What to Do about Fannie and Freddie: A Primer on Housing Finance Reform

The Macroeconomic Fallout of Shutting Down the Banking System

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In September 2008, the U.S. government took control of Fannie Mae and Freddie Mac, the two dominant entities in U.S. residential mortgage markets. The government placed Fannie and Freddie into a conservatorship, meant to be temporary to curtail the risk of financial contagion during the financial crisis, conserve the value of the companies, and return them to safe-and-sound condition. But as of mid-2020, the conservatorship persists. Fannie and Freddie together with other mortgage-finance institutions have been meeting several important goals over the past few years, arguably satisfying most households’ mortgage needs and, on balance, supporting financial stability. Even so, almost all policymakers, researchers, and industry advocates agree on the need to move to a system of mortgage finance in which the government plays a less direct role.

Jordan Rappaport reviews the current system of mortgage finance and analyzes the key issues policymakers face in reforming it, including what to do with Fannie and Freddie. Although policymakers have reached a rough consensus on several key issues, they disagree on the share of lending the government should backstop against widespread defaults and how many companies should have access to the backstop.

The Macroeconomic Fallout of Shutting Down the Banking System

By Qian Chen, Christoffer Koch, Gary Richardson, and Padma Sharma

During the 2008–09 financial crisis, the U.S. government arranged bailouts of major banks to prevent a suspension of bank deposits, where banks cease paying checks and refuse depositors’ requests to withdraw funds. Although these bailouts likely helped firms and households continue to make payments, they have been debated due to potential moral hazard concerns as well as the high cost to taxpayers. Assessing the costs and benefits of preventing deposit suspensions is difficult, as nationwide bank suspensions have not occurred since the Great Depression.

To circumvent this challenge, Qian Chen, Christoffer Koch, Gary Richardson, and Padma Sharma study the effects of more recent deposit suspensions at the state level (Nebraska in 1983, Ohio and Maryland in 1985, and Rhode Island in 1991). They find that the suspension in Rhode Island,
which occurred during a recession, lowered employment, gross state product, and per capital personal income. Their results suggest that interventions that prevent large deposit suspensions during recessions, such as those undertaken after 2008, are likely worth the costs. Effective interventions not only help avoid economic losses during recessions, but also prevent losses to output and employment several years into the future.

**Unconventional Monetary Policy and International Interest Rate Spillovers**

*By Karlye Dilts Stedman*

After the 2008 global financial crisis, advanced economies turned to unconventional monetary policies to provide additional monetary stimulus while short-term interest rates were constrained by their effective lower bound. However, the speed of economic recovery differed markedly among these economies, leading to differences in the timing and intensity of unconventional monetary policies across central banks. These differences may have generated “spillover effects” that undermined policy tightening in the United States after 2015.

Karlye Dilts Stedman assesses whether monetary policies from the European Central Bank, the Bank of Japan, and the Bank of England affect U.S. borrowing costs at and away from the effective lower bound. She finds evidence of spillovers from each of these central banks to the United States as well as evidence that these spillovers increased during the asynchronous withdrawal from unconventional monetary policy. Her results suggest that in the absence of international spillovers, long-term yields in the United States would have been higher than those observed at the end of 2017.

**Drought Risk to the Agriculture Sector**

*By David Rodziewicz and Jacob Dice*

Drought is a perennial and long-term risk that can negatively affect the farm economy through lower yields, loss of crops, reduced farm revenues, and lower sales for farm suppliers. As risks from climate change mount, understanding how drought will affect farmers across the country has become even more important. Drought risk can vary by region, crop type, and production method, and may disproportionately affect some farmers more than others. Although many farmers have crop insurance to protect against losses, insurance does not cover all of their crop’s value, and
even insured farmers face losses from drought. These losses can negatively affect farm finances, resulting in financial strain that may spill over into the broader agricultural economy.

David Rodziewicz and Jacob Dice analyze the relationship between county-level drought exposure and direct farmer losses (specifically, crop insurance deductibles) from 2000 to 2019. They find that farmer losses from drought vary by crop type: although losses rise steadily along with drought intensity for corn and wheat, losses spike noticeably in extreme drought for soybeans. These losses represent an economically relevant share of crop production values: farmer losses from extreme drought can reach 20 percent of production value for corn and wheat and 35 percent for soybeans.
In September 2008, amid collapsing home prices and soaring mortgage defaults, the U.S. government took control of Fannie Mae and Freddie Mac, the two dominant entities in U.S. residential mortgage markets. Specifically, the government placed Fannie and Freddie into a conservatorship, extending each a $100 billion line of credit and replacing their CEOs and boards of directors. This conservatorship was meant to be temporary to curtail the risk of financial contagion during the financial crisis, conserve the value of the companies, and return them to safe-and-sound condition. But as of mid-2020, more than 11 years later, the conservatorship persists.

The conservatorship together with other mortgage-finance institutions have been meeting several important goals over the past few years, arguably satisfying most households’ mortgage needs and, on balance, supporting financial stability. Even so, almost all policymakers, researchers, and industry advocates agree on the need to move to a system of mortgage finance in which the government plays a less direct role. Such a system might also better achieve certain goals such as holding down mortgage interest rates and boosting incentives to monitor mortgage credit quality.

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This primer reviews the current system of mortgage finance and analyzes the key issues policymakers face in reforming it, including what to do with Fannie and Freddie. While policymakers have reached a rough consensus on several key issues, such as allowing the government to continue to help some households finance purchasing homes, they disagree on the share of mortgage lending the government should backstop against widespread defaults and how many companies should have access to the backstop.

Section I reviews the U.S. system of financing mortgages for single-family homes in the years leading up to and during the conservatorship. Section II describes some strengths and weaknesses of the current system under the conservatorship. Section III discusses the extent to which the government should backstop residential mortgage lending and the number of companies that should succeed Fannie and Freddie.

I. The U.S. System of Mortgage Finance

Fannie Mae—formally, the Federal National Mortgage Association—was established as a federal government agency during the Great Depression to increase the supply of mortgage funds available across the country. Rather than lending to consumers directly, Fannie Mae purchased mortgage loans from private lenders, typically banks, in the “secondary” mortgage market. In doing so, Fannie Mae increased lenders’ funds so that they could extend new mortgage loans.

The loans Fannie Mae purchased were limited to those insured by the Federal Housing Administration (FHA), meaning the FHA covered any delinquent payments by borrowers and paid off mortgages in the event of foreclosure. Fannie Mae retained some of the loans it purchased and pooled others together to sell as securities. Private investors in these mortgage-backed securities (MBS) received monthly cash flows based on borrowers’ payments of principal and interest on the mortgages in the underlying pool. The FHA insurance, backed by a full-faith U.S. government guarantee, made these securities very low risk and therefore attractive to investors. Following World War II, Fannie also began purchasing loans insured by the recently formed Veterans Administration (VA).

Over the following decades, Fannie Mae went through a series of transformations. Most importantly, in 1968, Congress rechartered...
Fannie as a government-sponsored enterprise (GSE). Henceforth, Fannie Mae would be a for-profit, shareholder-owned company regulated by the Department of Housing and Urban Development, raising funds on public stock and bond markets while retaining its government mandate to increase liquidity in secondary mortgage markets. A new government organization known as Ginnie Mae (formally, the Government National Mortgage Association) took over the purchase and securitization of mortgages insured by the FHA and VA. Fannie, instead, would purchase only mortgages not insured by the federal government, which it would hold in portfolio. Mortgages eligible for purchase had to meet two legislated requirements: first, the loan principal had to fall below a proscribed maximum; second, borrowers had to either make a down payment above a certain threshold or purchase mortgage insurance that would pay Fannie if the borrowers defaulted. In addition to these requirements, Fannie itself imposed relatively conservative underwriting standards.

Two years later, in 1970, Congress chartered a second housing GSE, Freddie Mac (the Federal Home Loan Mortgage Corporation). Like Fannie, Freddie purchased eligible mortgages from lenders and imposed relatively conservative underwriting standards. But instead of holding these loans in portfolio, Freddie Mac pooled most of them into securities that it sold to investors. In return for a fee, Freddie Mac guaranteed investors that the securities would pay out as scheduled even if borrowers missed payments or defaulted. While Freddie Mac stated explicitly that this guarantee was not backed by the federal government, many investors nevertheless perceived the government’s sponsorship and regulation as implying that it would backstop Freddie rather than let it default on its obligations.

Securitizing mortgages proved more profitable than holding them in portfolio, so Fannie shifted to this model during the 1980s, as both its business and that of Freddie soared. The blue bars in Chart 1 show that MBS guaranteed by Fannie or Freddie increased from 7 percent of U.S. single-family mortgage debt in 1980 to 26 percent in 1990. The green bars, which add loans securitized by Ginnie Mae, show that MBS guaranteed by the three firms rose from 17 percent of single-family mortgage debt in 1980 to 41 percent in 1990. Most remaining single-family mortgage debt during the 1980s took the form of individual
Chart 1
Outstanding Mortgage Servicing

loans held in portfolio by banks and other financial institutions (yellow bars).

The orange bars in Chart 1 show that “private-label” securities became increasingly popular during the 1990s, as Fannie and Freddie’s success begot increasing competition from investment banks. Rather than guaranteeing payments, investment banks issued MBS that were split into different tranches of seniority: more junior tranches, which paid a higher interest rate, absorbed any delinquencies and defaults before the more senior tranches. Some of these private-label securities bundled “jumbo” loans—which had principal above the conforming limit—made to households with good credit. Others bundled “Alt-A” loans to households unable to sufficiently document a steady source of income and “subprime” loans to households with poorer credit. The private-label securities, including their most senior tranches, paid a higher interest rate than Fannie and Freddie securities, compensating investors for the riskiness of the loans and the lack of a perceived government guarantee.

Partly in response to the competition from private investment banks, Fannie and Freddie took on increasing risk during the early 2000s. For example, the share of mortgage loans Fannie and Freddie
purchased that had down payments of 10 percent or less of the home’s appraised value increased substantially from 2003 to 2007, as did the share of mortgages with nonstandard features such as an initial period during which principal payments were not required (Frame and others 2015). At the same time, borrowers began increasingly relying on a second mortgage to make the down payment on a first mortgage, increasing their indebtedness and thus their risk of default (Davis and others 2019). In addition, Fannie and Freddie bulked up their portfolio holdings of risky Alt-A and subprime MBS, which they judged to be especially profitable. Notwithstanding this shift to a riskier business strategy, Fannie and Freddie continued to hold relatively shallow capital buffers to absorb losses, rationalized by the low historical default rates of loans they had previously securitized. Defaults remained low during the early 2000s, reflecting fast home price growth propelled in part by relaxed mortgage lending standards.

The undercapitalization of Fannie and Freddie, the increased riskiness of their portfolios, and the increasingly risky loans they guaranteed were made possible by lax regulation and investors’ inattention to the firms’ creditworthiness. First, Fannie and Freddie’s safety-and-soundness regulator at the time, the Office of Federal Housing Enterprise Oversight (OFHEO), lacked the authority to set capital standards or place Fannie and Freddie into bankruptcy. In addition, the OFHEO was funded by congressional appropriations and so subject to influence by elected officials, who typically favored more relaxed lending standards (Frame and others 2015). Second, most investors believed that the federal government would backstop Fannie and Freddie against default, partly reflecting the government’s sponsorship and regulatory oversight and partly reflecting that the expected financial damage from a default by Fannie or Freddie made them “too big to fail.” This belief in an implicit government backstop dulled investors’ incentive to monitor whether Fannie and Freddie could meet their debt and MBS guarantee obligations and thus removed an important incentive for Fannie and Freddie to temper risk-taking. Estimates suggest that without the implicit backstop, Fannie and Freddie would have had to pay interest rates on their debt that were 20 to 40 basis points (0.2 to 0.4 percentage point) higher (Frame and others 2015).
Home prices peaked in mid-2006 and then began sharply contracting in early 2007, eventually provoking a wave of mortgage defaults that threatened Fannie and Freddie’s solvency. In response, the government placed both firms into a conservatorship on September 6, 2008. Specifically, Fannie and Freddie were placed under the control of a recently created regulator, the Federal Housing Financing Agency (FHFA), which immediately replaced the chief executives and directors of each firm. The goal of the conservatorship was to ensure Fannie and Freddie would continue to meet their guarantee and debt obligations as well as continue to purchase and securitize residential mortgages. To make this possible, the U.S. Treasury agreed to inject up to $100 billion in cash to each enterprise (later doubled to $200 billion) as needed to keep them solvent, in effect making the implicit guarantee explicit. In return for these injections, Fannie and Freddie issued senior preferred stock to the Treasury that paid a 10 percent dividend and gave warrants to the Treasury to purchase common stock equivalent to 79.9 percent of each company. The firms also agreed to pay an unspecified fee to the government for its funding commitment.

Over the remainder of 2008 through the first quarter of 2012, Fannie and Freddie together drew $187.5 billion from the Treasury. The firms used a portion of these draws to pay the required dividend; in other words, Fannie and Freddie used injections from the Treasury to pay the Treasury. Partly to stop this circularity, the FHFA modified the preferred stock purchase agreement in mid-2012: instead of paying the 10 percent dividend, Fannie and Freddie would henceforth pay any profits they earned to the Treasury. This “income sweep” also prevented the firms from building a capital base from retained earnings, which became especially relevant as house prices stabilized and then began increasing. As a result of the modified agreement, Fannie and Freddie together paid the Treasury $301 billion in cumulative profits through the end of 2019.

Fannie and Freddie remain the two most dominant entities in single-family residential finance, together guaranteeing almost half of newly originated mortgages in 2018. Including loans insured by the FHA, VA, and U.S. Department of Agriculture (USDA), the federal government directly controls entities guaranteeing more than two-thirds of single-family residential lending.
II. **Strengths and Weaknesses of the Current System**

The government’s direct control of the majority of residential mortgage funding has concerned policymakers for a variety of reasons, including possible lack of competition, mispricing of credit, inefficiencies, and excessive taxpayer-financed support. However, unwinding the conservatorship has proved challenging. Any mortgage-finance system that replaces it will need to balance five competing goals: meeting households’ mortgage credit needs, holding down taxpayer support, supporting financial stability, maintaining the flow of new mortgage credit during financial crises, and improving access to affordable housing for low- and moderate-income (LMI) households. The current system under the conservatorship has several strengths when it comes to meeting these goals; it also has some weaknesses that reforms may be able to address.

