CHARTING THE FINANCIAL CRISIS

U.S. Strategy and Outcomes

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Hutchins Center
on Fiscal & Monetary Policy
at BROOKINGS

Yale SCHOOL OF MANAGEMENT
Program on Financial Stability

Introduction

The global financial crisis and great recession of 2007–2009 constituted the worst shocks to the United States economy in generations. Books have been and will be written about the housing bubble and bust, the financial panic that followed, the economic devastation that resulted, and the steps that various arms of the U.S. and foreign governments took to prevent the Great Depression 2.0. But the story can also be told graphically, as these charts aim to do.

What comes quickly into focus is that as the crisis intensified, so did the government's response. Although the seeds of the harrowing events of 2007–2009 were sown over decades, and the U.S. government was initially slow to act, the combined efforts of the Federal Reserve, Treasury Department, and other agencies were ultimately forceful, flexible, and effective. Federal regulators greatly expanded their crisis management tool kit as the damage unfolded, moving from traditional and domestic measures to actions that were innovative and sometimes even international in reach. As panic spread, so too did their efforts broaden to quell it. In the end, the government was able to stabilize the system, re-start key financial markets, and limit the extent of the harm to the economy.

No collection of charts, even as extensive as this, can convey all the complexities and details of the crisis and the government's interventions. But these figures capture the essential features of one of the worst episodes in American economic history and the ultimately successful, even if politically unpopular, government response.

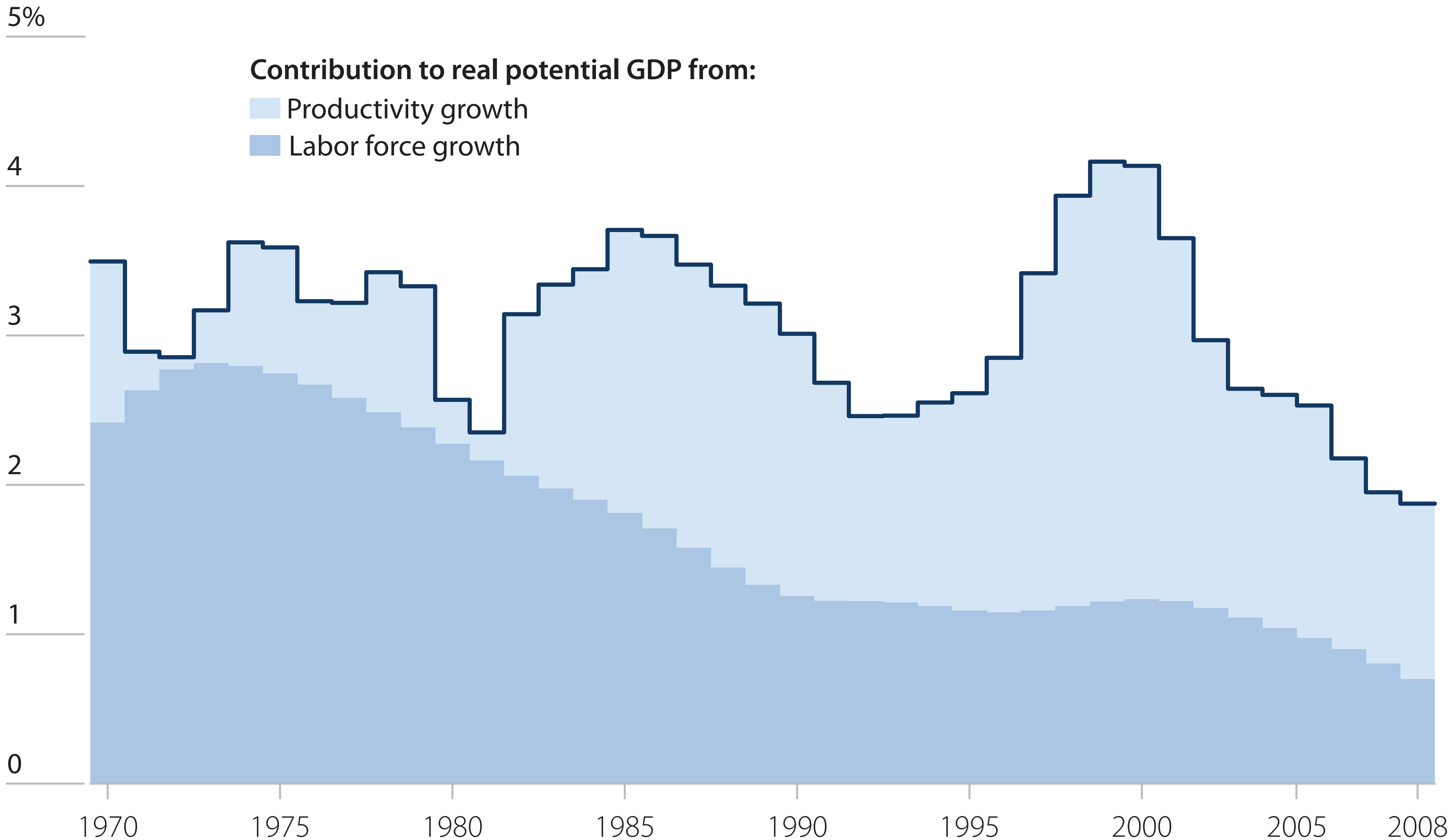
www.som.yale.edu/financialcrisischarts

Antecedents of the Crisis

In the years leading up to the crisis, the underlying performance of the U.S. economy had eroded in important ways.

Because the growth of productivity and the labor force had slowed in the decade before the crisis, the potential economic growth rate was falling.

Growth in real potential GDP

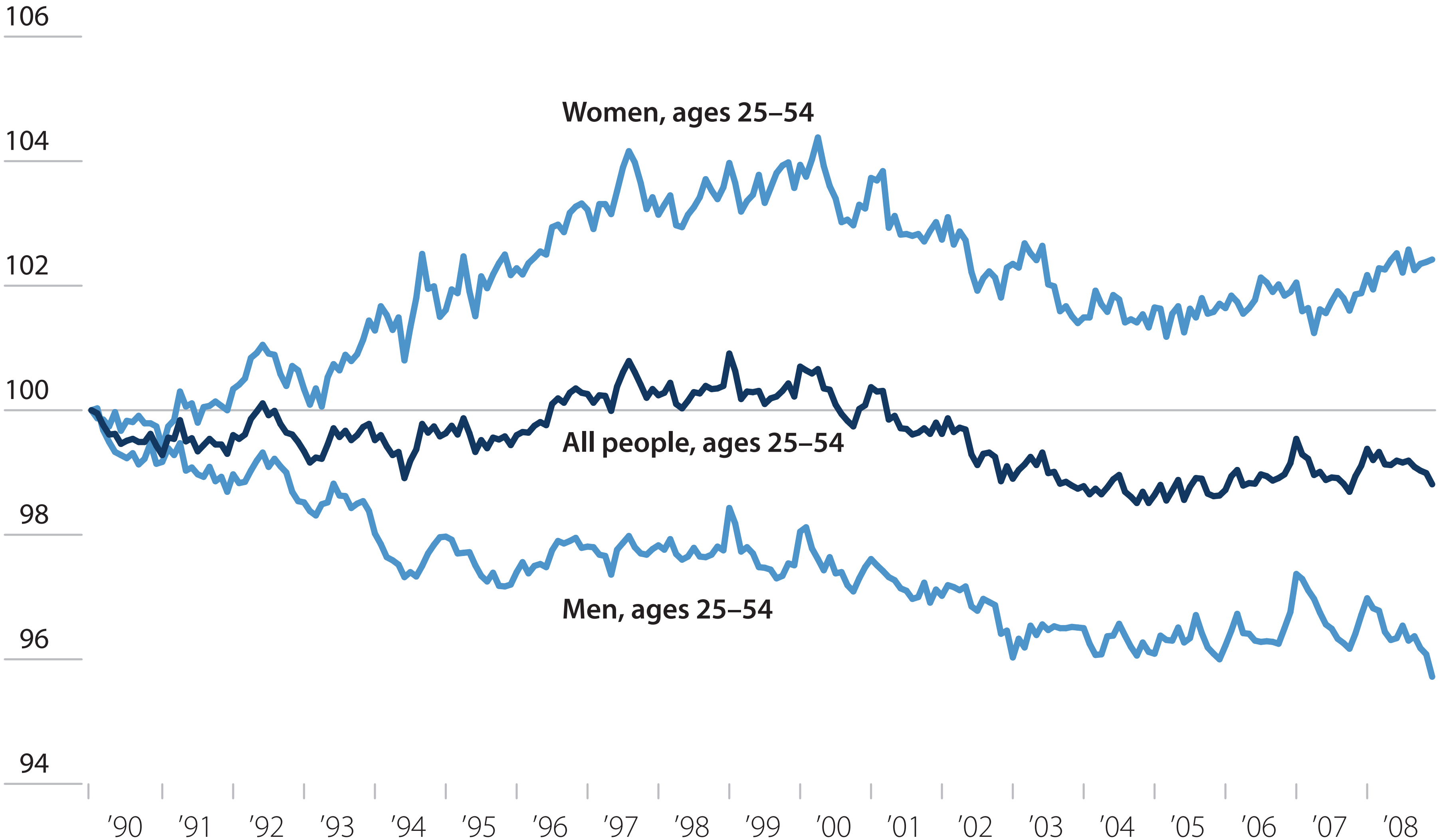


Sources: Congressional Budget Office, "An Update to the Economic Outlook: 2018 to 2028"; authors' calculations

ANTECEDENTS

Overall prime-age participation in the labor force had been falling, as the participation of women slowed and men's continued a decades-long decline.

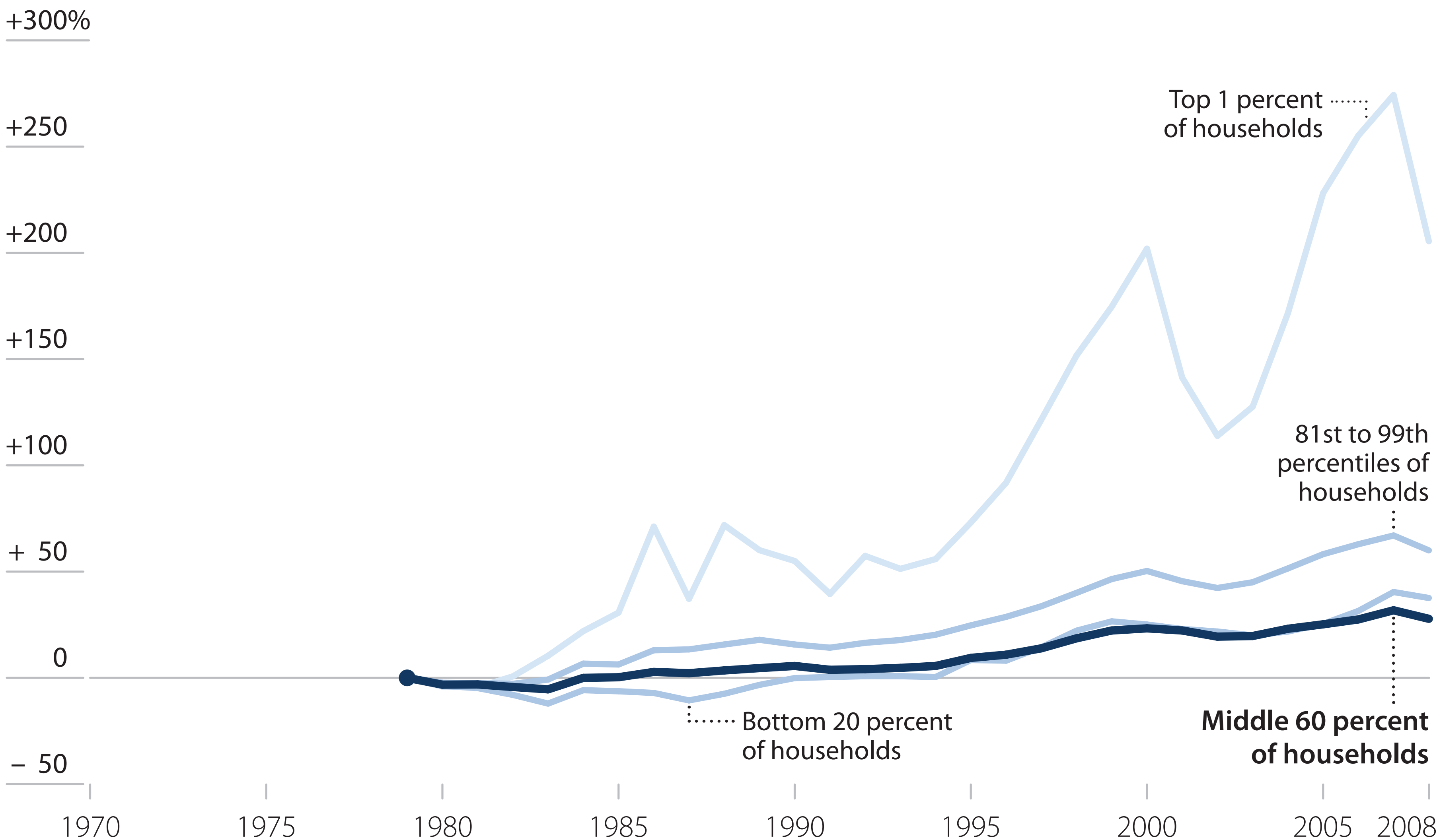
Civilian labor force participation rates for people ages 25–54, indexed to January 1990=100



Source: Bureau of Labor Statistics via Haver Analytics

Income growth for the top 1 percent had risen sharply, driving income inequality to levels not seen since the 1920s.

Cumulative growth in average income since 1979, before transfers and taxes, by income group

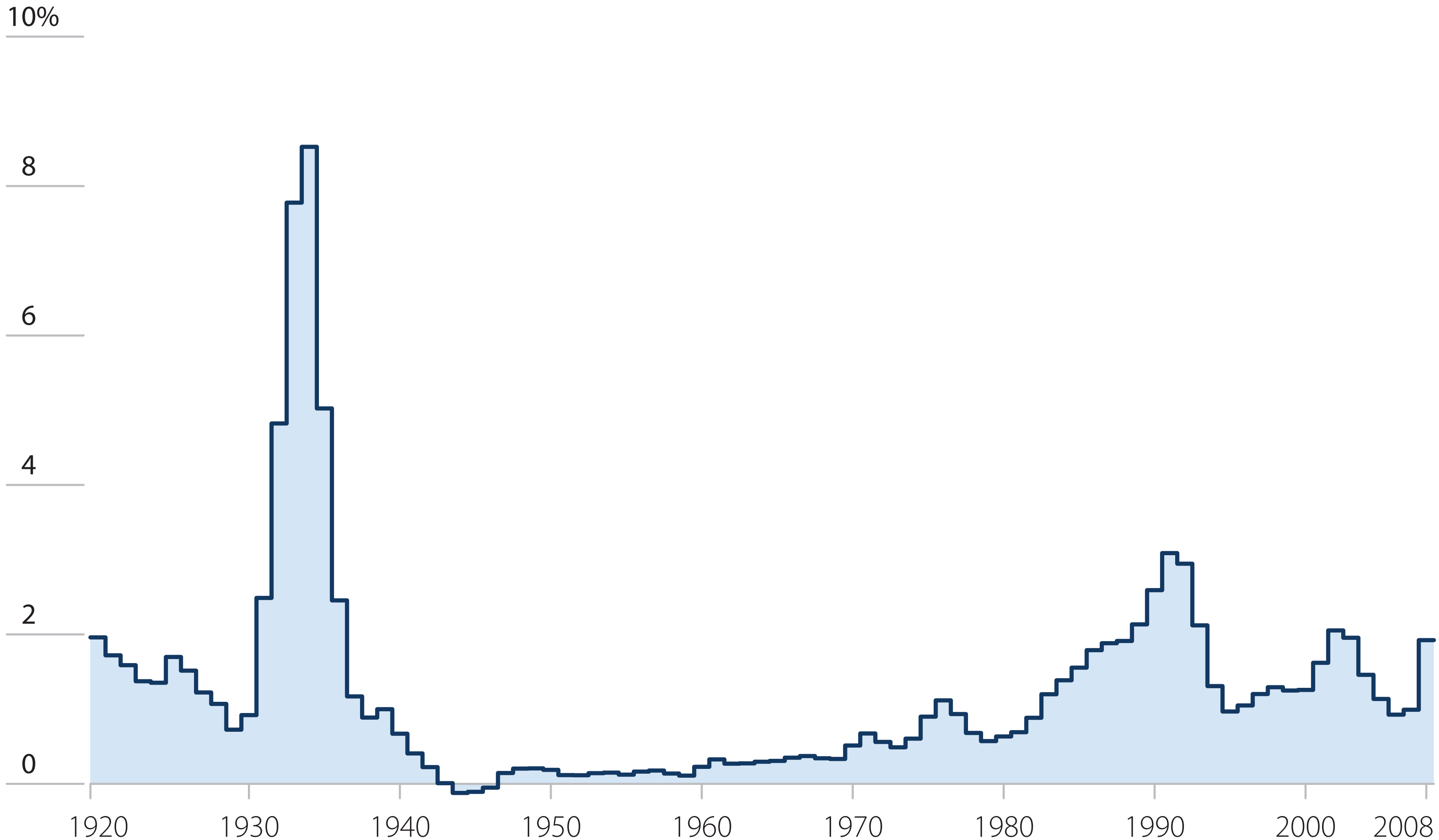


Source: Congressional Budget Office, "The Distribution of Household Income, 2014"

Meanwhile, the financial system was becoming increasingly fragile.

A "quiet period" of relatively low bank losses had extended for nearly 70 years and created a false sense of strength.

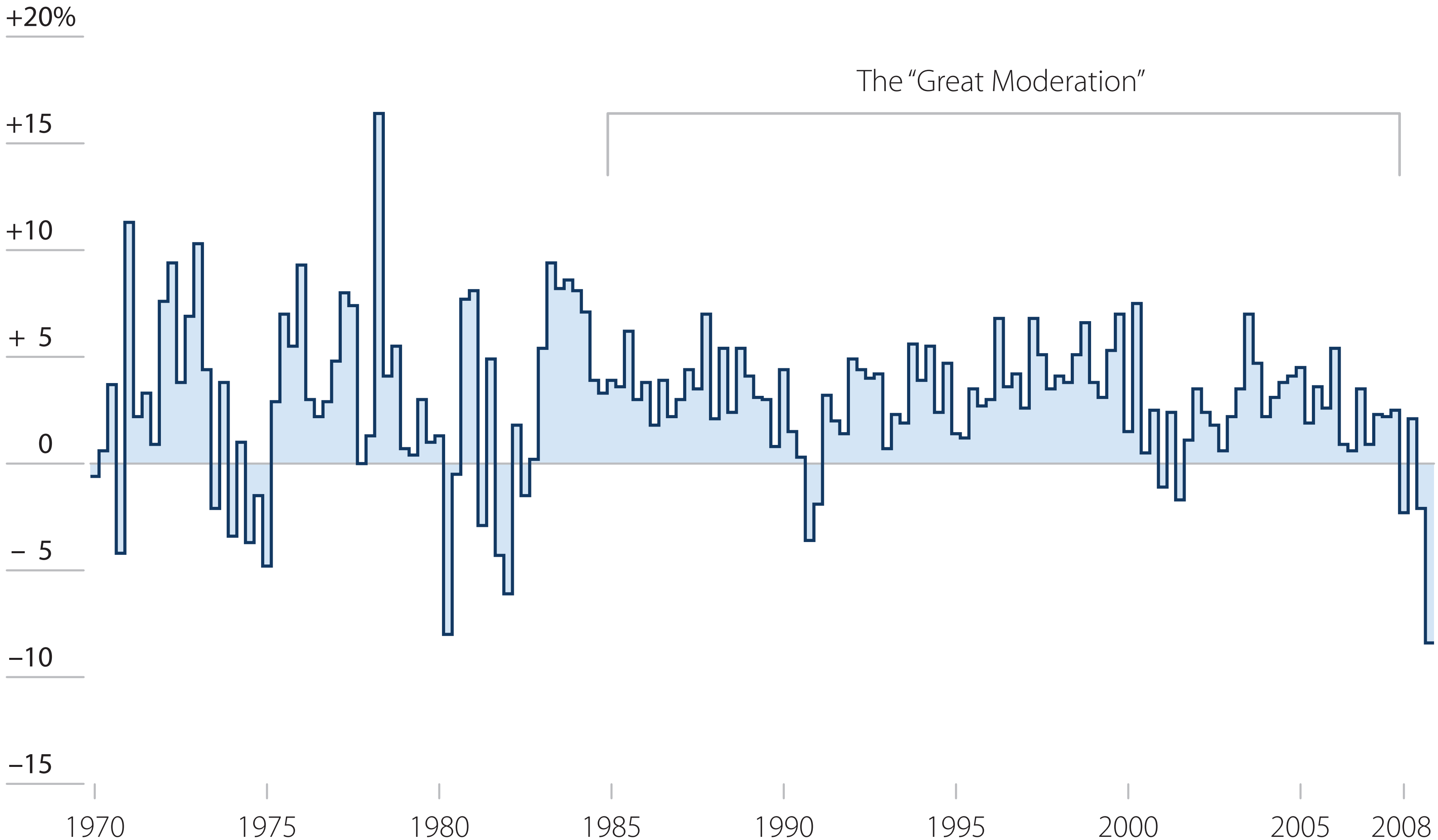
Two-year historical loan-loss rates for commercial banks



Sources: Federal Deposit Insurance Corp.; Federal Reserve Board; International Monetary Fund

The "Great Moderation"—two decades of more stable economic outcomes with shorter, shallower recessions and lower inflation—had added to complacency.

Quarterly real GDP growth, percent change from preceding period



Source: Bureau of Economic Analysis via Federal Reserve Economic Data (FRED)

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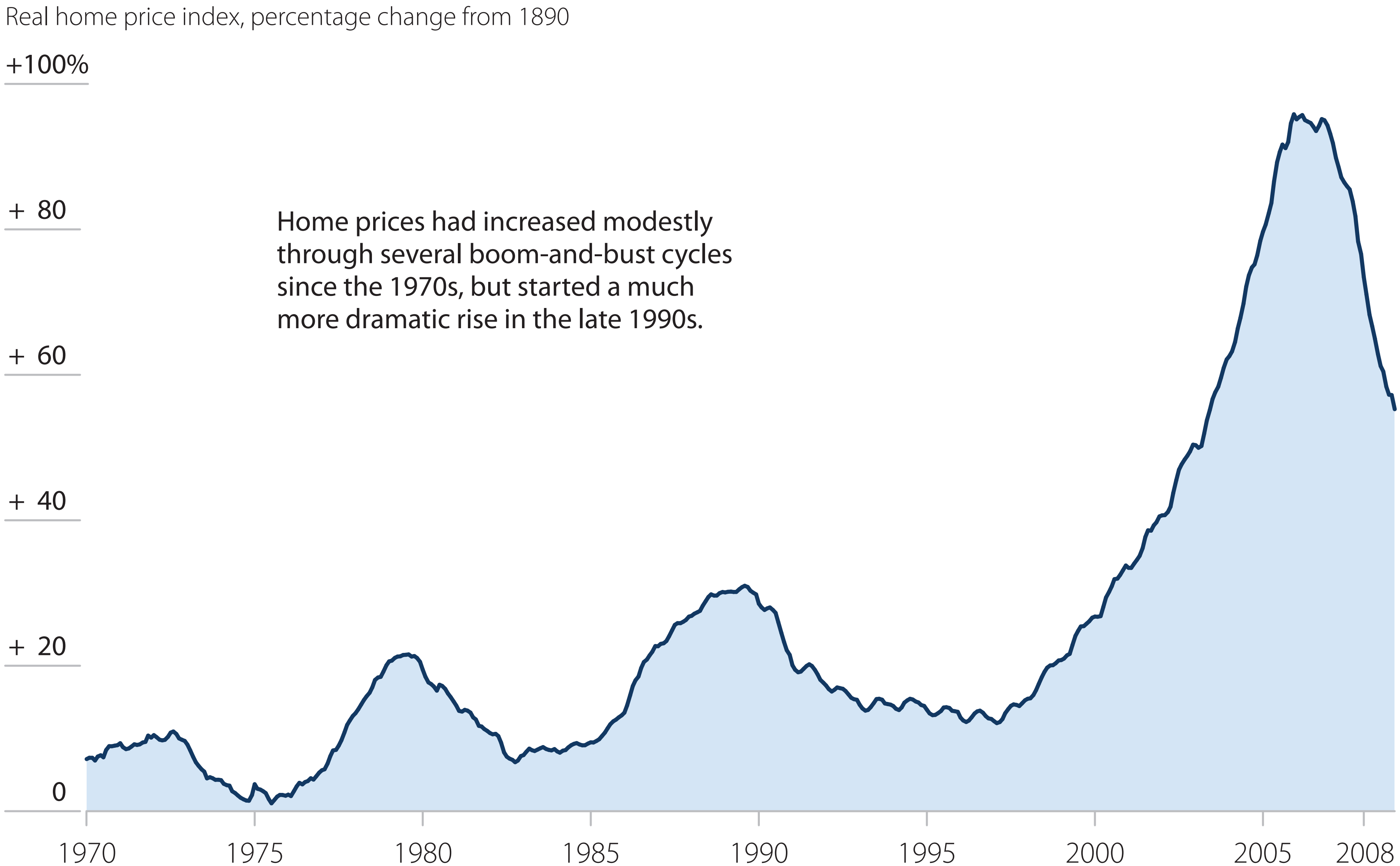
Long-term interest rates had been falling for decades, reflecting decreasing inflation, an aging workforce, and a rise in global savings.

Benchmark interest rates, monthly

Sources: Federal Reserve Board and Freddie Mac Primary Mortgage Market Survey® via Federal Reserve Economic Data (FRED)

ANTECEDENTS

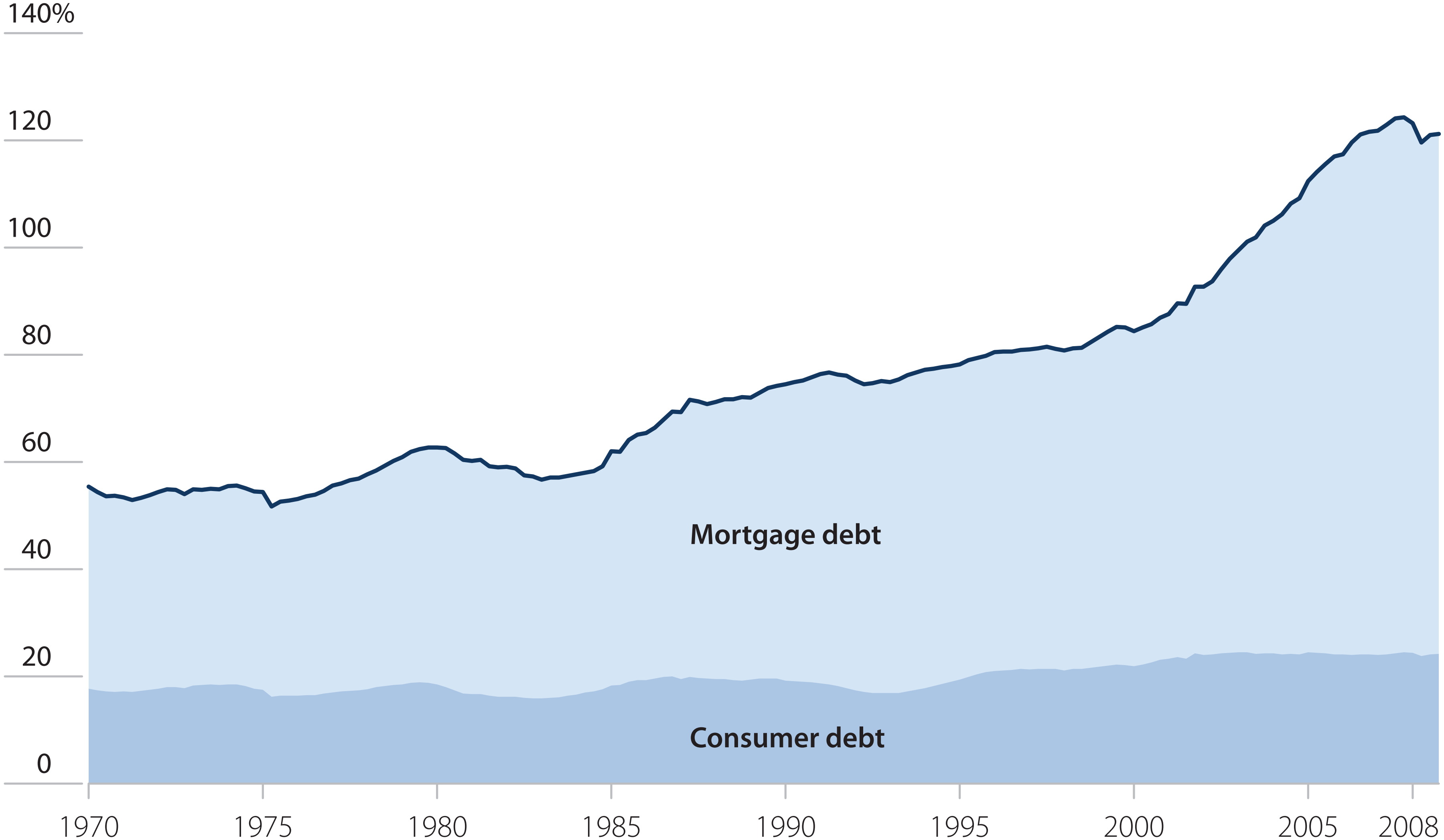
Home prices across the country had been rising rapidly for nearly a decade.



Source: U.S. Home Price and Related Data, Robert J. Shiller, *Irrational Exuberance*

Household debt as a share of income had risen to alarming heights.

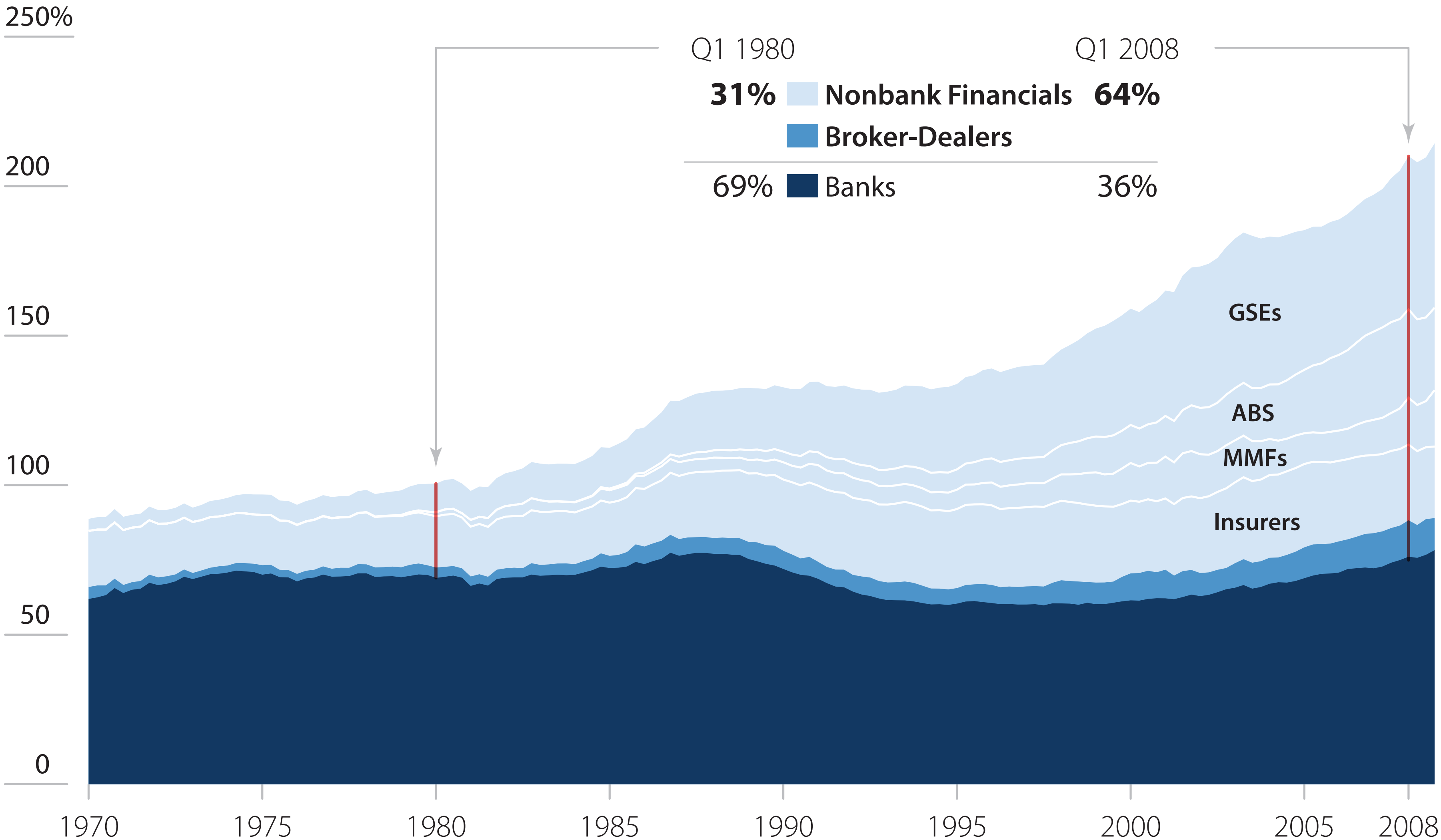
Aggregate household debt as a share of disposable personal income



Source: Federal Reserve Board Financial Accounts of the United States, based on Ahn et al. (2018)

Credit and risk had migrated outside the regulated banking system.

