtedness. But a similar regime in a rerun of the crisis would still have required political backing to widen the perimeter of regulation to capture loosely regulated nonbank financial institutions and then to act aggressively.

This raises the important question of how much direct authority a macroprudential regulator requires. Many macroprudential regulators must rely on making nonbinding recommendations to other regulators. The evidence presented above suggests that one obvious risk of this arrangement is that the recipient of these recommendations does not share the macroprudential regulator's objectives, and no action will be taken. A less obvious risk is that a financial stability committee that lacks the authority to address risks will be tempted to see risks everywhere—after all, warning of such risks is costless and a useful way to hedge one's bets. For this reason, the warnings of a more powerful financial stability committee might be more targeted and informative.¹⁶

¹⁶ We would like to thank Sir Jon Cunliffe for suggesting this point to us.

A related question is how wide the remit of a macroprudential regulator should be. The evidence summarized above suggests that it may be necessary to take actions to ensure the resilience of both lender and borrower balance sheets, including by taking targeted action to prevent build-ups in household debt. While many countries have implemented policies aimed at preventing excessive levels of household debt, they remain controversial. Preventing a willing borrower and lender from consummating a mortgage contract where neither party is likely to default, for fear of the macroeconomic spillovers such contracts might create, is a more interventionist conception of macroprudential policy than one focused solely on resilience of the banking and financial system. It is not clear whether such interventions should be left to technical committees or to democratically elected governments (Balls, Howat, and Stansbury 2016; Tucker 2018).

A key challenge in making macroprudential policy effective is therefore to give the relevant financial stability committees clear powers and an appropriately wide remit, but also to put in place robust governance arrangements that ensure macroprudential policymakers are accountable for the way in which they use their tools.

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