**Meeting households’ mortgage credit needs**

The current system of U.S. mortgage finance under the conservatorship and government-insured lending appears, on balance, to be meeting the mortgage needs of most middle-income households. In particular, it lowers interest rates on backstopped mortgages, contributes to the viability of long-term fixed-rate mortgages, and arguably lets most households with at least moderate creditworthiness access mortgage borrowing. To be sure, high housing prices have made purchasing a home a steep financial challenge. But down-payment requirements for FHA loans are low, making the affordability of monthly payments the primary borrowing constraint.

One way the current system lowers mortgage interest rates is by eliminating default risk. Specifically, the full-faith U.S. government backstop drives high demand for agency MBS—those guaranteed by Fannie, Freddie, or Ginnie—by risk-adverse investors such as insurance firms and foreign central banks. This high demand increases the market value of individual mortgages eligible to be included in the underlying pools, in turn allowing lenders to offer lower interest rates to households. When credit markets are functioning normally, this channel is estimated to lower interest rates on conforming mortgages by 30 basis points relative to rates on ineligible mortgages (Scharfstein and Swagel 2016; Frame and others 2015). During periods of financial stress,
this channel lowers relative interest rates on conforming mortgages by somewhat more.

In eliminating default risk, the backstop also lowers borrower interest rates by increasing the market liquidity of agency securities. The liquidity of a market—the ease of matching buyers and sellers—depends on the substitutability of the traded securities. For some securities, such as a specific company’s common stock, the traded shares are identical and thus considered perfect substitutes. In contrast, agency MBS with the same identifying characteristics—such as the specific guarantor (Fannie, Freddie, or Ginnie), interest rate on face value, and maturity—are not identical: instead, each security represents a different mortgage pool made up of multiple individual loans. By eliminating default risk, the backstop allows investors to trade agency MBS with the same identifying characteristics without scrutinizing the credit quality of underlying pools. The resulting substitutability has been sufficiently high to make the agency MBS market one of the most liquid in the world. Chart 2 shows that the average daily trading volume of agency MBS, a measure of liquidity, dwarfs the daily volume of U.S. corporate and municipal securities. Estimates suggest that this high liquidity lowers borrower interest rates by 10 to 25 basis points during normal times and by somewhat more during times of financial stress (Vickery and Wright 2013).

In addition to lowering interest rates, the high liquidity of the agency market also contributes to the viability of long-term fixed-rate mortgages, which are far and away the most popular mortgage type in the United States but are widely available in only one other country, Denmark (Wachter and Tracy 2016; Wachter 2018). For a depository institution, lending at a fixed interest rate for a long duration, such as 30 years, incurs high risk: rising rates can considerably lower the value of such loans, thereby eroding the depository’s capital base. An important feature of long-term fixed-rate mortgages in the United States—borrowers’ ability to pay down principal before scheduled without a penalty—exacerbates this interest rate risk. Because of the prepay option, borrowers often refinance their mortgages following declines in interest rates, eliminating lenders’ potential to profit from downswings. However, the high liquidity of the agency market allows U.S. lenders to immediately and inexpensively offload interest-rate and
prepayment risks, boosting lenders’ willingness to originate long-term fixed-rate mortgages (Fuster and Vickery 2015; Kanojia and Grant 2016). In contrast, mortgages in almost all other countries are characterized by shorter maturities, variable interest rates, and significant penalties for early payoff.

Finally, middle-income households arguably retain ample access to mortgage credit under the current system, though not necessarily because of the government backstop. In 2019, for example, 72 percent of U.S. adults with a credit history had sufficient credit to qualify for a mortgage (Housing Finance Policy Center 2020; Dornhelm 2019). Similarly, income requirements have remained moderate relative to loan amounts, allowing households to take on considerable debt. For example, the median debt service-to-income (DTI) ratio of households that purchased a home in 2019—the sum of monthly payments on all of a household’s borrowing relative to the household’s pre-tax monthly income—was 39 percent (Housing Finance Policy Center 2020). Down-payment requirements have also remained moderate relative to home purchase prices. The median cash down payment in 2019 was 6 percent of a home’s purchase price, and loans insured by the FHA
required a down payment of only 3.5 percent (Housing Finance Policy Center 2020).\textsuperscript{8}

A possible weakness of the current system’s ability to meet households’ mortgage needs is its lack of competition. The government directly controls all of the agencies with access to its backstop, dulling their incentives to compete. A lack of competition may allow Fannie and Freddie to operate inefficiently, increasing guarantee fees paid by lenders, and, in turn, increasing interest rates as lenders pass these fees on to borrowers. Moreover, a lack of competition may allow Fannie and Freddie to become complacent, depressing the innovation of new mortgage products.\textsuperscript{9}

**Minimizing taxpayer-financed support**

The current system has had mixed success achieving a second key goal of mortgage finance: minimizing taxpayer-financed spending, especially by reducing the collective liability associated with widespread mortgage defaults. The FHA has largely been successful in controlling costs to the taxpayer. Due to the insurance reserve it maintains, funded by an upfront fee on mortgage originations and a continuing annual fee on unpaid balances, the FHA has only needed to draw from the Treasury once—in 2013 for a relatively modest $1.7 billion—to meet its expected losses. But Fannie and Freddie have been less successful in achieving this goal. Together, the two agencies drew more than $187 billion from the Treasury during the financial crisis. While Fannie and Freddie have since paid the government more than $300 billion in dividend payments, the Treasury continues to guarantee $5 trillion of their outstanding single-family MBS.

In recent years, the FHFA has directed Fannie and Freddie to put in place buffers that can absorb large losses. To do so, in 2013 Fannie and Freddie began contracting with private investors, reinsurance companies, and lending banks to cover losses when mortgages in the pools backing MBS default. These “credit risk transfers” (CRTs) include securities Fannie and Freddie sell to private investors, from whom they receive principal payments when mortgages default; reinsurance, which Fannie and Freddie purchase on pools of mortgages; and lender recourse, in which the originators of mortgages retain a portion of the default risk.\textsuperscript{10}
However, as of the end of 2019, the value of CRTs for single-family mortgages was only about 2 percent of Fannie and Freddie’s outstanding guarantees, which is unlikely to cover losses in the event of widespread mortgage defaults. During the Great Recession, Fannie and Freddie’s losses on single-family mortgages approximated 5 percent of guaranteed value. Taking into account the higher credit quality of recently securitized single-family mortgages, a crisis similar in magnitude to 2007–10 would likely entail losses approximating 3 percent of guaranteed value (Goodman and Zhu 2013). Moreover, during periods of financial stress, investor demand for CRTs is likely to wane, forcing Fannie and Freddie to rely primarily on their own capital to make new guarantees.

**Financial stability**

The current mortgage-finance system also has some strengths in addressing the goal of financial stability. Most importantly, the full-faith government guarantee of MBS issued by Fannie and Freddie and loans insured by the FHA, VA, or USDA—together with their high combined market share—greatly diminishes the possibility that widespread mortgage defaults would seize up financial markets. The vast aggregate value of U.S. residential mortgage debt, approximately $11 trillion in 2018, is held in large quantities by numerous financial institutions. During periods when mortgages are rapidly defaulting, investors may fear the solvency of financial institutions holding considerable mortgage debt and thus be less willing to trade with them. These fears can quickly multiply to include, for example, the solvency of financial institutions that hold little mortgage debt themselves but lend to other institutions that do. Concerns about financial markets seizing in this manner helped drive the Treasury’s 2008 decision to rescue Fannie and Freddie. Backstopping a large share of single-family lending lowers the amount of risky mortgage assets held by financial institutions, making markets less likely to seize.

A potential weakness of the current system in terms of financial stability are the dulled incentives to monitor Fannie and Freddie’s credit quality (described in Section I). However, the credit quality of Fannie and Freddie’s loan pools as of mid-2020 appear to remain high. One reason for this relatively high credit quality may be the political pressure to avoid another rescue and the associated careful scrutiny by the
FHFA. A second reason may be careful scrutiny by investors in Fannie and Freddie’s CRTs. A third reason may be lenders’ caution to avoid liabilities for poor underwriting, which regulators imposed following the housing crisis.

**Maintaining the flow of new mortgage credit during periods of financial stress**

Another strength of the current system is that the government backstop critically contributes to keeping new mortgage credit flowing when financial markets are stressed, helping to stave off a collapse of residential investment. Maintaining the flow of mortgage credit also helps transmit monetary policy easing, allowing homeowners to refinance at lower interest rates. Currently, backstopped lending can quickly scale up to meet most demand for mortgage lending. During the financial crisis, mortgages insured by the FHA, VA, or USDA, together with mortgages securitized by Fannie or Freddie, nearly doubled in value. Chart 3 shows that from 2006 to 2009, the share of origination value accounted for by these mortgages jumped from 35 to 97 percent.14

A corresponding weakness, however, is that a significant share of the ramped-up lending during times of financial stress may be for unduly risky transactions. For example, Fannie and Freddie significantly increased mortgage purchases in the year leading up to the financial crisis to replace withdrawn funding from other channels. Loans with approximately 12 percent of the value of the ramped-up purchases eventually defaulted, up from less than 2 percent of the value of loans purchased by Fannie and Freddie in each year from 1999 through 2002 (Goodman and Zhu 2013).

**Access to affordable housing**

Finally, the current system of backstopped lending provides some support for affordable housing for LMI households. The FHA, for example, has historically focused on insuring loans to first-time homebuyers, LMI households, and households with credit histories that make them ineligible for Fannie and Freddie securitization (Congressional Research Service 2019). For these mortgages, the FHA requires a down payment of just 3.5 percent. In addition, Fannie and Freddie have long had to meet annual affordable housing goals specifying a minimum share of securitized mortgages that fund the purchase of single-family
homes occupied by LMI households or located in LMI neighborhoods. In 2015, Fannie and Freddie also began collecting a small fee for use by government agencies supporting affordable housing. In 2016, they were obligated with a “duty to serve” LMI households in several underserved markets, for example by encouraging lenders to extend mortgage financing and liaising with housing development organizations.

Despite this support, the success of the current mortgage-finance system in improving access to affordable housing by LMI households is unclear. On the one hand, FHA insurance and guarantees by Fannie and Freddie have helped millions of LMI households obtain mortgage financing. On the other hand, single-family home prices remain high for many households, in part reflecting the current system’s widespread access to mortgage financing. Renting an apartment is typically less expensive and thus may be a better option for many LMI households. Lending programs focused on increasing the supply of less-expensive rental apartments may be more effective in improving LMI households’ access to affordable housing than lending programs focused on improving LMI households’ access to mortgage financing. The FHA, Fannie, and Freddie currently have a number of such programs.
III. Reforming Mortgage Finance

Many of the strengths of the current system of mortgage finance—including relatively low borrower interest rates, the widespread availability of long-term fixed-rate mortgages, and the continued flow of new credit during periods of financial stress—at least partly depend on the government backstop. Thus, any plan to end the conservatorship will likely retain at least a portion of it. However, questions remain over the appropriate “footprint” of the government backstop as well as how many guarantors—entities such as Fannie and Freddie that guarantee monthly MBS payments to bondholders—should have access to it. The answers to these questions will determine how successful any new system of mortgage finance will be in meeting the five goals discussed in the previous section.

The backstop footprint

A broad consensus holds that the government should continue to backstop at least some residential mortgage debt (Wachter 2018; Bright and DeMarco 2016; Wallison and Pinto 2018; Fisher and others 2018). But policymakers disagree on the ideal size of the backstop footprint. The current footprint constitutes mortgage-backed securities guaranteed by Fannie and Freddie as well as government-insured lending via the FHA, VA, or USDA. Most remaining residential mortgages are either held in portfolio by financial institutions or securitized in private-label offerings.

The size of the backstop footprint relative to other mortgage lending is primarily determined by three factors: eligibility criteria for backstopped loans, capital requirements for existing or new guarantors, and fees the government charges guarantors, lenders, and households for access to the backstop. Tight eligibility criteria, high capital requirements, and high government fees narrow the footprint. Relaxed eligibility criteria, low capital requirements, and low government fees broaden it. The three factors indirectly affect mortgage-finance goals by increasing or decreasing the size of the footprint. However, they each also directly affect mortgage-finance goals, possibly offsetting their indirect effects through the size of the footprint.
Eligibility criteria help determine the backstop footprint by including or excluding specific types of households, risk profiles, and loan purposes in backstopped lending. Some reformers have proposed adjusting eligibility criteria to explicitly limit the backstop footprint—for example, by excluding loans to purchase a vacation home, purchase a home as an investment, or refinance an existing mortgage while increasing the loan principal.

Capital requirements and government fees also help determine the backstop footprint by making backstopped lending more or less competitive relative to non-backstopped lending. Higher capital requirements and government fees increase the charges Fannie and Freddie collect from borrower payments before passing the remaining cash flow on to investors; these higher charges are, in turn, passed on to individual borrowers in the form of higher interest rates. Higher interest rates make backstopped loans less competitive, thereby decreasing their market share. Similarly, higher insurance fees on mortgages backed by the FHA, VA, or USDA increase their effective cost to borrowers, lowering the competitiveness of these loans relative to loans funded through non-backstopped channels, thereby decreasing their market share.

As noted in the previous section, a broad government backstop contributes positively to several mortgage-finance goals. First, a broad backstop implies that a large share of homeowners enjoy the lower mortgage interest rates made possible by the government guarantee. Second, a broad backstop helps maintain the widespread availability of long-term fixed-rate mortgages. Third, a broad backstop has sufficient baseline capacity to quickly ramp up funding when other channels of mortgage credit dry up, thereby keeping new mortgage credit flowing during a financial crisis. Fourth, a broad backstop supports financial stability by lowering investors’ aggregate exposure to widespread mortgage defaults.