Credit market debt outstanding, by holder, as a share of nominal GDP



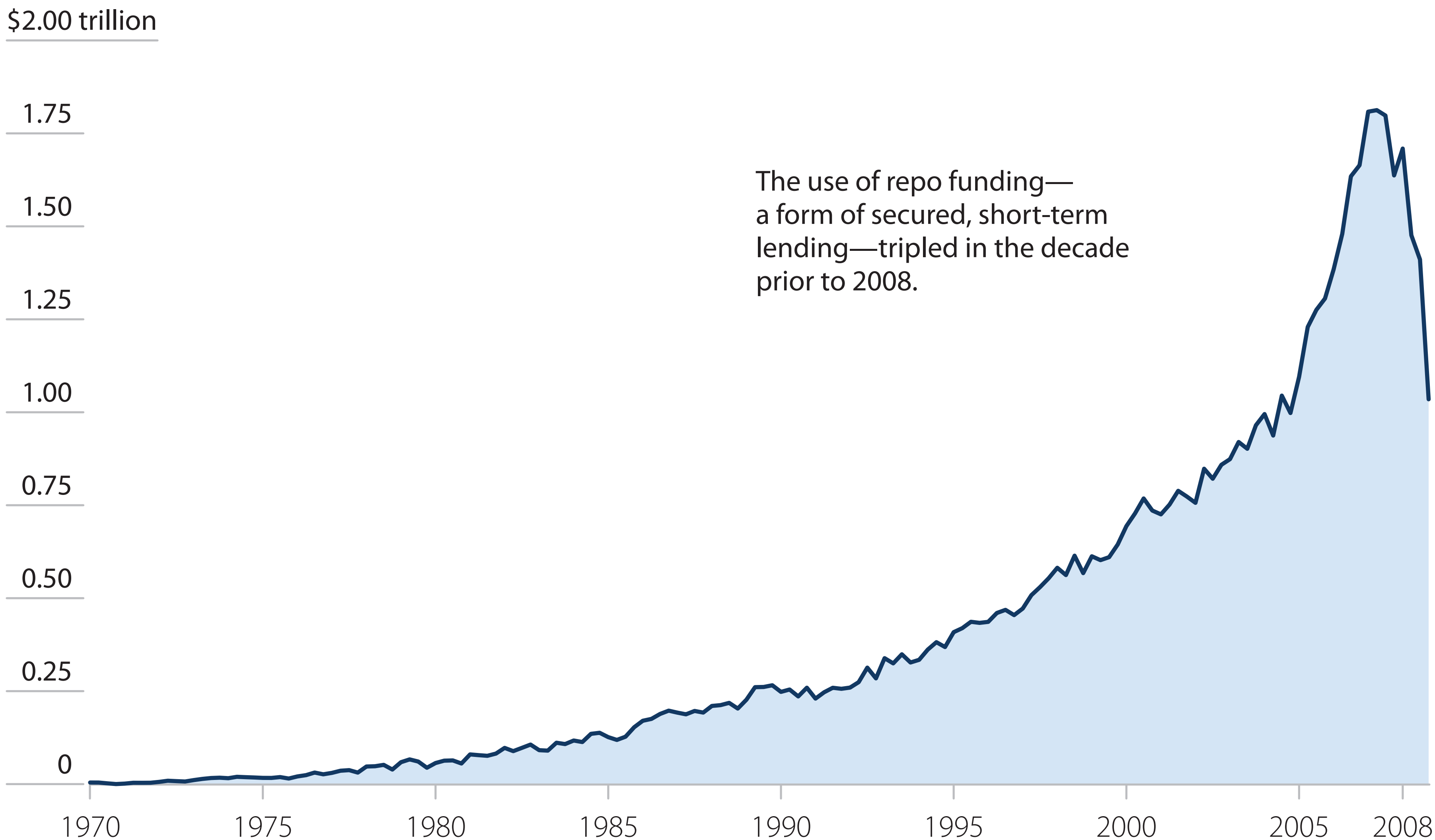
Notes: GSE: government-sponsored enterprise (including Fannie Mae and Freddie Mac); ABS: asset-backed securities issuers; MMFs: money market funds

Source: Federal Reserve Board Financial Accounts of the United States

ANTECEDENTS

The amount of financial assets financed with short-term liabilities had also risen sharply, increasing the vulnerability of the financial system to runs.

Net repo funding to banks and broker-dealers



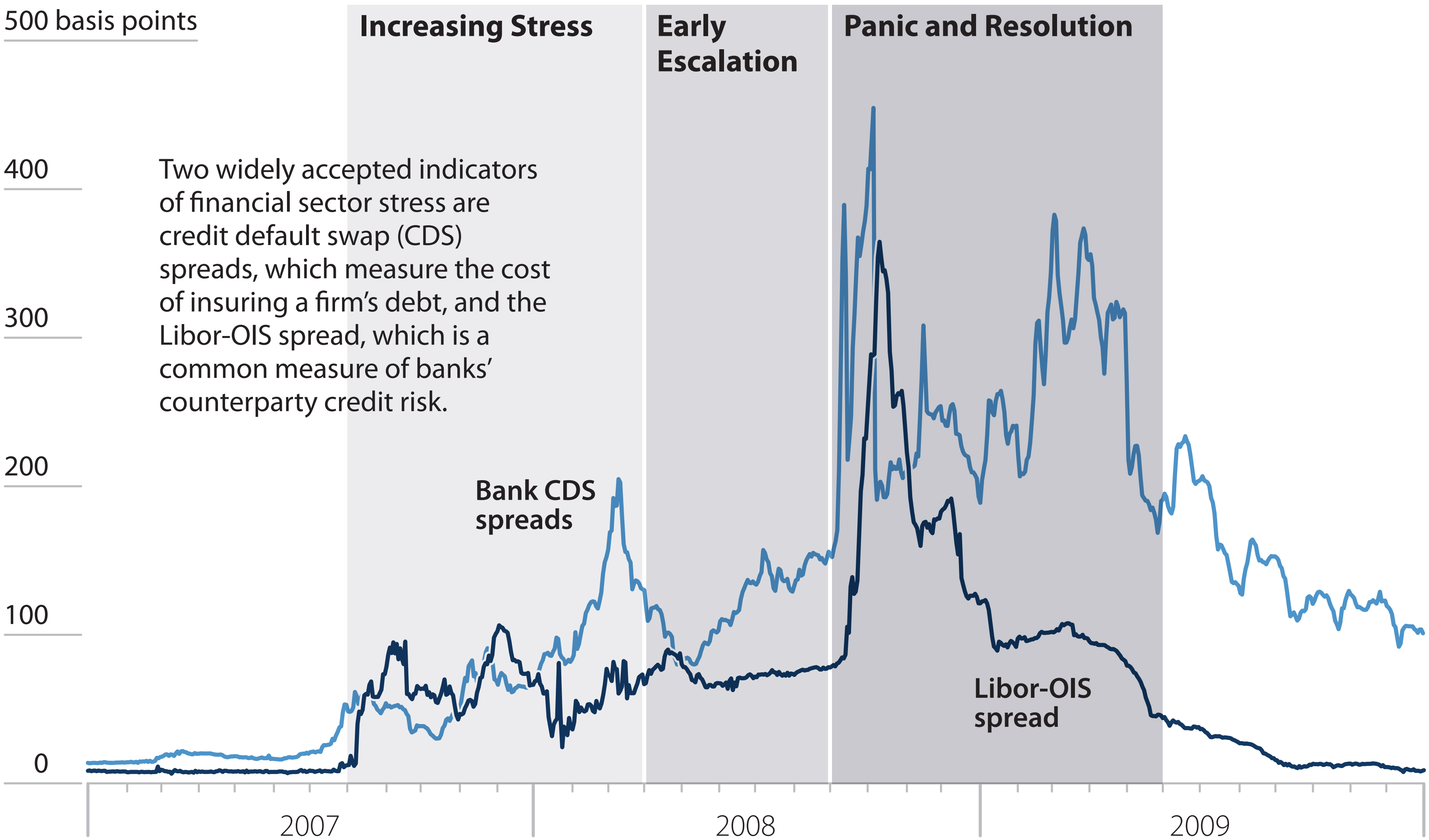
Source: Federal Reserve Board Financial Accounts of the United States

The Arc of the Crisis

ARC OF THE CRISIS

The financial crisis unfolded in several phases.

Bank credit default swap spreads and Libor-OIS spread



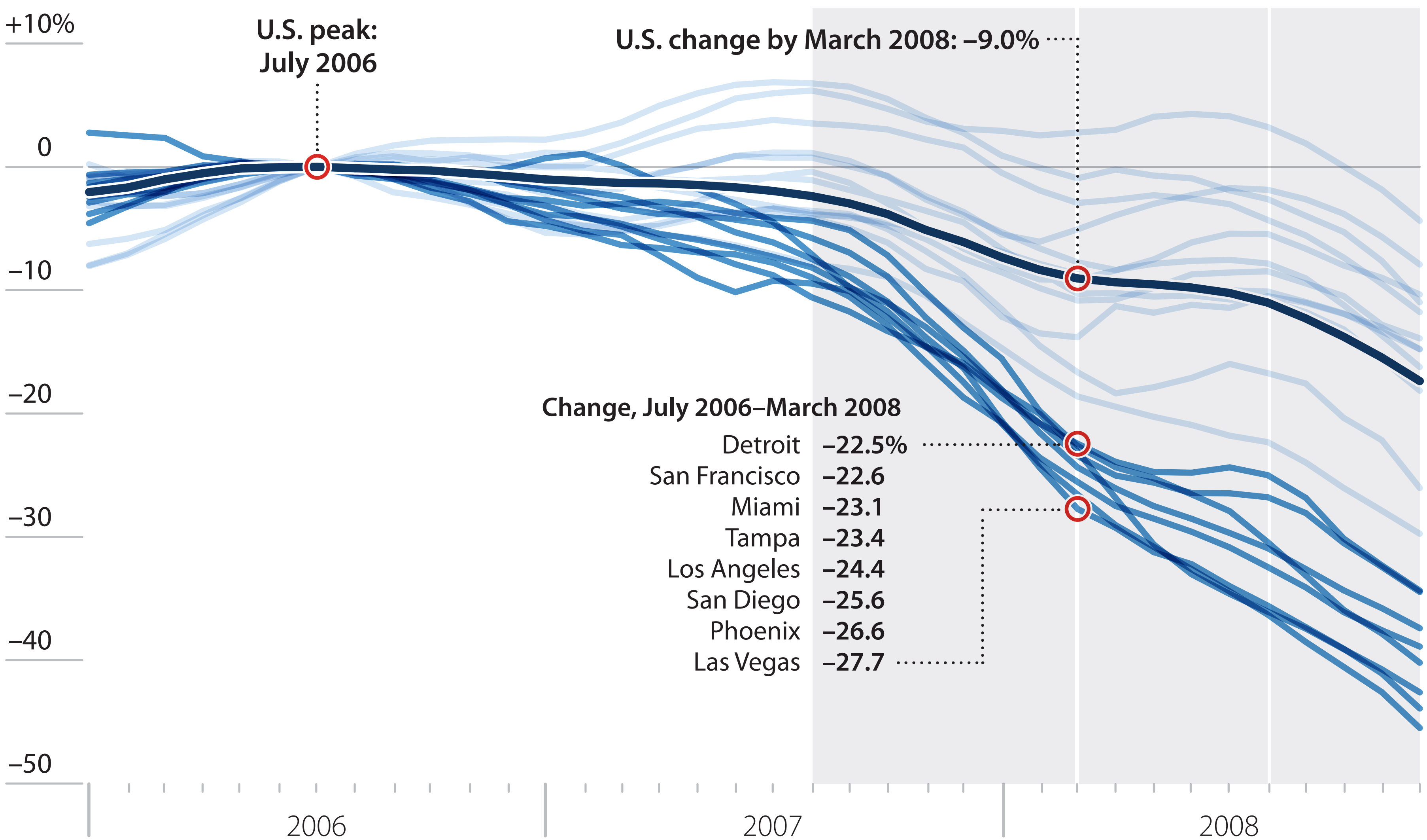
Notes: Credit default swap spreads are equal-weighted averages of JPMorgan Chase, Citigroup, Wells Fargo, Bank of America, Morgan Stanley, and Goldman Sachs. Libor-OIS spread used throughout is the spread between the 3-month London Interbank Offered Rate and the 3-month USD overnight indexed swap rate.

Sources: Libor-OIS: Bloomberg Finance L.P.; bank CDS spreads: Bloomberg Finance L.P., IHS Markit

ARC OF THE CRISIS

Home prices peaked nationally in the summer of 2006, then fell rapidly—eight major cities had declines of more than 20 percent by March 2008.

Change in S&P CoreLogic Case-Shiller Home Price Indexes for 20 cities and U.S., from U.S. peak in July 2006, not seasonally adjusted



Sources: S&P CoreLogic Case-Shiller Home Price Indexes for 20 individual cities and National Home Price Index via Federal Reserve Economic Data (FRED)

ARC OF THE CRISIS

Stress in the financial system built up gradually over late 2007 and early 2008, as mortgage troubles and recession fears increased.

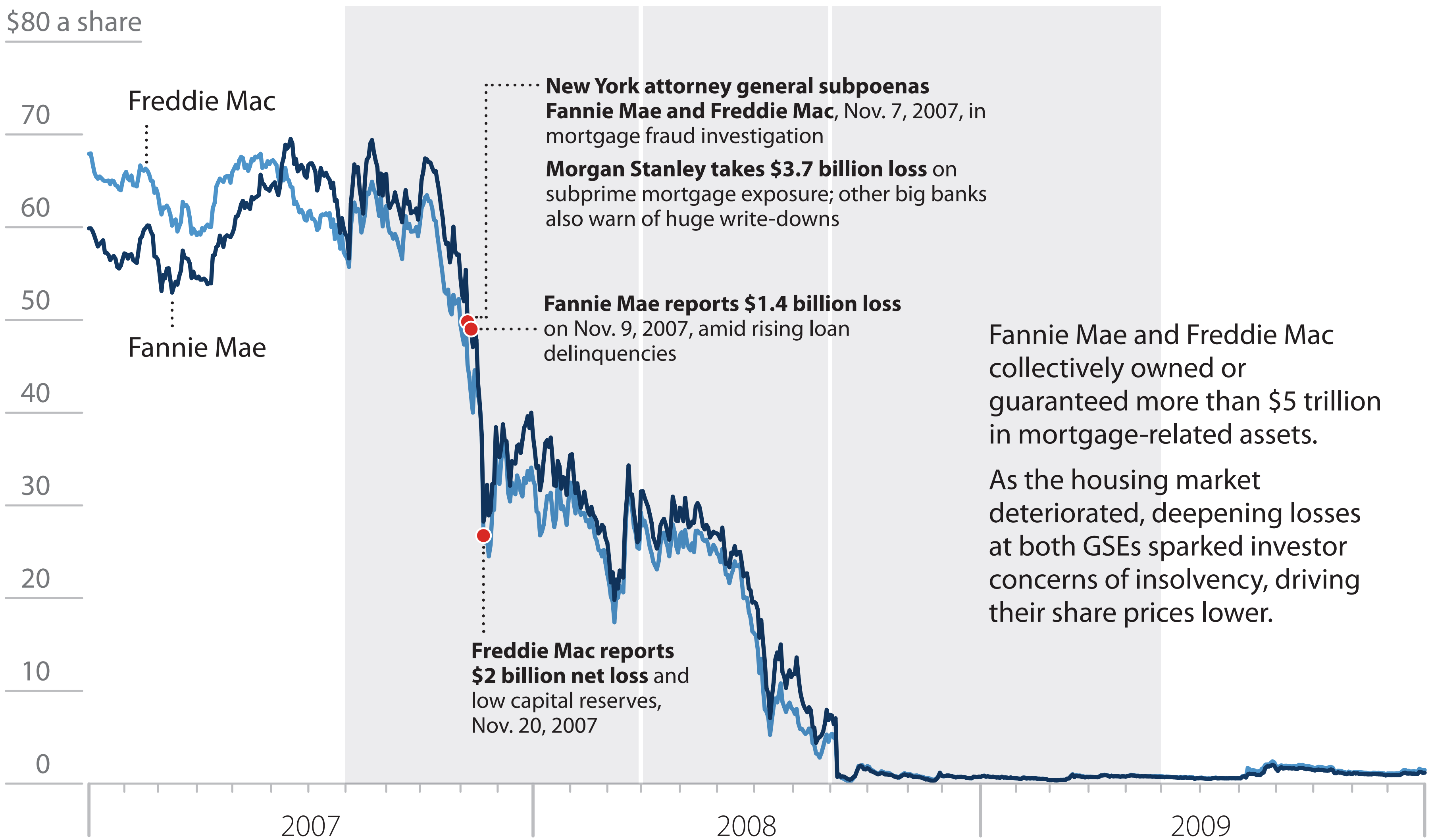
Note: GSE: government-sponsored enterprise

Source: Bloomberg Finance L.P.

ARC OF THE CRISIS

Investors were fearful that the mortgage giants Fannie Mae and Freddie Mac might collapse and cause severe damage to the housing market.

Stock price of Fannie Mae and Freddie Mac



Fannie Mae and Freddie Mac collectively owned or guaranteed more than $5 trillion in mortgage-related assets.

As the housing market deteriorated, deepening losses at both GSEs sparked investor concerns of insolvency, driving their share prices lower.

Source: The Center for Research in Security Prices at Chicago Booth via Wharton Research Data Services (WRDS)

ARC OF THE CRISIS

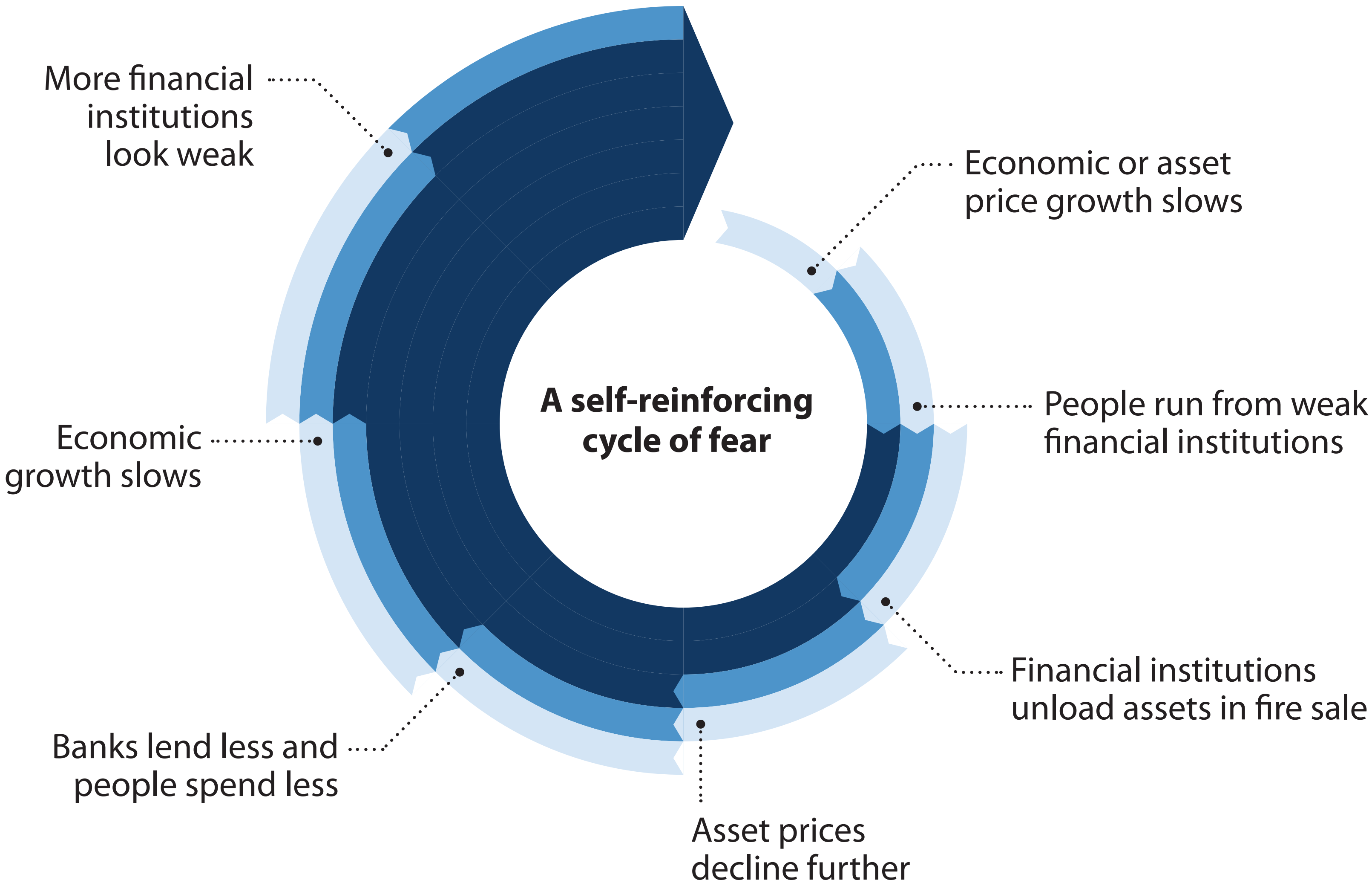
As panic spread, the nation's largest banks and investment banks looked increasingly vulnerable to failure.

S&P 500 Financials index level, and average of six big banks' CDS spreads in basis points

Note: Credit default swap spread is an equal-weighted average of JPMorgan Chase, Citigroup, Wells Fargo, Bank of America, Morgan Stanley, and Goldman Sachs.

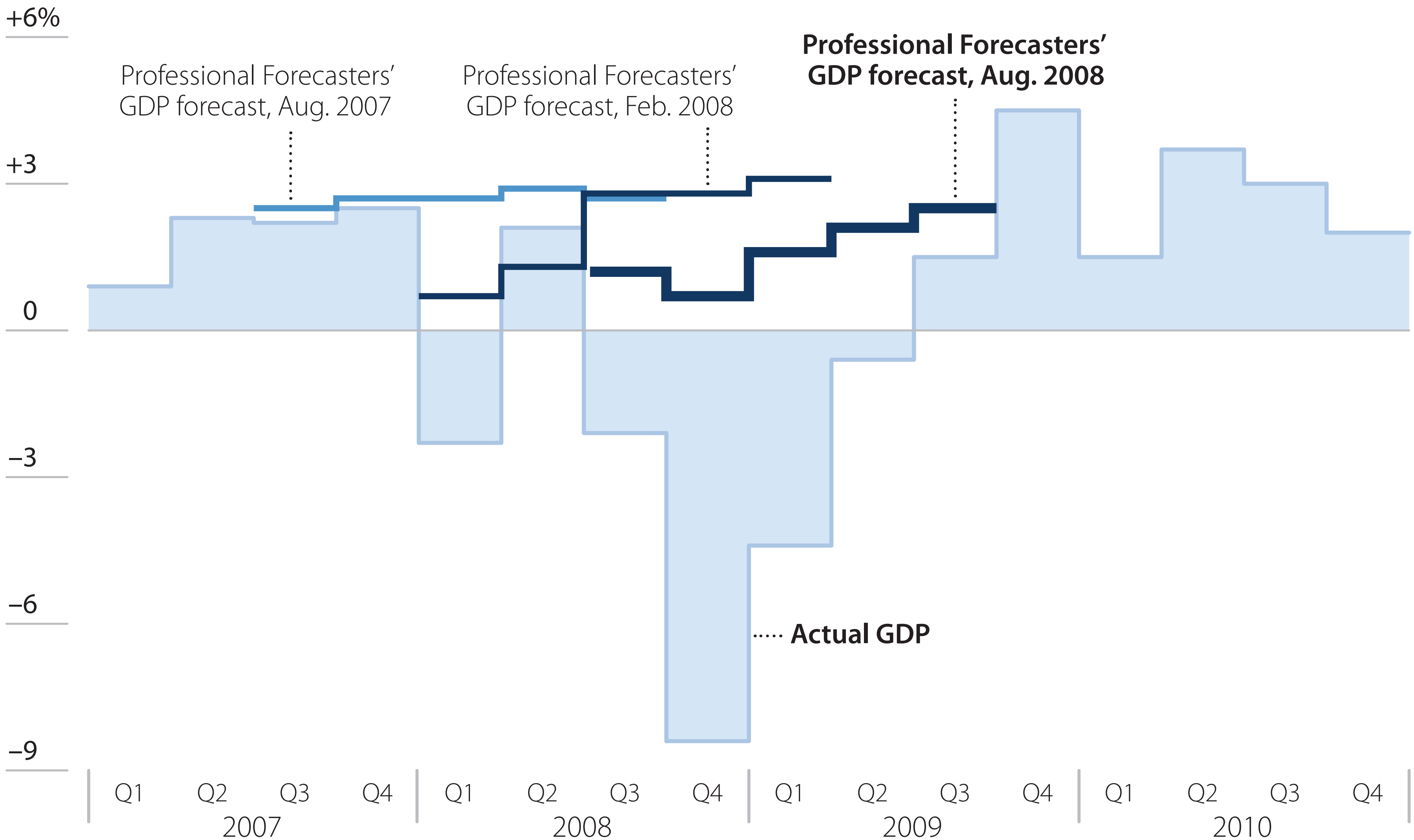
Sources: S&P 500 Financials: Bloomberg Finance L.P., S&P Dow Jones Indices LLC; bank CDS spreads: Bloomberg Finance L.P., IHS Markit

The rise in losses, the fear of further losses, and the liquidity pressures on the system pushed the price of financial assets down and added to concerns about the solvency of the financial system.



Yet the economic forecasts suggested a modest and manageable slowdown in economic growth. The forecasters were wrong.

Real GDP, percent change from preceding quarter, SAAR, and Philadelphia Fed surveys of professional forecasters



Sources: Bureau of Economic Analysis via Federal Reserve Economic Data (FRED) (data update of Aug. 29, 2018); Philadelphia Federal Reserve Survey of Professional Forecasters, Q3 2007 and Q1 and Q3 2008

The U.S. Strategy

Among the key elements of the U.S. policy response were:

Use of the Fed's lender-of-last-resort authorities beyond the banking system, for investment banks and funding markets.

An expansive use of guarantees to prevent runs on money market funds and a broad array of financial institutions.

An aggressive recapitalization of the financial system, in two stages, backed by expanded FDIC guarantees.

A powerful use of monetary and fiscal policy to limit the severity of the recession and restore economic growth.

A broad mix of housing policies to prevent the failure of the GSEs, slow the fall of home values, lower mortgage rates, and aid in refinancings.

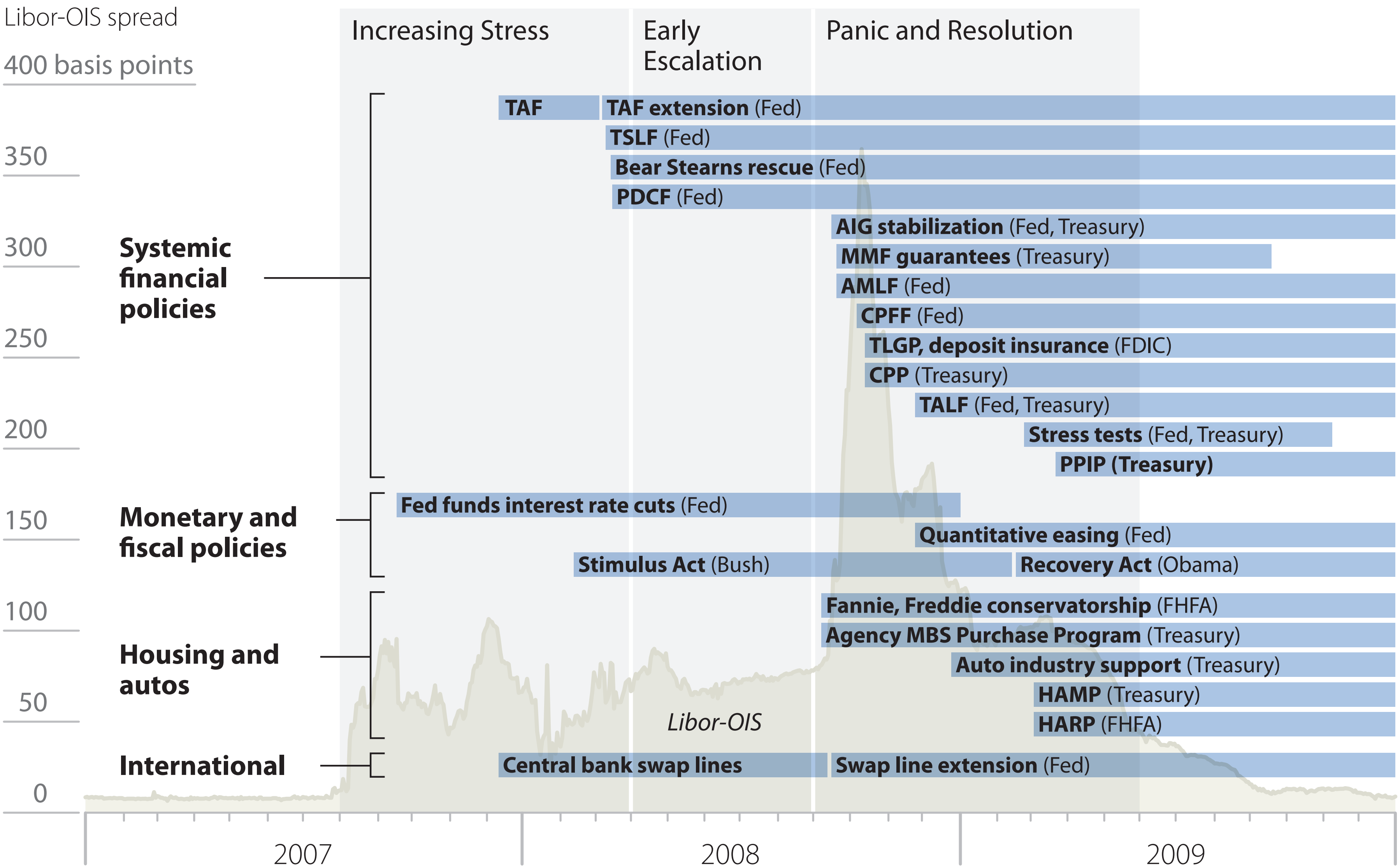
An extension of dollar liquidity to the global financial system, combined with international cooperation and Keynesian stimulus.

