

Refinancing, Monetary Policy, and the Credit Cycle

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Annu. Rev. Financ. Econ. 2020. 12:67–93

First published as a Review in Advance on
August 3, 2020

The *Annual Review of Financial Economics* is online at
financial.annualreviews.org

<https://doi.org/10.1146/annurev-financial-012720-120430>

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JEL codes: D12, D14, E50, G21, G51, R31

Keywords

mortgage rates, refinance, consumption, monetary policy, fixed-rate mortgage, credit constraints

Abstract

We assess the complicated reality of monetary policy transmission through mortgage markets by synthesizing the existing literature on the role of refinancing in policy implementation. After briefly reviewing mortgage market institutions in the USA and documenting refinance activity over time, we summarize the links between refinancing and consumption and describe the frictions impeding the refinancing channel. The review draws heavily on research emerging from the experience of the financial crisis of 2008–2009, as it highlights a combination of market, institutional, and policy-making factors that dulled the transmission mechanism. We conclude with a discussion of potential mortgage market innovations and the applicability of lessons learned to the ongoing stresses induced by the COVID-19 pandemic.

1. INTRODUCTION

Monetary policy plays a central role in business cycle management. One of the primary transmission channels for policy actions by the Federal Reserve is to stimulate household consumption by lowering the cost of consumer credit. Although monetary policy accommodation affects all household borrowing rates, from credit cards to auto loans, its potential is arguably greatest in mortgage markets. There is a rather straightforward reason for this: Housing constitutes the largest and most widely held asset of US households, with 78 million homeowners owning roughly \$30 trillion of real estate. This real asset serves as collateral for mortgage loans, making mortgages by far the largest consumer credit market, with an aggregate value of approximately \$11 trillion. Because of the size and wide participation in mortgage markets, influencing the cost of housing credit has the potential to generate sizable income and wealth effects that can be converted into household consumption.

In an idealized setting, a Fed-induced decline in short-term rates results in lower funding costs for financial institutions. These lower costs, in turn, encourage lenders to lower rates they charge to borrowers, thereby expanding the provision of credit. Some of this credit takes the form of home mortgages, which allow homeowners to refinance, thereby replacing their existing debt with new contracts bearing a lower interest rate. The resulting decline in the present value of debt obligations and in the attendant monthly service flows generates both wealth and income effects for borrowers that can be used to support additional household consumption. In this simplified depiction of the easing cycle, the monetary authority transmits stimulus to households through financial intermediaries.

The reality, however, is much more complicated. Monetary policy actions by themselves affect the cost of credit only in the short-term interbank lending market. The extent to which these actions are transmitted to homeowners depends critically on two sets of factors: (a) the pass-through of monetary policy actions to mortgage interest rates and (b) the ability of households to access mortgage markets. Each of these factors—which can be thought of as the intensive and extensive margins of policy transmission—is determined by a multitude of economic forces. For instance, the ability to lower mortgage rates at the zero lower bound (ZLB) is affected by central bank portfolio choices and by mortgage originator capacity. In the USA, households' access to refinancing is predicated on their ability to remain creditworthy and on the availability of housing equity. Policy makers' attempts to open refinancing opportunities to borrowers lacking sufficient equity depend on properly aligning the incentives of market participants and on preserving mortgage lending infrastructure.

This review assesses the reality of these frictions by synthesizing the existing literature on the role of refinancing in monetary policy implementation. Much of the literature we review is based on the experience of the 2008–2009 financial crisis, which pushed markets, policy makers, and households to their limits. This experience and the concurrent surge in available data resources helped the profession formulate better answers to the following key questions: (a) How important is the refinancing channel for transmission of monetary policy to households? (b) What frictions inhibit smooth functioning of this channel, and what ex post policy actions help mitigate them? (c) What market and policy innovations hold promise for making it function better in the future?¹ As we argue below, monetary transmission through the housing market was made particularly fraught by a unique combination of a central bank with a limited arsenal of policy tools at the

¹In addition to mortgage servicer and credit bureau databases, researchers have been able to use data from participants in government-sponsored mortgage modification programs, government-sponsored enterprises (GSEs), public records, investment banks, and financial firm bankruptcy estates.

ZLB, a multitude of policy-making bodies charting fiscal and housing policy actions with less than complete coordination, and a mortgage market dominated by long-term fixed-rate contracts.

After describing the institutional environment in Section 2, we focus in Section 3 on the specifics of transforming monetary policy actions into mortgage rates, both in a typical interest rate environment and under the constraint of the ZLB. In Section 4, we provide empirical evidence on refinancing and equity extraction activity over the past 30 years to give context for our subsequent discussion. Section 5 centers on both cyclical and behavioral impediments to effective functioning of the refinancing channel, as well as on the ability of various policy actions to counteract them. We emphasize institutional arrangements, private actors' incentives, and regulatory structure, all of which proved to be crucial in inhibiting monetary policy transmission during the financial crisis.

Section 6 assesses the links between refinancing and stimulating household consumption. We consider the role played by the relaxation of liquidity constraints and that of extracting home equity, and we stress heterogeneity in household responses. Sections 7 and 8 look to the future and discuss recent research that highlights the importance of market innovations in designing more robust mortgage contracts and in stressing the limits of the refinancing channel of monetary policy. The lessons learned from the financial crisis are particularly pertinent today, as policy makers face unprecedented economic disruption from the COVID-19 pandemic. Section 9 thus highlights some of the key implications of the pandemic for monetary policy, mortgage markets, and policy choices before concluding with directions for future research.