However, policymakers may prefer a somewhat smaller footprint to encourage competition with respect to innovation and interest rates, thereby better meeting households’ mortgage needs. This competition may be among guarantors and government agencies within the backstop footprint, among private financial firms operating outside the footprint, and between those operating inside the footprint and those operating outside of it. An especially broad footprint would limit
competition only to guarantors and government agencies. An especially narrow footprint would limit competition only to financial firms. The ideal footprint probably lies between these extremes, allowing for all three forms of competition.

An intermediate-sized footprint, rather than a narrow one, may better meet the goal of limiting taxpayer-funded spending on mortgage finance. Although a narrow footprint would minimize explicitly obligated government outlays, it may on net lead to greater total outlays in the event of a financial crisis. In 2008, for example, the threat of severe financial consequences motivated the government to rescue Fannie and Freddie even though it was not obligated to do so. Expectations of a similar government rescue may undermine the future incentive of investors and originators to monitor credit risk outside the explicit footprint. A broader explicit footprint that lowers the amount of mortgage debt remaining outside of it would lessen the financial damage from widespread defaults on this remaining debt. Lower damage increases the credibility that the government will refrain from rescuing investors in non-backstopped mortgages. Such investors thus have greater incentive to scrutinize loan quality, in turn causing originators to apply higher credit standards and lessening the probability of widespread defaults. In addition, keeping the backstop explicit, as under the conservatorship, rather than implicit, as it was previously, would allow the government to charge guarantors a fee for providing it, thereby limiting net taxpayer outlays.

The three determinants of the backstop footprint—eligibility criteria, capital requirements, and government fees—also have their own, independent effects on mortgage-finance goals that may work in the opposite direction of their indirect effects through the size of the footprint. For example, tighter eligibility criteria for loans included in backstopped MBS may directly increase financial stability by requiring characteristics that make default less likely, such as a high credit score, large down payment, and low ratio of debt payments to income. But as described previously, tighter eligibility criteria also decrease the size of the backstop footprint, possibly lowering financial stability indirectly. Similarly, deep capital buffers allow guarantors to absorb widespread defaults, strengthening financial stability and lowering expected taxpayer support. But deep capital buffers also make backstopped funding more expensive
and so diminish the backstop footprint, possibly contributing to lower stability and higher taxpayer support. A consensus view on balancing this latter tension is that capital buffers should be sufficiently deep to absorb losses under almost all circumstances, leaving the government backstop to cover only “catastrophic” risk such as a surge in borrower defaults similar to what occurred in 2007–10 (Wachter and Tracy 2016; Scharfstein and Swagel 2016).

The number of guarantors

Several reform proposals seek to spur additional competition within the backstop footprint by increasing the number of guarantors. Doing so, however, potentially threatens the current system’s high liquidity, undermining some of its key strengths. The liquidity of an asset partly depends on the value of the asset that is outstanding and the number of investors who own it. For example, Fannie Mae’s MBS have historically traded at a slight premium to Freddie Mac’s MBS, reflecting an outstanding value that has remained about 50 percent larger (Layton 2019).

One way to avoid decreased liquidity is to make different guarantors’ MBS almost perfectly substitutable, allowing them to be traded interchangeably (that is, without knowing the identity of the guarantor). Fannie and Freddie, at the direction of the FHFA, achieved this interchangeability in mid-2019. For new guarantors to achieve the same interchangeability, they would also need to eliminate default risk (as described in Section II). In addition, new guarantors would need to closely align the prepayment risk of their securities with those of Fannie and Freddie—that is, the probability that borrowers will refinance after interest rates decline, hurting the return to investors. If the prepayment risk instead significantly differs among guarantors’ securities, investors will demand to know the identity of the guarantor before purchasing an MBS.

Maintaining interchangeability with just Fannie and Freddie as guarantors presents a considerable challenge. To help do so, the FHFA closely monitors prepayment rates and issues guidance on pooling practices (FHFA 2019a, 2019b). Maintaining interchangeability among even a few more guarantors may not be possible, especially if the guarantors differentiate themselves by focusing their purchases on mortgages originated in specific lending markets across which prepayment
risks diverge (Wachter 2018). For example, prepayment rates may vary by geographic region, reflecting differences in home price movements and borrower demographics. Indeed, the challenge of maintaining interchangeability has contributed to reform proposals calling for a single guarantor to succeed Freddie and Fannie, which would purchase government reinsurance against systematic credit events and be closely regulated along the lines of a monopoly utility (Mosser, Tracy, and Wright 2013; Parrott and others 2016; Wachter and McCoy 2016).

A possible alternative way to maintain high liquidity with multiple guarantors is to combine mortgage pools created by each into a single traded MBS, similar to how Ginnie Mae securitizes loans insured by the FHA, VA, or USDA (Bright and DeMarco 2016). In this context, it is helpful to think of the individual guarantors as issuers of pooled mortgages, which they originate themselves or purchase from other lenders. Each month, hundreds of these issuers contribute mortgage pools that Ginnie Mae bundles into a single MBS and prorates back to the issuers to sell. The issuers service the mortgages they pool, collecting monthly principal and interest payments from borrowers and remitting them to holders of the bundled Ginnie MBS. Like Fannie and Freddie, the issuers promise to make such remittances regardless of whether the borrowers pay. Ginnie Mae provides a second-level guarantee to make these remittances in case issuers fail to do so. The issuers and Ginnie Mae can hold relatively shallow capital buffers compared with Fannie and Freddie because they need only to temporarily cover cash shortfalls until either borrowers fix their arrears or the insuring government agency covers the missed payments and purchases the defaulted mortgage.

This system of multiple issuers providing a first-level guarantee and a bundling organization providing a second-level one could be adapted to bundle pools of uninsured mortgages. To do so successfully, issuers and bundling organizations would need to hold considerably larger capital buffers than under the current Ginnie Mae system, reflecting the requirements to permanently rather than temporarily cover borrower arrears and to purchase defaulted mortgages. The deeper capital buffers would likely need to include significant credit transfers to additional private investors, reinsurance companies, and lending banks. A government backstop of the bundled MBS would serve as a third-level guarantee that completely eliminates default risk.19
The ideal number of guarantors thus depends on whether guarantors issue MBS that are sufficiently substitutable to be interchangeable or instead issue pools of mortgages that a second-level guarantor bundles into a single MBS. The first option, which would likely require no more than a few guarantors, has the advantage of being similar to the present system, thus minimizing possible disruptions and unforeseen consequences. The second option, which would allow for numerous first-level guarantors, promises more competition while achieving perfect substitutability in the secondary market. An intermediate solution—with a moderate number of guarantors issuing MBS—is unlikely to be successful, as such a system would struggle to achieve interchangeability, thereby diminishing liquidity, increasing borrower interest rates, and possibly threatening the widespread availability of fixed-rate long-term mortgages.

**Conclusion**

More than 11 years after the onset of the 2007–08 financial crisis, the U.S. government continues to directly control the two most dominant firms in U.S. residential markets, Fannie Mae and Freddie Mac. Including the activity of the FHA, VA, and USDA, the U.S. government currently backstops more than two-thirds of newly originated single-family mortgages. Although the current setup appears on balance to meet households’ mortgage needs, a reformed system of mortgage finance may be better able to achieve certain goals, including holding down mortgage interest rates and lowering expected taxpayer support.

In balancing goals, proposed reforms must address two key questions: how broadly the backstop footprint should extend and how many guarantors it should include. An intermediate-sized footprint will likely maintain many of the strengths of the current system while encouraging competition with respect to innovation and interest rates. The number of guarantors is more difficult to determine. If these guarantors continue to issue their own MBS, the number will need to be limited to maintain the present system’s high liquidity. This option would also minimize the risks associated with large-scale reforms. However, if guarantors issue mortgage pools that are bundled into a single MBS, many more guarantors could be accommodated, maintaining high liquidity while possibly increasing competition with respect to innovation and interest rates.
Of course, reforms may also address several other concerns, from improving LMI households’ access to affordable housing, to implementing and enforcing regulation, to smoothing the transition to the reformed system. Reaching legislative consensus on how to address these concerns while meeting households’ mortgage credit needs, holding down taxpayer support, supporting financial stability, and maintaining the flow of new mortgage credit during financial crises represents a steep challenge, especially to the extent that the current setup is perceived to be working satisfactorily. For this reason, the system of mortgage finance that emerges after the conservatorship may look similar to the current setup.
Endnotes

1Ginnie Mae began securitizing mortgages insured by the U.S. Department of Agriculture Rural Housing Service in the mid-1990s. It also currently securitizes a small number of mortgages insured by the Department of Housing and Urban Development’s Office of Public and Indian Housing.

2Single-family homes are those in which a physical structure includes only one housing unit. Physical structures are considered distinct from each other if they are separated by a ground-to-roof wall and do not share heating, air-conditioning, and other utilities. Thus, some row houses and townhouses are considered single family. Fannie and Freddie classify some MBS as single family that include mortgages on housing structures with two to four units and mortgages on individual condominium and cooperative units in multifamily buildings.

3A secondary mortgage is subordinate to a first mortgage in the sense that any proceeds from the sale of a foreclosed home go first to pay off the primary mortgage. However, a homeowner’s decision to default typically depends on the combined servicing costs and unpaid principal of both mortgages.

4Strong evidence supports that profitability was the main motivation for Fannie and Freddie’s purchases of Alt-A and subprime MBS (Financial Crisis Inquiry Commission 2011). However, Wallison (2011) presents a dissenting view, suggesting the purchases were primarily to meet affordable housing goals set by Fannie and Freddie’s regulator.

5Fannie Mae drew down an additional $3.7 billion in 2017.

6The agency market is made up of a number of submarkets. Until recently, Fannie, Freddie, and Ginnie MBS traded in separate submarkets. (Starting in mid-2019, newly issued Fannie and Freddie MBS traded on the same market.) Each of these submarkets is further divided based on MBS maturity (15, 20, or 30 years) and coupon rate (interest rate on the face value of the MBS, denominated in 50 basis point increments).

7Lenders typically use FICO scores as a measure of a person’s creditworthiness. The 10th percentile FICO score on newly originated mortgages to purchase a home, which I use as a lower-bound measure of the creditworthiness to qualify for a mortgage, hovered near 650 from 2014 through 2019 (Housing Finance Policy Center 2020). Among persons with sufficient previous commercial borrowing to calculate a FICO score, 72 percent received a score of 650 or higher in 2019 (Dornhelm 2019). A large share of those with scores below 650 had significant credit blemishes such as having been at least 90 days late over the previous two years on a credit card, auto finance, or real estate loan.

8The cash down-payment median of 6 percent in 2019 corresponds to a combined loan-to-value (LTV) median of 94 percent. The combined LTV measures the sum of the principal borrowed from first and second mortgages relative to the purchase price of a home.
To be sure, several important innovations took place during the conservatorship. For example, Fannie and Freddie introduced a new investment product in 2013 that let them transfer a significant portion of MBS credit risk to private investors.

The principal payments from CRT investors are pre-funded in the sense that Fannie and Freddie reduce future cash flow payments to investors rather than actually collecting new funds.

As of the fourth quarter of 2019, Freddie Mac had in force CRTs equal to 2.3 percent of its outstanding single-family MBS (Freddie Mac 2020). Data to calculate the comparable 2019 coverage for Fannie Mae were not available. From 2013 to 2018, cumulative CRTs on single-family mortgages equaled 2.1 percent of Freddie’s single-family MBS issuance and 1.5 percent of Fannie’s single-family MBS issuance, with a combined share of 1.7 percent. But a portion of these CRTs and the corresponding mortgage pools was paid down during this period. In 2018, Freddie and Fannie transferred credit risk equal to 3.6 percent and 2.4 percent, respectively, of their single-family MBS issuance, implying a combined share of 2.8 percent (FHFA 2019c).

Estimated losses are for mortgages securitized in 2007, the vintage that performed worst.

Following the escalation of the COVID-19 pandemic in February 2020, fears that agency MBS would default appear to have been minimal. While the interest-rate spread of agency MBS over matched-duration Treasuries spiked in mid-March, this largely reflected short-term liquidity conditions as bond funds sold off a wide range of assets to meet investor redemptions. As of early May, agency MBS spreads have fallen back to their level prior to the pandemic. The government backstop has likely played an important role in preventing a longer-term increase in the agency spread, as have large-scale purchases of agency MBS by the Federal Reserve.

The extent to which the government backstop is keeping new mortgage credit flowing during the COVID-19 pandemic is less clear. Surveys suggest that credit standards for mortgages eligible to be insured by the FHA or for purchase by Fannie and Freddie have tightened, though by considerably less than for loans with principal above the eligibility limit. The tightening for eligible mortgages partly reflects increased uncertainty about households’ income rather than financing conditions per se. It also partly reflects government mandates that allow borrowers of mortgages insured by FHA or securitized by Fannie or Freddie to receive forbearance on monthly payments of principal and interest. Firms that service the loans in Fannie and Freddie pools, many of which originate such loans, must cover skipped payments for four months before Fannie or Freddie will. Originators intending to sell loans to Fannie and Freddie face the risk that new loans will go into forbearance before they do, in which case the originator would either incur losses from the missed payments or pay a significant penalty fee when selling such loans to Fannie or Freddie.
For example, one goal for 2018–20 is that 24 percent of the mortgages in single-family pools be to families with income no greater than 80 percent of their area’s median income. Another goal is that 6 percent of such mortgages be to families with incomes no greater than 50 percent of their area’s median income.

The relevant legislation designated three underserved markets: manufactured housing, affordable housing preservation, and rural housing.

Home prices would likely be lower if mortgage financing were less readily available (Fisher and others 2018; Wallison and Pinto 2018).

For example, the “Housing Finance Reform and Taxpayer Protection Act of 2014” proposes replacing Fannie and Freddie with multiple private guarantors, whose MBS would be backed by a government-run insurance fund. The Mortgage Bankers Association (2017) recommends rechartering Fannie and Freddie as the first of multiple regulated utilities issuing interchangeable MBS.