The U.S. government's initial response to the crisis was gradual, and the tools were limited and antiquated because they were designed for traditional banks.

TOOLS AVAILABLE	NO AUTHORITY
FDIC • Resolution authority for banks, with a systemic risk exception to allow for the provision of broader guarantees • Deposit insurance for banks **Federal Reserve** • Discount window lending for banks, and in extremis for other institutions • Swap lines for foreign central banks	• **To intervene to manage the failure of or nationalize nonbanks** • **To guarantee the broader liabilities of the financial system** • **To inject capital into the financial system** • **For the Fed to purchase assets other than Treasuries, Agencies, and Agency MBS*** • **To inject capital or guarantee the GSEs**

*Agencies are debt securities issued or guaranteed by U.S. federal agencies or GSEs; agency MBS are mortgage-backed securities issued or guaranteed by U.S. federal agencies or GSEs.

But the response became more forceful and comprehensive as the crisis intensified and Congress provided new emergency authority.



Source: Libor-OIS: Bloomberg Finance L.P. Note: Start dates for programs reflect the date of their announcement. The Federal Reserve administered the bank stress tests under the SCAP while the Treasury established a capital backstop under the CAP.

The U.S. government deployed a mix of systemic policies to stabilize financial institutions and markets:

Liquidity programs to keep financial institutions operating and credit flowing to consumers and businesses.

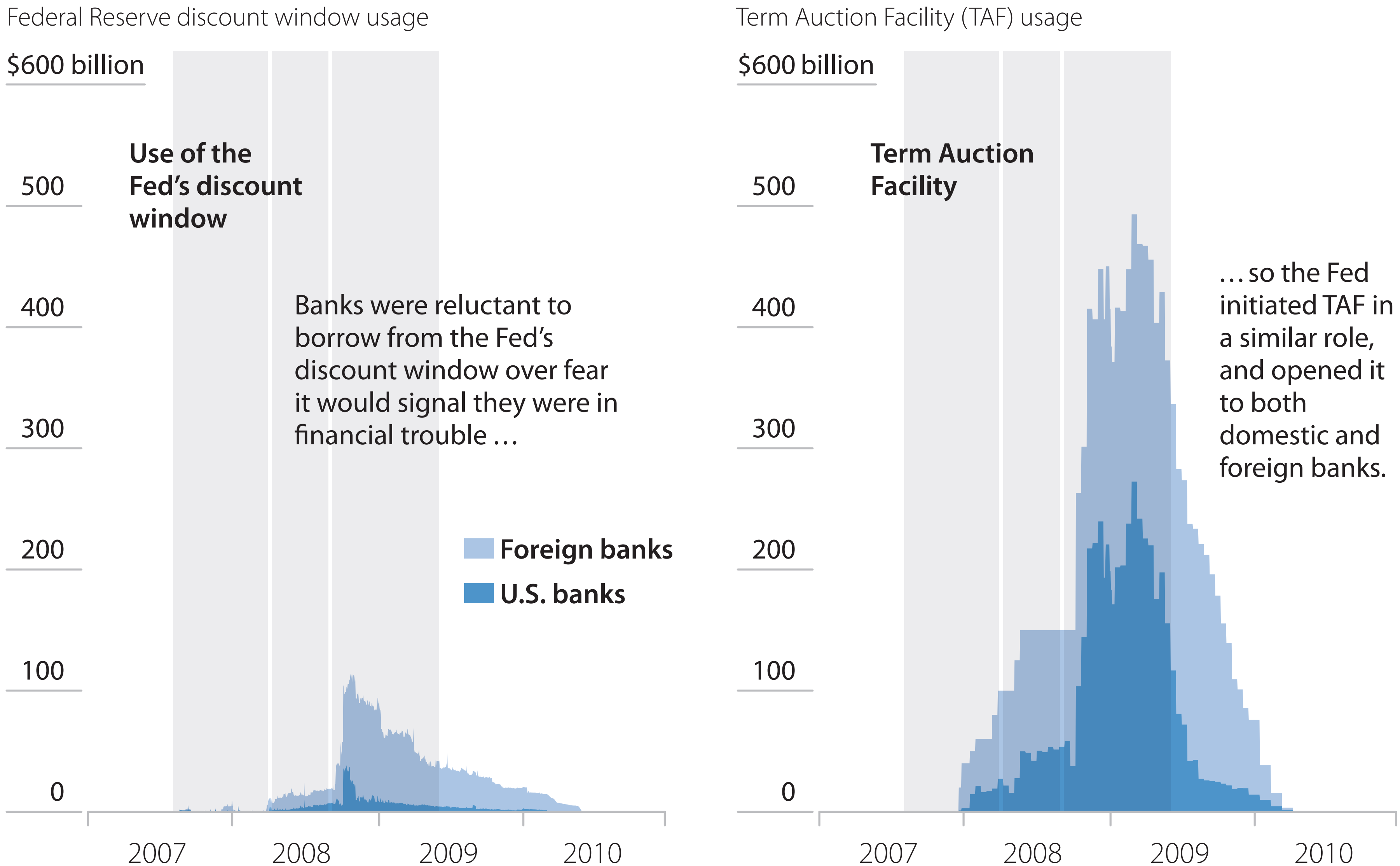
Guarantee programs to support critical funding markets for financial institutions.

Capitalization strategies with private and government capital to prevent the failure of systemic institutions and resolve uncertainty about the financial system.

As the crisis intensified, the U.S. government's liquidity programs expanded along several dimensions:

- Domestic $\longrightarrow$ International
- Traditional $\longrightarrow$ Novel
- Institutions $\longrightarrow$ Markets

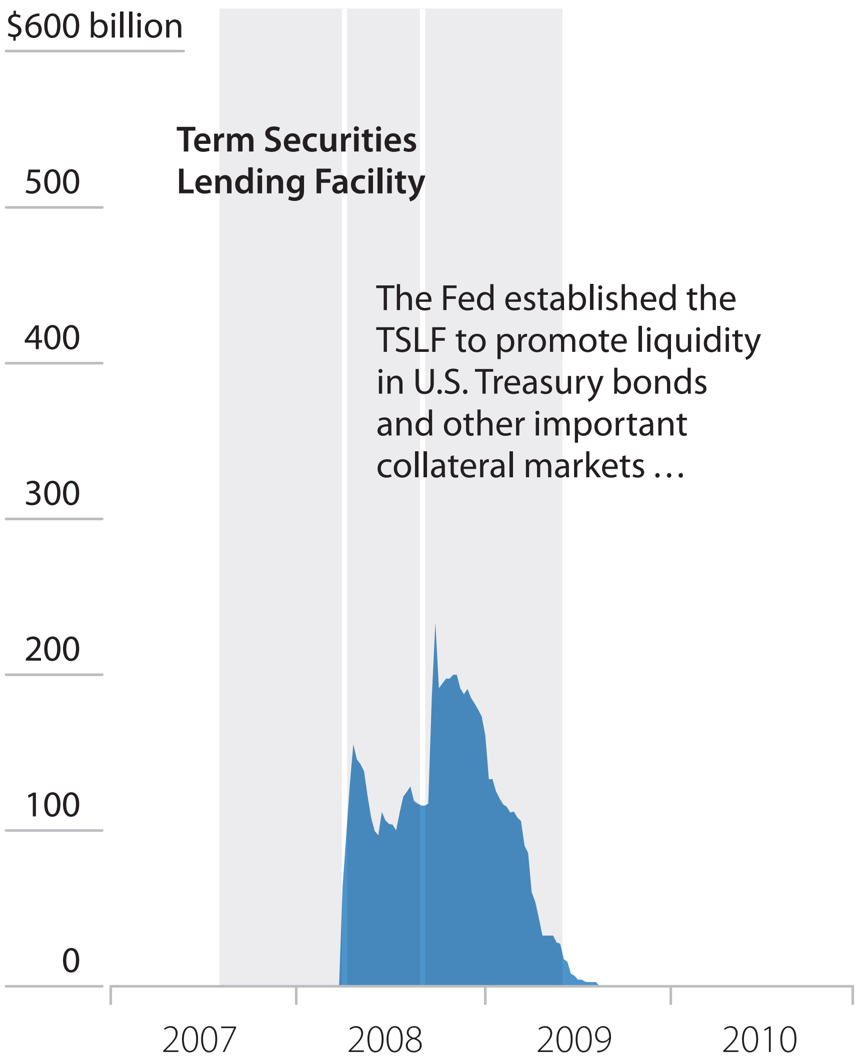
The Federal Reserve initially deployed its traditional lender-of-last-resort tools to provide liquidity to the banking system.



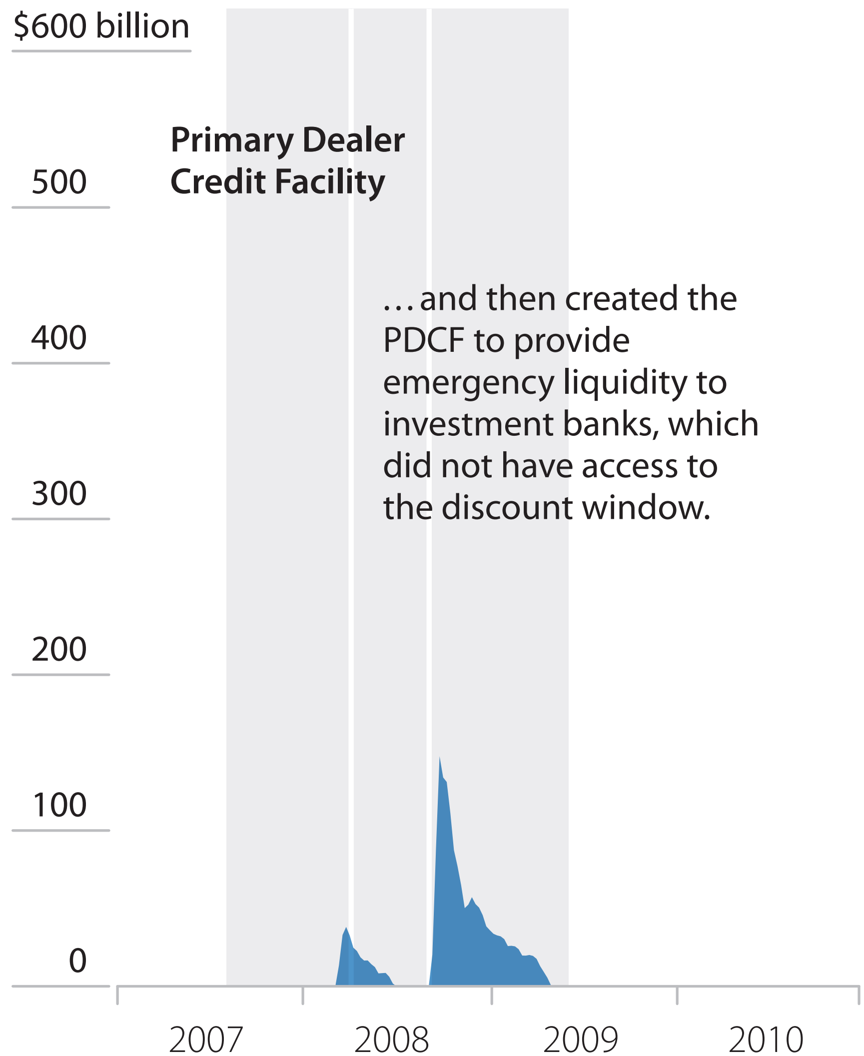
Source: Federal Reserve Board, based on English and Mosser (2020). Transaction-level data on discount window lending during the crisis were released under Freedom of Information Act court decisions (see: https://www.federalreserve.gov/foia/servicecenter.htm)

And then the Fed expanded its tools to support dealers and funding markets.

Securities lent to dealers: Term Securities Lending Facility



Primary Dealer Credit Facility (PDCF) loans

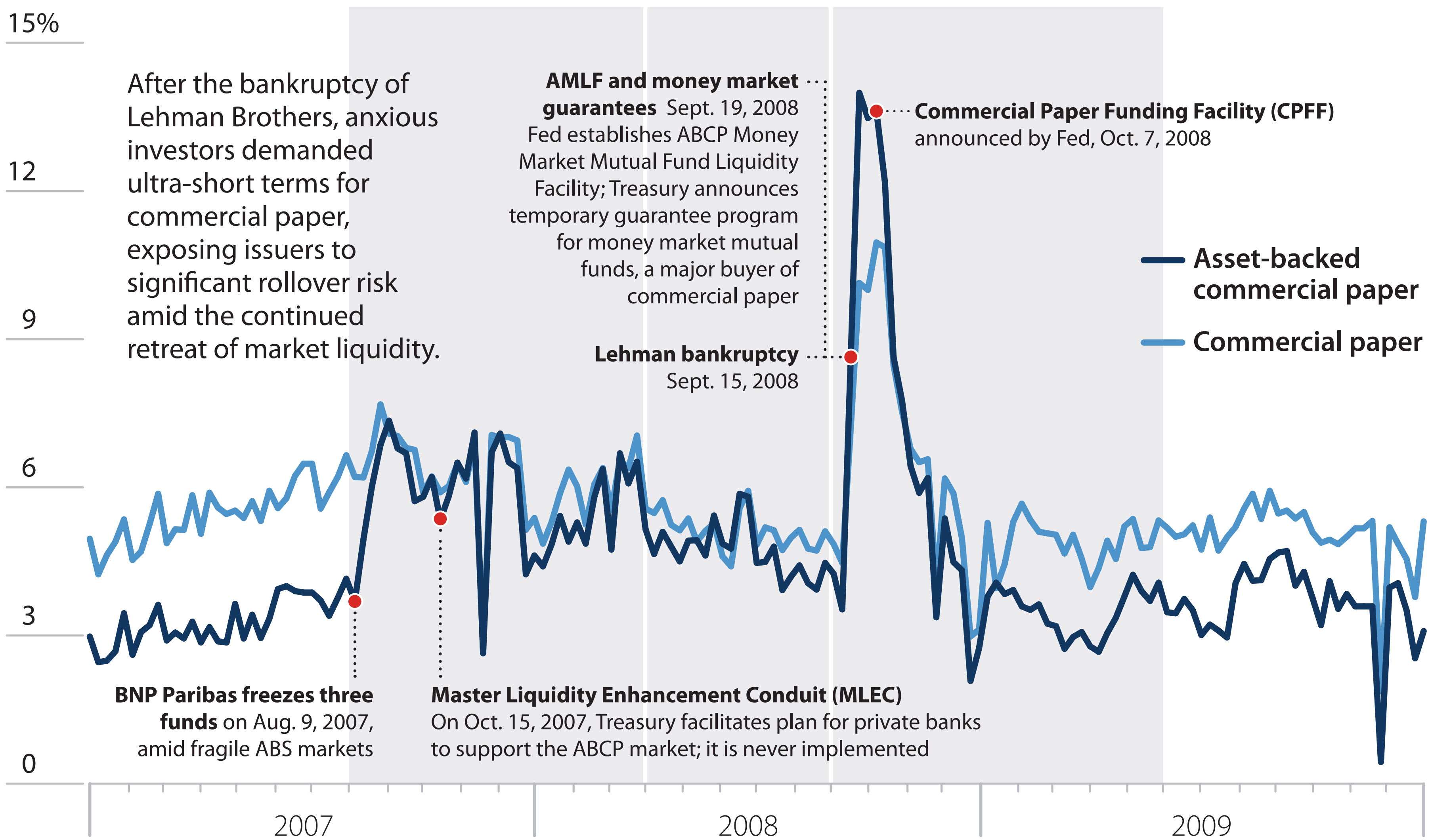


Note: PDCF includes loans extended to select other broker-dealers.

Source: Federal Reserve Board via Federal Reserve Economic Data (FRED)

The Fed and Treasury introduced programs to address fragility in the commercial paper market, a key source of funding to financial institutions and businesses.

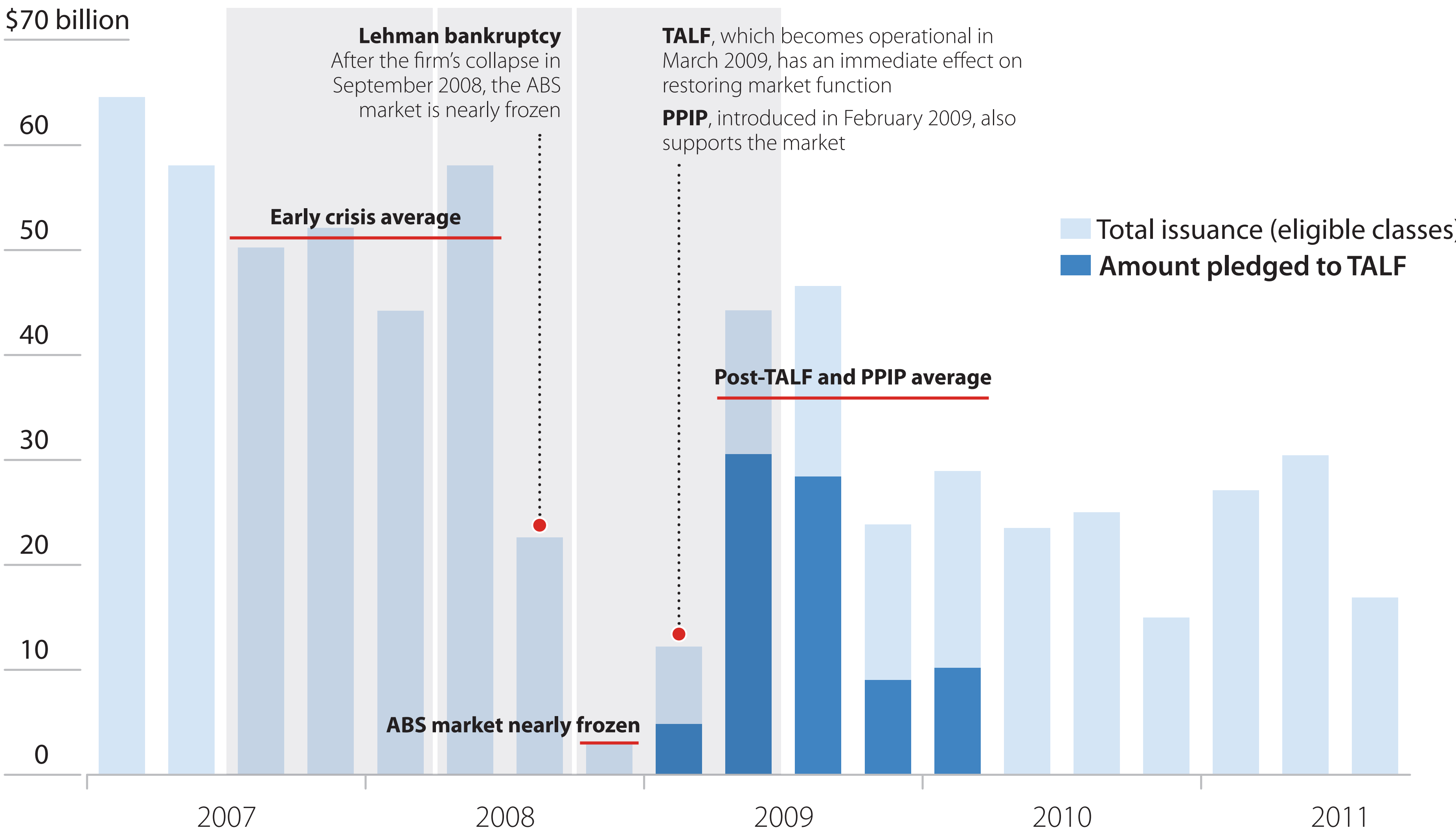
Overnight issuance as a share of outstanding commercial paper



Source: Federal Reserve Bank of New York based on data from the Federal Reserve Board of Governors, "Commercial Paper Rates and Outstanding Summary," derived from data supplied by the Depository Trust & Clearing Corporation

The Fed and Treasury also helped restart the asset-backed securitization market, a vital source of funding for credit cards, auto loans, and mortgage lending.

Asset-backed securities issuance (eligible classes) and amount pledged to TALF



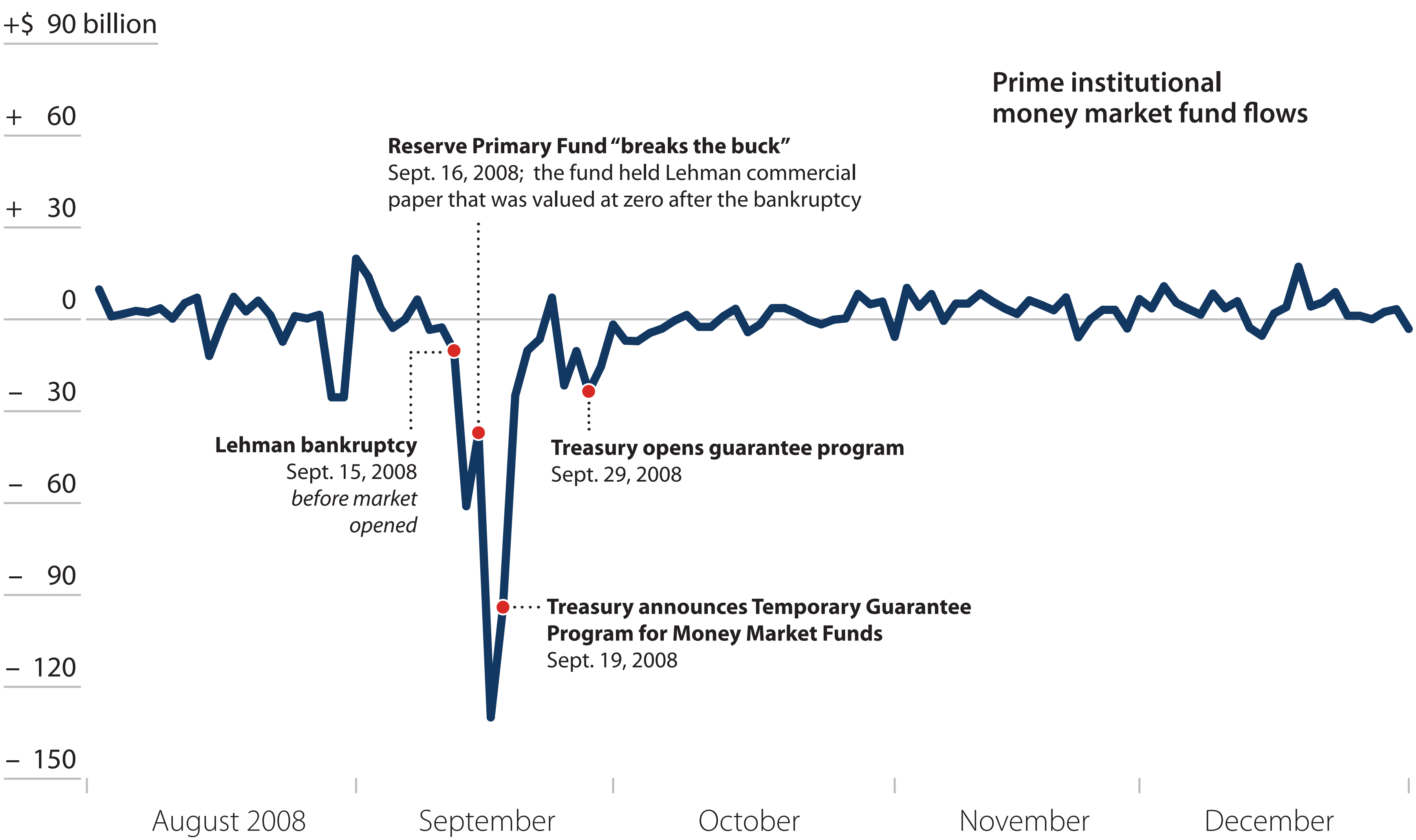
Sources: Federal Reserve Bank of New York based on data from JP Morgan, Bloomberg Finance L.P., and the Federal Reserve Board of Governors

The U.S. government put in place a mix of guarantees to backstop critical parts of the financial system.

U.S. STRATEGY

Treasury agreed to guarantee about $3.2 trillion of money market fund assets to stop the run on prime money market funds.

Daily U.S. money market fund flows

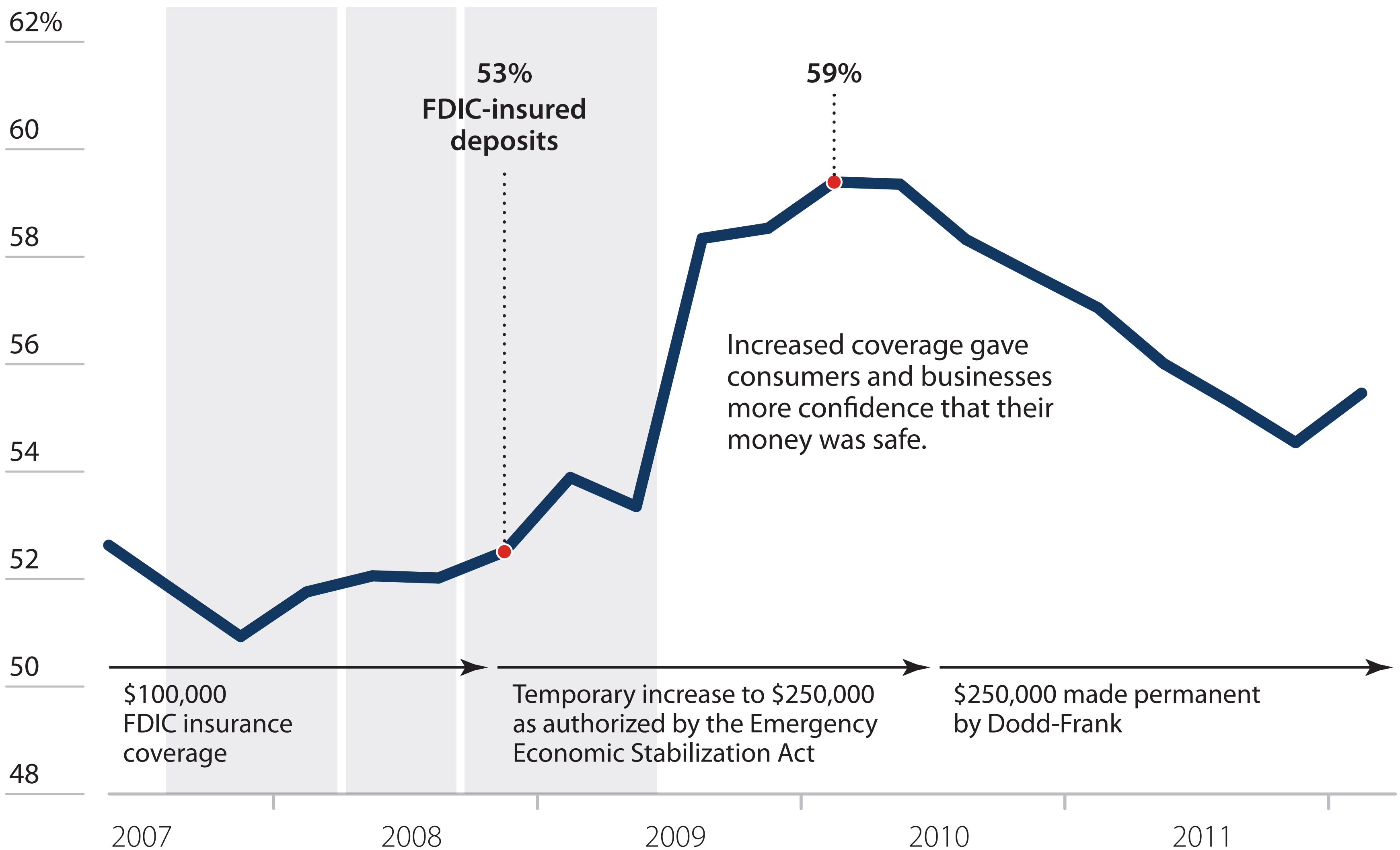


Sources: iMoneyNet; authors' calculations based on Schmidt et al. (2016)

U.S. STRATEGY

The FDIC expanded its deposit insurance coverage limits on consumer and business accounts in an effort to prevent bank runs.

Share of total deposits FDIC insured

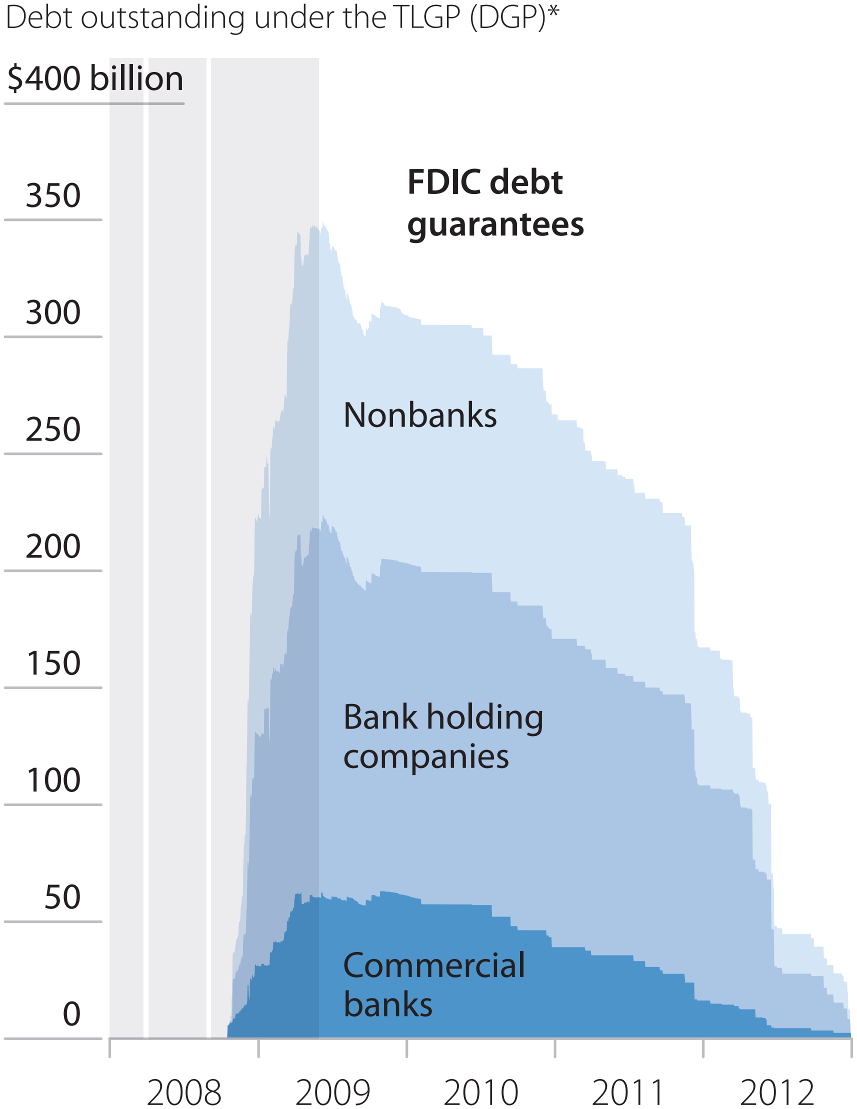


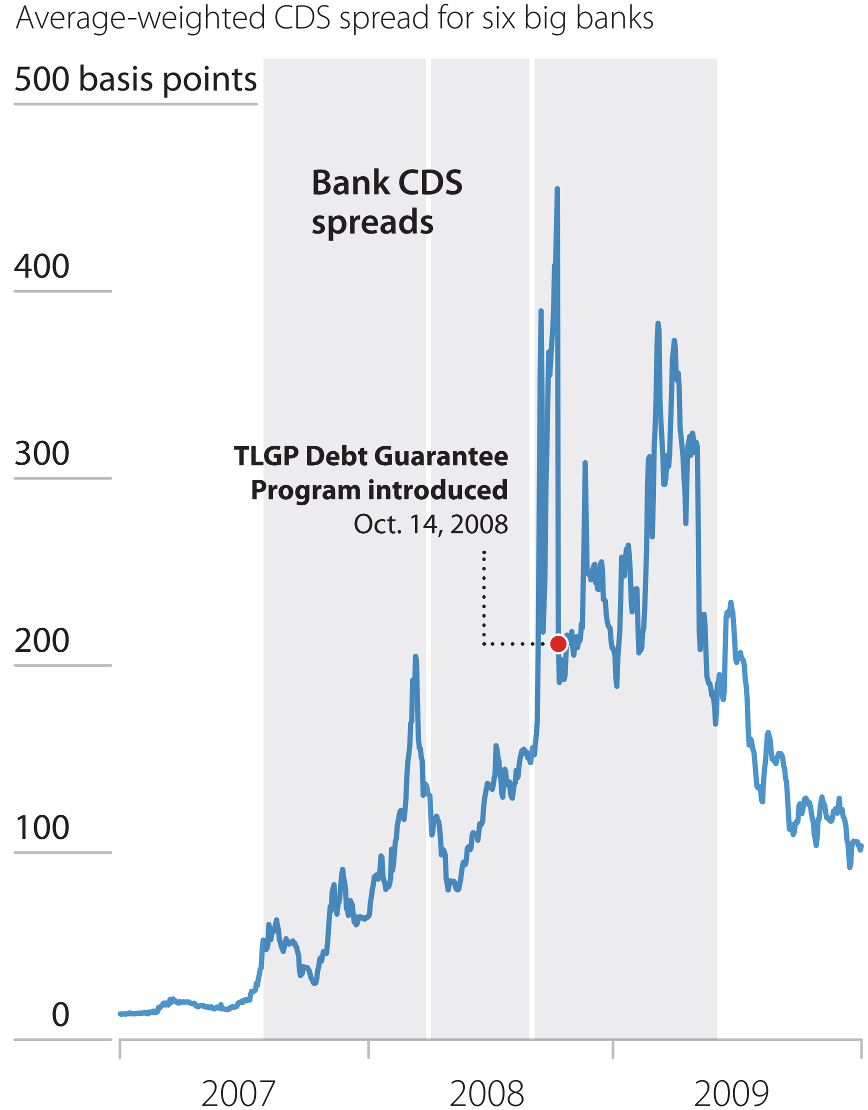
Note: Does not include non-interest-bearing transaction account amounts insured by Dodd-Frank through the end of 2012.