2. INSTITUTIONAL BACKGROUND: THE 30-YEAR FIXED-RATE MORTGAGE AND GOVERNMENT INVOLVEMENT IN THE US MORTGAGE MARKET

The predominance of the 30-year fixed-rate mortgage (FRM) is a defining feature of the US housing finance system, with significant implications for the transmission of monetary policy. **Figure 1** indicates that more than 90% of home-purchase mortgage originations in 2018 were 30-year FRMs, and an additional 4% were FRMs with terms of at least 15 years (see the **Supplemental Material** for tables showing the statistics for all figures in this review). The main alternatives in the USA to these long-term FRMs are fully amortizing hybrid adjustable-rate mortgages (ARMs) with an initial fixed rate typically for the first 3 or 5 years.² There has been some fluctuation over time in the 30-year FRM share, driven in part by changes in the relative prices of different mortgage products (Kojien, Van Hemert & Van Nieuwerburgh 2009). Still, throughout the 2 decades depicted in **Figure 1**, FRMs accounted for the lion's share of outstanding residential mortgages.

The popularity of the 30-year FRM reflects several consumer-friendly features that appeal to risk-averse households (Campbell & Cocco 2003, Coulibaly & Li 2009). FRMs provide nominal payment certainty, relatively low payment size because of the long amortization term, and protection against rising interest rates. At the same time, 30-year FRM borrowers in the USA can generally prepay their loans at any time without penalty.³ This embedded call option allows

Supplemental Material >

²During the housing boom, mortgages with various nontraditional features became prevalent (Amromin et al. 2018; Dokko, Keys & Relihan 2019).

³In many countries, there are sizable prepayment penalties (Jaffee 2015). The lack of prepayment penalties in the USA can be traced to government policy and the institutions that insure and guarantee 30-year FRMs. Most recently, the new qualified mortgage rules issued under the Dodd–Frank Act discourage prepayment penalties.

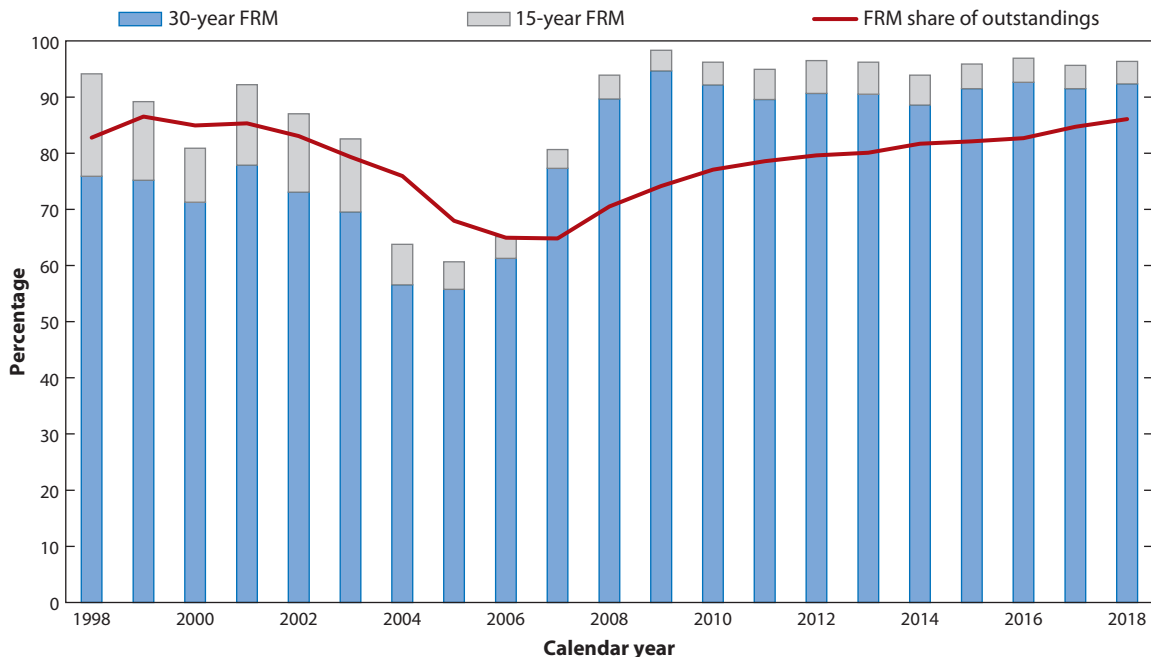


Figure 1

Fixed-rate mortgage (FRM) share of annual issuance of purchase mortgages and outstandings, 1998–2018. The bars show fractions, by count, of home-purchase originations that are 30-year (*blue*) and 15-year (or higher, but less than 30-year; *gray*) FRMs. The red line shows the fraction, by dollar volume, of all outstanding mortgage debt that is fixed rate with at least a 15-year term. Figure based on the authors' tabulations from a 5% sample of Black Knight McDash data and includes only single-family, first-lien, owner-occupied mortgages. The McDash data are based on data from the largest mortgage servicers. Coverage of the mortgage market has increased over time, ranging from approximately 25% in 1998 to more than 50% since 2006.

households to more easily move, liquidate home equity, and take advantage of declining interest rates by refinancing.