A drawback of such a system is that the prepayment risk of the single security depends on the prepayment risk of each of the underlying MBS, making the security vulnerable to the pooling practices of individual guarantors. For example, some lender/guarantors of VA-insured loans encourage borrowers to rapidly refinance to generate origination fees. The associated high prepayment rates depress the price of Ginnie Mae securities, contributing to higher interest rates on all loans insured by the FHA, VA, and USDA (Bright 2018; Goodman, Golding, and Neal 2019).
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The Macroeconomic Fallout of Shutting Down the Banking System

By Qian Chen, Christoffer Koch, Gary Richardson, and Padma Sharma

During the 2008–09 financial crisis, the U.S. government acted quickly to prevent the commercial banking system from shutting down. Policymakers arranged bailouts of major banks to prevent a suspension of bank deposits, where banks cease paying checks and refuse depositors’ requests to withdraw funds. These bailouts helped the United States avoid a kind of financial paralysis in which firms are unable to pay workers and households cannot pay for goods and services. However, since 2008, many policymakers and private citizens have debated the wisdom of bank bailouts, citing potential moral hazard concerns as well as the high cost to taxpayers.

Crucial to this debate is an accurate assessment of the costs and benefits of preventing a suspension of bank deposits, which can be difficult to determine. Prevention costs, for example, go beyond bailout spending in moments of crisis. Preventing deposit suspensions also involves significant spending on the ongoing operations of regulatory agencies, which can amount to billions of dollars each year. Benefits can be even

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more challenging to determine with precision, as policymakers cannot directly observe the loss to economic activity that might have occurred if they had allowed the banking system to shut down. Although past experiences with national payment suspensions can provide insight into potential losses, they likely have limited relevance, as nationwide bank suspensions have not occurred since the Great Depression.

One way to circumvent these challenges is to study the effects of more recent deposit suspensions that occurred at the state level. In this article, we study the effects of deposit suspensions in Nebraska in 1983, Ohio and Maryland in 1985, and Rhode Island in 1991. We find that the effect of the suspensions varied by the phase of the business cycle as well as the duration and magnitude of the suspensions. In Rhode Island, which underwent a long and complete deposit suspension in a recession, the suspension persistently lowered employment, gross state product, and per capita personal income. In contrast, in Maryland, Nebraska, and Ohio—states that experienced relatively short and partial suspensions during economic expansions—suspensions had little measurable effect on macroeconomic aggregates. Our results suggest that interventions that prevent large deposit suspensions during recessions, such as those undertaken after 2008, are likely worth the costs. Effective interventions not only help avoid economic losses during recessions, but also prevent losses to output and employment several years into the future.

Section I reviews the causes of the four state deposit suspensions. Section II summarizes the effect of deposit suspensions on macroeconomic aggregates in each of the four states. Section III discusses the lessons from the four state suspensions and their implications for evaluating interventions during the global financial crisis.

I. The Causes of Bank Deposit Suspensions

Historically, policymakers have suspended deposits—that is, temporarily prohibited depositors from withdrawing their funds—to prevent bank runs. Bank runs deplete banks’ resources and can trigger bank failures if left unchecked. In the Great Depression, for example, depositors grew concerned about the safety of their funds and withdrew them simultaneously, jeopardizing the stability of thousands of banks and prompting deposit suspensions (Richardson 2013). To
prevent the recurrence of pervasive bank runs and to reassure depositors of the safety of their funds in the banking system, Congress established the Federal Deposit Insurance Corporation (FDIC) in 1933 and the Federal Savings and Loans Insurance Corporation (FSLIC) in 1934. Both institutions provided a government guarantee to protect the value of deposits up to $5,000 and were responsible for disposing of the assets and liabilities of failed banks.¹

These regulatory reforms did not end bank runs entirely. Although the FDIC and FLSIC insured a significant share of deposits made at banks with federal charters, many banks chartered at the state level did not have these protections and were instead insured by state-level private deposit insurers. Because state-insured banks were outside the supervisory purview of federal agencies, the Federal Reserve, the FDIC, and the FSLIC could not take preemptive actions to prevent bank failures or support the financial system with a liquidity backstop. Instead, state-insured banks were subject to regulation by state regulators, who lacked resources and specialized skills to handle institutions in distress (English 1993). Indeed, difficulties at state-level insurers led directly to bank runs in Maryland, Nebraska, Ohio, and Rhode Island from 1983 to 1991. In each state, the failure of a single large financial institution due to mismanagement and malfeasance threatened the solvency of the state insurance fund.² News about these failures frightened depositors, who feared for the safety of their deposits in other institutions covered by the distressed insurers and rushed to withdraw their funds. When these bank runs reached healthy depository institutions, the governors of all four states suspended deposits.

The failure of mismanaged institutions was merely a catalyst for the failure of state deposit insurers, which had deep-rooted weaknesses. State-level insurance systems collected premiums from their member banks that were too low relative to the risk they insured. Furthermore, the insurers’ members were predominately inadequately regulated institutions with weak risk-management practices and thereby posed a risk to the solvency of the insurance fund (English 1993). Poorly managed state-insured institutions and insufficiently funded insurance in the four states eroded depositors’ confidence in the insurers. This loss of public trust made the banking systems vulnerable to bank runs—and, therefore, subject to deposit suspensions.
After the four states suspended deposits, the FDIC, FSLIC, and Federal Reserve took steps to minimize the severity and duration of the ensuing economic shock. The FDIC and FSLIC accelerated the process of transitioning state-insured institutions in Ohio, Maryland, and Rhode Island to federal insurance. The Federal Reserve rerouted all automated clearinghouse (ACH) payments in Rhode Island to federally insured institutions and relaxed restrictions on mortgage lending to keep payments and credit flowing. State-insured banks in Ohio and Maryland received substantial advances from the Federal Reserve’s discount window, and the Federal Reserve Bank of Boston stood prepared to make advances to Rhode Island’s state-insured institutions (Todd 1994). These interventions allowed depositors to access incoming funds and obtain new credit, but depositors were still unable to withdraw previously deposited funds from their accounts.

Although the four state deposit suspensions had similar causes, they occurred in very different economic environments. In Chen and others (2020), we compile data on each of the four deposit suspensions and their macroeconomic consequences. Table 1 summarizes key differences across the four episodes. A fundamental difference across the four states was the phase of the business cycle in which they suspended deposits, as measured by per capita personal income. Rhode Island was the only state to suspend deposits during an economic contraction: per capita personal income declined by 1.85 percent on average in the four quarters prior to the onset of the payments suspension. The remaining three states suspended deposits during economic expansions: per capita personal income grew in Maryland, Nebraska, and Ohio prior to the suspensions.

A second difference across states was the extent of the deposit suspensions. The suspension in Rhode Island was complete: depositors did not have access to any of their deposits until institutions were reopened or payouts were made to depositors by a state government agency. In contrast, suspensions in the remaining three states were partial. Depositors in Maryland and Ohio were permitted to withdraw up to $1,000 and $750 a month, respectively. In Nebraska, depositors retained access to their checking accounts but could not withdraw certificates of deposit until maturity. Table 1 shows that the value of suspended deposits was substantially larger in Rhode Island and
Table 1
State-Level Suspensions of Bank Payments, 1983–91

<table>
<thead>
<tr>
<th>State</th>
<th>Insured institutions</th>
<th>Date of failure</th>
<th>Percent growth in per capita personal income (four-quarter average)</th>
<th>Deposits per household as a percentage of median household income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryland</td>
<td>SL</td>
<td>1985 May</td>
<td>2.37</td>
<td>19.1</td>
</tr>
<tr>
<td>Nebraska</td>
<td>T, CU, SL</td>
<td>1983 Nov.</td>
<td>5.38</td>
<td>5.7</td>
</tr>
<tr>
<td>Ohio</td>
<td>SL</td>
<td>1985 March</td>
<td>3.39</td>
<td>3.1</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>B, CU, SL</td>
<td>1991 Jan.</td>
<td>-1.85</td>
<td>13.9</td>
</tr>
</tbody>
</table>

Notes: In the column “Type” under “Insured Institutions,” B indicates banks, T indicates trust companies, and CU indicates credit unions and cooperative credit corporations. SL indicates savings and loans and similar thrifts, including building and loans, mutual savings banks, and industrial loan and investment companies.


Maryland than in Ohio and Nebraska. In Rhode Island and Maryland, suspended deposits represented 19 and 14 percent of median household income, respectively. In Nebraska and Ohio, these deposits represented a mere 6 and 3 percent of median household income.

Finally, the suspension lasted longer in Rhode Island than in Maryland, Ohio, and Nebraska. Rhode Island’s governor suspended deposits in January 1991, and nearly three years elapsed before all depositors in the state were fully repaid. Around 50 percent of deposits were paid out or made accessible in the first six months, another 46 percent were paid out in the following year, and the remaining 4 percent were paid out in September 1993. In contrast, governments in Maryland and Ohio acted quickly to establish new deposit insurance funds within 10 days of suspending deposits to protect institutions. In Ohio, institutions eligible for FSLIC insurance were allowed to reopen within two weeks after suspensions were first imposed.5

Political factors played a substantial role in delaying the resolution of the crisis in Rhode Island. Instead of using state funds to resolve the crisis, Rhode Island’s government first sought to raise funds by requesting bailouts from the federal government. Although the federal government provided a loan guarantee for Rhode Island bonds, it did not offer direct assistance. The state also filed lawsuits against failed institutions and the auditor of the state insurance fund to recover lost deposits. This strategy for raising funds required the suspension to remain in place until legislative hearings were complete and lawsuits were settled.
Although the state obtained $103 million in the settlement of the lawsuit against the auditor of the insurance fund, the reluctance of Rhode Island’s administration to respond speedily to the crisis using its own funds resulted in a prolonged period of financial paralysis in the state (House of Representatives 1991a, 1991b; Prosky 2018).

II. Macroeconomic Consequences of Suspensions of Bank Payments

Deposit suspensions have the potential to generate widespread economic consequences. However, the effects of deposit suspensions likely vary based on the duration and intensity of the suspension. To account for differences in deposit suspensions across Rhode Island, Maryland, Nebraska, and Ohio, we measure the difference between actual economic outcomes in each state following the deposit suspensions and “counterfactual” outcomes—those realizations estimated to have occurred had states not suspended payments and instead used their resources to support the banking system and prevent payment disruptions.

Measuring counterfactual outcomes can be challenging. In Rhode Island, for example, estimating the counterfactual outcome means quantifying economic activity in a hypothetical parallel world in which the state did not suspend bank deposits in 1991. We estimate this hypothetical outcome by using the weighted average of economic outcomes from states that most resembled Rhode Island before suspensions in 1991. We refer to this subgroup of states as “control states.” We similarly estimate the hypothetical economic outcomes in Maryland, Nebraska, and Ohio using the weighted average of economic outcomes in their respective control states.

The economic indicators for which we estimate counterfactuals are the unemployment rate, the labor force participation rate, employment, and output. These economic indicators broadly describe the health of an economy and represent key measures of interest to policymakers. The unemployment rate measures the share of individuals who do not have a job, are available for work, and have actively looked for work in the four weeks prior to measurement. The labor force participation rate measures the proportion of the working-age, civilian population that is either employed or actively looking for work. Employment is based on surveys of firms that report the total number of individuals on
payrolls in their establishments. Finally, output or gross state product is the value of all final economic output produced within the state during a specific period.

Chart 1 shows differences in the paths of the unemployment rate, the labor force participation rate, employment, and gross state product in Rhode Island alongside their estimated counterfactuals. Panel A of Chart 1 shows that before the deposit suspension, the unemployment rate in Rhode Island moved in lockstep with the counterfactual from control states. However, after deposits were suspended, the two series diverged: the unemployment rate in the control states peaked in December 1991 and began to decline, while the unemployment rate in Rhode Island continued to rise until 1993. From 1993 to 2001, Rhode Island’s unemployment rate declined but remained at a higher level than the counterfactual. Specifically, the unemployment rate in Rhode Island remained approximately 1 percentage point higher a decade after deposit suspensions, relative to the counterfactual.

Panels B through D of Chart 1 show that the deposit suspension in Rhode Island also are estimated to have had persistent effects on the labor force participation rate, employment, and gross state product. Panel B shows that the suspension lowered the labor force participation rate by 3 percentage points relative to control states. The effect peaked nearly four years after deposits were first suspended, and the recovery was gradual: by 2001, the labor force participation rate was still more than 1.5 percentage points lower in Rhode Island. Panel C shows that the level of employment declined steadily and substantially relative to controls. By 1994, Rhode Island had lost 40,000 more jobs than it would have absent the suspension. This decline appears to have been prolonged and possibly permanent. Finally, Panel D shows that gross state product also declined substantially in Rhode Island relative to controls. An examination of a range of other state-level series show that this result is driven by several factors, including a decline in Rhode Island’s population during the 1990s counter to the experience of other East Coast states, a decline in the labor force participation rate (which was greater than in control states), and slow growth in per capita productivity relative to states that benefited from the technology and finance booms of the 1990s.
Chart 1
Effects of Payments Suspensions in Rhode Island

Panel A: Unemployment Rates

Panel B: Labor Force Participation Rate

Panel C: Employment
Table 2 provides quantitative support to the graphical overview by summarizing the effects of deposit suspensions on nine state-level series. For each series, the table reports the average difference between outcomes in each of the four states and their estimated counterfactuals two and five years after the suspensions. The second column indicates the direction of difference between observed and counterfactual outcomes that is characteristic of an adverse change in each series. Examples of adverse changes include an increase in the unemployment rate or a decline in output in the state that underwent deposit suspensions relative to controls.