Source: U.S. Treasury, "Reforming Wall Street, Protecting Main Street"

U.S. STRATEGY

By agreeing to guarantee new financial debt, the FDIC helped institutions obtain more stable funding.





*Debt Guarantee Program covered debt issued by both the parent company and its affiliates.

Sources: Debt issuance: Federal Deposit Insurance Corp., authors' calculations; CDS spreads: Bloomberg Finance L.P., IHS Markit

The U.S. government moved to strengthen the capital in the financial system as the crisis intensified by:

Encouraging the biggest institutions to raise private capital early in the crisis.

Injecting substantial government capital into the banking system when the crisis worsened and Congress provided emergency authority.

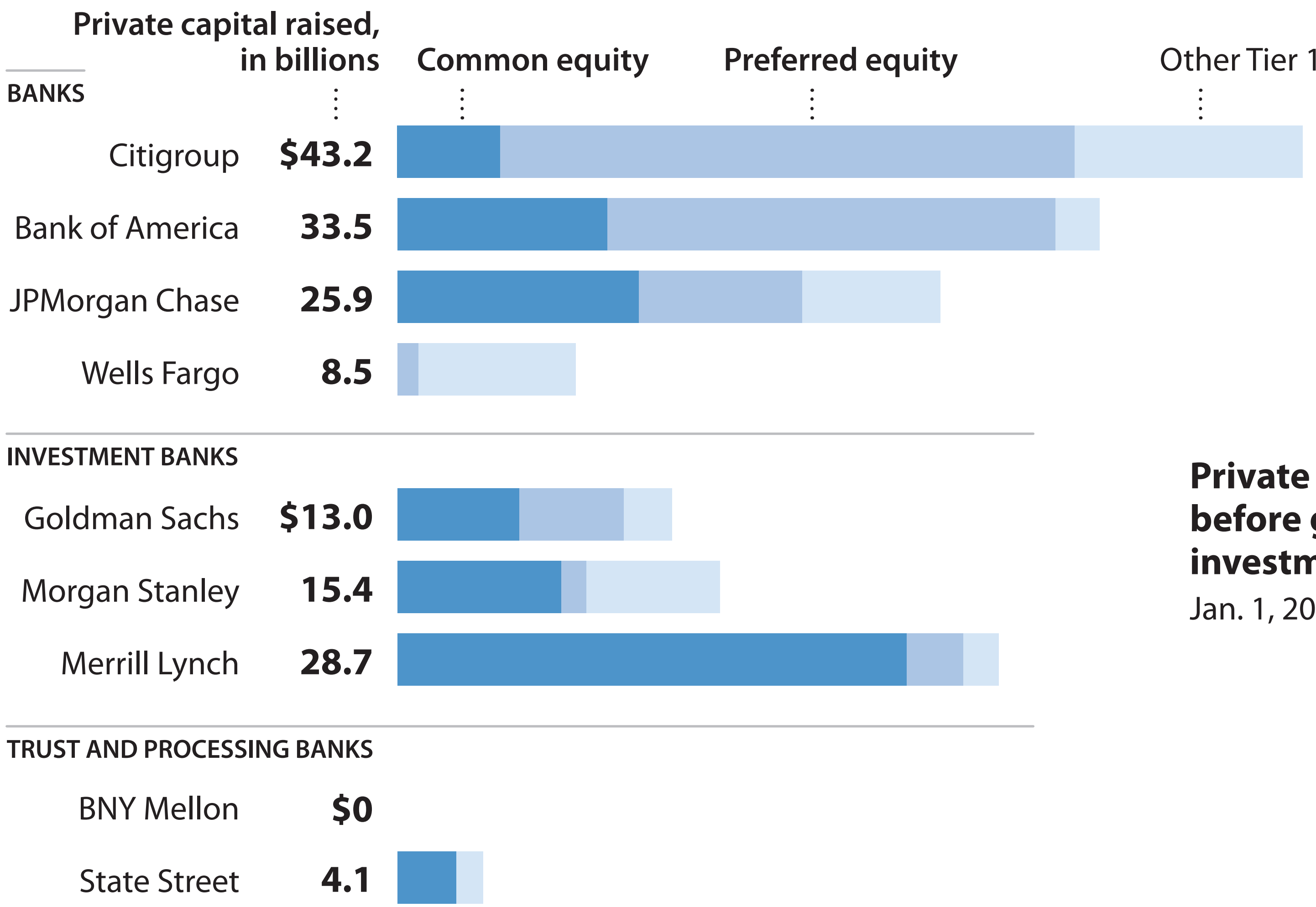
Stabilizing the most troubled banks with additional capital and ring-fence guarantees.

Conducting stress tests to complete the recapitalization of the financial system.

U.S. STRATEGY

As losses worsened early in the crisis, U.S. policymakers urged financial institutions to raise private capital.

Private capital raised between Jan. 1, 2007, and Oct. 13, 2008, for the nine banks receiving initial government investments

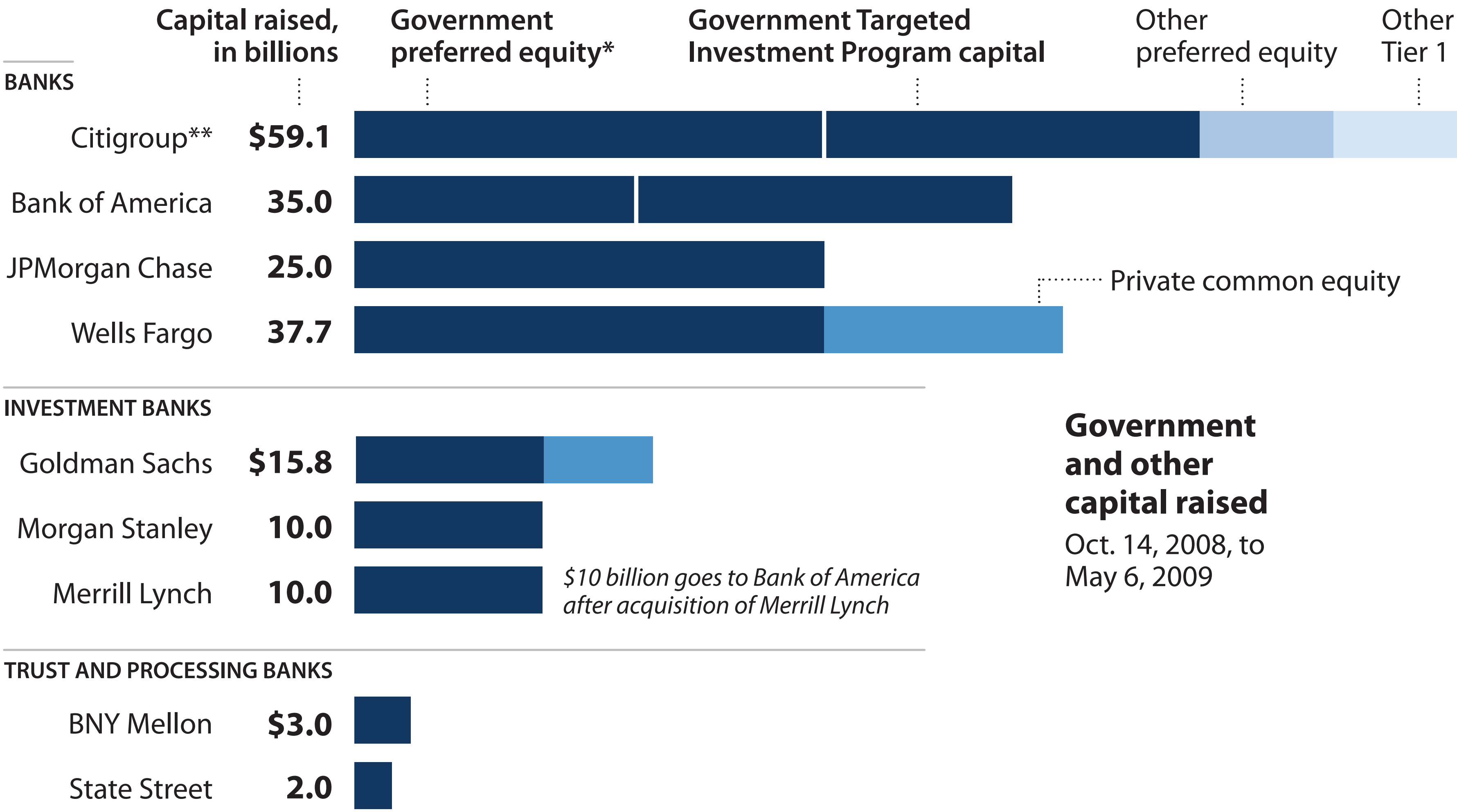


Private capital raised before government investments
Jan. 1, 2007, to Oct. 13, 2008

Source: Goldman Sachs

Then, as panic followed the collapse of Lehman Brothers, Treasury made large capital investments in the biggest banks using new authority from Congress …

Government and other capital raised between Oct. 14, 2008, and May 6, 2009, the day before stress test results were released

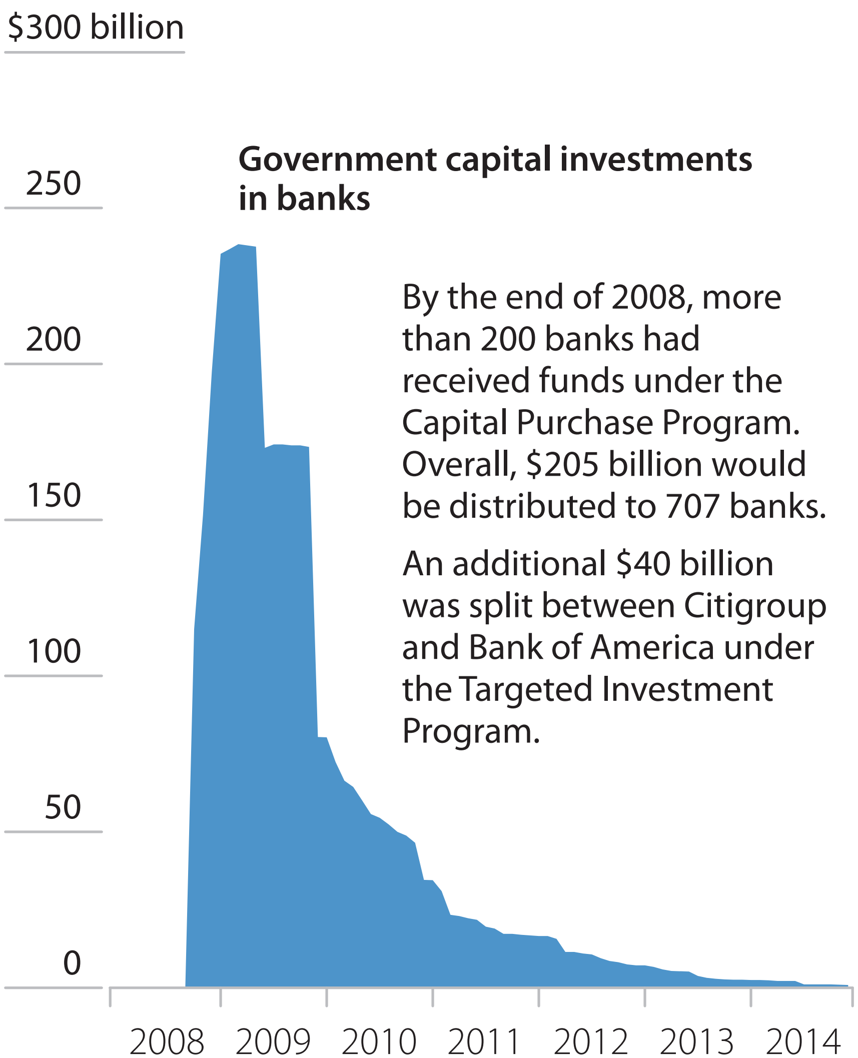


*Includes capital injections made under the Capital Purchase Program (CPP).
**Citigroup later converted approximately $58 billion of preferred stock and other securities into common equity.

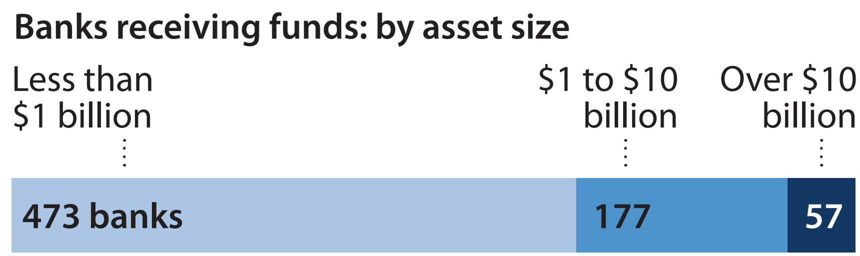
Source: Goldman Sachs

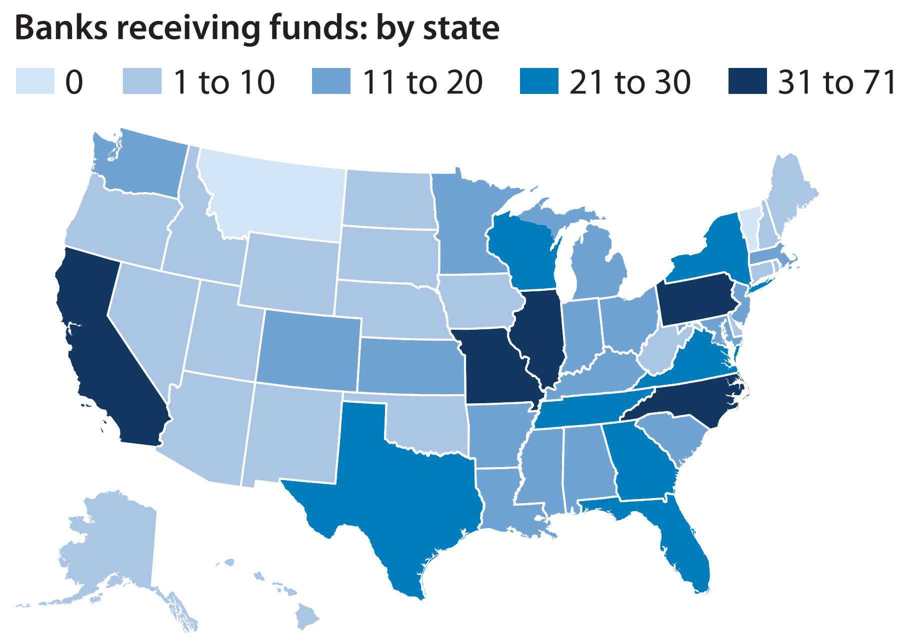
…and used additional funds to make direct government investments in hundreds of smaller banks.

Principal outstanding for government bank capital investments



Distribution of banks participating in the Capital Purchase Program

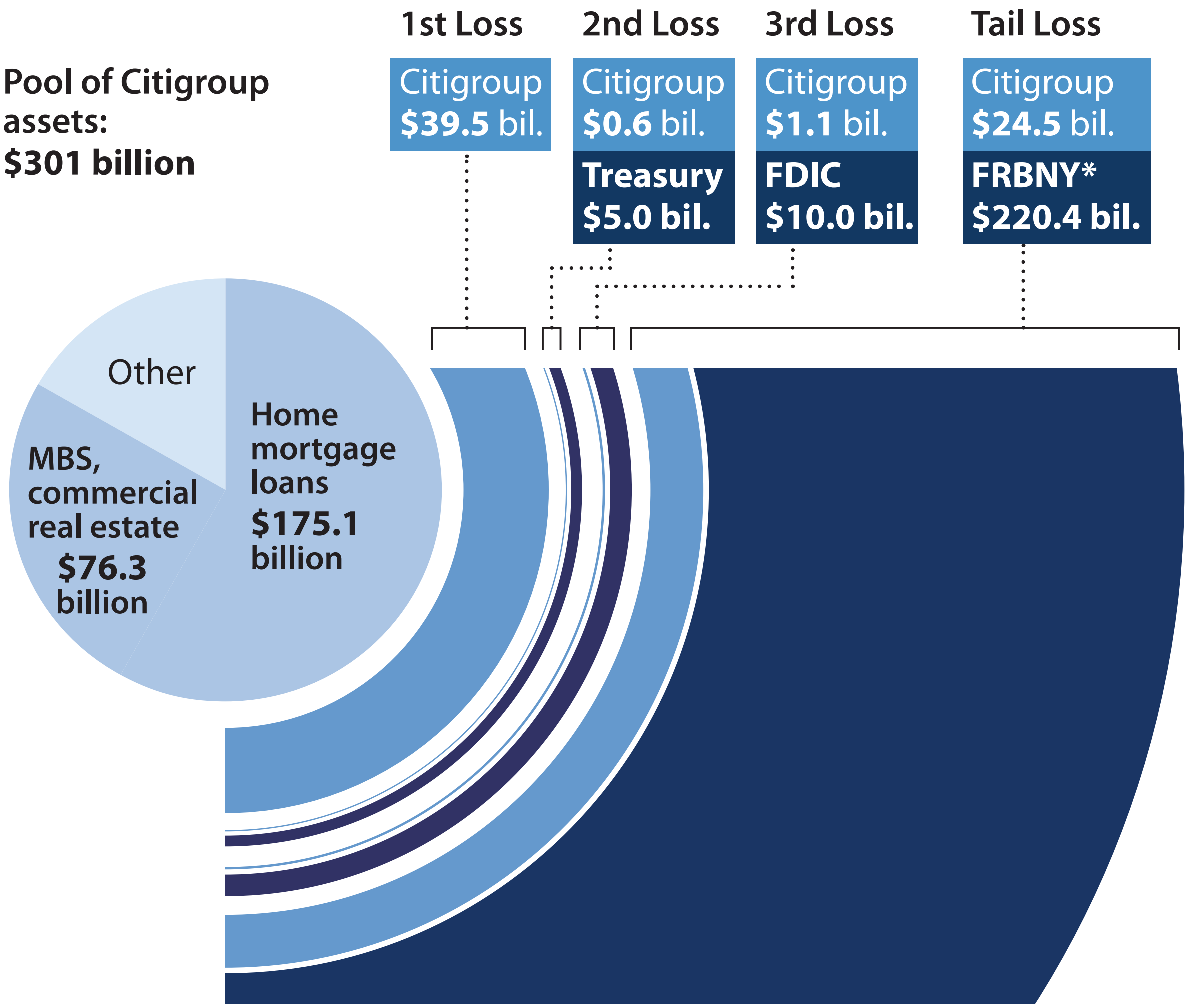


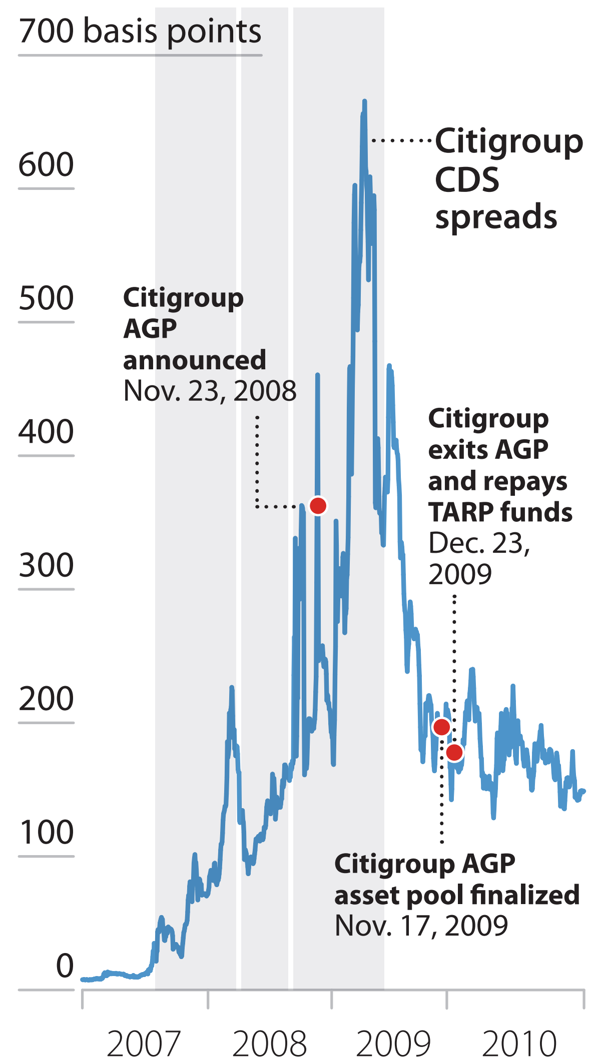


Sources: Timeline of funds outstanding: TARP Tracker; banks receiving funds, by asset size: U.S. Treasury, "Troubled Asset Relief Program: Two Year Retrospective," SNL Financial; banks receiving funds, by state: authors' calculations based on TARP Investment Program transaction reports, Aug. 8, 2018

In addition to capital injections, the government expanded its tools with asset guarantees for the most troubled banks, Citigroup and Bank of America.

Asset Guarantee Program (AGP), Citigroup assets, and "ring-fence" loss responsibility structure
(Asset guarantees for Bank of America were drawn up but never implemented.)





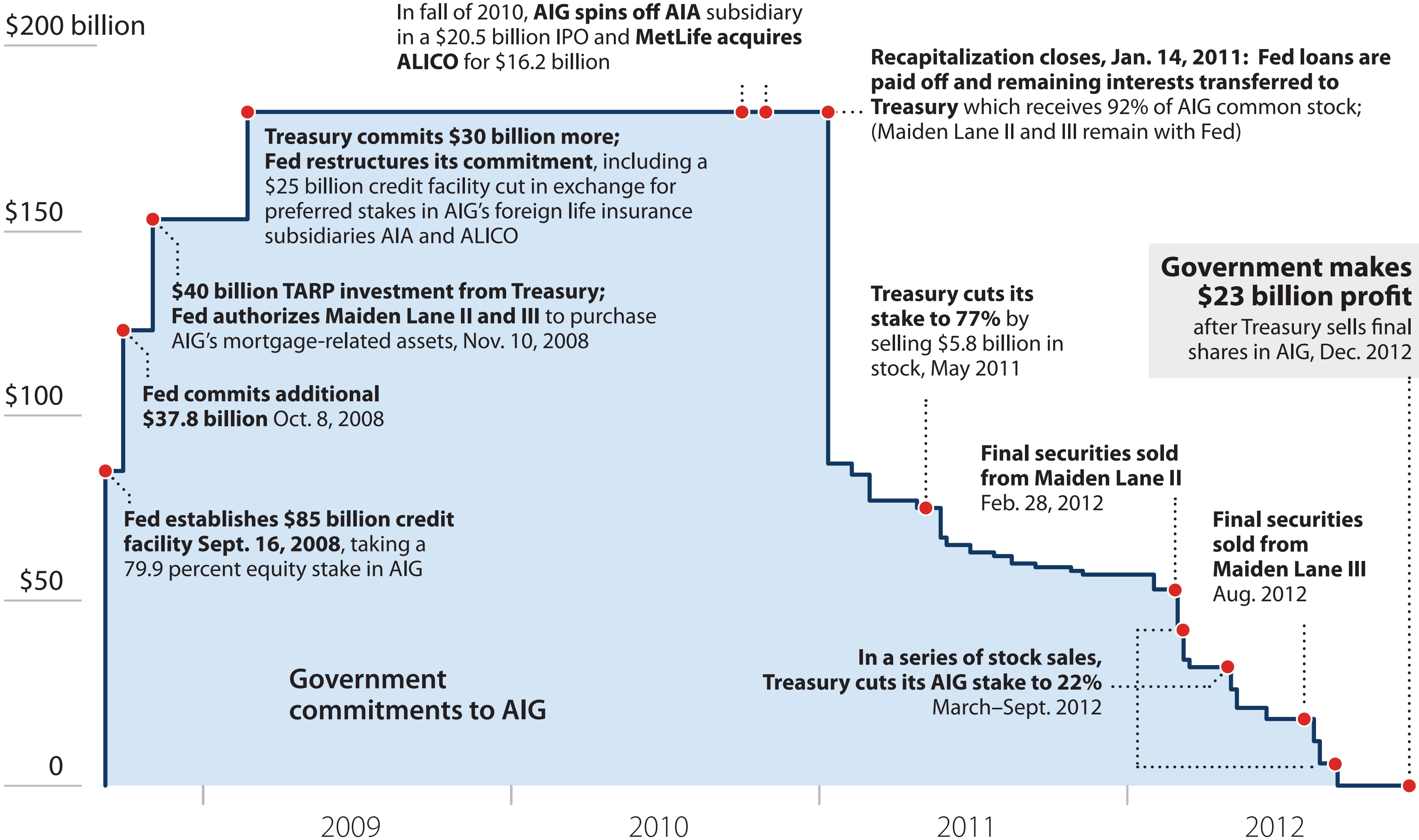
*The Federal Reserve Bank of New York's loss position was structured in the form of a nonrecourse loan.

Sources: Asset Guarantee Program terms: Special Inspector General for TARP, "Extraordinary Financial Assistance Provided to Citigroup, Inc.";
CDS spreads: Bloomberg Finance L.P., IHS Markit

U.S. STRATEGY

The government provided emergency loans, capital, and guarantees to AIG to prevent a disorderly failure that would have disrupted the financial system.

Outstanding commitment to AIG

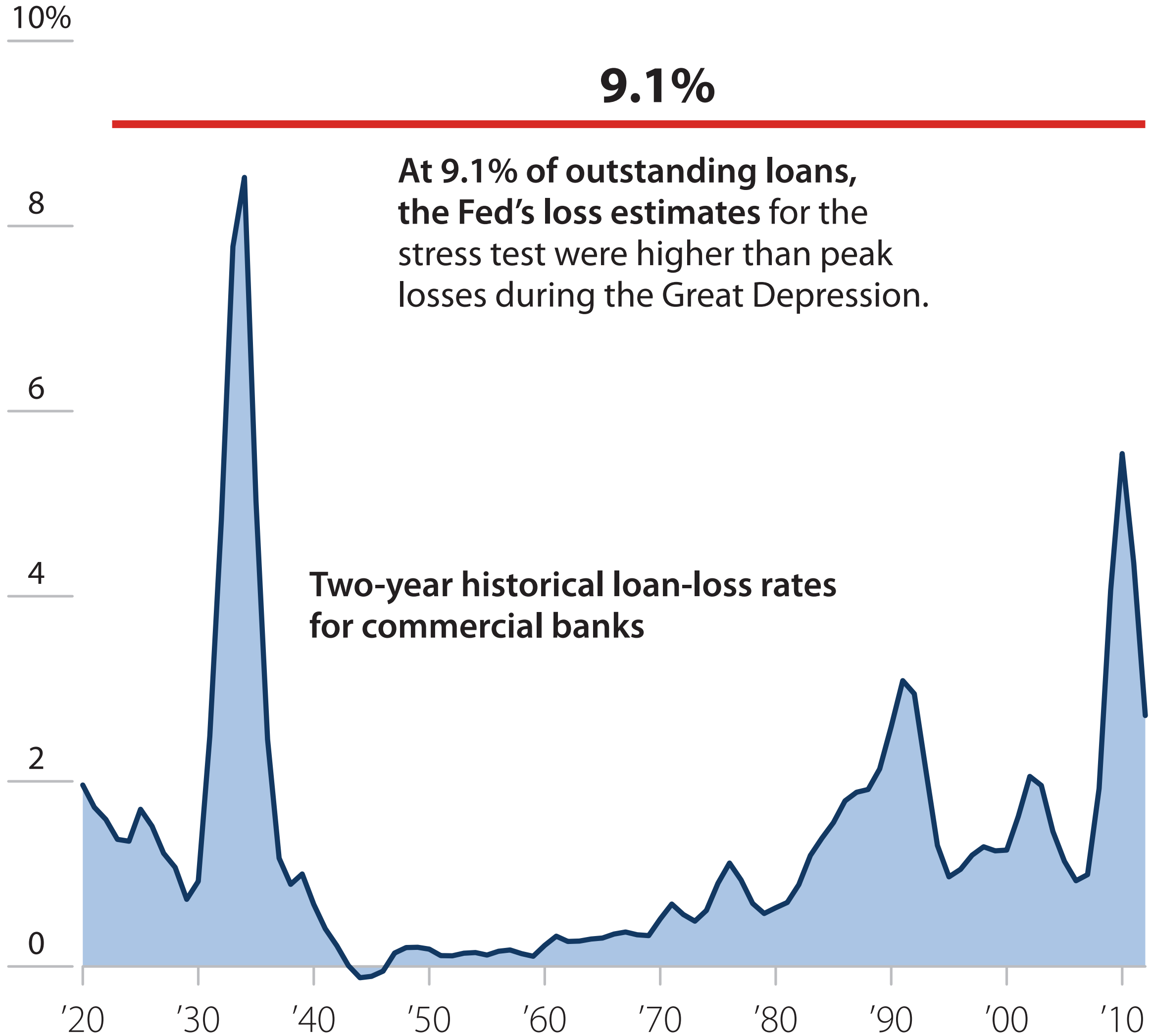


Note: Repayments occurred over the lifetime of the commitment. Any reduction in the commitment, however, is not reflected until the January 2011 recapitalization transaction.