These benefits, though, are not without downsides. First, as we discuss in more detail in Section 5, there are several impediments to refinancing, limiting the extent to which households benefit from interest rate declines. Second, because FRMs shift multiple risks related to future interest rate movements to investors, borrowers typically pay a substantial premium relative to ARMs.⁴

The widespread availability of 30-year FRMs in the USA stands in stark contrast to most developed countries, where ARMs and shorter-term fixed-rate loans tend to prevail (Lea 2010; Campbell 2013; Badarinza, Campbell & Ramadorai 2018).⁵ The depth of securitization markets may help explain such cross-country differences (Fuster & Vickery 2015). Pooling mortgages into mortgage-backed securities (MBS) and selling them in international capital markets avoid the

⁴When rates rise, FRM assets lose value as consumers remain in their relatively low-cost mortgage. Yet if rates fall, consumers tend to prepay, forcing investors to reinvest at lower yields.

⁵For example, in the United Kingdom, ARMs and hybrid ARMs dominate (Cloyne, Ferreira & Surico 2020). In Canada, most mortgages have a term of 1, 3, or 5 years, but with a 25-year amortization schedule, and the interest rate must then be renegotiated at the end of the term (Allen, Clark & Houde 2014).

maturity mismatch problem presented when banks hold long-term mortgages funded with short-term deposits.⁶

Demand and institutional factors may also help explain cross-country variation in securitization and FRM use. As Green & Wachter (2005) point out, there may be some path dependence in the types of loans consumers feel comfortable with. Long-term fixed-rate amortizing contracts have been available throughout the USA since the early twentieth century (Rose 2019). The Federal Land Bank System and the Joint-Stock Land Banks have offered 33-year contracts since 1916, and building and loan associations have offered 12-year mortgages. Both types of contracts had similar antecedents in Europe, but it was the US Government's entry into mortgage markets that made long-term, self-amortizing FRMs a widely adopted alternative to the short-term balloon mortgages that precipitated a foreclosure wave during the Great Depression (Green & Wachter 2005). To improve the funding and availability of such loans, the government created the Federal Housing Administration (FHA) to insure these mortgages and Fannie Mae to issue bonds and purchase FHA-insured FRMs. In the absence of such government intervention, the 30-year FRM may never have caught on in the USA.

Today, the federal government continues to play a central role in the US housing finance system. Several government agencies, such as the FHA and the Veterans Administration (VA), insure or guarantee many mortgages, including both FRMs and ARMs that meet agency-specific size, underwriting, and eligibility requirements. The other key players in housing finance are the government-sponsored enterprises (GSEs) Fannie Mae and Freddie Mac. Prior to the financial crisis, the GSEs were private institutions that were established and chartered by the federal government for public policy purposes. The GSEs purchase conventional mortgages (i.e., mortgages that are not FHA or VA backed) that meet GSE credit standards and loan size limits set by Congress (i.e., Conforming Loan Limits), and pool them into agency MBS that carry a GSE guarantee against credit risk.⁷ Despite their private status, investors in GSE MBS long perceived the GSE credit guarantee to be as good as a government guarantee, giving the GSEs a funding advantage and allowing them to dominate the market (Frame & White 2005, Passmore 2005, Acharya et al. 2011). This perception became reality during the financial crisis, as the GSEs were bailed out by the government and taken into conservatorship in 2008. More than 10 years later, the GSEs remain under government control.

Figure 2 shows the shares of new loans insured or guaranteed by the GSEs and federal agencies over time. These shares fluctuated dramatically during the housing boom and bust. As the financial crisis deepened and private capital dried up, the mortgage market became extraordinarily dependent on these institutions. A key lesson from this episode is that these institutions can help smooth fluctuations in credit availability over the business cycle, and thus can help transmit accommodative monetary policy to households through the mortgage market (Hurst et al. 2016, Passmore & Sherlund 2019). Moreover, as we discuss below, the government was able to exploit the wide footprint of these institutions to implement large-scale refinancing programs. Such countercyclical benefits have featured prominently in the debate about the future of housing finance in the USA.

⁶That said, banks do maintain some exposure to long-term FRMs, holding both whole loans and MBS on their balance sheets. Such holdings may not be as risky as traditionally thought, as deposit rates in the USA have been shown to be quite sticky rather than a pure floating-rate liability (e.g., Driscoll & Judson 2013). Drechsler, Savov & Schnabl (2018) attribute this stickiness to banks' market power.

⁷Note that the term agency MBS can also include Ginnie Mae MBS composed of government-backed loans.