The first row of Table 2 indicates two years after the deposit suspension, the unemployment rate in Rhode Island was on average 0.63 percentage point higher than the counterfactual. Five years after the suspension, unemployment in Rhode Island was on average 0.94 percentage point higher than in controls. Mortgage delinquency and bankruptcy filings were also higher on average in Rhode Island relative to their counterfactuals two and five years after deposits were suspended. Conversely, output, employment, the labor force participation rate, per capita personal income, population, and the CredAbility Consumer Distress Index (a measure of household financial distress) were lower on average in Rhode Island relative to the control states. The substantial
## Table 2
Effects of Payments Suspensions on Economic Aggregates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adverse change</th>
<th>Rhode Island</th>
<th>Maryland</th>
<th>Nebraska</th>
<th>Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Two-year</td>
<td>Five-year</td>
<td>Two-year</td>
<td>Five-year</td>
</tr>
<tr>
<td>Monthly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment rate (percent)</td>
<td>Rise</td>
<td>0.63</td>
<td>0.94</td>
<td>-0.21</td>
<td>-0.03</td>
</tr>
<tr>
<td></td>
<td>Decline</td>
<td>-0.68</td>
<td>-1.81</td>
<td>0.23</td>
<td>0.61</td>
</tr>
<tr>
<td>Labor force participation rate (percent)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quarterly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per capita personal income (U.S. dollars)</td>
<td>Decline</td>
<td>-662</td>
<td>-6.30</td>
<td>395</td>
<td>245</td>
</tr>
<tr>
<td></td>
<td>Rise</td>
<td>0.08</td>
<td>0.05</td>
<td>-0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Bankruptcy filings (per thousand people)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortgages past due (percent)</td>
<td>Rise</td>
<td>1.21</td>
<td>0.91</td>
<td>-0.09</td>
<td>-0.40</td>
</tr>
<tr>
<td></td>
<td>Decline</td>
<td>-0.77</td>
<td>-1.56</td>
<td>-1.01</td>
<td>-0.89</td>
</tr>
<tr>
<td>CredAbility consumer distress index</td>
<td>Decline</td>
<td>-22</td>
<td>-44</td>
<td>84</td>
<td>168</td>
</tr>
<tr>
<td>Population (thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Annually                                      | Decline        | -37,512      | -49,602  | 65,738   | 89,426 | 16,713| 14,180| 71,010| 111,671|}

and persistent adverse effects across a broad range of economic indicators suggest that the deposit suspension in Rhode Island amplified the recessionary dynamics that were prevalent in New England at the time.

In contrast, the results for Maryland, Ohio, and Nebraska in Table 2 reveal that their deposit suspensions hardly affected the economies of those states. The effects we estimate for these states are small or are consistent with economic expansion, rather than contraction. Specifically, we find that in Maryland and Nebraska, the unemployment rate declined and per capita personal income and employment increased relative to control states. In Ohio, the unemployment rate increased and output declined over the two-year horizon, but these effects subsided after five years. Overall, we find no systematic relationship between macroeconomic aggregates and the deposit suspensions in Maryland, Ohio, and Nebraska. This result suggests that deposit suspensions accelerated recessionary dynamics but had little effect in expansionary phases of the business cycle.

III. Lessons and Implications for the Global Financial Crisis

In the immediate aftermath of the deposit suspension in Rhode Island, states worked to root out the institutional features that kindled the crisis. Most states made it mandatory for depository institutions to obtain federal insurance and phased out state deposit insurance systems (English 1993). By 2007, no state-level primary insurers for banks and savings associations remained. As of 2017, only 2 percent of credit unions are privately insured and outside the coverage of the National Credit Union Association (FDIC 2007; GAO 2017). These reforms make it unlikely that a future deposit suspension will arise from the failure of state-level insurance systems.

However, the financial landscape in the United States evolved from the early 1990s to 2008, and other vulnerabilities emerged. Banks held increasingly complex financial securities on their balance sheets, and the actual risks inherent in these products were not apparent. Moreover, the financial system became more integrated over time, exposing banks to weaknesses in institutions beyond the commercial banking sector such as investment banks and insurance companies. These vulnerabilities came to the fore during the global financial crisis of 2008–09. Our estimates
of the effects of the payments crisis in Rhode Island offer a framework to evaluate policy responses during the global financial crisis.

The broad policy lesson from Rhode Island is that banking crises that occur in a contraction, such as the collapse of large financial services firms during the global financial crisis, require earlier and more forceful interventions. The delayed interventions in Rhode Island lengthened and deepened the contraction that the state was already experiencing. During the global financial crisis, legislative measures enacted to rescue the banking system were subject to public criticism owing to the use of taxpayer funds. Our results for the Rhode Island crisis suggest that these interventions were necessary. When Congress passed the Troubled Assets Relief Program (TARP) on September 29, 2008, allocating $700 billion to support financial institutions, the U.S. economy had already been in contraction since the start of the year, and panic prevailed in the financial system.8 Successive, “old-fashioned” deposit runs on financial institutions posed a threat to the stability of the overall financial system (Rose 2015). For instance, Lehman Brothers’ failure on September 15, 2008, triggered runs on Washington Mutual, which eventually failed on September 25, 2008. This episode led to a run on Wachovia, and within a week, the bank was out of resources to meet creditors’ claims.

Policymakers’ fears of deposit suspensions likely would have materialized absent interventions to check the spread of panic among depositors. Our results indicate that if deposits had been suspended during the global financial crisis, the trough of the recession in the United States would have been deeper and longer, and adverse effects on output, employment, the labor force participation rate, and bankruptcies would have persisted long after the crisis began. Timely interventions from the Federal Reserve and FDIC (in the form of TARP and the Temporary Liquidity Guarantee Program, respectively) preserved output and employment relationships that would have been lost otherwise due to the scarring effects of deposit suspensions.9 On balance, the preserved output and employment over the medium term provided by these interventions compare favorably with their cost of approximately 3.5 percent of U.S. gross domestic product in 2009 as determined by Lucas (2019).10
Conclusion

Interventions taken to stabilize the financial system after the 2008 financial crisis were controversial at the time due to perceived high costs to taxpayers. However, the costs of allowing the bank system to shut down may have been much higher in the longer term. We study modern episodes of state deposit suspensions to quantify the effects of shutting down the commercial banking system on aggregate economic activity. We find that the suspension in Rhode Island, which was imposed during a recession, increased unemployment and reduced output for at least 10 years after the crisis. The suspensions in Maryland, Ohio, and Nebraska, which occurred during economic expansions, did not have a measurable economic effect.

The events in Rhode Island offer a crucial lesson in safeguarding the financial system against future payments crises. Adequate regulation and supervision of depository institutions are essential in preventing deposit suspensions. In the wake of the global financial crisis, the Dodd-Frank Act introduced new regulations aimed at limiting excessive risk-taking and enhancing the resilience of the banking system. Some of these measures include stress tests, capital regulations and requirements for complex financial institutions to submit “living wills” that outline their plans for orderly dissolution in the event of a crisis. These measures not only bolster the solvency and liquidity of the depository institutions but also provide regulators with regular snapshots of the risks in bank balance sheets. The current enhanced regulatory structure helps protect the banking system against a recurrence of a crisis resembling the deposit suspension in Rhode Island or the global financial crisis. The disparate origins of Rhode Island’s crisis in the 1990s and the global financial crisis two decades later underline the importance of updating regulations in line with the growing complexity of the financial landscape.
Endnotes

1The FSLIC was closed in 1989 due to insolvency. Following the FSLIC’s closure, the FDIC took over insurance of savings and loans institutions. The amount insured by the FDIC has been increased by Congress several times since its inception and is currently $250,000 per depositor per FDIC-insured bank for each account ownership category.

2The state-level insurance funds that became insolvent were the Maryland Savings Share Insurance Corporation (MSSIC), the Nebraska Depository Insurance Guaranty Corporation (NDIGC), the Ohio Deposit Guaranty Fund (ODGF), and the Rhode Island Share and Deposit Indemnity Corporation (RISDIC). The NDIGC failed in 1983, the MSSIC and ODGF in 1985, and the RISDIC in 1991. The insurance corporations were chartered at the state level but did not have financial backing from the state government. They raised capital from the insured financial institutions, which paid premiums to the insurance fund.

3The Depositors Economic Protection Corporation, which was set up by the state government to return depositors’ funds from suspended accounts, took over deposits from the RISDIC.

4The certificates of deposit were issued by industrial savings companies and were called “investment certificates.”

5Institutions had to demonstrate that they were solvent, financially stable, and able to conform to the FDIC or FSLIC’s regulatory requirements to be eligible to receive insurance from either of the two agencies.

6This method, known as “synthetic control,” was originally developed by Abadie and Gardeazabal (2003). In Chen and others (2020), we develop a Bayesian synthetic control method based on the earlier authors’ technique. The key difference between the two is that our method offers a systematic technique to determine when a measured effect is statistically important. These inferences are still an ongoing area of research under the former method.

7The CredAbility Consumer Distress Index is a comprehensive measure of the financial condition of the average American household. A lower value is indicative of greater financial distress.

8The U.S. Treasury provided capital to banks under TARP by purchasing their preferred shares. TARP aimed to restore financial stability by bolstering banks’ capital.

9Under the Temporary Liquidity Guarantee Program, the FDIC guaranteed newly issued debt by banks, thrifts, and their holding companies. This guarantee was provided to restore creditors’ confidence in debt issued by financial institutions.

10Articles in the press have suggested that the government profited from TARP given net receipts from assisted financial institutions. However, Lucas (2019) concludes that the bailouts involved net costs of $500 billion by using a fair-value approach based on the net present value of costs and payoffs incurred at the time of bailouts. Reports concluding that TARP resulted in a profit to the Treasury are based on after-the-fact accounting that Lucas argues may not be the correct approach to evaluating the program’s costs and benefits.
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Unconventional Monetary Policy and International Interest Rate Spillovers

By Karlye Dilts Stedman

After the 2008 global financial crisis, advanced economies turned to unconventional monetary policies, such as forward guidance and large-scale asset purchases, to provide additional monetary stimulus while short-term interest rates were constrained by their effective lower bound. However, the speed of economic recovery differed markedly among these economies, leading to increasingly divergent monetary conditions heading into 2020. While the euro area and Japan increased their unconventional monetary stimulus through 2020, the United States and the United Kingdom began raising short-term interest rates in December 2015 and November 2017, respectively.

Differences in the timing and intensity of unconventional monetary policies across central banks generate potentially unique international “spillover effects.” As some central banks normalize policy by moving policy rates off their effective lower bound, domestic short-term interest rates rise. But this increase in short-term rates may not translate into higher longer-term rates if unconventional monetary policies in other countries spill over internationally, exerting downward pressure on rates. In this way, expansionary spillovers from other central banks may have undermined policy tightening in the United States (as well as the United Kingdom). However, while abundant research documents...
spillovers from the Federal Reserve’s monetary policy to other economies, the effects of other central banks’ policies on the United States have received limited study despite an evolving policy landscape.

In this article, I assess whether monetary policies from the European Central Bank (ECB), the Bank of Japan, and the Bank of England affect U.S. borrowing costs differentially at and away from the effective lower bound from 2004 to 2017. I find evidence of spillovers from each of these central banks to the United States as well as evidence that these spillovers increased during the Federal Reserve’s asynchronous withdrawal from unconventional monetary policy. My results imply that in the absence of international spillovers, long-term yields in the United States would have been higher than those observed at the end of 2017. More generally, my results contradict an implicit assumption in prior research that the United States generates monetary policy spillovers without also receiving them.

Section I discusses the mechanisms of monetary policy at and away from the effective lower bound to clarify why policy might spill over from one country to another. Section II discusses how I measure monetary policy and its associated spillovers. Section III documents increased spillovers from foreign central banks to the United States during and after the global financial crisis.

I. Monetary Policy at and away from the Effective Lower Bound

In theory, both conventional and unconventional monetary policy in one country can affect other economies. Conventional expansionary monetary policy lowers short-term borrowing costs by decreasing the interest rates banks charge one another for overnight loans, which banks in turn pass on to the broader economy.1 This accommodative policy could generate expansionary or contractionary spillovers to other countries. On the one hand, by boosting real activity in the domestic economy, conventional channels of monetary policy may also increase the economic activity of international trading partners by boosting their net exports (Brainard 2017). On the other hand, if expansionary policy leads to local currency depreciation, trading partners may see a decrease in their net exports.
More directly, conventional monetary policy in one country can influence financial conditions in others by raising or lowering the cost of capital for firms and individuals that lend funds abroad (see, for example, Cetorelli and Goldberg 2012; Morais and others 2019; Baskaya and others 2017; and Miranda-Agrippino, Nenova, and Rey 2020). Conventional monetary policy can also affect foreign economies through central bank communications, as when a central bank reveals information about global economic news that foreign investors expect to affect them at home (Kose, Otrok, and Whiteman 2003; Baxter and Kouparitsas 2005).

Unconventional monetary policies, such as those central banks have undertaken in recent years, have the potential for additional spillover effects to foreign economies. After the global financial crisis, most central banks lowered short-term interest rates to near zero, limiting their ability to stimulate growth through additional rate cuts—a constraint commonly referred to as the “effective lower bound.” To provide additional monetary accommodation in the face of this constraint, central banks pursued large-scale asset purchases (LSAPs) which, coupled with forward guidance regarding the future path of policy, aim specifically to lower long-term interest rates by managing market expectations and reducing term premiums. Most LSAPs have targeted government bonds to lower their yields, with the ultimate goal of lowering borrowing costs for households and businesses. Lower government bond yields give investors incentive to replace government bonds with as close a substitute as possible. Many investors will shift to another domestic asset, lowering the yield on that asset and thereby decreasing borrowing costs for the firms that issue it. However, investors may also shift to foreign bonds, generating unique international spillovers. When domestic investors shift to foreign bonds in response to a decrease in domestic bond yields, they decrease borrowing costs abroad.

Given the potential for international spillovers from LSAPs, central banks’ asynchronous withdrawal from LSAPs may have created additional headwinds for the Federal Reserve in normalizing policy. In 2013, the Federal Reserve began to taper its asset purchases as a first step in the policy normalization process—in other words, the unwinding of unconventional policies and return to conventional monetary policy through short-term interest rate adjustments. Starting in
December 2015, the Federal Reserve entered a normalization period in which it slowly raised rates. However, the ECB and the Bank of Japan did not follow suit, and as of the end of the sample in late 2017, neither bank had yet to begin policy normalization. The Bank of England took an approach between these poles, halting asset purchases in 2013 but keeping the interest rate near zero until late 2017. Ongoing policy accommodation from the ECB, Bank of Japan, and to a lesser extent, the Bank of England may have dampened long-term interest rates in the United States in particular as its monetary policy diverged from that of the other three largest advanced economies.