Source: U.S. Treasury

As confidence in banks further eroded, government "stress tests" increased transparency, helping regulators and investors make credible loss projections …

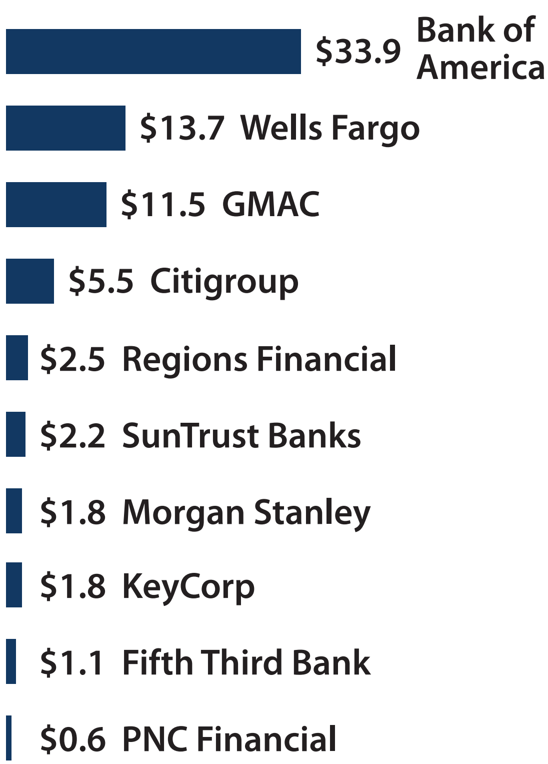
Two-year historical loan-loss rates for commercial banks



SCAP capital shortfall, May 7, 2009

CAPITAL RAISES NEEDED, IN BILLIONS

Of 19 institutions participating in the Supervisory Capital Assessment Program (SCAP), ten were required to raise $74.6 billion in capital; nine others did not need additional capital.



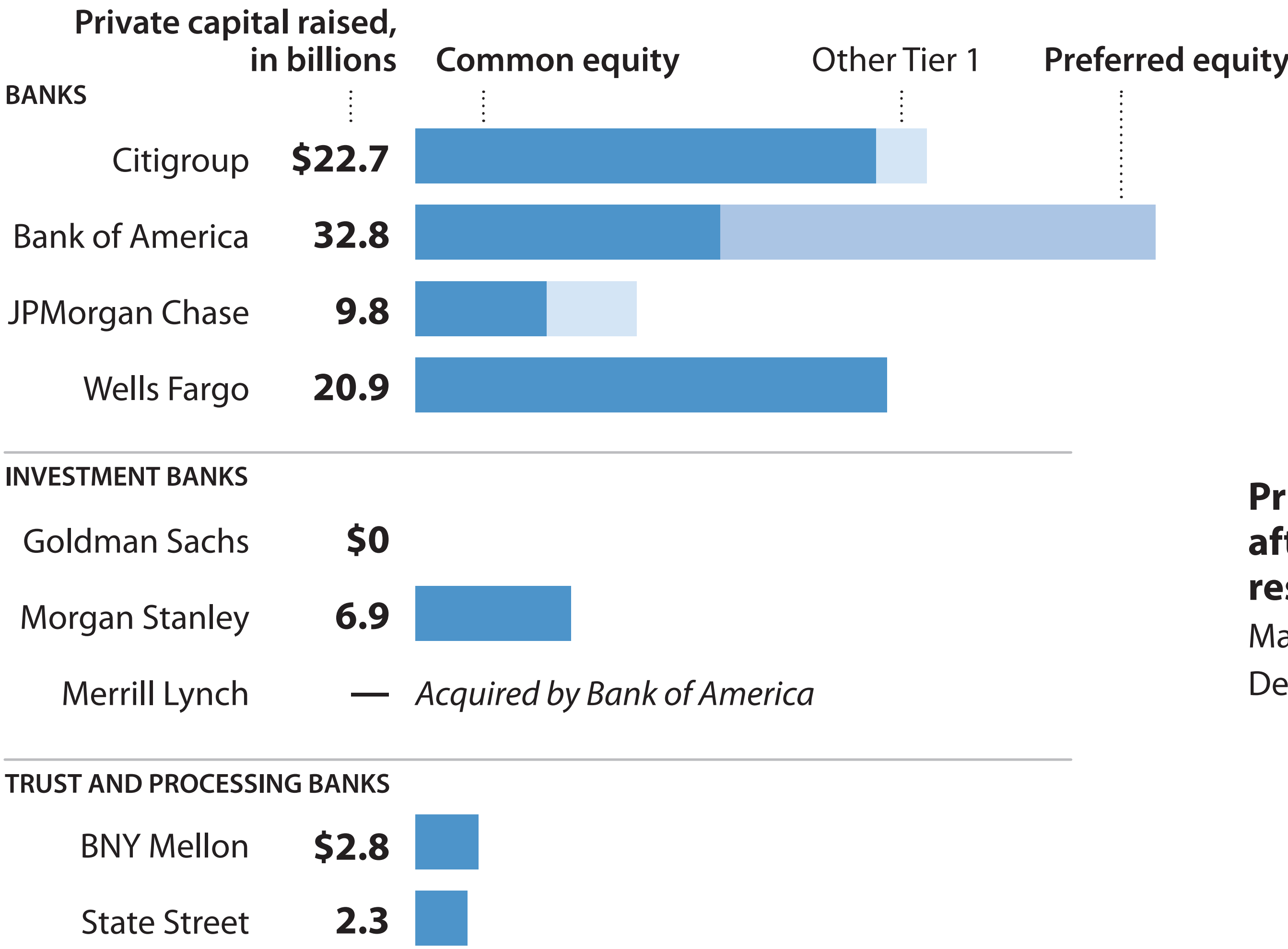
Note: The $74.6 billion in required capital is after earnings and capital measures in the first quarter of 2009. Citigroup's requirement, for example, fell from $92.6 billion to $5.5 billion after adjusting for capital actions and earnings in the first quarter of 2009 and its plan to convert approximately $58 billion of preferred stock into common equity.

Sources: Federal Deposit Insurance Corp.; Federal Reserve Board; International Monetary Fund

U.S. STRATEGY

…and accelerated the return of private capital.

Private capital raised, May 7, 2009, through Dec. 31, 2010



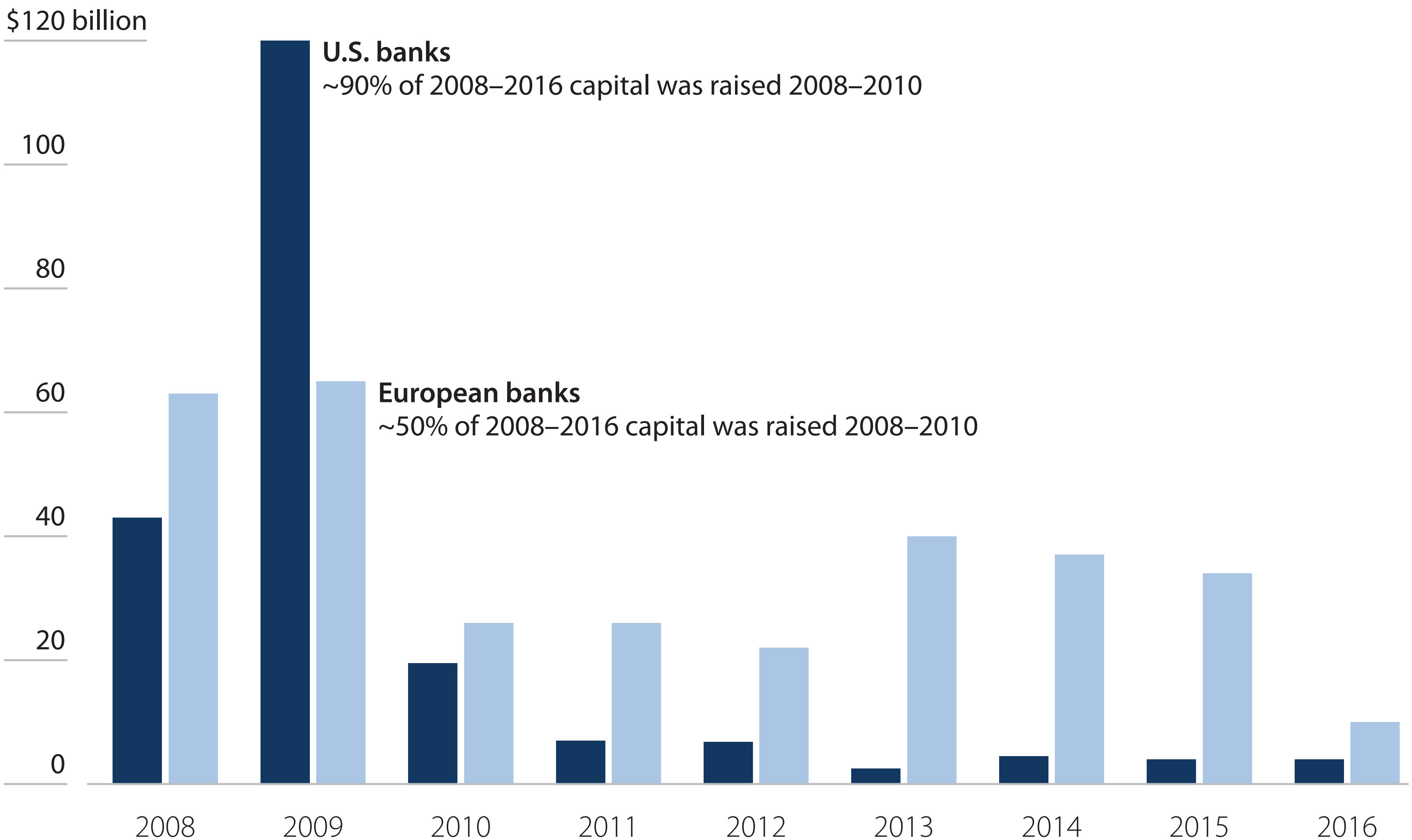
Private capital raised after stress test results released
May 7, 2009, through Dec. 31, 2010

Note: In April 2009, before the release of stress test results, Goldman Sachs raised $5.8 billion in capital for the repayment of TARP funds.

Source: Goldman Sachs

Indeed, the U.S. recapitalized its banking system more quickly and aggressively than Europe.

Capital raised each year



Note: Authors' estimates based on figures from Goldman Sachs.

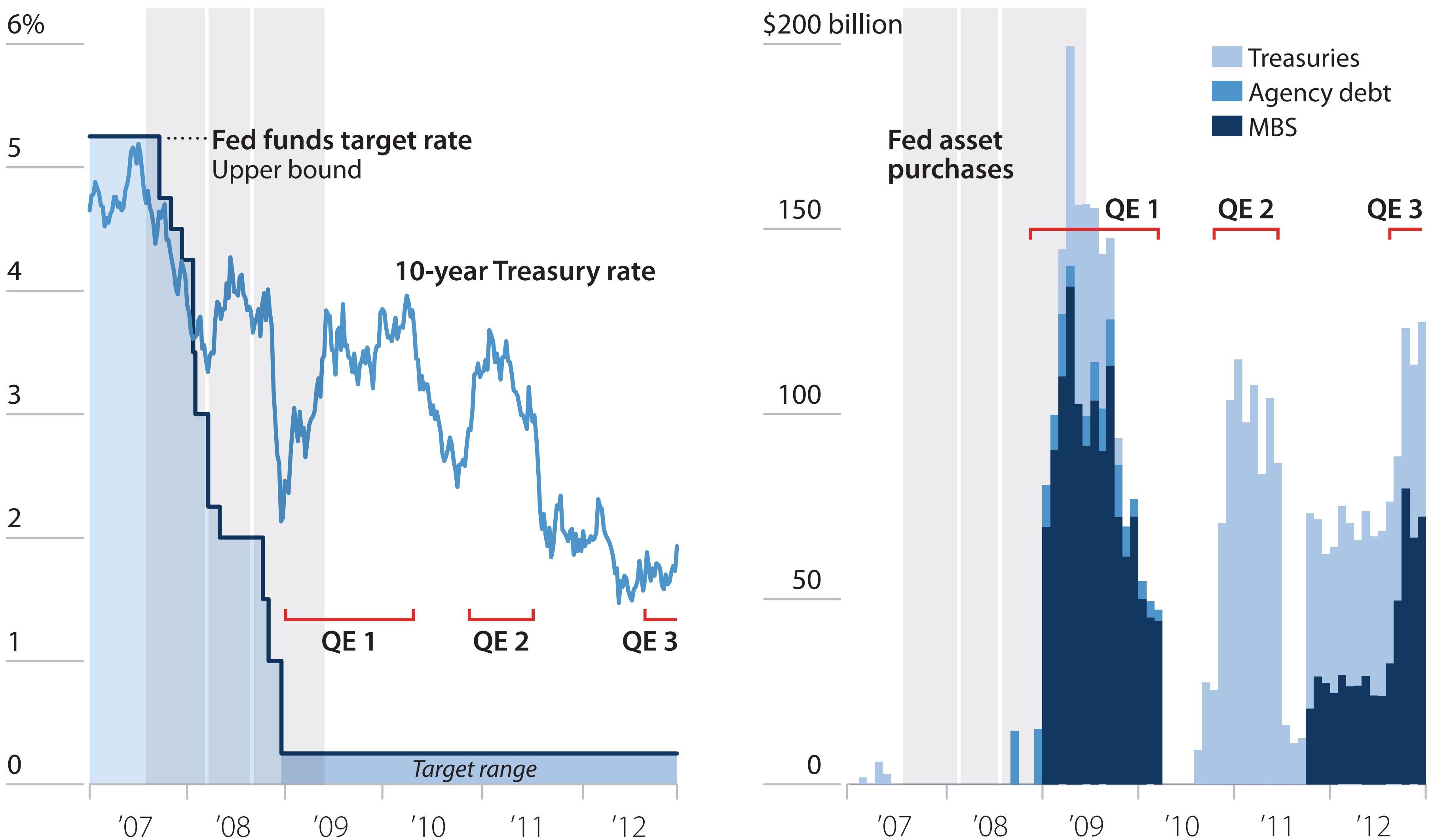
Source: Goldman Sachs

Alongside programs designed to address the systemic problems in the financial system, the Fed and Treasury put in place a forceful mix of monetary policy and fiscal stimulus.

As the Fed funds rate neared zero, the Fed made large-scale asset purchases to drive down long-term interest rates—a policy known as quantitative easing.

Fed funds target rate or range and 10-year Treasury rate

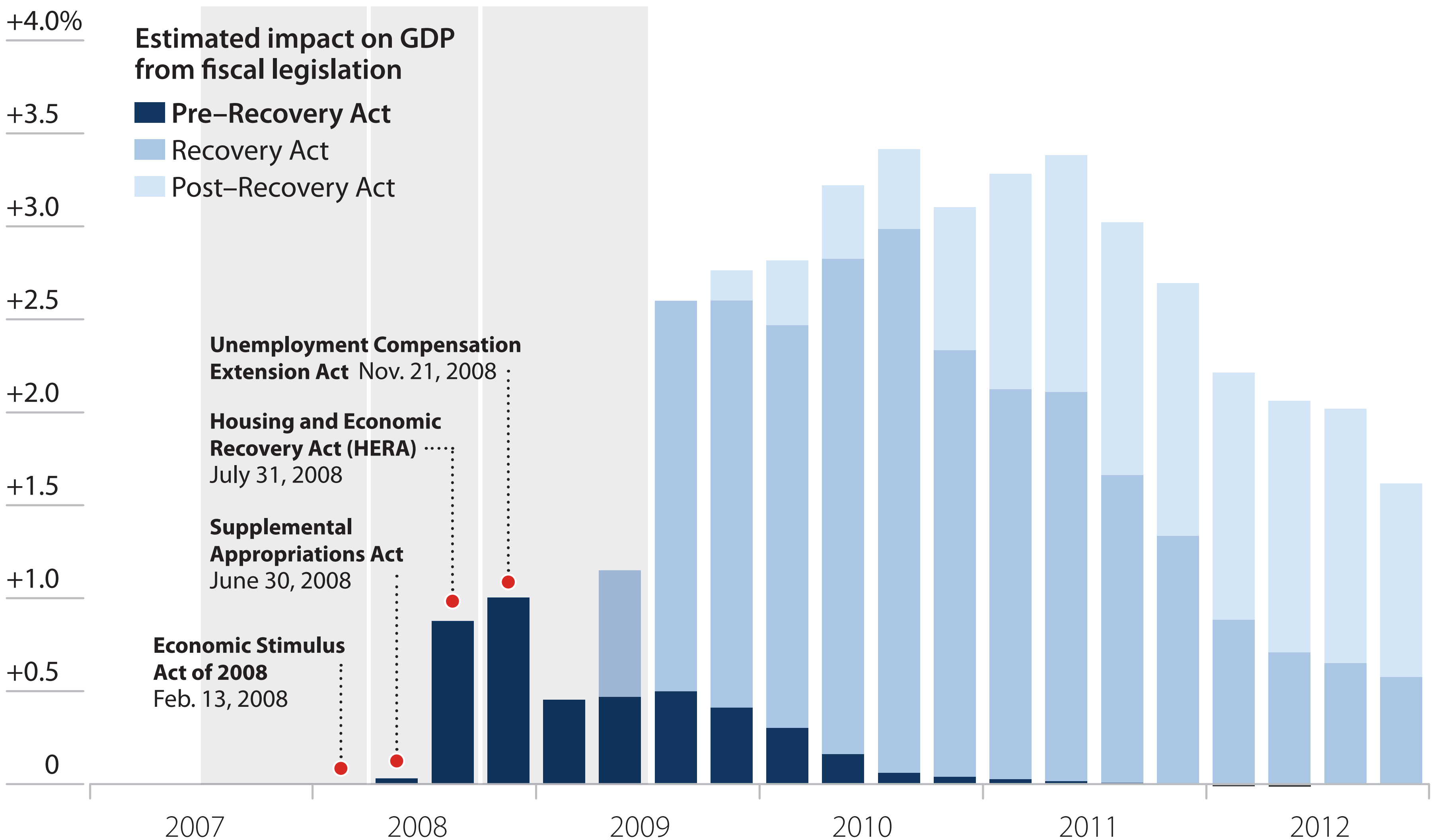
Gross asset purchases, monthly



Sources: Target rate: Federal Reserve Board; 10-year Treasury: Federal Reserve Board via Federal Reserve Economic Data (FRED); monthly asset purchases: Federal Reserve Bank of New York, Haver Analytics

The U.S. passed the first fiscal stimulus very early in the crisis. But at $168 billion, it was relatively small and needed time to take effect.

Quarterly effect of fiscal stimulus measures on GDP



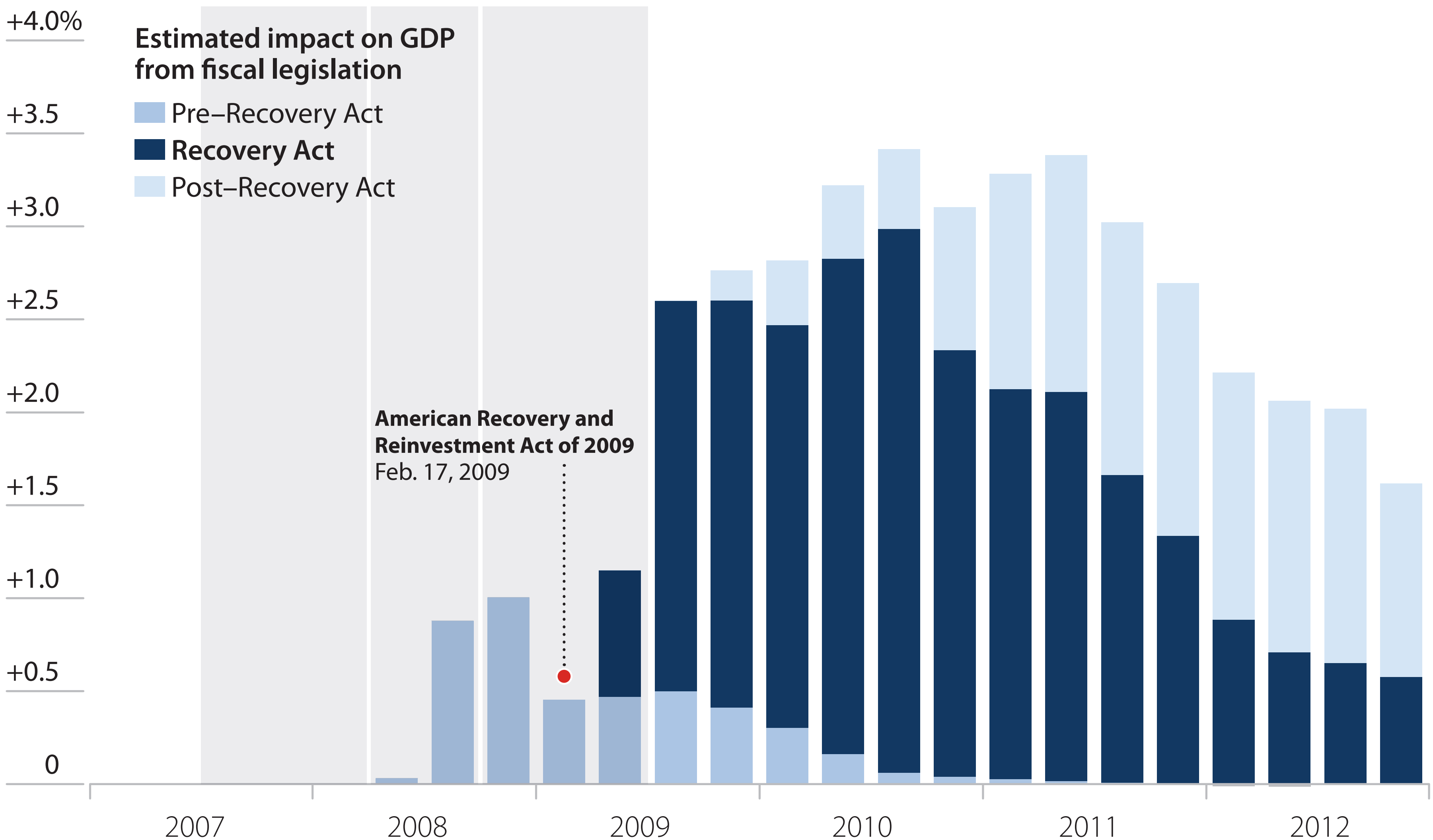
Note: $168 billion represents the combined stimulus from pre–Recovery Act measures through 2012.

Sources: Council of Economic Advisers; Congressional Budget Office; Bureau of Economic Analysis; calculations by Jason Furman

U.S. STRATEGY

The Recovery Act of 2009 provided a larger mix—$712 billion—of temporary tax cuts and spending increases, offsetting some but not all of the fall in GDP.

Quarterly effect of fiscal stimulus measures on GDP

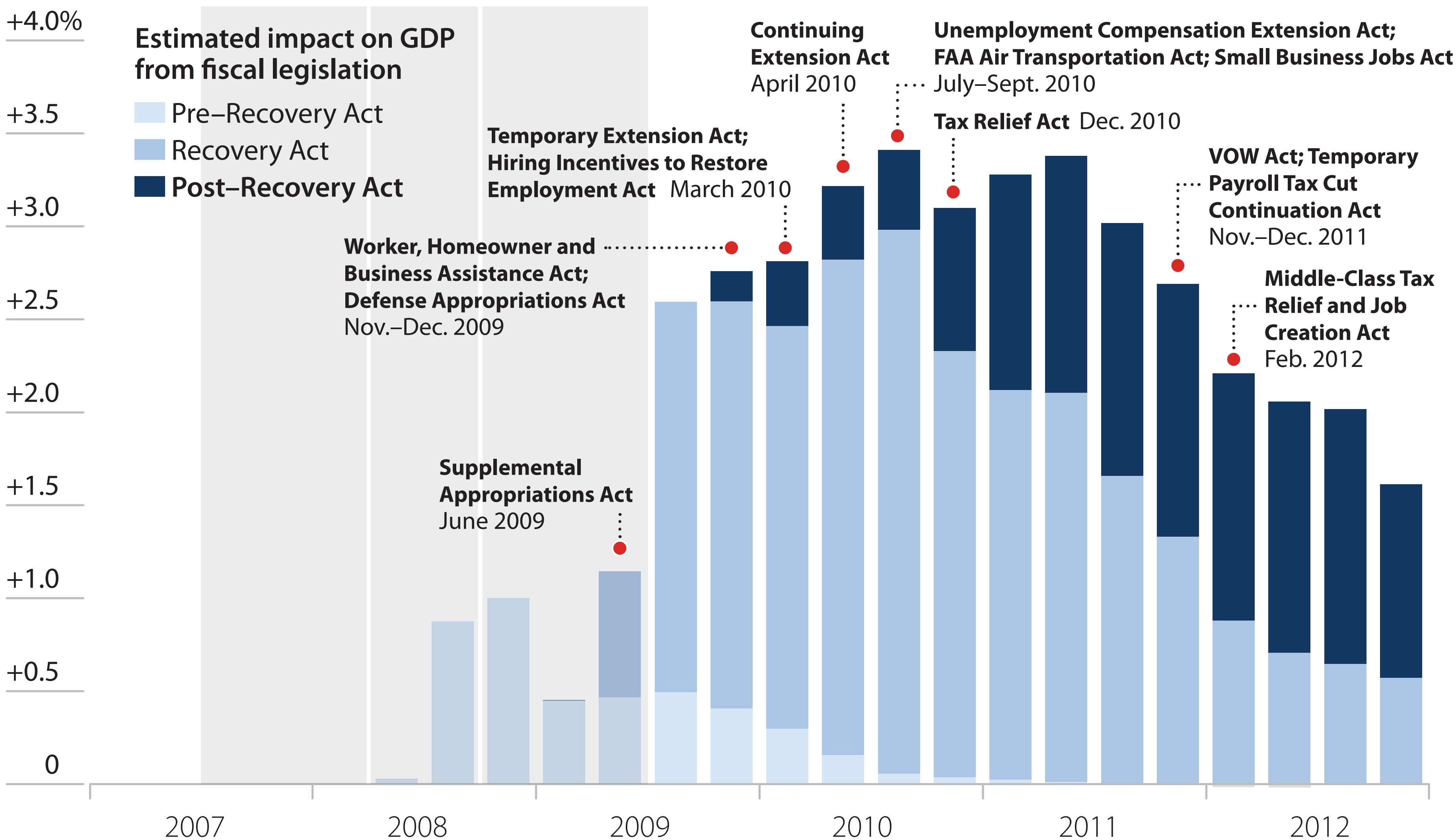


Note: $712 billion represents the stimulus from the Recovery Act through 2012.

Sources: Council of Economic Advisers; Congressional Budget Office; Bureau of Economic Analysis; calculations by Jason Furman

A further $657 billion from a series of smaller post–Recovery Act measures added to the level of economic support …

Quarterly effect of fiscal stimulus measures on GDP

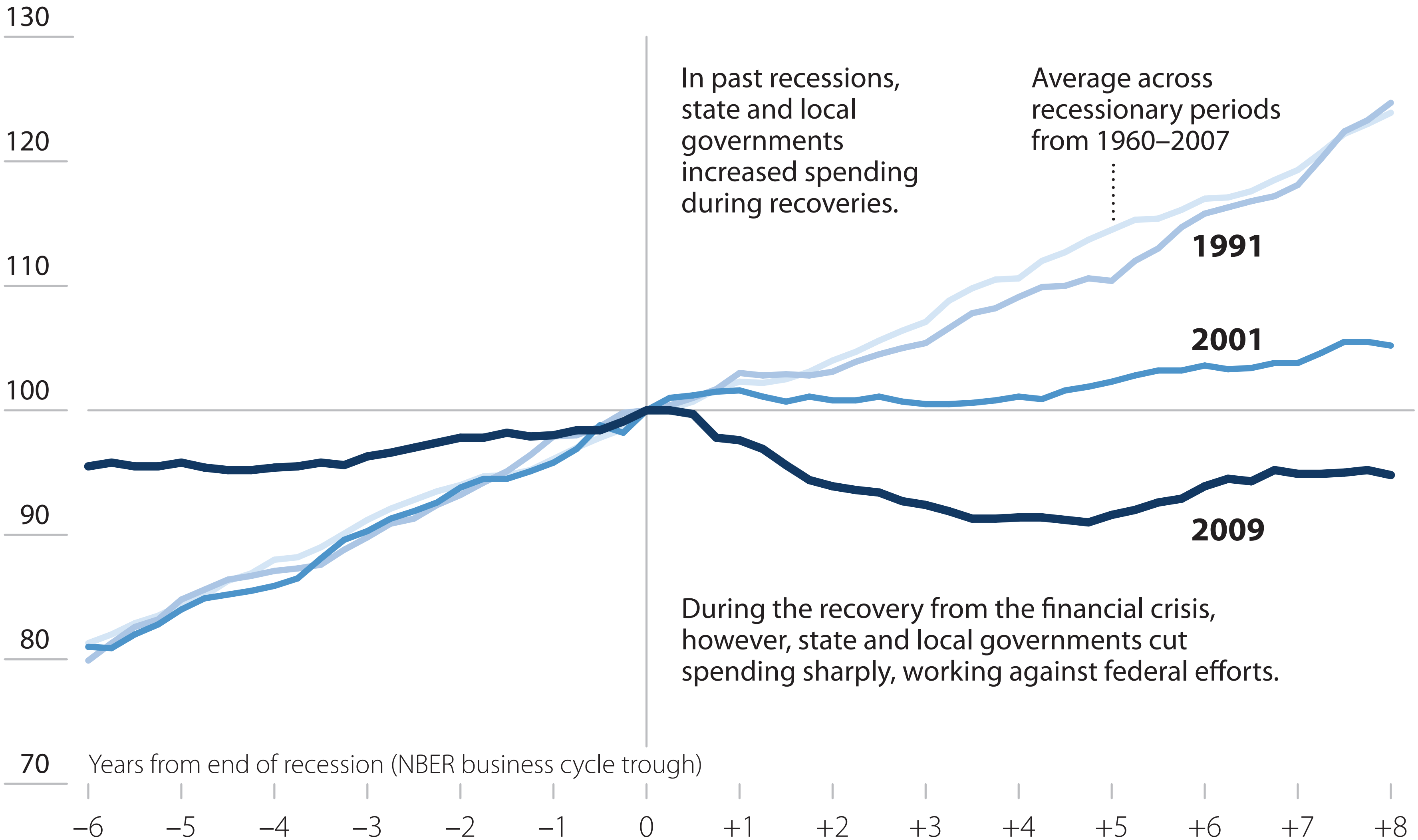


Note: $657 billion represents the combined stimulus from post–Recovery Act measures through 2012.

Sources: Council of Economic Advisers; Congressional Budget Office; Bureau of Economic Analysis; calculations by Jason Furman

…but even as the federal government ramped up stimulus, state and local cutbacks worked against the effort.

Real state and local government purchases during recoveries, 1960–2015, indexed to quarterly level at end of recession



Note: Average does not include the 1980 recession owing to overlap with the 1981–82 recession.