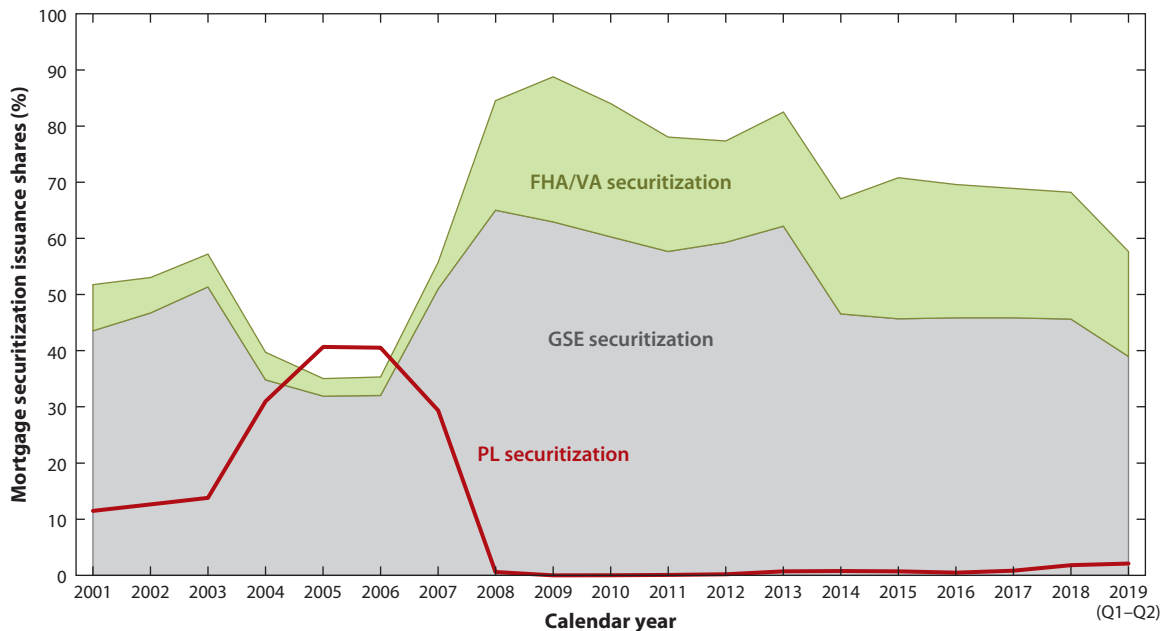


Figure 2

Government-backed, government-sponsored enterprises (GSEs), and private-label (PL) securitization issuance shares, 2001–2019. Government-backed securitizations are Ginnie Mae securities composed primarily of mortgages insured or guaranteed by the Federal Housing Administration (FHA) or Veterans Administration (VA). GSE securities are composed of mortgages purchased by Fannie Mae and Freddie Mac. Residual issuance can be attributed to mortgages held in bank portfolios. Figure adapted from the Urban Institute and Inside Mortgage Finance.

3. MONETARY POLICY AND MORTGAGE RATES

Before discussing how changes in mortgage rates affect household balance sheets and spending via mortgage refinancing, we consider the question of whether the Federal Reserve influences the interest rates at which households and firms can borrow. This question has long been studied by economists, but significant progress has been made in recent years using new data and innovative empirical methods.

Conventional monetary policy—as opposed to unconventional monetary policy, which we discuss later in this section—entails the Fed changing its target for the federal funds rate (the rate at which banks lend to each other overnight) and trading securities in the open market to achieve that rate. One empirical challenge in identifying the effect of a change in the target rate is that Fed actions generally occur endogenously in response to economic events that themselves could affect interest rates in the economy. For example, during the financial crisis, the Fed aggressively lowered the federal funds rate, and rates on Treasury securities also declined (**Figure 3**). But the declines in Treasury rates likely reflected both the independent effects of monetary policy and the increased demand for highly liquid, risk-free assets. Another empirical challenge is that markets may anticipate what the Fed will do at its next policy meeting (typically every 8 weeks), especially if Fed officials signal upcoming rate changes through speeches and other communications. Thus, when the Fed officially announces a change to the target federal funds rate, other interest rates may have already moved in anticipation, and it may thus appear as though Fed policy had no effect.