II. Measuring Monetary Policy Spillovers

Measuring the effect of monetary policy can be challenging. To the extent households and businesses observe the state of the economy and know the mandate that guides a central bank’s policy response, they may anticipate future policy changes and adjust their consumption and production decisions accordingly in advance of the actual policy change. Thus, only the announcement of unexpected changes to monetary policy—or monetary policy “shocks”—should have an observable effect on real and financial variables. At the time of the announcement, market participants update their information about the policy stance, which is immediately reflected in the prices of affected securities.

To extract monetary policy shocks for each central bank, I follow Kuttner (2001) and Gürkaynak, Sack, and Swanson (2005), among others, who measure shocks using the change in the price of a chosen asset from before a central bank announcement to shortly after. The assumption underlying this approach is that, on average, only new information about monetary policy affects the asset’s price in this window. In other words, if markets that are closely linked to monetary policy decisions change immediately after a monetary policy announcement, the asset’s price is assumed to have changed because of monetary policy itself.

I focus on monetary policy shocks from 2004 to 2017 from the Bank of England, Bank of Japan, and ECB for two reasons. First, they are key advanced-economy central banks (apart from the Federal Reserve); because of the size of their balance sheets, they are the most likely to generate spillovers to the United States. Second, U.S. Treasuries may be considered a close substitute for sovereign bonds issued by
the United Kingdom, Japan, or euro area governments, which makes them more likely to have propagated spillovers from LSAPs.

To extract the magnitude of a monetary policy shock that can be compared across all four central banks, I use assets that are not only linked to monetary policy outcomes, but also commonly traded. Each economy has an active interbank lending market with its own three-month interbank offered rate, the benchmark interest rate at which banks make short-term loans to one another. This rate is strongly influenced by current policy and expectations of future policy rates. Futures contracts based on this rate and settling two years in the future are all traded continuously throughout the 2004–17 sample period and continue to vary even when short-term interest rates remain near zero.5 I use the daily change in the yields implied by these overnight interbank interest rate futures prices as my measure of the surprise element contained in announcements by each respective central bank. For ease of interpretation and comparability across central banks, I normalize monetary policy shocks to a one-standard-deviation reduction in the two-year-ahead futures rate, in basis points.

Each central bank publishes policy committee announcement and meeting dates on their respective web sites. The majority of included central bank announcement dates in the sample correspond to regularly scheduled meetings. However, I also include some unscheduled announcement dates due to their importance during the early months of the global financial crisis. While most announcements reflect no change in policy (or a change that is widely anticipated) and cause little reaction in financial markets, some announcements are unexpected. These unexpected announcements cause identifiable asset price movements linked to the effects of policy shocks on financial markets.

To find the effect of monetary policy on borrowing costs, I use a well-established statistical model to measure the effect of monetary policy shocks on the yields on sovereign securities in each of the sample countries at short (one to three year), medium (five to seven year), and long (10 year) maturities from 2004 to 2017 (full model details are available in Dilts Stedman [2019]).6

Because central bank policy actions changed dramatically before, during, and after the 2008 financial crisis, I break the full sample into three subsamples based on significant changes to the Federal Reserve’s
LSAP policies. I focus on LSAPs because they represent a key unconventional tool used by all four central banks. I define the subsamples based on U.S. dates in particular because the Federal Reserve both initiated and ended LSAPs first among central banks in the post-2007 period. Table 1 defines the three subsamples, which are the same for all central banks for ease of comparison. The first, from September 4, 2004, to September 14, 2008, captures the pre-crisis period before the failure of Lehman Brothers set off market volatility that resulted in the first round of the Federal Reserve's LSAPs. During the pre-crisis period, central banks were not only all engaged in short-term interest rate policy, but were also all in a tightening cycle. The second period comprises the second and third rounds of the Federal Reserve’s LSAPs in response to the global financial crisis and the European debt crisis, along with the Maturity Extension Program, from November 25, 2008, to May 21, 2013. In this period, all four central banks lowered policy rates to near zero and began pursuing monetary policy loosening through various means that fall under the rubric of unconventional monetary policy.7 The third and final subsample begins on May 22, 2013, with the announcement that the Federal Reserve would soon begin to taper its asset purchases and thereby begin the process of monetary policy normalization, and ends with the last date in the sample, December 15, 2017. In this subsample, the Federal Reserve announced it would begin to remove some of its monetary policy accommodation and begin a return to conventional monetary policy, thereby altering market expectations. In contrast, the other central banks either maintained their existing policy stance (Bank of England) or increased their degree of monetary policy accommodation with further asset purchases and negative interest rates (ECB and Bank of Japan).

III. Documenting the Evolution of International Spillovers

To visualize the differences in potential spillovers across maturities, I plot the effect of one-standard-deviation monetary policy shocks from the Bank of Japan, ECB, and Bank of England on one, three, five, seven, and 10-year U.S. Treasury yields. For comparison, Chart 1 plots the estimates from the full sample with no regime changes alongside estimates of the domestic effects of Federal Reserve actions. The full
Table 1
Regime Changes in U.S. Monetary Policy, 2004–17

<table>
<thead>
<tr>
<th>Date</th>
<th>Subsample break dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep. 15, 2008</td>
<td>End of the pre-crisis period: The collapse of Lehman Brothers ignites turmoil in financial</td>
</tr>
<tr>
<td></td>
<td>markets that elicits monetary policy easing in advanced economies.</td>
</tr>
<tr>
<td>Nov. 25, 2008</td>
<td>Initial QE: The Federal Reserve announces its first quantitative easing program.</td>
</tr>
<tr>
<td>May 22, 2013</td>
<td>Normalization: Ben Bernanke testifies to Congress that the Federal Reserve will likely soon</td>
</tr>
<tr>
<td></td>
<td>begin to taper its LSAPs. Markets abruptly price in normalization.</td>
</tr>
</tbody>
</table>

Chart 1
The Effect of U.S. and Foreign Monetary Policy Shocks on U.S. Yields (Full Sample)

Sample results suggest significant effects of Federal Reserve policy shocks on U.S. Treasury rates but minimal spillovers from other central bank policy shocks to U.S. Treasuries, with little difference across maturities.

However, the full sample obfuscates important subsample patterns. Charts 2–4 show that the effect of monetary policy shocks by maturity differs substantially by subsample, underscoring the importance of re-evaluating spillovers as conditions change. In particular, Chart 2 shows that spillovers from the ECB to the United States increased substantially during the global financial crisis and increased even further when the United States began withdrawing from unconventional monetary policy. In the initial LSAP period (green line), a monetary policy shock from the ECB lowered U.S. yields on five-year notes by 2.2 basis points;
**Chart 2**
The Effect of ECB Monetary Policy Shocks on U.S. Yields

Sources: Board of Governors of the Federal Reserve System, ECB, and author’s calculations.

**Chart 3**
The Effect of Bank of England Monetary Policy Shocks on U.S. Yields

in the normalization period (orange line), the same-size shock lowered yields by 2.91 basis points, corresponding to an increase in spillovers of about 33 percent.

One explanation for the greater spillovers in the normalization period relative to the initial LSAP period is that this period coincides with the ECB’s first purchases of government securities of member countries in a form analogous to the other central banks in the sample. However, Chart 3 shows that the Bank of England also propagated greater spillovers in the normalization period. In particular, Chart 3 shows that monetary policy shocks from the Bank of England generated substantial spillovers to the United States in the pre-crisis period, which ebbed in the initial LSAP period but returned to pre-crisis levels during Federal Reserve policy normalization.

Adding up the spillovers in Charts 2 and 3 shows that during the Federal Reserve's policy normalization period, monetary policy shocks from the Bank of England and ECB had a combined effect on 10-year U.S. yields that nearly eclipsed the 6.1 basis point effect of the Federal Reserve’s own policy tightening ($2.2 + 2.8 = 5.0$). Indeed, in Dilts Stedman (2019), I find that the combined effect overshadows the domestic effect in estimates that separate out the period of lift-off from the effective lower bound from the tapering announcement two
years earlier. Thus, spillovers from Bank of England and ECB monetary policies more than offset the effect of Federal Reserve policy normalization on U.S. longer-term rates, neutralizing the transmission of domestic monetary policy to long-term interest rates.

In contrast, Chart 4 shows that spillovers from the Bank of Japan were small across subsamples and maturities, reflecting low co-movement with other advanced economies in general. This low historical co-movement suggests that U.S. and Japanese sovereign bonds may not be close substitutes.

In summary, in the pre-crisis period, spillovers to the United States were generally small across maturities and more prevalent for Treasuries with shorter maturities. In the initial LSAP period, spillovers to the United States strengthened from the ECB but weakened from the Bank of England. And in the period of U.S. monetary policy normalization, characterized by the highest degree of policy asynchronicity, spillovers increased from both the ECB and Bank of England. Together, these results suggest that asynchronous normalization was indeed, on net, consistent with lower long-term yields than would otherwise have prevailed from tightening domestic policy.

To illustrate the cumulative effect of spillovers, Chart 5 plots actual yields for 10-year Treasury securities from 2004 through the end of the sample in 2017 (blue line) alongside a counterfactual (green line)
depicting what yields would have been in the absence of international spillovers. My results suggest that without international spillovers, the 10-year Treasury yield would have been an average of 35 basis points higher over the period of normalization from 2013 to 2017.

Conclusion

In 2020, central banks across the world have again lowered short-term interest rates to the effective lower bound in response to the COVID-19 pandemic. With the lessons from the global financial crisis in hand, central banks would do well to acknowledge the influence of spillovers on sovereign bond yields—including spillovers from other central banks to the United States, which have received much less attention in the past. While the United States receives much attention for its influence on the global financial cycle, I find evidence of surprisingly strong spillovers to the United States from the United Kingdom and the euro area at the effective lower bound, particularly during the period of asynchronous monetary policy normalization. These results highlight the unique international features of monetary policy at the effective lower bound and suggest that failure to consider the differential effects of different policy environments may lead to the mismeasurement of spillovers.

The mechanisms of unconventional monetary policy that distinguish it from conventional monetary policy present unique challenges to the withdrawal of monetary stimulus, particularly in the presence of spillovers. Domestic long-term interest rates may respond less to policy rate increases when other countries are simultaneously engaging in LSAPs. Thus, without international spillovers, long-term yields in the United States would have been higher in the policy normalization period.

These spillovers have implications for the conduct of foreign monetary policy as well. In the absence of international spillovers, the ECB and Bank of England’s LSAPs would have been more effective in lowering long-term private borrowing costs in the euro area and the United Kingdom, respectively, after the 2008 financial crisis. Without leakages to U.S. Treasuries, investors in the United Kingdom and euro area would have more fully allocated their funds to domestic private assets, as intended.
Endnotes

Since lifting off the effective lower bound in 2015, the Federal Reserve has targeted the federal funds rate by setting the interest rate on bank reserves.

The longer the maturity on a bond (or any debt), the more expensive it typically is to borrow. Longer-term interest rates tend to be higher than short-term interest rates because lenders’ expectations over future growth, policy rates, and inflation are subject to the risk that the bond they purchase may become less valuable relative to future offered market rates. The return on long-term bonds over and above the amount expected by reinvesting short-term securities is called the term premium, which increases with the bond’s maturity (Bernanke 2013).

Central banks have also engaged in LSAPs to achieve other goals. For example, in its initial responses to the global financial crisis, the Federal Reserve first purchased assets in markets experiencing distress, such as mortgage-backed securities, to lower their yields. By standing willing to purchase such assets, the Federal Reserve decreases the risk that they cannot be sold.

When the Federal Reserve and, to a lesser extent, the Bank of England began to unwind unconventional monetary policy, they focused first on tapering asset purchases. The Federal Reserve took the additional step of raising interest rates before decreasing the size of its balance sheet and is the only advanced central bank in this study to have reached this step of normalization before the economic crisis in 2020. Thus, the Federal Reserve’s approach to normalization raised short-term interest rates before fully unwinding the long-duration assets on its balance sheet.

These are the three-month Euro Interbank Offered Rate (EURIBOR), Sterling London Interbank Offered Rate (Sterling LIBOR), Eurodollar, and Euroyen Tokyo Interbank Offered Rate (Euroyen TIBOR).

To account for the possibility of other economic or financial news being released on the same day as a monetary policy announcement, I include in my model a measure of news surprises from Citigroup (the Citigroup Economic Surprise Index or CESI) for each of the sample countries to strengthen the assumption that the daily effect measured is from monetary policy. These results can be accessed in Dilts Stedman (2019).

In practice, the effective lower bound has differed across countries. While the Federal Reserve and Bank of England lowered (and kept) their interest rates near, but above, zero, the ECB and Bank of Japan have pursued negative interest rate policies.

I follow Bernanke (2009) and others and define LSAPs as a central bank balance sheet expansion focused on the mix of loans and securities that the central bank holds, with explicit consideration on the effect this composition of assets affects credit conditions. This definition distinguishes the experience of the ECB from the Federal Reserve, the Bank of England, and the Bank of Japan. In contrast to these other central banks, the ECB’s balance sheet expansion during
its early crisis response mainly reflects its increased intermediation role and the growth of its lending to banks, which play a crucial part in financing the euro area’s private sector. While the other central banks orchestrated the growth of their balance sheets as part of their LSAPs, in the case of the ECB, the requirements of commercial banks and their need for refinancing drove balance sheet expansion. The contraction of the ECB’s balance sheet that began in 2012 reflected the banks’ declining need for liquidity following the reduction in financial fragmentation in the euro area.

In Dilts Stedman (2019), I find that after adding an estimate for the size of spillovers when the Federal Reserve began to lift off from the zero lower bound, spillovers from the Bank of England increased even further, surpassing their pre-crisis effect.
References


Drought Risk to the Agriculture Sector

By David Rodziewicz and Jacob Dice

After experiencing severe flooding in 2019, areas of the western United States and Great Plains are once again starting to experience drought. The average share of the continental United States experiencing drought rose from a little less than 24 percent in 2019 to over 40 percent in 2020. Drought is a perennial and long-term risk that can negatively affect the farm economy through lower yields, losses of crops, reduced farm revenues, and lower sales for farm suppliers. Recent drought episodes have kept these economic costs front of mind for farmers, agribusinesses, and agricultural lenders. Losses from the 2012 Midwest and 2011–17 California droughts still loom large, with national disaster costs near $35 billion in 2012 for the Midwest drought and $4 billion in 2014 for the California drought.