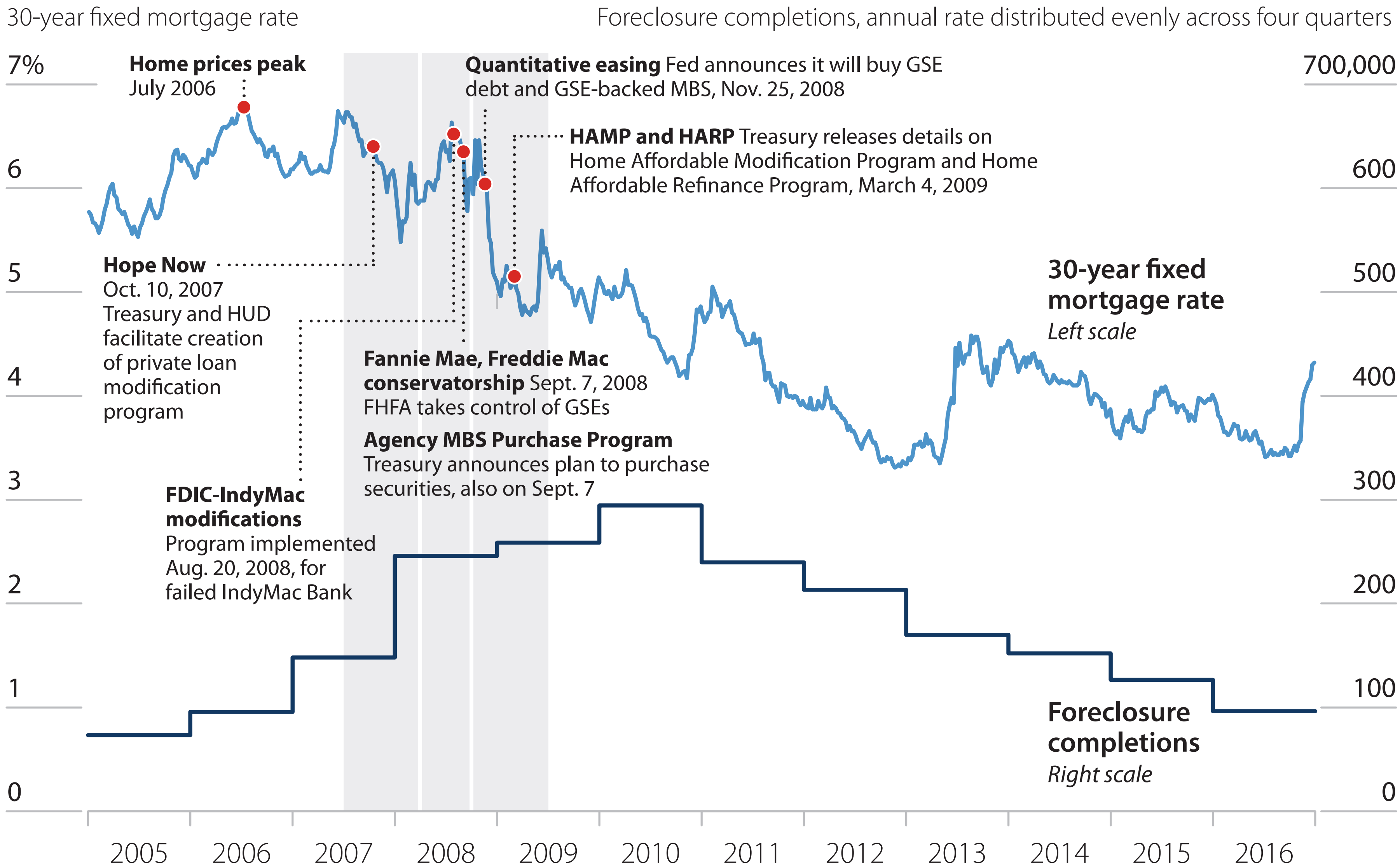
Sources: Bureau of Economic Analysis via Haver Analytics; authors' calculations

The government put in place a series of housing programs to:

- **Lower mortgage rates and ensure the availability of credit**
- **Reduce mortgage foreclosures**
- **Help struggling borrowers refinance mortgages to take advantage of lower rates**

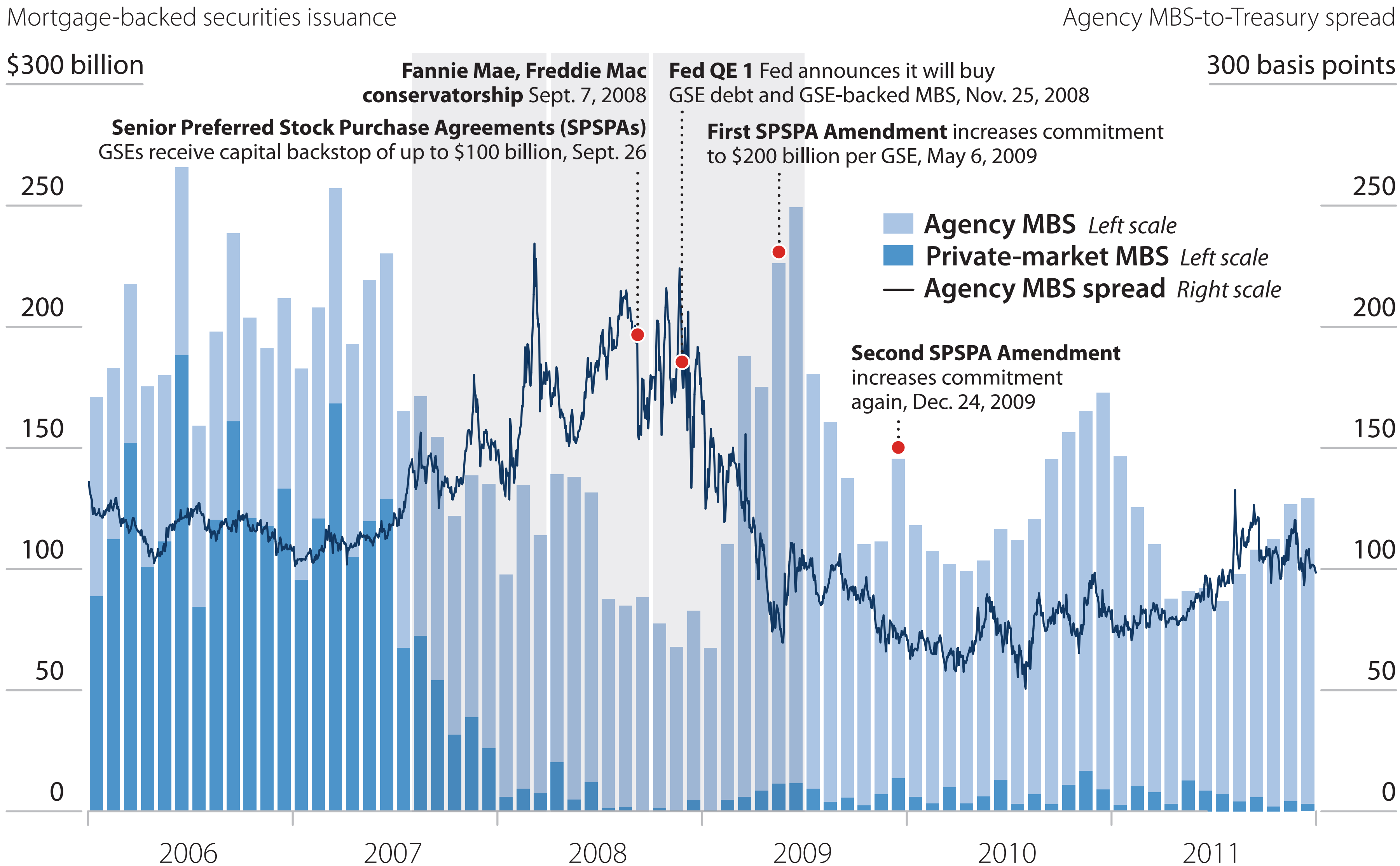
U.S. STRATEGY

The government's housing programs brought down mortgage rates and reduced foreclosures but were not powerful enough to contain the damage.



Sources: Mortgage rates: Freddie Mac Primary Mortgage Market Survey® via Federal Reserve Economic Data (FRED); foreclosure completions: CoreLogic

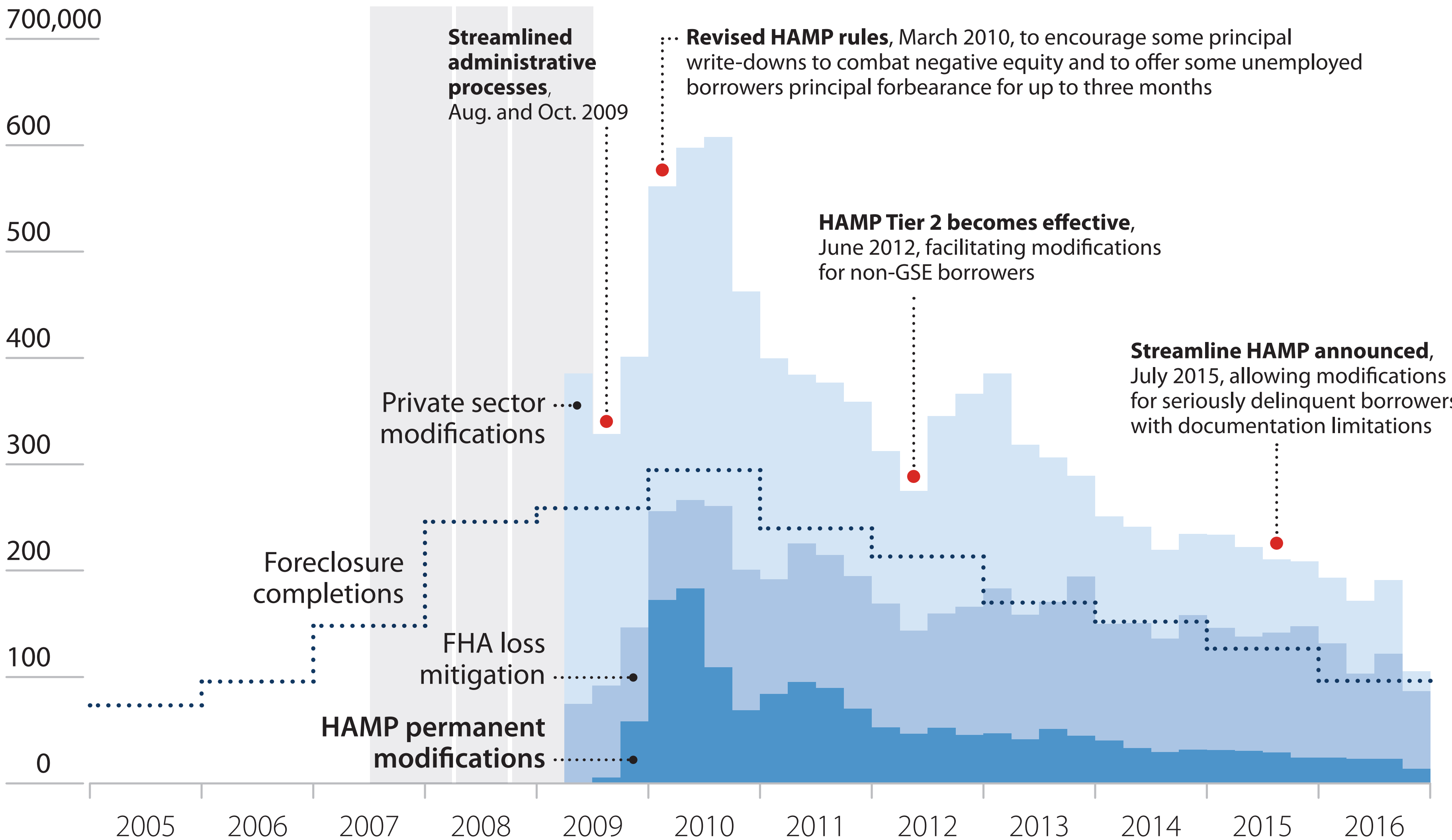
Government support of Fannie Mae and Freddie Mac kept mortgage credit flowing and stabilized the housing market after private issuers pulled back.



Sources: MBS issuance: Securities Industry and Financial Markets Association; agency MBS spread: Bloomberg Finance L.P., authors' calculations

Loan modification programs, including HAMP, helped millions of struggling home owners with their mortgages.

Mortgages modified or receiving loss mitigation aid, April 1, 2009, through Nov. 30, 2016



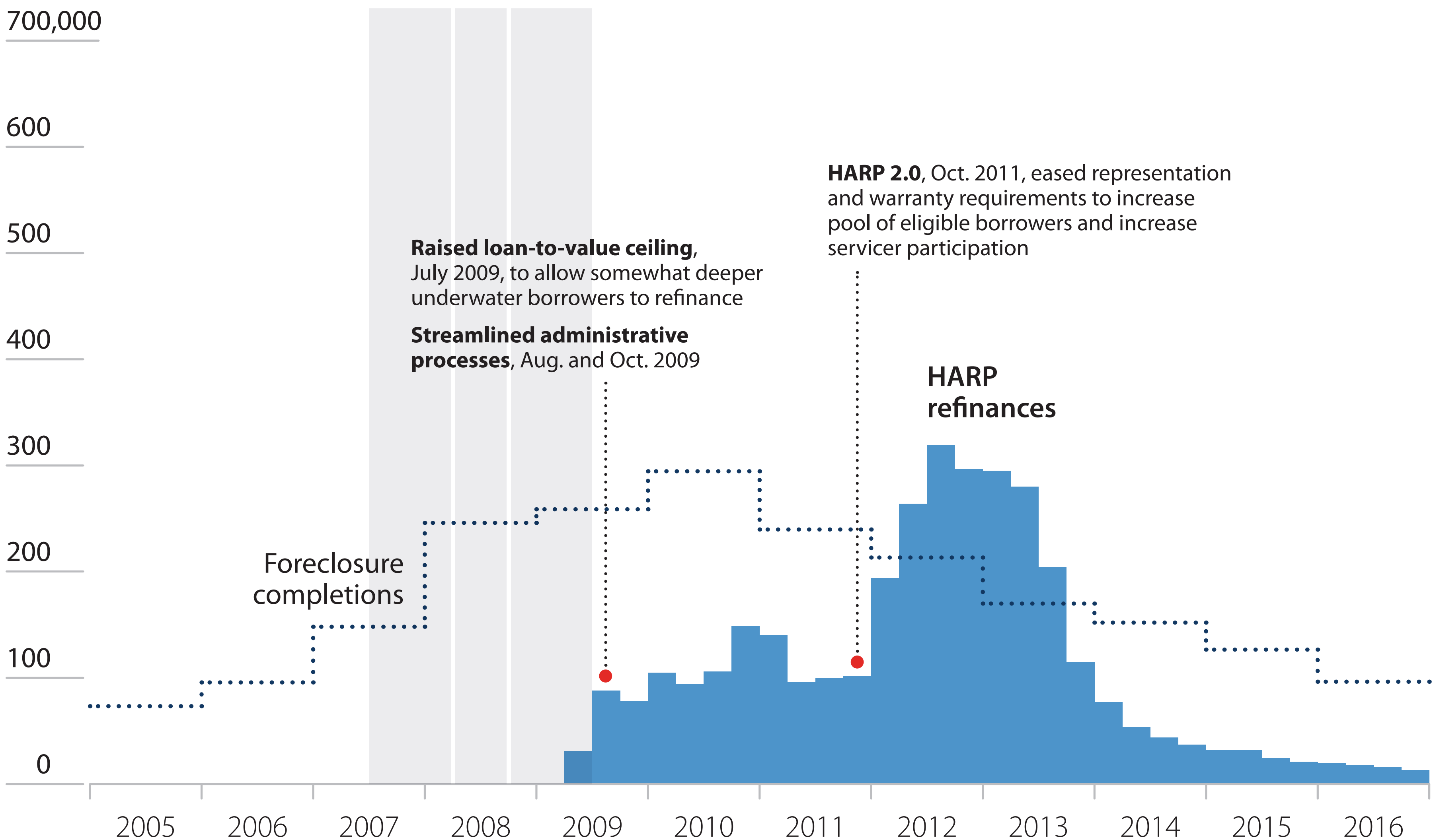
Note: Modifications through Nov. 2016; other program results through 2016. Foreclosure completions are plotted using an annual rate distributed evenly across four quarters.

Sources: FHA loss mitigation: Dept. of Housing and Urban Development; HAMP modifications: U.S. Treasury; private sector modifications: HOPE NOW; foreclosure completions: CoreLogic

U.S. STRATEGY

The Home Affordable Refinance Program lowered mortgage rates, encouraged refinancings, and helped "underwater" home owners avoid foreclosure.

Loans refinanced through the Home Affordable Refinance Program



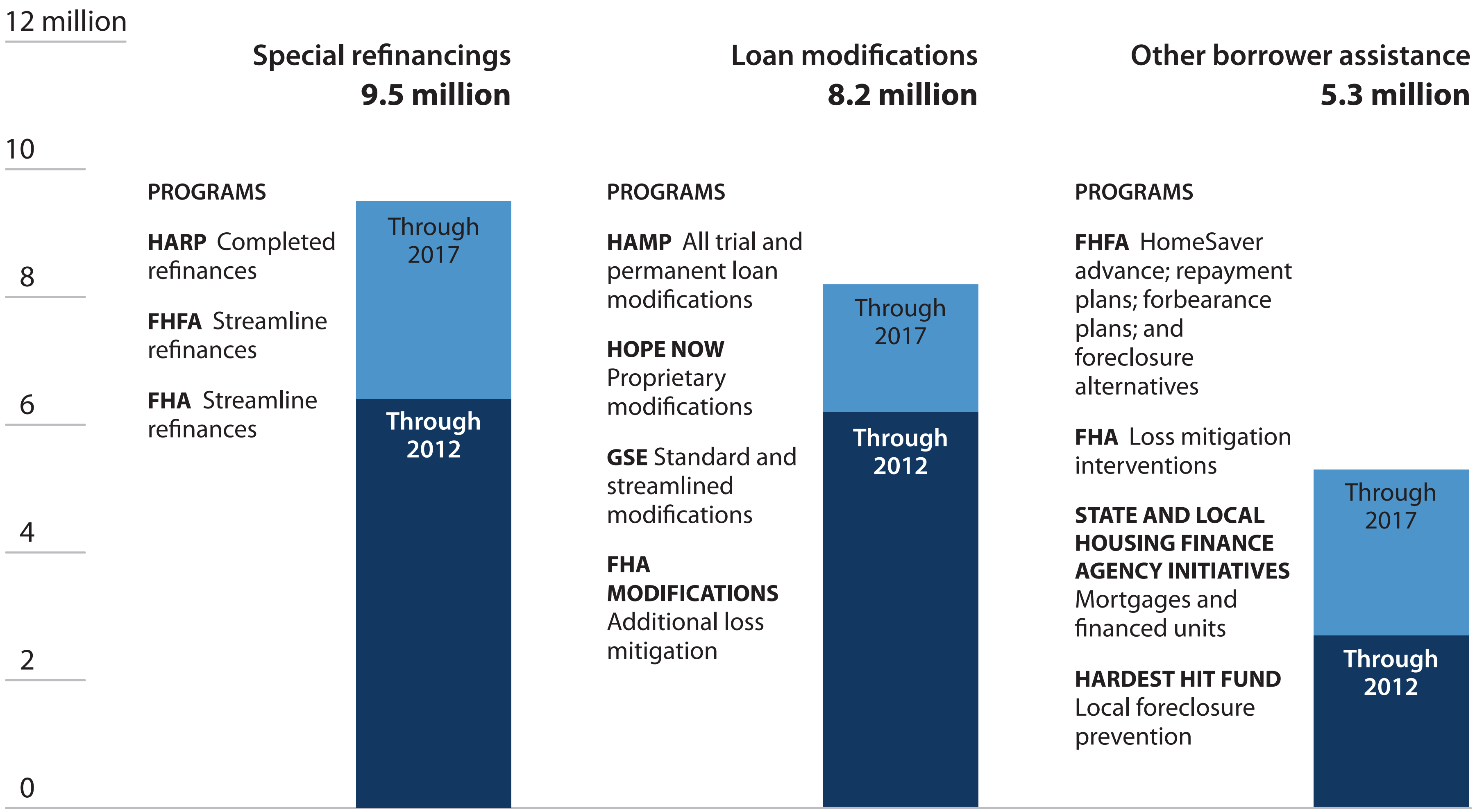
Note: Foreclosure completions are plotted using an annual rate distributed evenly across four quarters.

Sources: Refinances: Federal Housing Finance Agency; foreclosure completions: CoreLogic

U.S. STRATEGY

The government's programs helped millions of home owners, but were slow to take effect and reached a limited number of people threatened by foreclosure.

Home owners assisted through crisis-era loan modification programs and other foreclosure prevention actions



Source: Barr et al. (2020)

Even though the crisis started in the United States, its impact reverberated around the world—and the response required U.S. policymakers to work closely with their global counterparts to:

Establish central bank swap lines

to address dollar funding shortages

Coordinate monetary policy

to send a powerful message to the markets

Arrange for IMF support

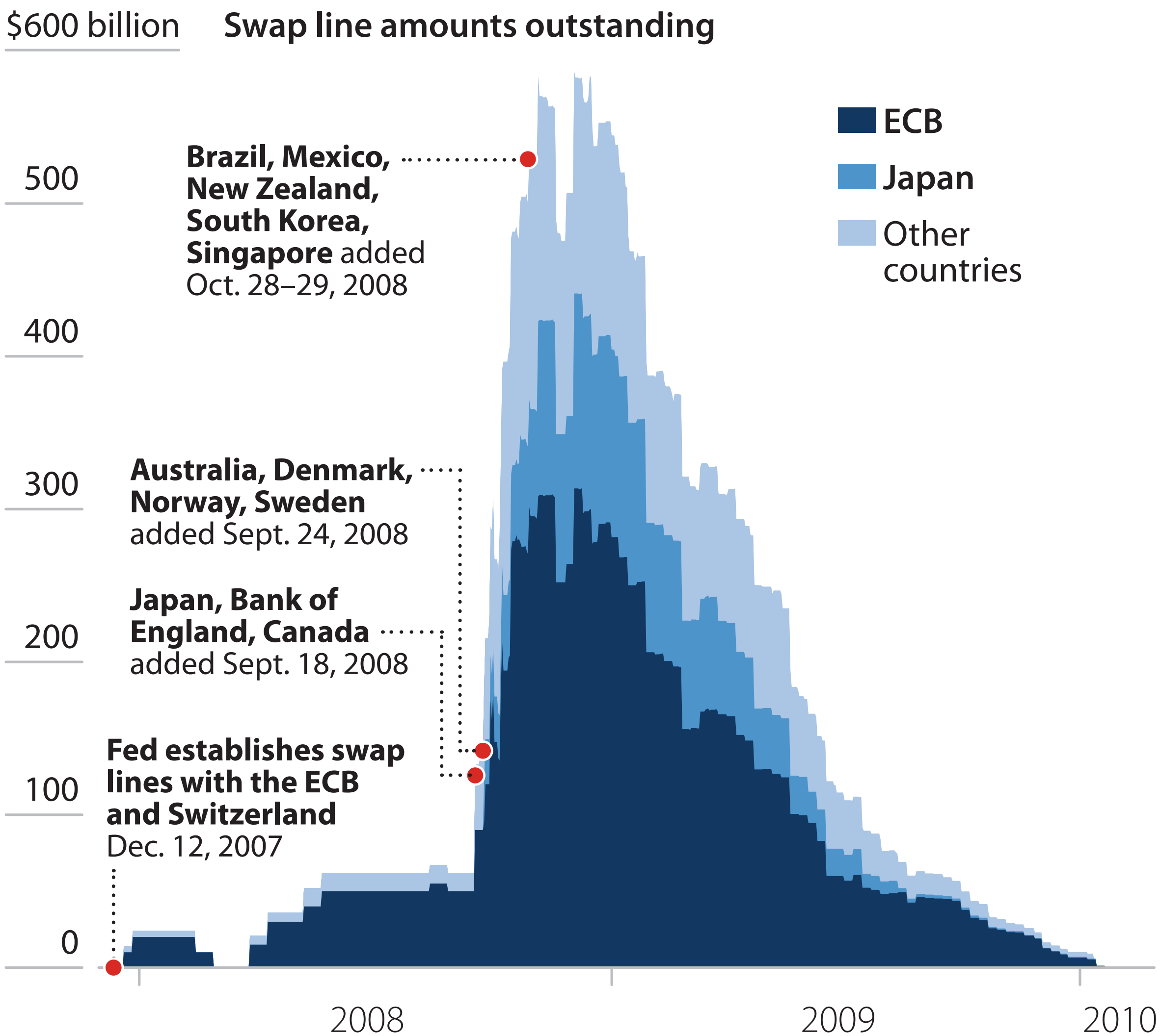
for emerging markets countries affected by the crisis

U.S. STRATEGY

The Federal Reserve established swap lines with more than a dozen foreign central banks to ease funding pressures arising from a shortage of dollars.

Central bank liquidity swaps

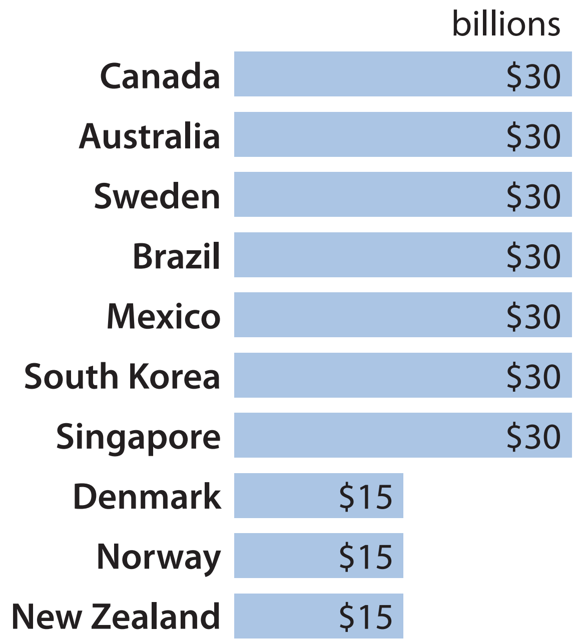
Swap line amounts outstanding



Swap line limits

By Oct. 14, 2008, the Fed had expanded currency swap lines to essentially unlimited amounts with four central banks: ECB, Switzerland, and the Banks of England and Japan.

Limited swap lines were arranged with 10 other central banks:

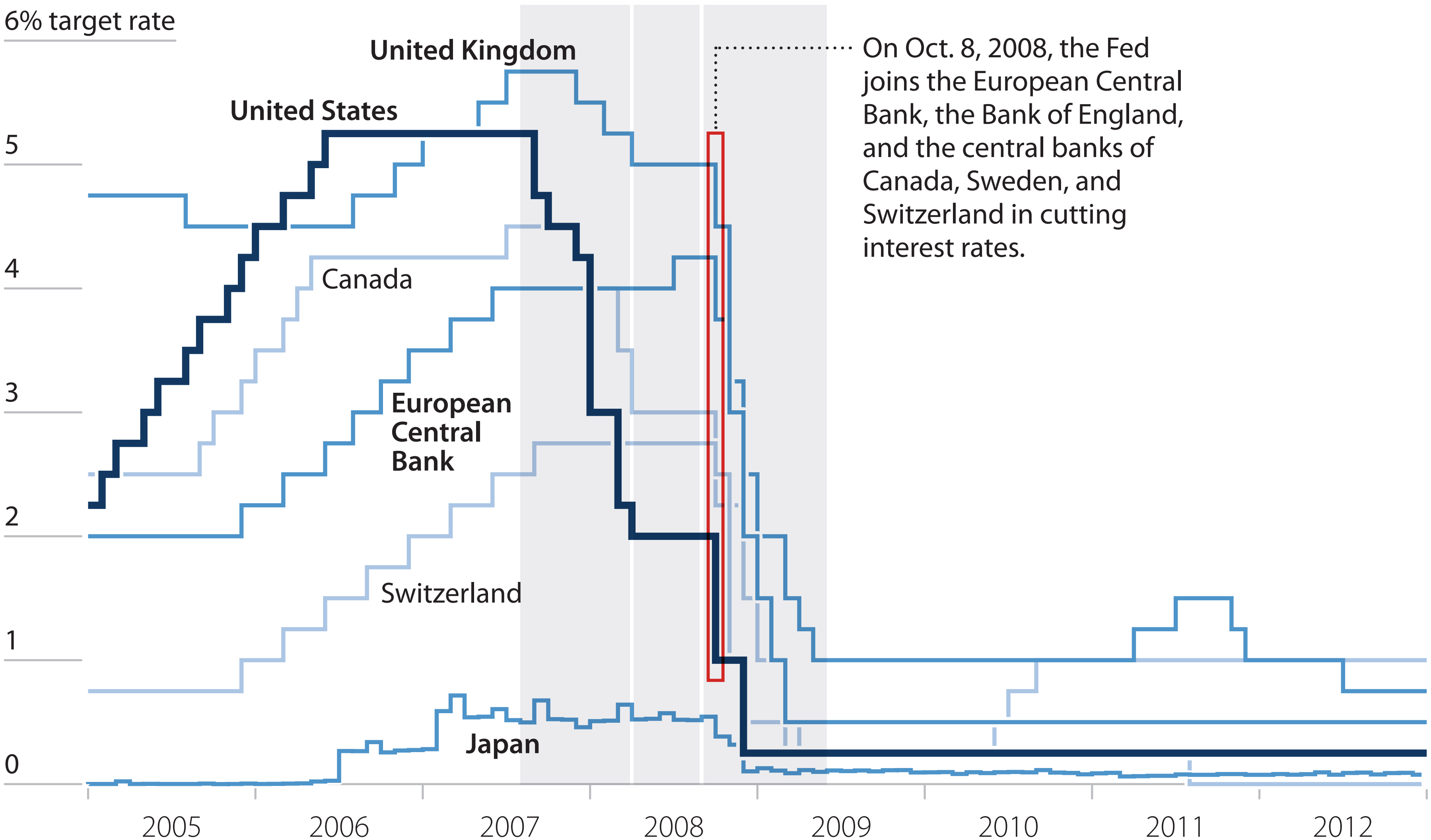


Sources: Amounts outstanding: Federal Reserve Board, authors' calculations; maximum commitments: Goldberg et al. (2010)

U.S. STRATEGY

The Federal Reserve and the world's major central banks orchestrated a coordinated interest rate cut.

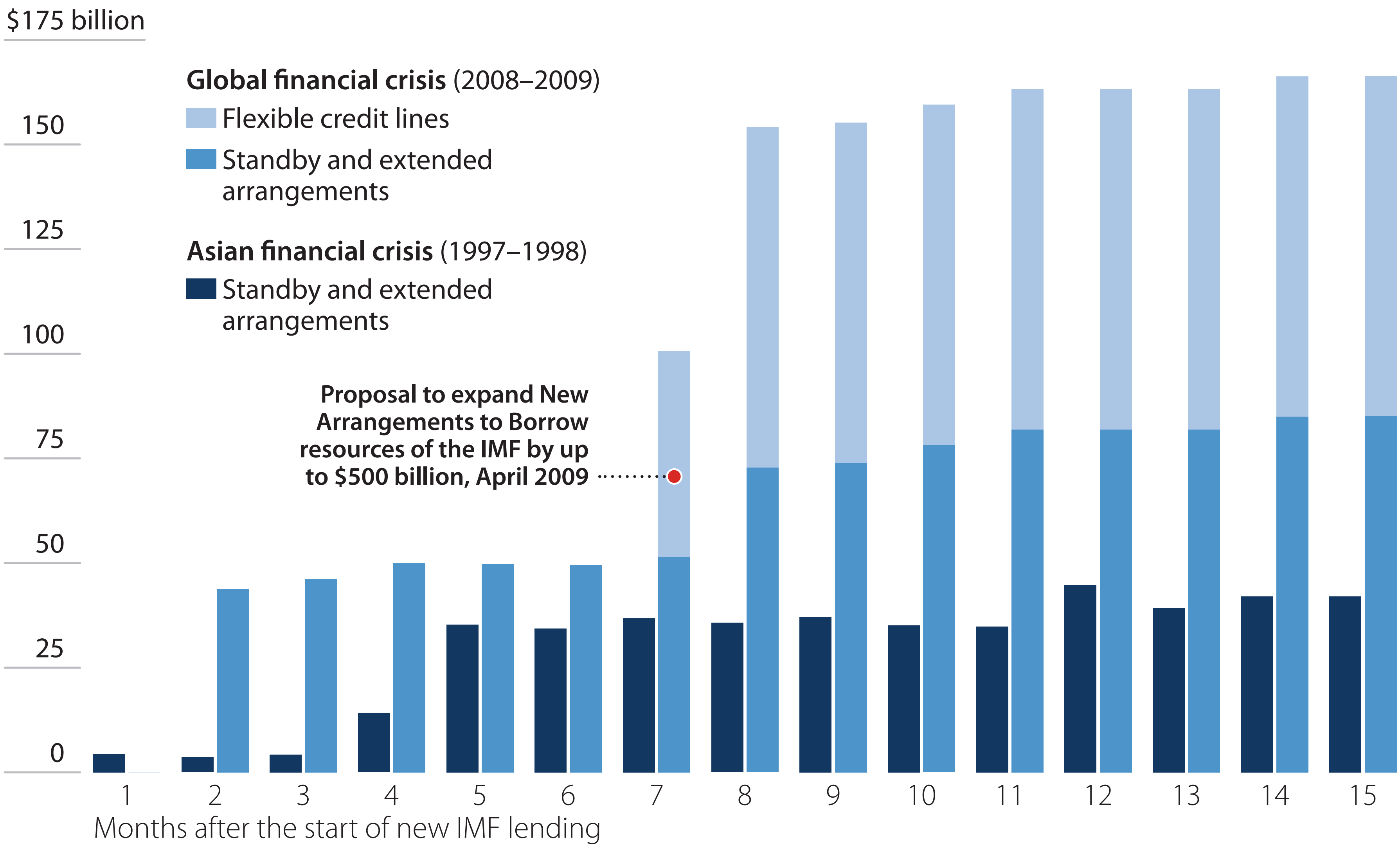
Central bank target interest rates for each country (month-end)



Source: Bloomberg Finance L.P.