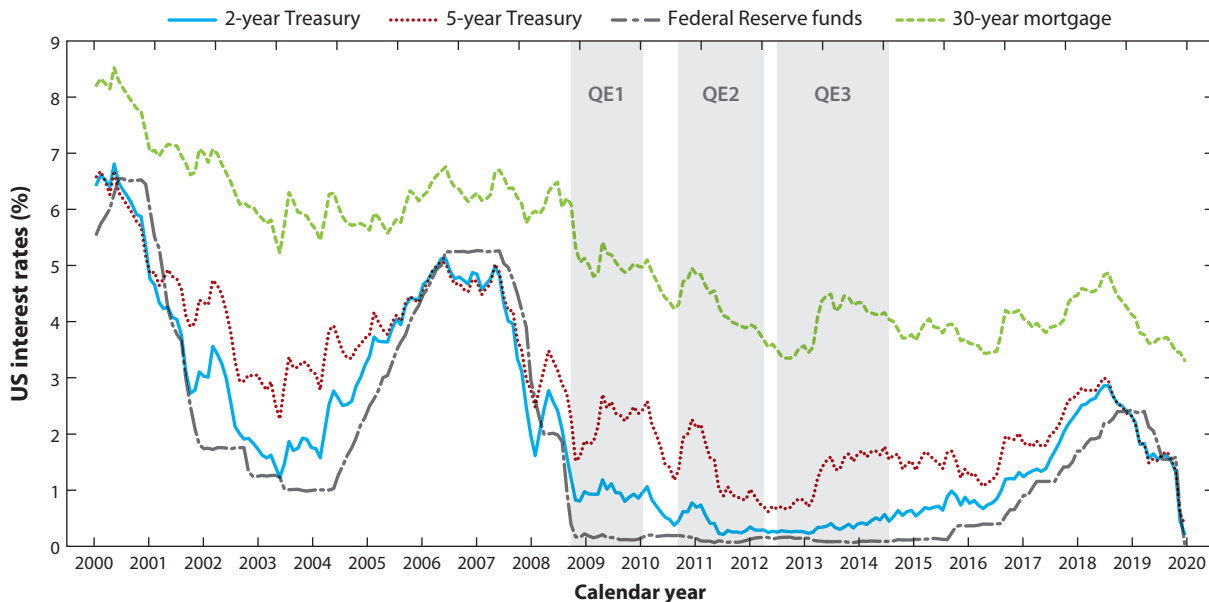


Figure 3

Key interest rates, 2000–2020. Interest rate data are monthly averages through April 2020. The 30-year mortgage rate refers to the average rate for a 30-year fixed-rate mortgage offered to prime borrowers by lenders in the Primary Mortgage Market Survey conducted by Freddie Mac. The gray areas indicate periods of quantitative easing (QE) by the Federal Reserve. Figure adapted from Haver Analytics.

In recent years, researchers have addressed these empirical challenges by using high-frequency (daily and intraday) interest rate data and event study designs to help identify the causal effects of monetary policy. Pioneered by Kuttner (2001) and Cochrane & Piazzesi (2002), the key idea in this approach is that the level of various market interest rates just prior to any Fed target rate announcement should fully embed all public information. Thus, any sharp change in short-term rates from just before to just after the announcement reflects a policy shock.⁸ In recent research, Nakamura & Steinsson (2018) use this event study approach to estimate that a 100-basis-point monetary policy shock is associated with an approximately 40-basis-point change in both nominal and real 10-year Treasury rates.⁹ Moreover, because households tend to prepay their mortgages within the first 10 years, fluctuations in 5–10-year Treasuries have a strong effect on mortgage rates. Gilchrist, López-Salido & Zakrajšek (2015) estimate that a conventional monetary shock of 10 basis points lowers interest rates on 30-year FRMs by approximately six basis points (also see Gertler & Karadi 2015).

⁸Cook & Hahn (1989) found that target-rate changes during the late 1970s were associated with changes in market rates, but subsequent research failed to find such connections during the 1980s and 1990s. However, as Kuttner (2001) points out, none of these early studies distinguished between anticipated and unanticipated changes to target rates.

⁹Nakamura & Steinsson (2018) also examine instantaneous forward rates at various horizons to show that the effect on 10-year Treasury rates reflects changes to expectations for short-term rates in the 3 to 5 years after the policy shock, as opposed to monetary policy having long-run effects on rate expectations. In contrast, Hanson & Stein (2015) find that monetary policy has a substantial effect on the 10-year forward real rate, although they argue that this long-run effect likely reflects changes in term premia.

During the financial crisis, the Fed exhausted its conventional tools as the federal funds rate hit the ZLB by the end of 2008. Constrained by the ZLB, the Fed was forced to rely on unconventional methods of monetary policy to provide further stimulus. These methods include trying to influence expectations of the future path of short-term interest rates (forward guidance) and trying to lower longer-term interest rates more directly through large-scale purchases of longer-term assets, including agency MBS. This purchase activity is often referred to as quantitative easing (QE).

Prior to the Fed's implementation of QE policies, research supported the notion that such an approach could be effective. For example, Bernanke, Reinhart & Sack (2004) find that shocks to the expected supply of Treasury debt indeed affect Treasury yields. After QE, event study-based evaluations indicate substantive drops in both Treasury and MBS yields immediately after surprise QE announcements of future asset purchases (e.g., Gagnon et al. 2010, Krishnamurthy & Vissing-Jorgensen 2011).¹⁰ Estimates suggest that QE1, which lasted from late 2008 to early 2010 (Figure 3), led to declines in MBS yields of approximately 100 basis points, reflecting the Fed's focus on MBS purchases during QE1.¹¹

In addition to affecting Treasury and MBS yields, QE has been found to have lowered primary market mortgage rates faced by households. It is important to separately test for the effects of QE on primary rates, given that secondary market and primary market rates can diverge (Fuster et al. 2013). Di Maggio, Kermani & Palmer (2020) test whether QE affected primary mortgage rates by comparing the evolution of rates paid for conforming-size loans—which were most directly affected by QE purchases of agency MBS—versus jumbo (GSE-ineligible) loans, before and after QE. They find that the interest rates on new conforming mortgages dropped by more than 50 basis points relative to jumbo loans.¹² Fuster & Willen (2010) and Hancock & Passmore (2011), using different data and methods, also provide evidence of sharp declines in primary mortgage rates due to QE.

In summary, the available research provides compelling evidence that both conventional and unconventional monetary policy have substantive direct effects on interest rates in the economy, including the mortgage rates faced by households. We now turn to the available evidence on how households respond to declines in mortgage rates.

4. MORTGAGE REFINANCING AND EQUITY EXTRACTION OVER TIME

In order for monetary policy to be successfully transmitted to the household sector, households must exercise their option to refinance. However, transaction costs, such as origination, appraisal, and title fees, as well as taxes, drive a wedge between interest rate changes and refinancing activity. Because of the transaction costs, mortgage rates must drop sufficiently to justify refinancing.