As risks from climate change—such as elevated global temperatures and water depletion—mount, understanding how drought will affect farmers across the country has become even more important. Drought

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risk can vary by region, crop type, and production method, and may disproportionately affect some farmers more than others. Although many farmers have crop insurance to protect against losses, insurance does not cover all of their crops’ value. Thus, even insured farmers face losses from drought. These losses can weaken farm finances, resulting in financial strain that may spill over into the broader agricultural economy.

In this article, we analyze the relationship between county-level drought exposure and direct farmer losses (specifically, crop insurance deductibles) from 2000 to 2019. We find that farmer losses from drought vary by crop type: although losses rise steadily along with drought intensity for corn and wheat, losses spike noticeably in extreme drought for soybeans. We also find that these losses represent an economically relevant share of crop production values: farmer losses from extreme drought can reach 20 percent of production value for corn and wheat and 35 percent for soybeans.

Section I provides an overview of U.S. drought, its connection to climate change, and the risks to the U.S. agriculture sector. Section II introduces data and statistical methods used to link drought, agricultural production areas, and farmer losses from drought. Section III shows how farmer losses rise with drought intensity and discusses differences across crop types.

I. Drought, Climate, and U.S. Agriculture

Although the U.S. agricultural sector is vulnerable to a myriad of natural hazards—excessive wind, flooding, tornadoes—drought represents an especially severe challenge. First, drought is a chronic condition that affects farms much longer than acute hazards such as storms or floods. The persistence of drought throughout the year may not only lower crop yields, but may also deplete surface and ground water supplies and lead to an increased incidence of wildfires (Challinor and others 2014; Donovan, Wonkka, and Twidwell 2017; Otkin and others 2018). Second, drought’s close links to climate mean it is likely to present a growing threat in the future as risks from climate change mount. A combination of rising growing season temperatures, increased drought incidence and severity, and amplified climate and drought variability is likely to depress yields and increase stress for the agriculture sector in the coming decades (Cook and others 2019; Gowda and others 2018;
Kukal and Irmak 2018; Schlenker 2020). Understanding these challenges—as well as the associated economic costs—can help farmers address increasing drought risk and help lenders better assess that risk for their agricultural borrowers.

U.S. drought exposure and agriculture

One common way to measure drought in the United States is through the U.S. Drought Monitor, which provides maps of drought intensity and duration. The Drought Monitor uses a series of climate and weather variables to create weekly estimates of drought severity across the United States (U.S. Drought Monitor 2020; Svoboda and others 2002). Drought categories range from “abnormally dry” (D0) to “exceptional drought” (D4).  

Chart 1 shows total continental U.S. land area in drought by intensity going back to 2000. Drought episodes have varied in intensity over the last 20 years. In 2012, for example, the United States witnessed a period of relatively extreme drought, with roughly 67 percent of land area on average in drought and roughly 14 percent of land area in the most extreme drought categories (D3–D4). By comparison, in 2019, the United States witnessed a period of relatively subdued drought, with less than 24 percent of land area on average in drought and less than 1 percent of land area in the most extreme drought categories.

Although aggregate drought exposure estimates are useful in illustrating the scope of the problem, these broader measures can mask the fortunes of local areas at certain times. Drought exposure varies across the country, affecting both local and regional agricultural areas. The Drought Monitor images in Map 1 illustrate two of the more extreme regional drought periods within the United States. Panel A shows the U.S. drought map during July 2012, the height of the 2011–12 Mid- west drought. Most of the country was in drought at the time, with large areas of the Midwest in the most extreme drought categories (D3–D4). This drought episode resulted in a loss of more than one-quarter of U.S. corn production by volume, nearly $22 billion in crop insurance claims payments, and national disaster costs around $35 billion (Rippey 2015; NOAA NCEI 2020). In contrast, Panel B shows the drought map during July 2014, the peak of the 2011–19 California drought, which was one of the longest in U.S. history (Williams 2020).
Chart 1
U.S. Continental Land Area in Drought

In 2014 alone, California had on average nearly 100 percent of its total land area in drought and 36 percent of its land area in exceptional drought (D4). As a result, 2014 crop insurance claims payments for California exceeded $305 million, and national disaster costs for the drought that year totaled roughly $4 billion (USDM 2020; NOAA NCEI 2020).  

Just as drought varies across the country, the effects of drought can vary by crop or type of production. Farmers planting row crops such as corn, wheat, and soybeans are largely affected by drought through diminished yields and lower production (Kuwayama and others 2018). However, some crops are more drought tolerant than others. Wheat, for example, is typically more drought tolerant than corn or soybeans. Moreover, some crops may respond differently to drought of different intensities: soybeans, for example, are known to face large production losses during severe drought episodes (Troy, Kipgen, and Pal 2015). Although other factors such as irrigation availability or style of production may contribute to drought losses, we focus our main analysis on how farmer losses from drought differ across types of crop production.

Drought and crop insurance

Although drought presents a substantial risk to the U.S. agriculture sector, one mitigating factor is federal crop insurance, which is
available for most major commodity crops such as corn, wheat, and soybeans. Roughly 89 percent of major U.S. crop acres are covered by federal crop insurance for a range of natural hazards such as drought (FCA 2017). Encouraging this wide coverage is the fact that federal crop insurance programs are highly subsidized, with the U.S. government paying a majority of insurance premiums (CRS 2018). However, crop insurance does not cover 100 percent of farmer losses. Instead, farmers
file claims on insured losses and receive indemnity payments equal to the losses that exceed their policy deductible. For example, a farmer might elect to purchase insurance that covers up to 75 percent of the value of their crops, making their policy deductible 25 percent. In the event of a severe drought that destroyed 25 percent of the crop value, the farmer would receive no indemnity payment, as the loss did not exceed their deductible. If the drought instead destroyed 60 percent of the crop value, the farmer would receive an indemnity equal to only 35 percent of the crop value (60 – 25 = 35). Thus, while crop insurance can mitigate the severity of farmer losses, it does not eradicate loss. It is this portion of farmer losses left over after insurance payouts that we use in our subsequent analysis. See the Box for an overview of federal crop insurance and relevant terminology.

Crop insurance payments nevertheless cover a meaningful share of the value of crop production, and drought is one of the leading reasons farmers file insurance claims. Chart 2 shows crop insurance claims payments (indemnities) by claim type over the last 20 years for the entire United States. Crop insurance indemnities averaged roughly 4.2 percent of total crop production value over the last decade, and drought-related insurance indemnities averaged 1.9 percent of total crop production value. On average, 42 percent of total crop insurance claim payments over the last 20 years were drought-related; in extreme drought years,
Federal Crop Insurance Overview

Federal crop insurance provides protection against natural hazards such as flood and drought as well as declines in commodity prices. A majority of crop insurance policies (84 percent) are categorized as individual revenue protection, which protects a farmer’s estimated production value (revenue) from production losses (CRS 2018). The value of a farmer’s insured crop is based on historical commodity exchange prices and the historical production from that farmer’s land. Farmers choose the average yield they wish to insure (coverage level), which typically ranges from 50 to 75 percent but can be as high as 85 percent in some locations (USDA RMA 2020). Coverage levels are broken down into two broad categories: catastrophic (CAT) and buy-up. CAT coverage, which is less common, is paid out at 55 cents for every dollar of losses exceeding 50 percent of the crop value. Most farmers choose buy-up coverage, paying a higher premium for a higher coverage level, and are paid out dollar-for-dollar for all losses exceeding their chosen coverage level.

The figure below illustrates a stylized buy-up crop insurance policy. The dotted line shows the farmer’s elected coverage level—in this example, 75 percent. If the farmer sees a 60 percent loss from a natural hazard, the farmer would be paid an indemnity of 35 percent of the insured crop value (green area). That farmer would still have 40 percent of their crop’s value to sell or market (gray area). Despite filing the crop insurance claim, the farmer would still absorb a loss (deductible) equal to 25 percent of the crop’s estimated value (blue area). It is this deductible that we use to measure direct economic losses for farmers.
this figure has reached as high as 83 percent. As these data demonstrate, drought is a substantial risk for the agriculture sector, and crop insurance can help mitigate some of those risks for U.S. farmers.

II. Mapping Drought to Farmer Losses

Given the importance of crop insurance for drought-related losses, especially for commodity crops, we use farmer crop insurance deductibles as our measure of farmer losses and focus specifically on losses to corn, wheat, and soybeans. Focusing on commodity crops allows us to gain broad geographic coverage across 47 continental U.S. states while excluding specialty crops such as fruits and tree nuts that may have a strikingly different production process or response to drought. Furthermore, corn, soybeans, and wheat in total make up over half of U.S. crop production by value and have some of the highest crop insurance market penetration: 89 percent of corn acres, 90 percent of soybean acres, and 85 percent of wheat acres are insured. By focusing on these crops, we can analyze a majority of farmer losses for these crops across most of the United States in the last 20 years (FCA 2017).

In our analysis, we first identify which agricultural production areas are exposed to drought at the county level using a series of geospatial data sets. We then use a simple statistical method to link county-level drought exposures to farmer losses in those counties.

Mapping crop-specific drought exposure

To create county-level drought exposure measures, we map drought exposure to commodity-specific agricultural production areas across the United States over the last 20 years. Specifically, we take weekly drought data from the U.S. Drought Monitor on agricultural land area in drought and match that information to crop-specific agriculture production areas using the U.S. Department of Agriculture’s Cropscape Cropland Data Layer. After matching the weekly drought data to crop-specific production areas, we then create average annual drought exposures at the county crop level (that is, average acres of corn, soybeans, and wheat in each county exposed to D0–D4 drought).

Map 2 shows our county-level drought exposure measures over two three-year periods: 2008–10, a period of relatively low drought in the United States, and 2011–13, a period of relatively intense drought.
Panel A shows that in the 2008–10 period, average drought intensity was relatively low for the three major commodity crops, with drought occurring mostly in the southern and eastern portion of the country. Panel B shows that in the 2011–13 period, average drought intensity was much higher, with drought occurring mostly in the central and western portion of the United States.

Measuring and mapping farmer losses from drought

To measure farmer losses from drought, we aggregate farmer deductibles from drought-related crop insurance claims to the county level. Most prior research uses yields or farm incomes to estimate agricultural losses from drought (Kuwayama and others 2018). Although these are reasonable measures of economic loss, they are imperfect in many ways. Farmers generally manage their operations to maximize profit, not necessarily yield—for example, if commodity prices are especially low, a farmer may choose to let a portion of their fields lie fallow rather than spend time and resources planting. Thus, yields may not fully capture drought’s economic effects on farmers. Farm income, on the other hand, can be affected by multiple factors, such as subsidies and changes in operations, making it an unreliable measure of the direct economic effect of drought. Crop insurance data allow us to measure direct drought-related losses at the county crop level for a given year.

We use the USDA’s Crop Insurance Cause of Loss and Summary of Business Data to estimate farmer losses for all drought-related crop insurance claims for corn, wheat, and soybeans from 2000 to 2019. See Appendix A for details on how we measure direct economic losses using these crop insurance data. Panels A and B of Map 3 show heat maps of drought-related losses as a share of county-level crop production values for the 2008–10 and 2011–13 periods. Not surprisingly, drought-related losses are broader-based and more intense during the 2011–13 period than the 2008–10 period. Comparing Map 3 with Map 2 shows that the counties with the greatest economic losses are largely those with the greatest drought intensity. The close relationship at the county crop level between drought exposures and crop insurance deductibles suggests deductibles are a useful measure of direct economic losses from drought.

Linking drought and farmer losses for individual crops

Although Maps 2 and 3 provide insight into overall farmer losses from drought, they may mask differences in losses across crop types. For example, wheat is typically considered to be more drought tolerant than corn or soybeans, potentially translating to smaller economic losses than those for the other two crops. We use a simple statistical model to estimate the average relationship between agricultural drought exposure
and farmer losses (deductibles) for individual crops—corn, soybeans, and wheat—from 2000 to 2019. Our analysis follows a similar statistical framework as Kuwayama and others (2018), who link drought to lower crop yields. We implement an ordinary least squares (fixed effects panel regression) to estimate the relationship between the average number of acres (by crop type) exposed to different drought levels (D0–D4) throughout the year and the dollar value of losses. Using the average annual drought exposures by drought category allows us to capture

Map 3
Average Drought Losses by County as a Share of Production Value (Corn, Wheat, and Soybeans)

Panel A: 2008–10

Panel B: 2011–13

Sources: USDA and U.S. Census Bureau.
the losses associated with drought intensity as well as duration, both of which matter when assessing direct economic losses from drought. Our final sample covers 2,203 counties and comprises 102,146 unique (county, crop, year) observations, 64,289 of which have a drought crop insurance claim. See Appendix B for details of our statistical model and robustness checks.

III. Farmer Losses from Drought by Crop Type

Unsurprisingly, we find a strong positive relationship between drought and direct drought-related farmer losses (deductibles) across all three crops analyzed (corn, wheat, and soybeans). Chart 3 shows the relationship between drought severity and the dollar value of losses per acre, adjusted for inflation using the 2019 Consumer Price Index. The upward-sloping lines show that farmer losses rise along with drought intensity across all three crop types.

However, Chart 3 also shows that the magnitude of losses differs by crop type. For corn, farmer losses range from $25.32 per acre in low-severity (D0) drought to $118.80 per acre in extreme (D4) drought. For soybeans, farmer losses are lower in D0 drought ($10.26 per acre) but much higher in D4 drought ($153.40). And for wheat, farmer losses are lowest across drought intensities, ranging from $6.64 per acre (D0) to $44.42 per acre (D4). The lower losses for wheat can partially be attributed to its lower production value per acre, which averages $214 per acre compared with $599 per acre for corn and $441 per acre for soybeans (USDA ERS 2019).

To account for these differences in production value, Chart 4 shows the same results from Chart 3 as a share of each crop’s average production value from 2000 to 2019. Across all crop types and drought categories, estimates of farmer losses are economically relevant compared with their average production value, with loss shares ranging from less than 5 percent for all three crops in D0 drought to roughly 20 percent for corn and wheat and nearly 35 percent for soybeans in D4 drought.