The IMF provided substantial aid to countries affected by the crisis, outpacing its response to the Asian financial crisis in 1997.

Increase in IMF lending commitments from start of Asian and global financial crises



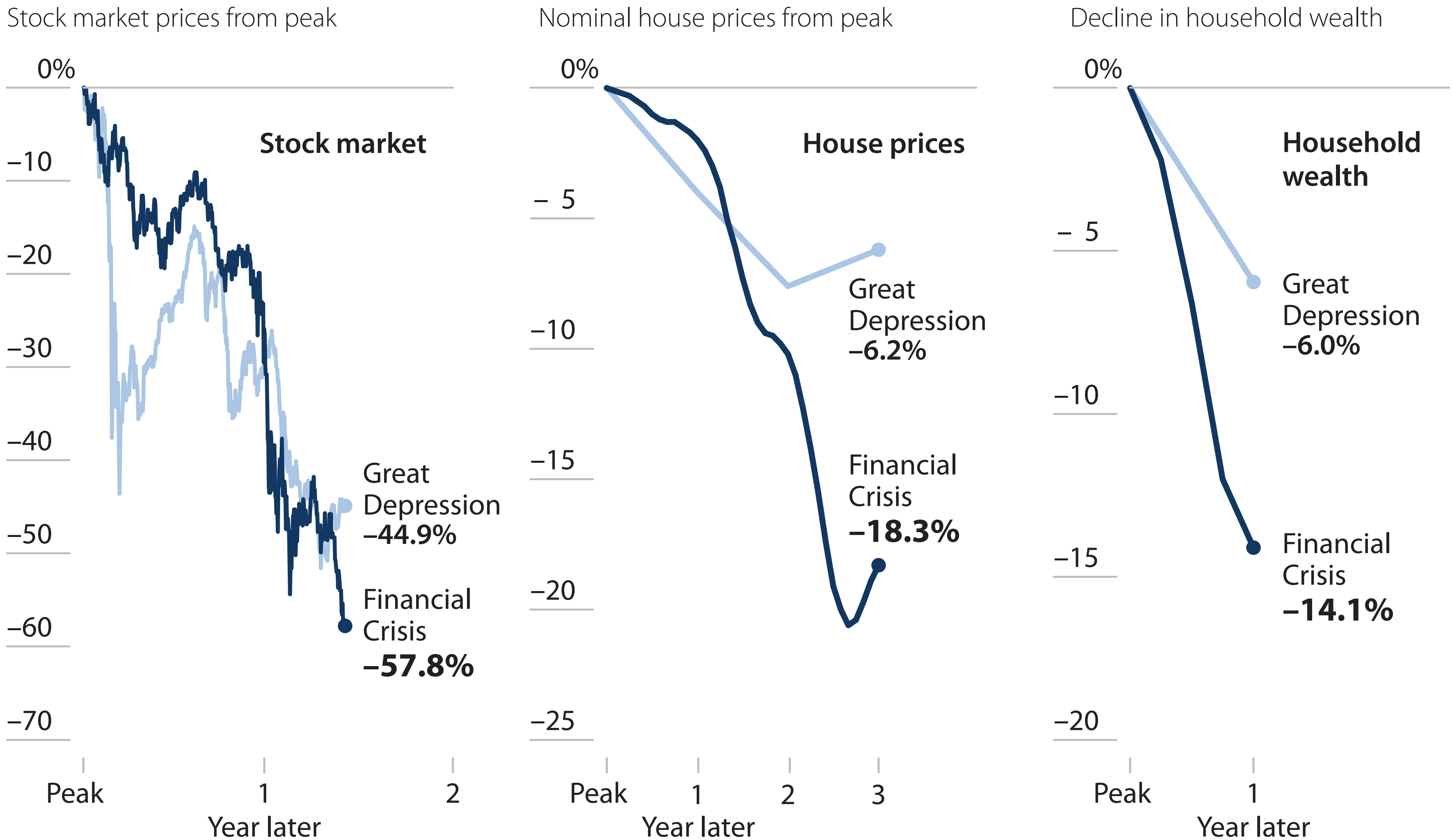
Note: Start date for new IMF lending for the Asian financial crisis (AFC) is July 1997 and for the global financial crisis (GFC) is Sept. 2008. SDR data were converted to U.S. dollars at $1.355820 per SDR (the rate on July 31, 1997) for the AFC and $1.557220 per SDR (the rate on Sept. 30, 2008) for the GFC.

Sources: International Monetary Fund; authors' calculations based on Lowery et al. (2020)

Outcomes

OUTCOMES

The severity of the stress of the 2008 financial crisis was, in some respects, worse than in the Great Depression.



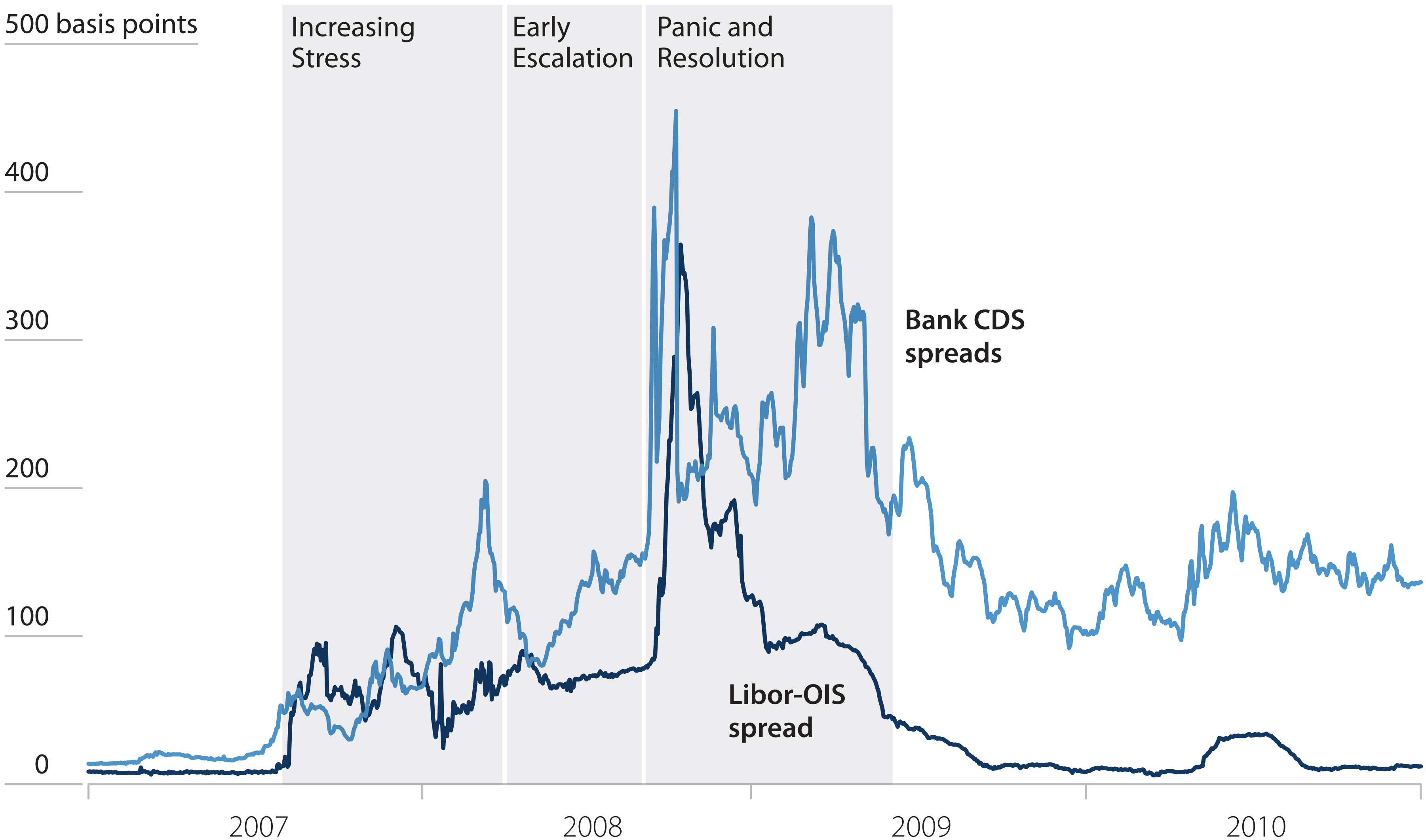
Notes: Stock declines shown to financial crisis trough; house prices 3 years after peak; household wealth figures are based on the change between the nominal annual average of 1929 and of 1930, and the change in the nominal level from Q1 2008 to Q1 2009.

Sources: Stock prices: The Center for Research in Security Prices at Chicago Booth via Wharton Research Data Services (WRDS); housing prices: U.S. home price and related data, Robert J. Shiller, *Irrational Exuberance*; GD household wealth: Mishkin (1978); GR household wealth: Federal Reserve Board Financial Accounts of the United States

OUTCOMES

The U.S. government response ultimately stopped the panic and stabilized the financial system …

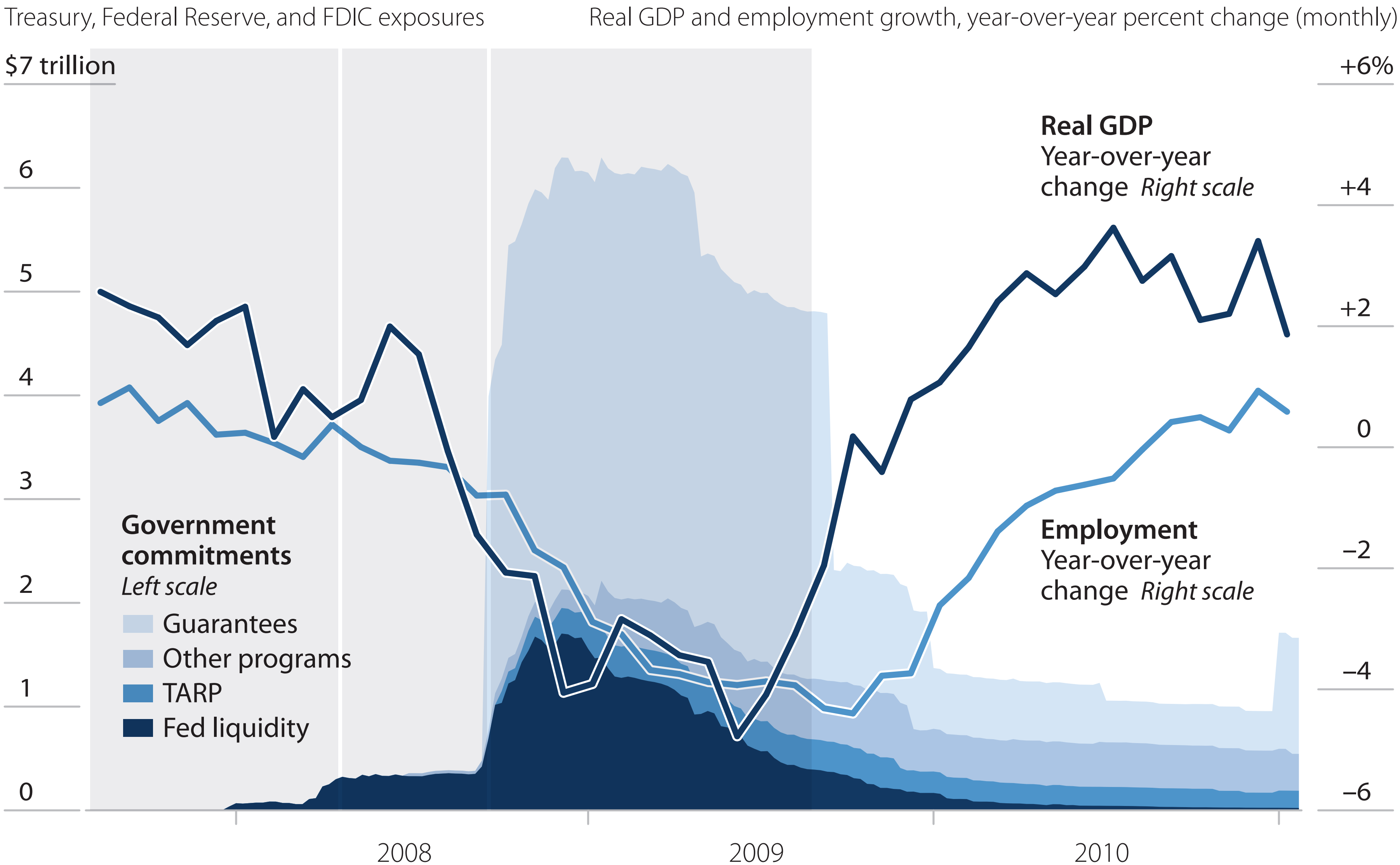
Bank CDS spreads and Libor-OIS spread



Note: Credit default swap spreads are equal-weighted averages of JPMorgan Chase, Citigroup, Wells Fargo, Bank of America, Morgan Stanley, and Goldman Sachs.

Sources: Libor-OIS: Bloomberg Finance L.P.; CDS spreads: Bloomberg Finance L.P., IHS Markit

. . . and allowed the economy to slowly begin digging out of a deep recession.

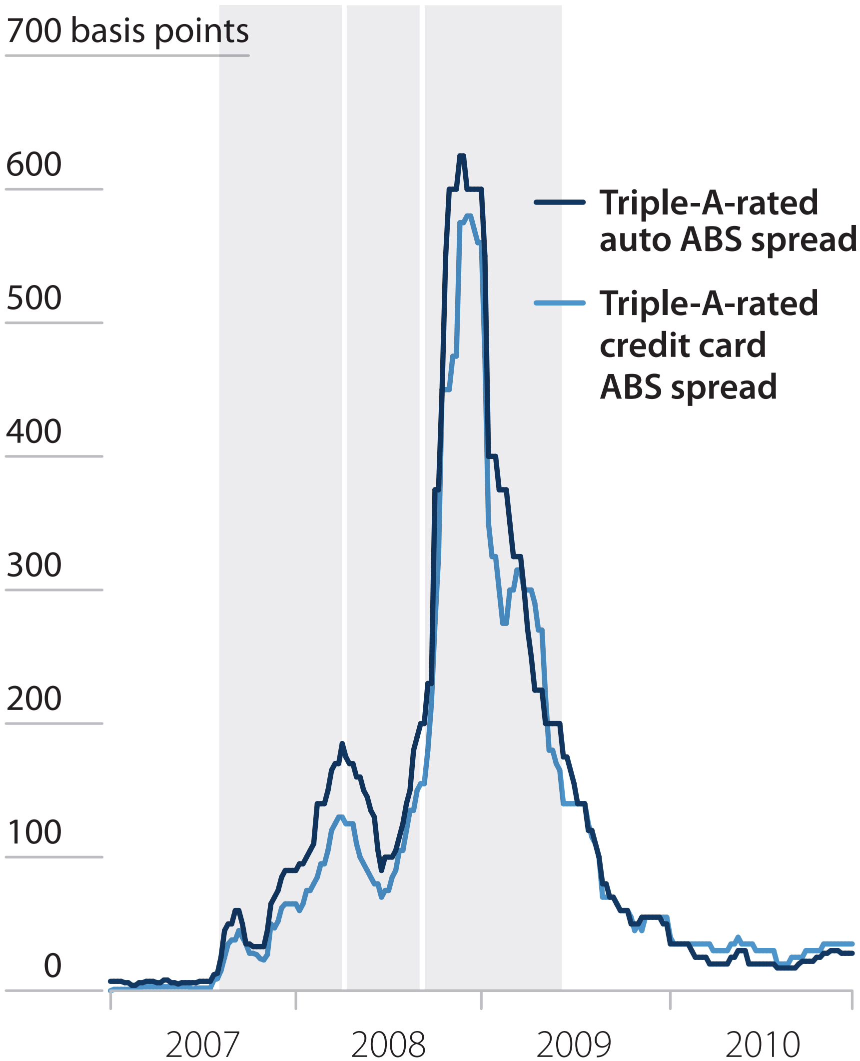


Sources: Liang et al. (2020), based on U.S. government exposures: Congressional Oversight Panel, "Guarantees and Contingent Payments in TARP and Related Programs" via Federal Reserve Bank of St. Louis, Federal Deposit Insurance Corp., Federal Reserve Board, Federal Housing Finance Agency, U.S. Treasury; employment: Bureau of Labor Statistics; real GDP: Macroeconomic Advisers via Haver Analytics

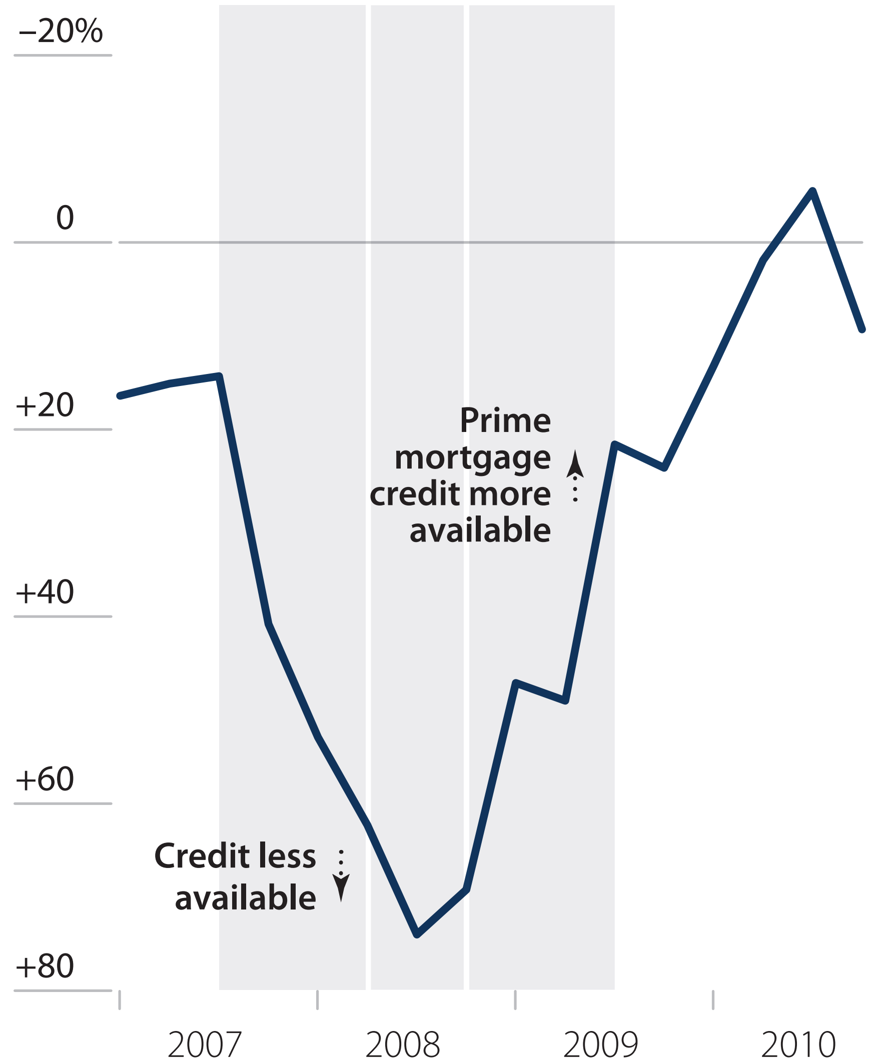
OUTCOMES

The response helped restart the credit markets and bank lending so that financing was once again cheaper and easier to obtain.

Consumer asset-backed security (ABS) spreads



Net percentage of banks tightening loan standards

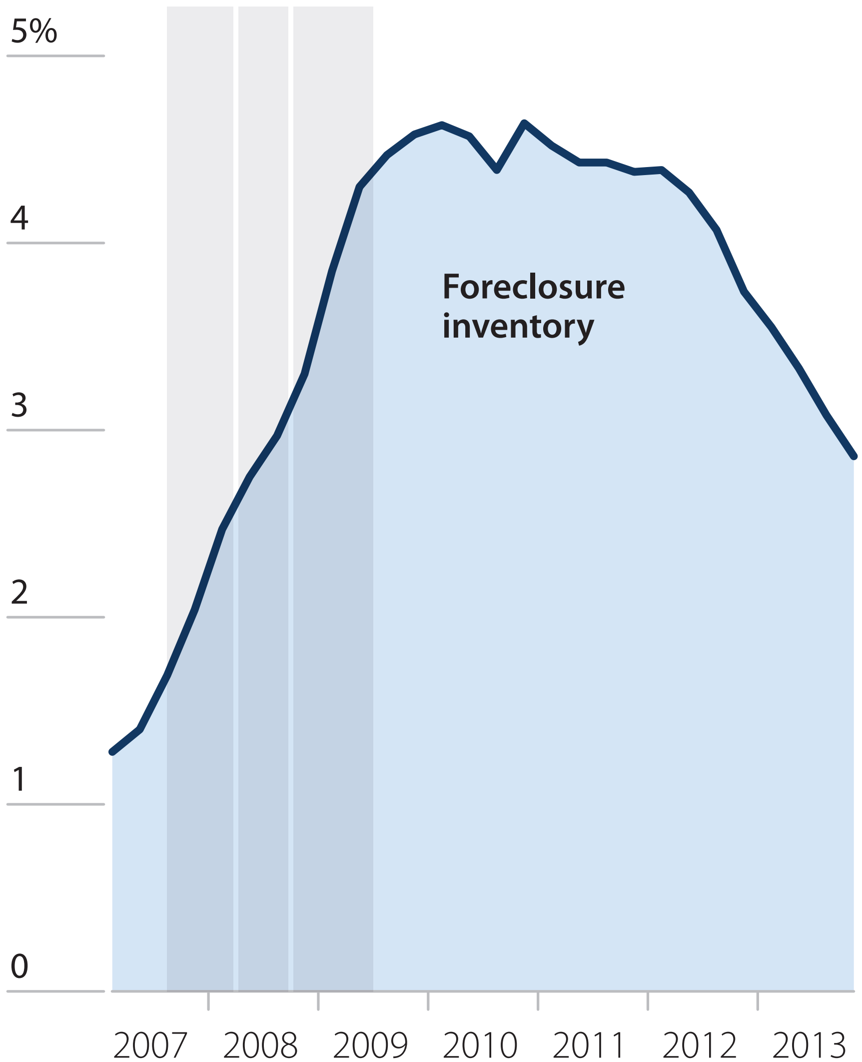


Sources: ABS spreads: Federal Reserve Bank of New York based on data from JP Morgan and Bloomberg Finance L.P.; lending standards: Federal Reserve Board

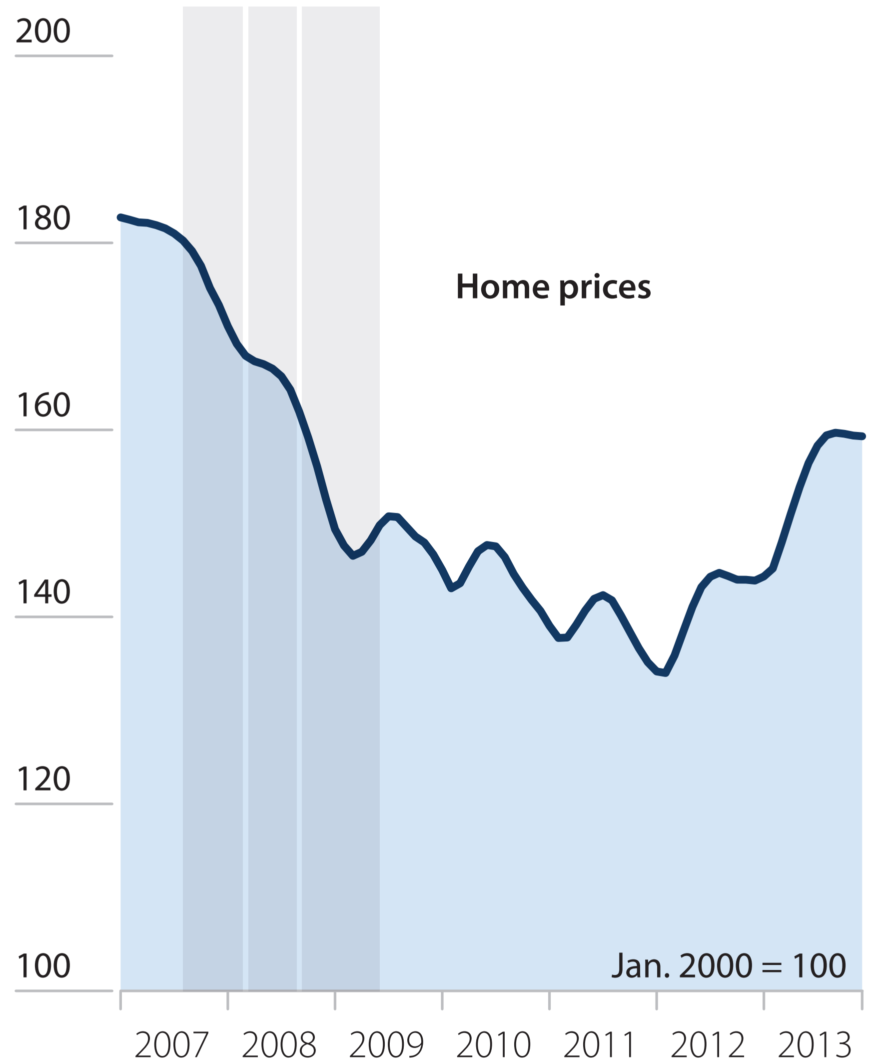
OUTCOMES

The surge in housing foreclosures stabilized and began to decline, and home prices eventually began to recover.

Foreclosures as a percent of total loans



S&P CoreLogic Case-Shiller U.S. National Home Price Index

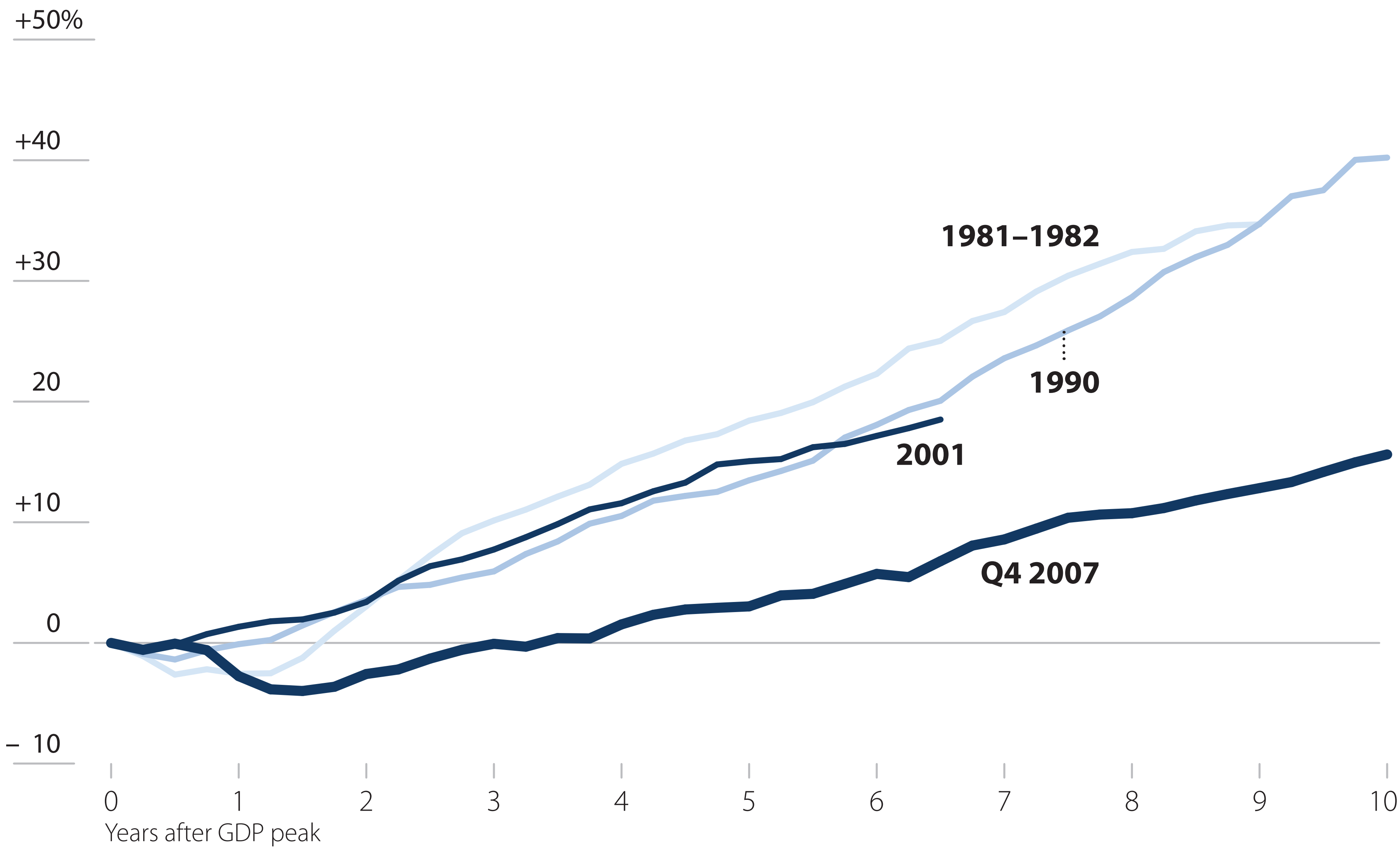


Sources: Foreclosure inventory: Mortgage Bankers Association's National Delinquency Survey, Bloomberg Finance L.P.; home price index: S&P CoreLogic Case-Shiller U.S. National Home Price Index, not seasonally adjusted, via Federal Reserve Economic Data (FRED)

OUTCOMES

The pace of the recovery in the U.S. was slow, as is typical following a severe financial crisis . . .