In addition, for a given drop in interest rates, the benefits of refinancing will vary across households depending on several factors, such as their expected time horizon in their home and their marginal tax rate. This heterogeneity implies that not all households would optimally refinance

¹⁰The estimated effects of QE1 are larger than QE2, which may reflect that the earliest QE announcements were the most significant and surprising (Krishnamurthy & Vissing-Jorgensen 2011).

¹¹The disproportionate effect of MBS purchases on MBS yields reflects a portfolio balance effect due to imperfect substitutability between assets of different types and maturities (Brainard & Tobin 1968). For another interesting example of such effects, see D'Amico & King (2013).

¹²To the extent that there were some spillover effects of QE on interest rates for jumbo mortgages, these difference-in-difference estimates of QE's effect on mortgage rates can be considered conservative.

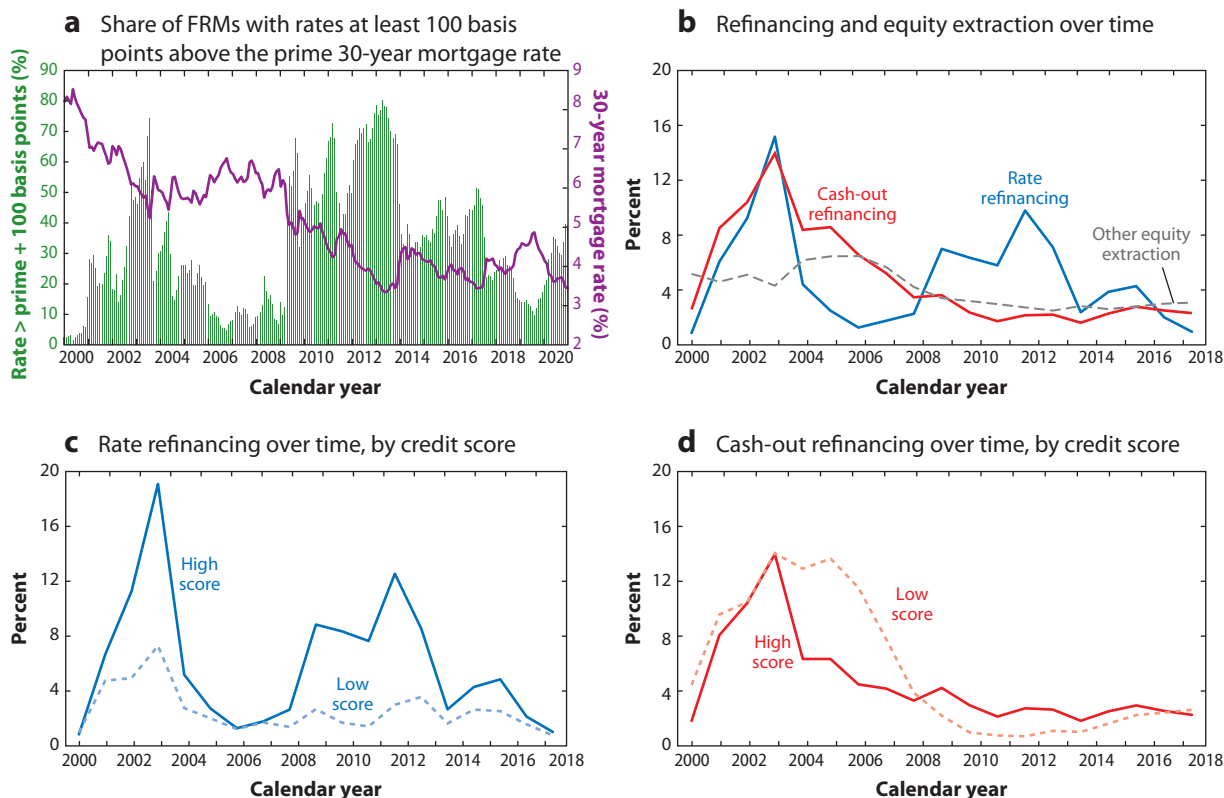


Figure 4

Refinancing, equity extraction and rate distribution over time, 2000–2018. Panel *a* shows the fraction of outstanding 30-year fixed-rate mortgages (FRMs) in the Black Knight McDash data with an interest rate at least 100 basis points above the average prime offer rate for a 30-year FRM from Freddie Mac's Primary Mortgage Market Survey (see the **Figure 1** caption for additional information about the McDash data). Panels *b*, *c*, and *d* use the Federal Reserve Bank of New York Consumer Credit Panel/Equifax Data (CCP), which represent a 5% sample of consumers with a credit file and a valid Social Security number and provide detailed credit data at a quarterly frequency. The statistics here are based on yearly samples of individuals who have at least \$5,000 in mortgage debt at the start of the year on only one property (inferred from their number of and size of mortgages) and who do not move during the year. "Rate refinance" is the share of sample borrowers who open a new first-lien mortgage during the year and whose mortgage debt does not grow by more than 5%. "Cash-out refinance" is the share of sample borrowers who open a new first-lien mortgage during the year and whose total mortgage debt grows by more than 5%. "Other equity extraction" is the share of sample borrowers whose mortgage debt grows by at least 5% either through a new second lien or by drawing on an existing home-equity line of credit. "Credit score" is the Equifax 3.0 Risk Score, measured at the start of the year; "high" is a score above 680. Observations are weighted to account for the higher likelihood of sampling joint mortgages. For computational reasons, we use a 2% sample of the CCP, resulting in a 0.1% sample of the population with a credit record.

at the same time. Finally, even when the present value of benefits exceeds the transaction costs, households may rationally delay refinancing if further declines in rates are possible.