Chart 4 shows that the trajectory of losses also varies by crop type and drought intensity. Losses for corn and wheat rise relatively slowly and steadily as drought intensity increases from D0 to D4. For both crops, the largest jump in farmer losses per acre occurs between D2 and
**Chart 3**
Loss Per Acre by Drought Category

Sources: USDA, U.S. Drought Monitor, and authors’ calculations.

**Chart 4**
Loss Share by Drought Category

Note: Loss share is based on real 2019 dollar values of production divided by acres of production averaged across the 2000–19 sample period.
Sources: USDA and Bureau of Labor Statistics.
D3 drought. For corn, losses rise from roughly 8 percent of production value in D2 drought to nearly 17 percent of value in D3 drought. For wheat, losses rise from nearly 9 percent in D2 drought to just over 18 percent in D3 drought. Although soybeans also see a jump in losses between D2 and D3 drought, the largest spike is between D3 and D4 drought. Specifically, losses per soybean acre rise from a little over 11 percent of production value to nearly 35 percent of value.8

To provide additional insight into how these losses might affect a given farmer, Chart 5 shows estimated farmer losses (deductibles), indemnities, and remaining crop values for a typical corn, wheat, and soybean farm (similar to the crop insurance policy figure in the Box).9 Panel A shows that an average corn farmer with 1,000 acres in severe drought (D2) might expect losses (deductibles) around $45,000, or approximately 8 percent of the expected production value for their land. If the corn acres were to move into extreme drought (D3), the farmer’s expected losses would be closer to $101,000, or roughly 17 percent of production value. Panel B shows that an average wheat farmer with 2,500 acres in severe drought (D2) might expect losses of $46,000, or roughly 9 percent of production value; moving into extreme drought (D3) would increase losses to around $99,000 or roughly 18 percent of value. Lastly, Panel C shows that an average soybean farmer with 675 acres in extreme drought (D3) might expect losses around $34,000 or roughly 11 percent of value; moving into exceptional drought (D4) would increase expected losses to nearly $104,000 or about 35 percent of value. As these representative examples demonstrate, even with crop insurance, the losses (deductibles) farmers face from drought can be a meaningful share of their farm’s production.10

Although our analysis focuses on direct losses to farmers, our results also have implications for risk to crop insurance programs under a changing climate. The green area in Chart 5 shows the estimated indemnity payments from crop insurers to farmers by drought category. In more extreme drought categories, indemnities rise more drastically than farmer losses. For example, corn indemnity payments rise from roughly 6 percent of crop production value in D0 drought to about 35 percent in D4 drought (Panel A). Wheat indemnities face a similar trajectory, rising from around 4 percent of production value in D0 drought to roughly 24 percent in D4 drought (Panel B). Soybean
Chart 5
Loss Share by Drought Category

Panel A: Corn

Panel B: Wheat
indemnities, like farmer losses, increase drastically in more extreme drought categories, rising from just under 2 percent of production value in D0 drought to over 48 percent of value in D4 drought. Together, these indemnity data illustrate that crop insurers also face substantial losses from increasing drought severity.

If drought-related losses continue to rise, the economic effects may spill over to the broader U.S. economy. Federal crop insurance costs the U.S. government an average of $7 billion each year through subsidies, with some of the largest losses taking place in extreme drought years. With steady growth in crop insurance market penetration over the last 20 years—and expectations that the cost of crop insurance programs will rise substantially under a changing climate—these programs could be at risk in the coming years (Glauber 2002; Crane-Droesch and others 2019). A rise in indemnity payments and crop insurance costs could result in elevated premiums for farmers (increasing their cost of production) or rising costs for the U.S. taxpayer through subsidies or transfer payments. All told, under a changing climate, the cost of managing climate risk for the U.S. agricultural sector is likely to rise in the coming decades.
Conclusion

Drought remains a perennial threat to the U.S. agriculture sector, causing lower crop yields, higher production costs, and increased financial stress to farmers. With climate change predictions suggesting a greater incidence of drought in the coming decades, understanding how drought affects different segments of the agriculture sector is of critical importance in assessing risk from this natural hazard.

We analyze drought exposure across the United States over the last 20 years for corn, wheat, and soybeans and link these exposures to a measure of direct farmer losses (crop insurance deductibles). We find that losses for farmers rise with drought intensity and that those losses are economically relevant. We also find noticeable differences across crop types. Losses for corn and wheat rise steadily from low-intensity drought (D0) to high-intensity drought (D4), with a noticeable jump in losses from D2 to D3. In contrast, losses for soybeans rise more slowly through lower-intensity drought categories (D0–D3), with a jump in losses in the most extreme drought category (D4).

Our results suggest losses from drought are economically meaningful. Farmer losses from extreme drought can reach 20 percent of production value for corn and wheat and 35 percent for soybeans. Moreover, these losses are likely to increase in the medium term. Temperatures are expected to rise in the coming decades, with associated increases in drought frequency and severity. These changes pose risks not only to farmers but also to crop insurers, as both deductibles and indemnities will become more costly under a changing climate. Understanding the true economic cost of drought exposure may help farmers, agriculture lenders, and regulators make more informed decisions in the years to come.
Appendix A

Measuring Farmer Deductibles and Total Losses from Crop Insurance Data

To calculate farmer loss (deductibles) and total loss at the county (i), crop (j), and year (t) level, we aggregate up from the policy (p) and insurance claim (c) level using the USDA Summary of Business crop insurance policy data and USDA Cause of Loss crop insurance claims data. These data sets provide all federal crop insurance policies and policy claims within the United States for all crops. We estimate losses in a series of steps:

1) USDA Summary of Business Data (all insurance policies)

   (i) Value of crop \( i,j,t \) = \( \sum \text{liability}_{i,j,p,t} / \text{coverage}_{i,j,p,t} \)

   We estimate the value of the crop (corn, wheat, and soybeans) within a given county by taking the liability for each crop insurance policy and dividing by the coverage level for that policy. We then sum up the crop values within a county across all crop insurance policies. This measure of crop value is used to generate county-level loss maps.

   (ii) Coverage \( i,j,t \) = weighted-average coverage level (by acres)

   We generate a weighted-average coverage level at the county, crop, and year level using policy-level coverage data. Individual coverage levels are unavailable in the Cause of Loss insurance claims data. Thus, we create a representative coverage level for a given county, crop, and year by averaging (by acres) across insurance policies within a given year. All policies labeled as catastrophic coverage (CAT) are excluded from this average coverage level calculation.

2) USDA Summary of Business Data (all insurance claims): drought only

   (i) Value of crop \( i,j,c,t \) = \( \text{liability}_{i,j,c,t} / \text{coverage}_{i,j,t} \)
We generate county-crop estimates of farmer deductibles from drought-related crop insurance claims. First we estimate crop values by taking the liability of a given claim and dividing by the representative coverage level in 1(ii). This estimate is applied for all claims that are not labeled CAT coverage. CAT coverage is paid out at 55 cents for every dollar of loss for losses exceeding 50 percent of the crop value. Thus, coverage on CAT policies is .275 (.50 × .55), and we apply that coverage ratio to estimate crop values on CAT policies.

(ii) Farmer loss (deductible) \( i,j,t \) = \( \sum \left[ \left( \text{value crop}_{i,j,c,t} \right) \left( 1 - \text{coverage}_{i,j,t} \right) \right] \)

We then estimate farmer losses (deductibles) at the county, crop, and year level by taking the estimated value of the crop multiplied by the difference between the total crop value and coverage of that crop. CAT coverage claims require a slightly different calculation for the farmer deductibles. Farmer deductibles for CAT policies are estimated by the following equation: crop value (0.50) + indemnity (.45/.55); as farmers are only paid 55 cents for every dollar of loss exceeding 50 percent of crop value. We then sum up farmer deductibles within a county to obtain our measure of farmer loss for a given county, crop, and year. It is this measure of loss that we use in our statistical model to link drought to farmer losses.

(iii) Total loss \( i,j,t \) = farmer loss (deductible) \( i,j,t \) + indemnity \( i,j,t \)

We also generate a measure of total losses by summing the estimated farmer losses (deductibles) in 2(ii) and the total indemnities paid for drought-related claims for a given county, crop, and year. We use this measure of total loss in our drought loss maps (specifically, Map 3). This measure of loss is also used in our statistical model to demonstrate what farmer losses might be without federal crop insurance.
Appendix B

Statistical Model: Panel Regression

We implement an ordinary least squares (OLS) panel regression framework to estimate the relationship between drought-exposed acres and farmer losses (deductibles) and total loss in real 2019 dollars. To examine the relationship between drought-exposed acres and losses, we estimate the following model for each crop (corn, wheat, and soybeans):

\[ \text{Loss}_{i,t} = \beta_0 + \beta_1 \text{drought}_{i,t} + \gamma_i + \alpha_t + \epsilon_{i,t} \]  \hspace{1cm} (1)

where \( \text{Loss}_{i,t} \) denotes the measure of loss (2019 dollars) for county \( i \) at time \( t \), \( \gamma_i \) denotes county fixed effects, and \( \alpha_t \) denotes time fixed effects. For our main specification, loss is measured as the farmer’s deductible. However, we estimate a second set of specifications that estimate the relationship between drought exposures and total loss (specifically, deductibles + indemnities) for county \( i \) at time \( t \). \( \text{Drought}_{i,t} \) denotes the measure of drought exposure in acres. We run two specifications: annual average exposed acres (all drought categories) and average annual acres exposed by drought category (D0–D4). We use county fixed effects to control for any time-invariant characteristics that are unique to that county (such as productivity, style of farming, and location). Time fixed effects control for factors that may affect the entire agriculture sector over time (such as commodity prices, supply and demand, or trade policy).

Additionally, we run a series of unreported robustness checks including model specifications that account for irrigated acreage, periods of high and low drought severity, trimming outliers, and that use shares of exposed acres against shares of lost value. Results from these specifications are not qualitatively different than our main specification linking drought-exposed acres to losses.
Table B-1
Model Results

Panel A: Corn

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Panel B: Wheat

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Table B-1 (continued)

Panel C: Soybeans

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* Significant at the 10 percent level
** Significant at the 5 percent level
*** Significant at the 1 percent level

Note: County-clustered standard errors are in parentheses.
Sources: U.S. Drought Monitor and USDA.
Endnotes

1The climate and weather variables that make up the U.S. Drought Monitor include the Palmer Drought Index, soil moisture, streamflow percentiles, percent normal precipitation, a precipitation index, and vegetation health. The drought categories are associated with their percentile chance of occurring within a 100-year period, with lowest-intensity drought D0 (“abnormally dry”) having a 20–30 percent probability of occurring and D4 (“exceptional drought”) having a less than 2 percent probability of occurring (Svoboda and others 2002; Kuwayama and others 2018; U.S. Drought Monitor 2020). The drought monitor further categorizes drought areas into short-term effects (less than six months) and long-term effects (greater than six months).

2Values are in CPI-adjusted 2019 dollars.

3Drought insurance claims include the following natural hazard categories: drought, heat, hot wind, and irrigation failure. Flood is the other major natural hazard faced by farmers, averaging roughly 30 percent of total crop insurance indemnities paid over the last 20 years.

4In addition to Hawaii and Alaska, we exclude Rhode Island due to its lack of drought exposure for the crops we analyze.

5Although irrigation can help some farmers mitigate drought risk during episodes of low rainfall, less than 10 percent of U.S. agriculture is irrigated, and roughly three-fourths of irrigated land is in the western United States (USDA ERS 2019). Even in areas where irrigation is possible, irrigating farmland can be expensive and may not completely offset drought risk when it is prolonged or extreme (USDA ERS 2019; Foster, Brozović, and Butler 2015). Given the relatively low share of irrigated agricultural land in the United States, our main analysis does not directly address the relationship between irrigation and drought risk. However, we do run a series of robustness checks that includes irrigated acreage. Results from these specifications are not qualitatively different than our main specification linking drought-exposed acres to losses.

6Our sample window is limited by the availability of drought data, which start in 2000 (USDM 2020). Our loss measure, while useful, may underestimate farmer losses from drought in two ways. First, our measure does not account for “shallow loss,” which is when a farmer’s loss is less than the deductible or coverage level. Second, our measure does not capture losses from uninsured crop production. For this reason, we focus on corn, soybeans, and wheat, which have high crop insurance market penetration.

7Appendix Table B-1 shows full results for each crop type. We provide results for both farmer deductibles and total losses (that is, indemnities + deductibles). Without crop insurance, estimated losses for farmers would roughly double.
The unique loss profile for soybeans may be attributable to soybeans’ higher yield declines during more extreme dry periods, as soybean production is more susceptible to more extreme drought conditions (Troy, Kipgen, and Pal 2015).

According to the USDA’s Agricultural Resource Management Survey, in 2018, the size of the average U.S. business farm was 1,023 acres for corn, 675 acres for soybeans, and 2,466 acres for wheat. Average production value per acre from 2000 to 2019 in real CPI-adjusted 2019 U.S. dollars is roughly $599 per acre for corn, $214 per acre for wheat, and $441 per acre for soybeans. Farmer loss estimates and indemnity estimates are taken from our model coefficient estimates in Appendix Table B-1. Indemnity estimates (per acre) are calculated as “Total loss” minus “Farmer deductible.” Although we focus a majority of our discussion and analysis on farmer losses (deductibles), we show estimated indemnities and remaining value to place farmer losses in the context of broader drought losses and crop insurance payments.

To further place farmer loss in context, consider that average net farm income from the USDA’s Agricultural Resources Management Survey (2014–18) in real 2019 dollars was roughly $138,000 for corn, $52,000 for wheat, and $88,000 for soybeans. Although our estimates for direct farmer loss represent a large portion of farmer income, we focus our example for the typical U.S. corn, wheat, and soybean farm on farmer losses relative to production value (revenue) rather than on income. Farm income is affected by several factors besides production, such as labor costs, seed and fertilizer expenses, fuel costs, and government payments. During a natural hazard such as drought, farmers may adjust their operations and expenses and may receive disaster payments, all of which can affect farm income separate from the shock to the farmer’s production.
References


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