Percentage change in real GDP from peak

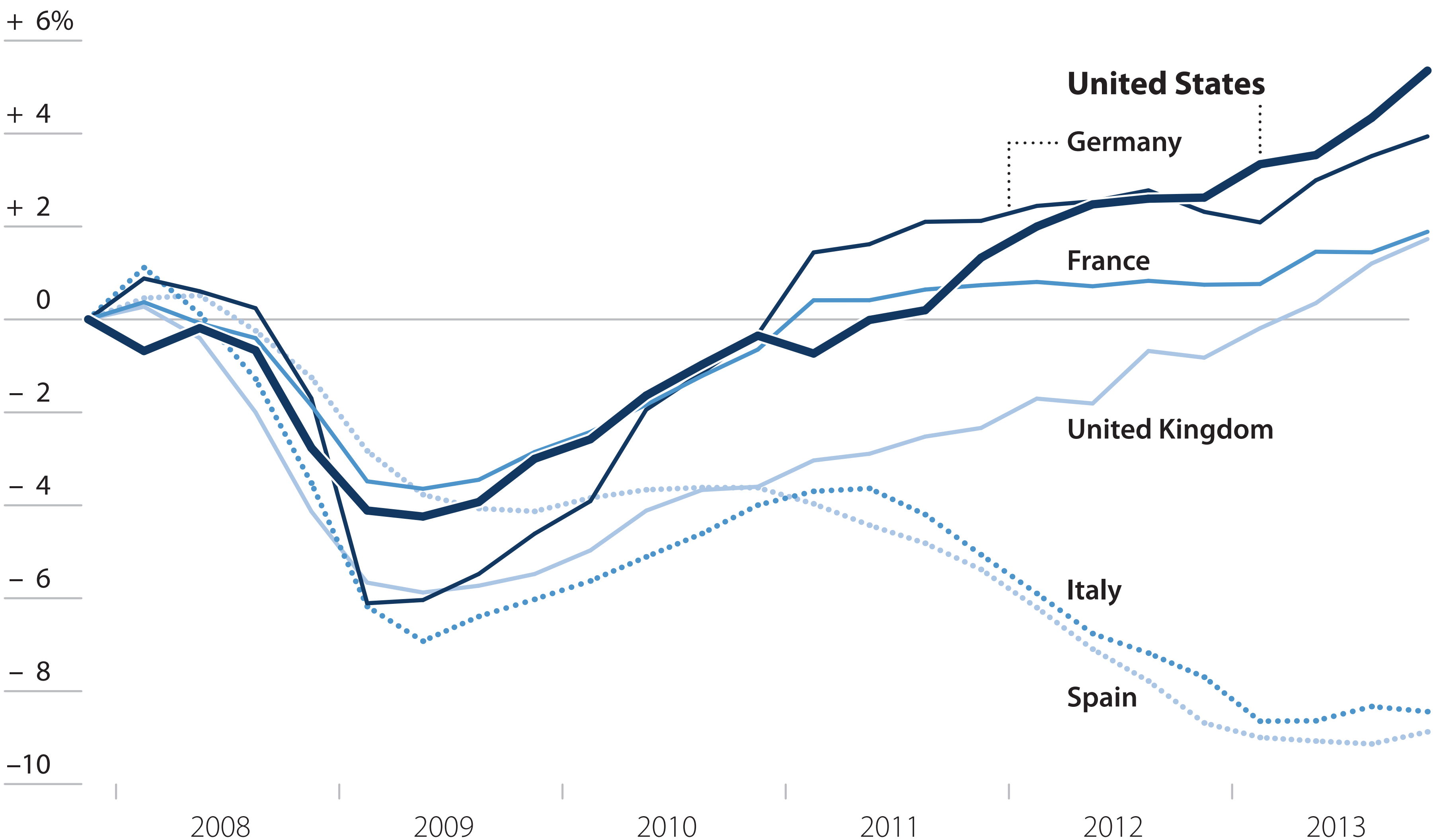


Source: Bureau of Economic Analysis via Federal Reserve Economic Data (FRED)

OUTCOMES

…although growth has been stronger than in many European countries.

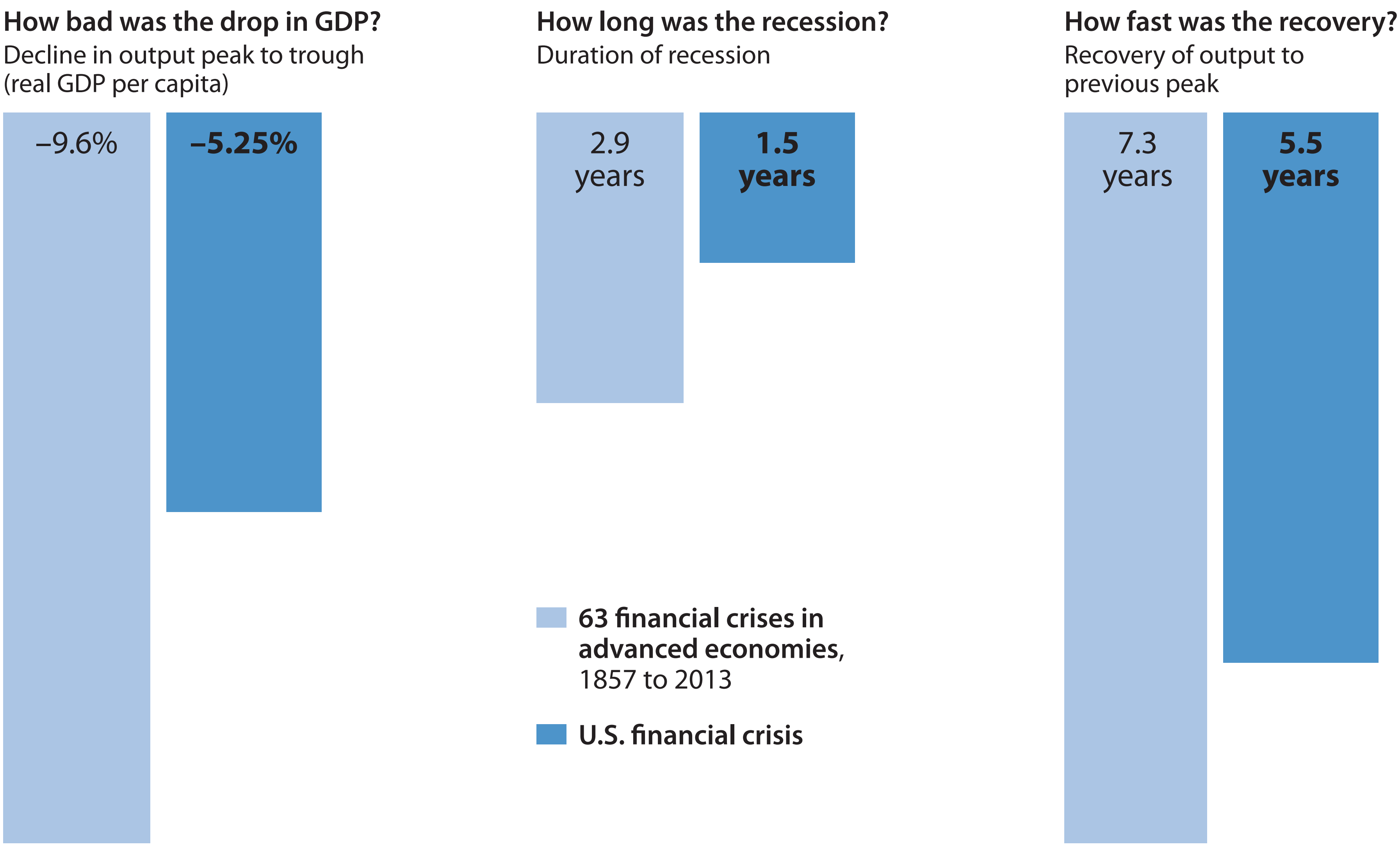
Real GDP, percentage change from 4th quarter 2007



Source: Organisation for Economic Co-operation and Development

OUTCOMES

Financial crises are typically costly to economic output, but the U.S. strategy was able to limit the damage compared to other crises.

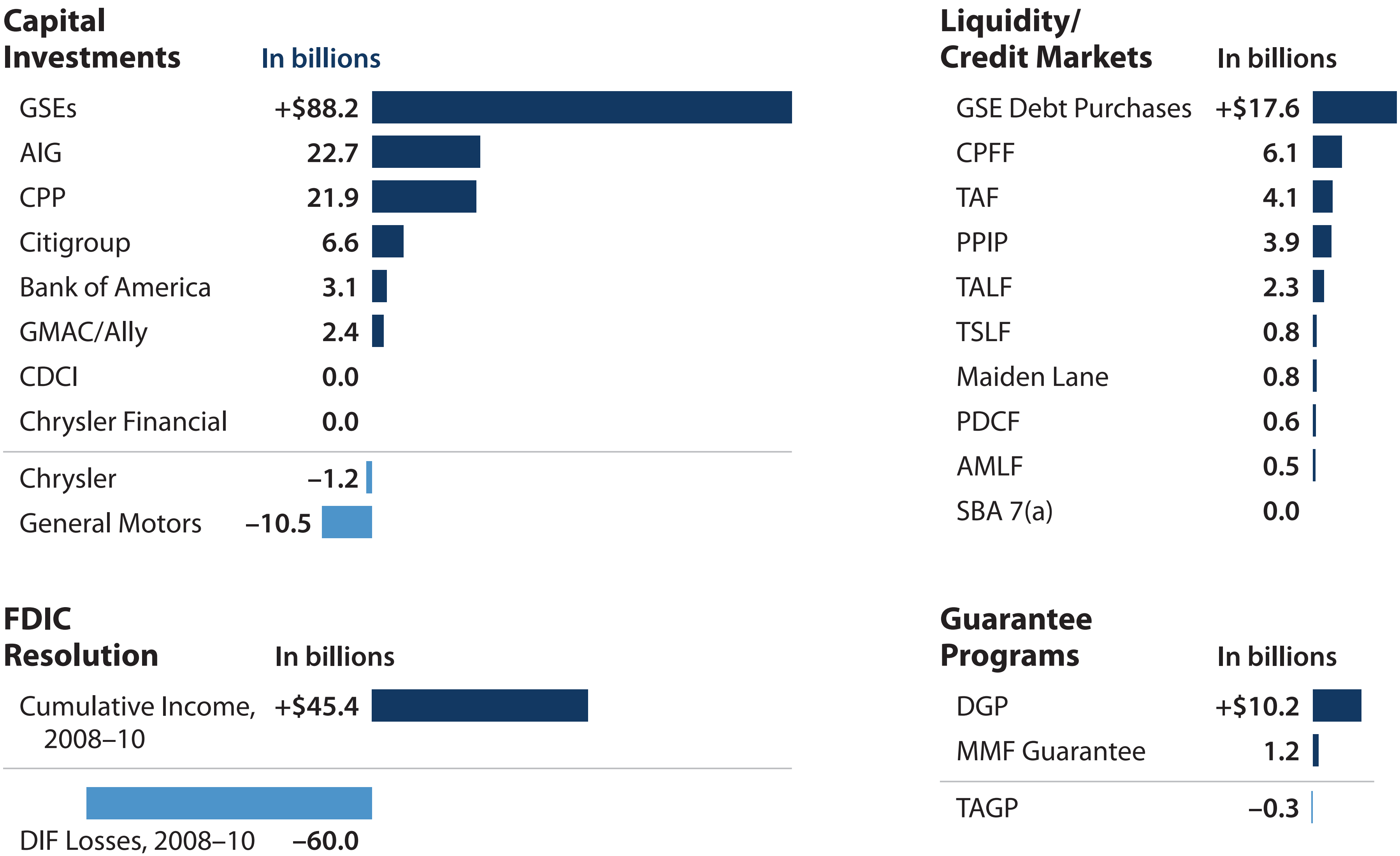


Sources: Reinhart and Rogoff (2009); Bureau of Economic Analysis via Federal Reserve Economic Data (FRED); based on comparisons from Liang et al. (2020)

OUTCOMES

U.S. taxpayers made a profit on the financial rescue.

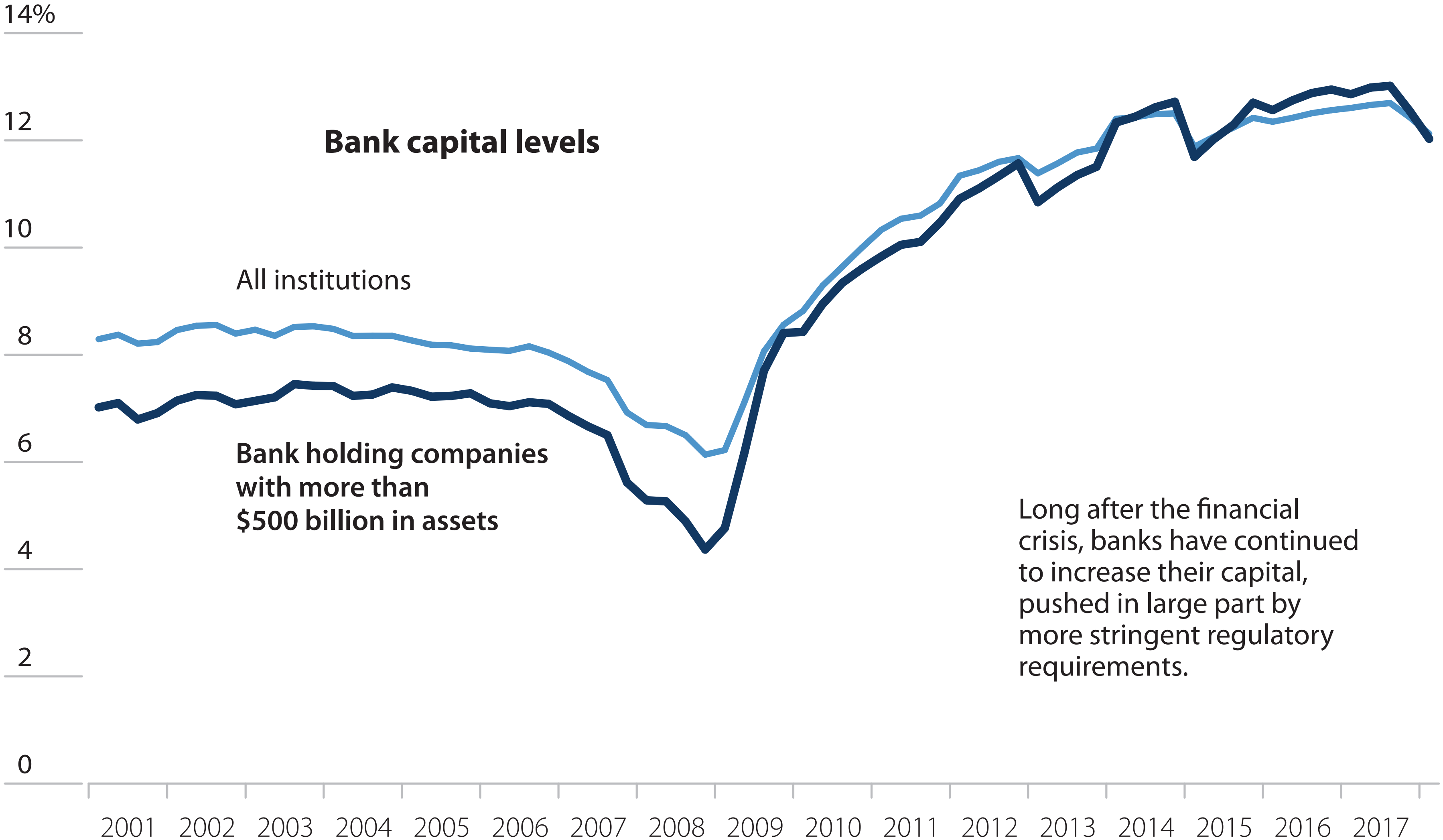
Income or cost of financial stability programs



Sources: Federal Deposit Insurance Corp.; Federal Housing Finance Agency; Federal Reserve Board; Webel and Labonte (2018); U.S. Treasury

Today the financial system has significantly more capital and would be better able to withstand losses in the event of a severe economic downturn.

CET1 and Tier 1 common equity as percent of risk-weighted assets

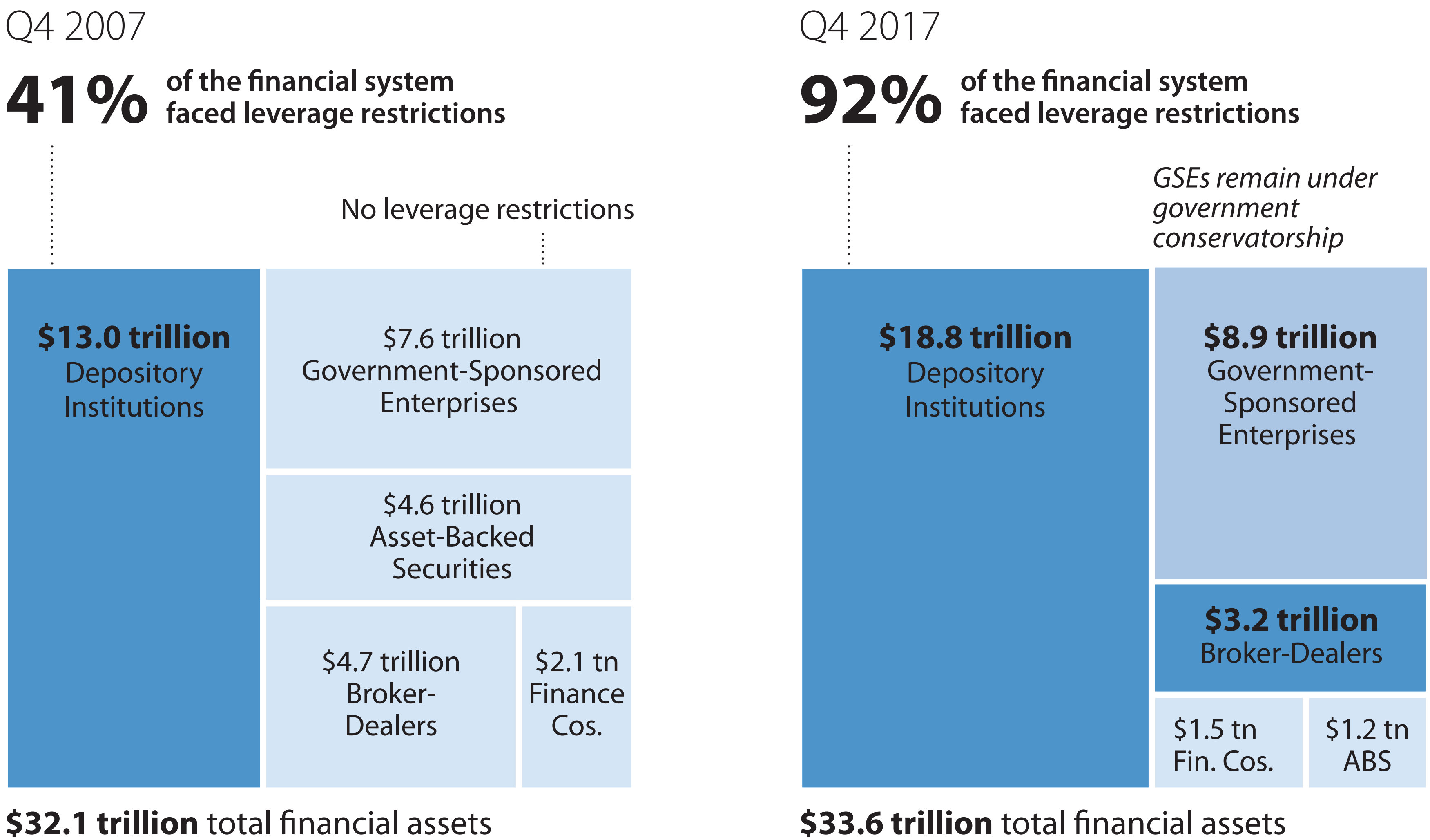


Note: Capital ratio is based on tier 1 common equity pre-2014 and common equity tier 1 (CET1) as of 2015, and is a combination of the two during 2014.

Source: Federal Reserve Bank of New York's Research and Statistics Group

OUTCOMES

Stronger regulations on capital are applied to a much broader share of the U.S. financial system.



Source: Federal Reserve Board Financial Accounts of the United States

Nonetheless, the emergency authorities available in the U.S. are still too limited to allow an effective response to a severe crisis.

PRE-CRISIS LIMITATIONS

- Limited reach of prudential limits on leverage
- Limited deposit insurance coverage
- No resolution authority for largest bank holding companies and nonbanks
- No ability to inject capital into financial firms
- No authority to stabilize GSEs

ESSENTIAL CRISIS AUTHORITIES

- Fed expanded lender of last resort
- Broader FDIC debt and money market fund guarantees
- GSE conservatorship
- Capital injections into financial firms

POST-CRISIS TOOLS

- Stronger capital requirements
- Stronger liquidity and funding requirements
- Living wills, bankruptcy, and resolution authority

POST-CRISIS LIMITATIONS

- Limitations on Fed lender of last resort
- No money market fund guarantees or FDIC debt guarantees without congressional action
- No authority to inject capital

This was a terribly damaging crisis. It did not need to be so bad.

The damage illustrates the costs of running a financial system with weak oversight, and of going into a crisis without the essential tools for aggressive early action to prevent disaster.

The recovery was slow and fragile, made slower by the premature shift to tighter fiscal policy.

Even after repairing the immediate damage, the U.S. economy still faces a number of longer-term challenges, with causes that predated the crisis.

Acronyms

ABCP	asset-backed commercial paper
ABS	asset-backed securities
AMLF	Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility
CAP	Capital Assistance Program
CDCI	Community Development Capital Initiative
CDS	credit default swaps
CET1	Common Equity Tier 1
CPFF	Commercial Paper Funding Facility
CPP	Capital Purchase Program
DGP	Debt Guarantee Program
DIF	Deposit Insurance Fund
EESA	Emergency Economic Stabilization Act of 2008
FDIC	Federal Deposit Insurance Corporation
FHA	Federal Housing Administration
FHFA	Federal Housing Finance Agency
GDP	gross domestic product
GSEs	government-sponsored enterprises
HAMP	Home Affordable Modification Program
HARP	Home Affordable Refinance Program
HUD	U.S. Department of Housing and Urban Development
Libor-OIS	London Interbank Offered Rate–Overnight Indexed Swap rate

Acronyms

MBS	mortgage-backed securities
MLEC	Master Liquidity Enhancement Conduit
MMFs	money market funds
NBER	National Bureau of Economic Research
PDCF	Primary Dealer Credit Facility
PPIP	Public-Private Investment Program
QE	Quantitative Easing
SAAR	seasonally adjusted annual rate
SBA 7(a)	Small Business Association Section 7(a) Securities Purchase Program
SCAP	Supervisory Capital Assessment Program
SDR	special drawing right
SPSPAs	Senior Preferred Stock Purchase Agreements
TAF	Term Auction Facility
TAGP	Transaction Account Guarantee Program
TALF	Term Asset-Backed Securities Loan Facility
TARP	Troubled Assets Relief Program
TLGP	Temporary Liquidity Guarantee Program
TSLF	Term Securities Lending Facility

Acknowledgments

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Data sources: Bloomberg Finance L.P.; the Center for Research in Security Prices at Chicago Booth; CoreLogic®, a property data and analytics company; Freddie Mac; Goldman Sachs; Haver Analytics; IHS Markit; iMoneyNet; Mortgage Bankers Association; Securities Industry and Financial Markets Association; SNL Financial; S&P Dow Jones Indices LLC; Standard & Poor's; S&P® and S&P 500® are registered trademarks of Standard & Poor's Financial Services LLC, and Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC. © 2017 S&P Dow Jones Indices LLC, its affiliates and/or its licensors. All rights reserved; U.S. Dept. of Housing and Urban Development; Wharton Research Data Services (WRDS).

Acknowledgments

Additional data sources: Bureau of Economic Analysis; Bureau of Labor Statistics; Congressional Budget Office; Congressional Oversight Panel; Council of Economic Advisers; Federal Deposit Insurance Corp.; Federal Housing Finance Agency; Federal Reserve Bank of New York Financial Crisis Policy Response Timeline; Federal Reserve Bank of New York's Research and Statistics Group; Federal Reserve Bank of Philadelphia; Federal Reserve Bank of St. Louis; Federal Reserve Bank of St. Louis Financial Crisis Policy Response Timeline; Federal Reserve Board; Federal Reserve Economic Data (FRED); International Monetary Fund; Macroeconomic Advisers®; Mishkin (1978); Organisation for Economic Co-operation and Development; U.S. Dept. of Treasury.

Notes

PAGE 5 Re-created with data underlying Figure 10, "The Distribution of Household Income, 2014," Congressional Budget Office (2018), www.cbo.gov/publication/53597. See link for definitions of income and income groups.

PAGE 10 Based on Figure 3.1, U.S. home price and related data, Robert J. Shiller, *Irrational Exuberance*, 3rd ed. (Princeton, NJ: Princeton University Press, 2015), as updated by the author, www.econ.yale.edu/~shiller/data.htm.

PAGE 11 Based on Figure 1, Panel 1, Michael Ahn, Michael Batty, and Ralf Meisenzahl, "Household Debt-to-Income Ratios in the Enhanced Financial Accounts," *FEDS Notes* (Washington, DC: Board of Governors of the Reserve System, January 11, 2018), https://doi.org/10.17016/2380-7172.2138.

PAGE 12 Based on Figure 4.1, Scott G. Alvarez, William Dudley, and J. Nellie Liang, "Nonbank Financial Institutions: New Vulnerabilities and Old Tools," in Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., with J. Nellie Liang, eds., *First Responders: Inside the U.S. Strategy for Fighting the 2007–2009 Global Financial Crisis* (New Haven: Yale University Press, 2020).

PAGE 13 Based on Exhibit 1, Gary Gorton and Andrew Metrick, "Who Ran on Repo?" (2012), http://faculty.som.yale.edu/garygorton/documents/whorancompleteoctober4.pdf.

Banks' portion includes net liabilities from federal funds agreements.

PAGE 28 Based on Figures 2.5 and 2.6, William English and Patricia Mosser, "The Use and Effectiveness of Conventional Liquidity Tools Early in the Financial Crisis," in Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., with J. Nellie Liang, eds. *First Responders: Inside the U.S. Strategy for Fighting the 2007–2009 Global Financial Crisis* (New Haven: Yale University Press, 2020).

Notes

PAGE 30 Based on Figure 3.7, Lorie Logan, William Nelson, and Patrick Parkinson, "The Fed's Novel Lender of Last Resort Programs," in Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., with J. Nellie Liang, eds., *First Responders: Inside the U.S. Strategy for Fighting the 2007–2009 Global Financial Crisis* (New Haven: Yale University Press, 2020).

PAGE 31 Based on Chart 5, Adam Ashcraft, Allan Malz, and Zoltan Pozsar, "The Federal Reserve's Term Asset-Backed Securities Loan Facility," *Federal Reserve Bank of New York Economic Policy Review* 18(3) (November 2012): 29-66, https://www.newyorkfed.org/medialibrary/media/research/epr/2012/EPRvol18n3.pdf.

PAGE 33 Based on Panel A, Lawrence Schmidt, Allan Timmermann, and Russ Wermers, "Runs on Money Market Mutual Funds," *American Economic Review* 106(9) (2016): 2625–57, www.aeaweb.org/articles?id=10.1257/aer.20140678.

PAGE 34 Based on Slide 4, "Reforming Wall Street, Protecting Main Street," U.S. Treasury, July 2012, www.treasury.gov/connect/blog/Documents/20120719_DFA_FINAL5.pdf.

PAGE 35 Commercial banks include depository institutions. Bank holding companies include bank holding companies, savings and loan holding companies, financial holding companies, and their funding affiliates. Nonbanks include nonbank entities and their affiliates, as well as bank holding companies with nonbank assets of nonbank subsidiaries comprising more than half of their total assets.

PAGE 41 Based on U.S. Treasury data and AIG infographic and timeline, www.treasury.gov/initiatives/financial-stability/TARP-Programs/aig/Pages/default.aspx.

PAGES 47, 48, 49 Based on Figure 16.3, Jason Furman, "The Fiscal Response to the Great Recession: Steps Taken, Paths Rejected, and Lessons for Next Time," in Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., with J. Nellie Liang, eds., *First Responders: Inside the U.S. Strategy for Fighting the 2007–2009 Global Financial Crisis* (New Haven: Yale University Press, 2020).

Notes

PAGE 53 Monthly mortgage-related securities issuance figures may not match annual figures reported by the Securities Industry and Financial Markets Association on its website owing to a methodological difference in the reporting of each series.

PAGE 54 Based on the figure "Mortgage Aid Extended More than 9.9 Million Times, Outpacing Foreclosures," December 2016 Housing Scorecard, www.hud.gov/sites/documents/SCORECARD_2016_12_508C.PDF.

PAGE 56 Some home owners may have participated in more than one program; the sum of home owners helped across all categories does not necessarily reflect the number of unique borrowers helped.

Based on Table 12.3, Michael Barr, Neel Kashkari, Andreas Lehnert, Phillip Swagel, "Crisis-Era Housing Programs," in Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., with J. Nellie Liang, eds., *First Responders: Inside the U.S. Strategy for Fighting the 2007–2009 Global Financial Crisis* (New Haven: Yale University Press, 2020).

PAGE 58 Maximum commitments were taken from Table 2, Linda S. Goldberg, Craig Kennedy, and Jason Miu, "Central Bank Dollar Swap Lines and Overseas Dollar Funding Costs," *Federal Reserve Bank of New York Economic Policy Review* 17(1) (May 2011): 3–20, www.newyorkfed.org/medialibrary/media/research/epr/11v17n1/1105gold.pdf.

PAGE 60 Based on Figure 17.9, Clay Lowery, Nathan Sheets, and Edwin (Ted) Truman, "International Coordination of Financial and Economic Policies," in Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., with J. Nellie Liang, eds., *First Responders: Inside the U.S. Strategy for Fighting the 2007–2009 Global Financial Crisis* (New Haven: Yale University Press, 2020).

PAGE 62 The stock market (NYSE/AMEX/NASDAQ/ARCA) is measured by total market value as reported by the Center for Research in Security Prices and is shown to financial crisis trough. House prices are shown to three years after peak. Household wealth is a comparison between the change in the annual average (in nominal terms) of household wealth from 1929 to 1930, and the change in the nominal level of household wealth from Q1 2008 to Q1 2009.

Notes

Estimates of real household net worth (wealth) during the Great Depression were taken from Table 1, Frederic S. Mishkin, "The Household Balance Sheet and the Great Depression," *The Journal of Economic History* 38(4) (December 1978): 918–37, www.jstor.org/stable/2118664.

PAGE 64 Guarantees: Reflects the U.S. Treasury's maximum commitments under the Temporary Guarantee Program for Money Market Funds and the FDIC's maximum commitments under the two components of the Temporary Liquidity Guarantee Program, the Debt Guarantee Program, and the Transaction Account Guarantee Program.

Troubled Assets Relief Program (TARP): Reflects principal outstanding for TARP programs including bank support programs, credit market programs, auto industry support, assistance to American International Group, and housing programs.

Federal Reserve Liquidity Programs: Reflects loan amounts outstanding under credit and liquidity programs established the Federal Reserve Board. These include discount window lending (primary credit, secondary credit, and seasonal credit), term auction credit, the Primary Dealer Credit Facility, the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, the Term Asset-Backed Securities Loan Facility, the Commercial Paper Funding Facility, and central bank liquidity swaps. Also reflects the value of outstanding securities lent through the Term Securities Lending Facility.

Other Programs: Reflects the Federal Reserve, FDIC, and Treasury's commitments under the Asset Guarantee Program; Federal Reserve Board assistance to Maiden Lane companies and support to American International Group; Treasury support for Fannie Mae and Freddie Mac through the senior preferred stock purchase agreements, as well as the face value of Treasury's total mortgage-backed securities (MBS) portfolio at the end of each month, from October 2008-March 2012.

Exposures via Treasury's Temporary Guarantee Program for Money Market Funds were taken from "Guarantees and Contingent Payments in TARP and Related Programs: Congressional Oversight Panel

Notes

November Oversight Report," Congressional Oversight Panel (November 2009), https://fraser.stlouisfed.org/title/5018.

Based on Figure 18.5, J. Nellie Liang, Margaret M. McConnell, and Phillip Swagel, "Evidence on Outcomes," in Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., with J. Nellie Liang, eds., *First Responders: Inside the U.S. Strategy for Fighting the 2007–2009 Global Financial Crisis* (New Haven: Yale University Press, 2020).

PAGE 69 Data for 63 financial crises in advanced economies, 1857 to 2013, were taken from Carmen Reinhart and Kenneth Rogoff, "Recovery from Financial Crises: Evidence from 100 Episodes," *American Economic Review: Papers & Proceedings* 104(5) (2014): 50–55, https://scholar.harvard.edu/files/rogoff/files/aer_104-5_50-55.pdf.

Based on Figure 18.3, J. Nellie Liang, Margaret M. McConnell, and Phillip Swagel, "Evidence on Outcomes," in Ben S. Bernanke, Timothy F. Geithner, and Henry M. Paulson, Jr., with J. Nellie Liang, eds., *First Responders: Inside the U.S. Strategy for Fighting the 2007–2009 Global Financial Crisis* (New Haven: Yale University Press, 2020).

PAGE 70 Based on Table 2 in Baird Webel and Marc Labonte, "Costs of Government Interventions in Response to the Financial Crisis: A Retrospective," Congressional Research Service (updated September 2018), https://fas.org/sgp/crs/misc/R43413.pdf.

All figures except otherwise noted are reported on a cash basis and as of Aug. 1, 2018. GSE debt purchases, DIF losses and cumulative income, and TAGP are as of Dec. 31, 2017; Maiden Lane is as of Jan. 31, 2018; and GSEs are as of Q2 2018.

PAGE 72 Depository institutions include U.S.-chartered depository institutions, foreign banking offices in the U.S., and credit unions.