In a groundbreaking paper, Agarwal, Driscoll & Laibson (2013) provide the first closed-form optimal refinancing rule, taking into account the various costs and benefits, as well as the option value of waiting given historical interest rate volatility. Their solution suggests that the interest rate differential required to make refinancing worthwhile is typically 100 basis points or more.

Figure 4a shows the fraction of 30-year FRM borrowers who are likely to be "in the money" for refinancing, having an interest rate at least 100 basis points higher than the prevailing average

prime offer rate from Freddie Mac's Primary Mortgage Market Survey. The share of likely refinance candidates was elevated in 2002–2003 as mortgage rates dropped below 6% for the first time in decades, and peaked in 2012 when rates hit all-time lows, though refinancing frictions (as discussed in Section 5) were quite severe. A caveat to **Figure 4a** is that not all borrowers can expect to qualify for the prime rate. For some, available rates are likely to be higher, but others may qualify for rates below prime. Data on specific offer rates for different types of borrowers have only recently become available to researchers (e.g., Bhutta, Fuster & Hizmo 2019), with a limited historical time series.

Contemporary mortgage research has also begun to exploit panel data from consumer credit agencies. Relative to the various loan-level data sets used in many papers, credit data are highly representative and allow researchers to observe all mortgages held by a borrower and to follow borrowers from one mortgage to the next. These attributes are extremely useful for studying refinancing activity.

Figure 4b uses the Federal Reserve Bank of New York Consumer Credit Panel/Equifax Data to plot annual estimates from 2000 to 2018 of the fraction of homeowners who refinanced their first-lien mortgage, split into the share doing a basic rate refinancing and the share doing a cash-out refinancing to extract equity. It also plots the fraction of households extracting equity without involving a first-lien refinancing (e.g., drawing on a home equity line of credit).¹³ This graph reveals a sharp spike in 2003 in both types of refinancing. We estimate that, combined, nearly 30% of borrowers refinanced. In contrast, in 2012, when mortgage rates dropped to well below 4% and refinance incentives were historically high, only about 10% of borrowers refinanced without cash-out, and very few—only 2.1%—did a cash-out refinance.

Panels *c* and *d* in **Figure 4** display propensities of rate and cash-out refinancing by credit score. **Figure 4c** shows that, whereas the likelihood of rate refinancing jumped in both 2003 and 2012 for higher-score borrowers, lower-score borrowers rarely did a pure rate refinancing. **Figure 4d**, however, shows that lower-score borrowers posted a similar propensity of cash-out refinancing as did higher-score borrowers in 2003, and cash-out refinancing was very limited for both groups in 2012. Notably, lower-score borrowers continued to do cash-out refinances at elevated propensities rates through 2006, despite rising interest rates. This pattern may reflect a credit expansion starting in mid-2003 (Justiniano, Primiceri & Tambalotti 2017), combined with long-running house price growth (Bhutta & Keys 2016).

Finally, to provide a longer-run perspective on refinancing activity, we turn to data reported by lenders under the Home Mortgage Disclosure Act, which contain information on nearly the universe of originated residential mortgages. **Figure 5** displays the dollar volume of all refinance originations (cash-out and rate refinances cannot be distinguished in these data) on one to four family properties each year, as a fraction of total outstanding residential mortgage debt as of the end of the prior year. The figure shows two additional waves of refinancing in 1993 and 1998. These two episodes fell short of the refinancing activity observed in 2003, but exceeded refinancing activity in 2010–2012, despite the historic drop in rates post crisis.

Overall, this section has provided new data on refinancing activity across several episodes of interest rate declines, highlighting that refinancing activity can be weaker than expected for some types of borrowers and at certain points in time. In the next section, we discuss both demand-side and supply-side factors that may impede refinancing activity.

¹³Note that those who refinance their first lien and simultaneously extract equity through a junior lien are included in the cash-out refinance category. This analysis draws on the methodology described by Bhutta & Keys (2016).

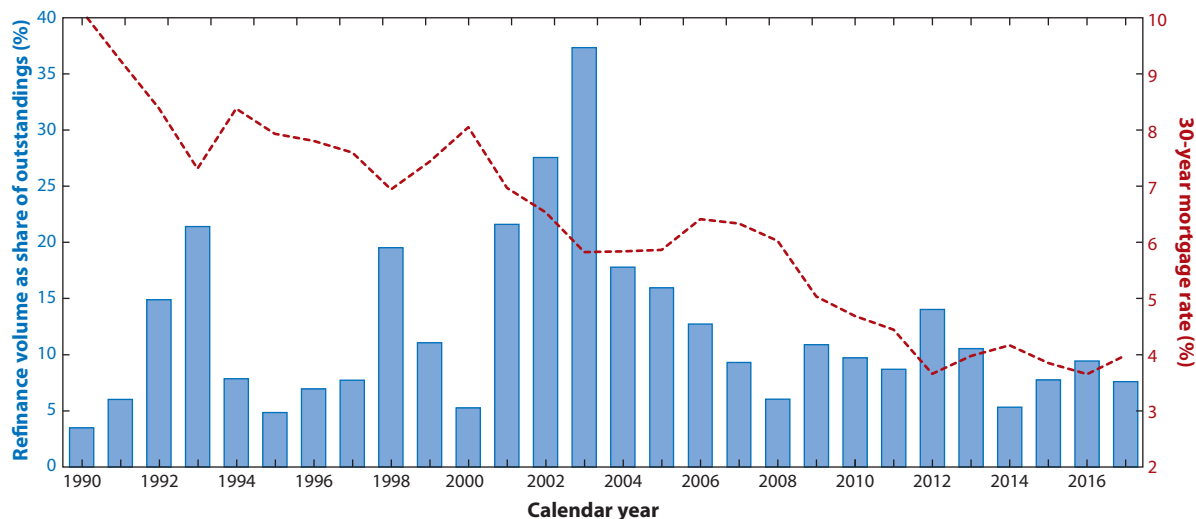


Figure 5

Refinancing and mortgage rates, 1990–2017. The blue bars represent the dollar volume of all refinance originations for one to four family properties reported in Home Mortgage Disclosure Act (HMDA) data, divided by outstanding mortgage debt from the Federal Reserve Financial Accounts of the US as of the fourth quarter of the previous year. Figure based on data from the HMDA, Federal Reserve Financial Accounts of the US, and the Freddie Mac Primary Mortgage Market Survey.

5. IMPEDIMENTS TO REFINANCING

The above discussion demonstrates that borrowers may not refinance even when rates have fallen and the option is in the money. In this section, we discuss both demand-side and supply-side factors that can inhibit the refinancing channel of monetary policy.

5.1. Behavioral Impediments to Refinancing

To determine whether a household's refinancing choice is optimal, researchers have compared the benefits (in the form of reduced monthly payments) of refinancing at today's interest rate with the transaction costs. In an influential paper, Stanton (1995) explicitly modeled heterogeneous transaction costs, and found that mortgage holders often behave as though they face extremely high costs.¹⁴ Those borrowers who fail to refinance are sometimes referred to in the literature as “ostriches” with their heads in the sand (Green & LaCour-Little 1999) or as “woodheads” (Deng & Quigley 2012) who do not react to new information.

Examining the mortgage market in December 2010, Keys, Pope & Pope (2016) estimate that 20% of unconstrained households (on the basis of house prices and origination FICO scores) for whom refinancing was optimal [based on the optimal rule of Agarwal, Driscoll & Laibson (2013)] had not done so. This decision was quite costly: Keys, Pope & Pope (2016) estimate that the median household would have saved \$160 per month in interest payments, or \$11,500 in discounted present value terms over the life of the loan. Agarwal, Ben-David & Yao (2016) and Agarwal, Rosen & Yao (2019) document mistakes not only of omission but also of commission:

¹⁴Even the earliest examinations of MBS performance identified failures of refinancing in both directions: prepaying when rates were too high and failing to refinance when rates fell (e.g., Dunn & McConnell 1981).

refinancing, but not at the optimal time. They estimate that half of refinancers did so at a rate that was at least 50 basis points from the optimal refinancing rate.

What can explain suboptimal refinancing behavior? Some research has pointed to a lack of borrower sophistication. For instance, Bucks & Pence (2008) show that a sizable fraction of borrowers cannot correctly recall the terms of their existing loans. Suboptimal refinancing occurs less frequently among homeowners with higher credit scores, incomes, and education (e.g., Campbell 2006; Agarwal, Ben-David & Yao 2016; Keys, Pope & Pope 2016).¹⁵ However, as the authors of these studies point out, the evidence is not clear cut, because these attributes may also be correlated with a higher likelihood of loan approval. A lack of financial acumen may also result in homeowners underestimating the financial benefit of refinancing. In a field experiment studied by Keys, Pope & Pope (2016), one-third of those who did not take up the refinancing offer did not think the savings were significant enough, despite no up-front expenses.

Beyond sophistication, research points to several behavioral factors that generate suboptimal refinancing. Andersen et al. (2015) find a role for both inattention, where individuals do not gather necessary information to make a refinance decision, and inertia, where individuals incur a psychological cost of acting on information. Johnson, Meier & Toubia (2018) point to mistrust of financial institutions in borrowers' reluctance to accept an in-the-money refinancing offer.

Finally, we note that while studies in this area typically assume that, on a given day, all borrowers face a single prevailing interest rate, recent research shows that there is actually wide dispersion in the rates lenders would offer to prospective borrowers (Alexandrov & Koulayev 2018; Bhutta, Fuster & Hizmo 2019). Because many borrowers do not shop around effectively and do not seem to appreciate that lenders vary in their pricing (Woodward & Hall 2012; Gurun, Matvos & Seru 2016; Bhutta, Fuster & Hizmo 2019), limited access to the best interest rates could negatively affect refinancing activity or lead to suboptimal refinancing outcomes.

5.2. Cyclical Impediments to the Refinancing Channel

In a setting dominated by FRM contracts, households need to refinance their existing obligations. Yet households' ability to do so can be severely compromised in recessions. This subsection describes various refinancing frictions in detail and lays the groundwork for a subsequent discussion of policies employed to remedy them.

Refinancing an existing mortgage to obtain better terms or to extract equity requires taking out a new loan contract to replace an existing one. As such, refinancing triggers a new round of underwriting that has traditionally consisted of reviewing a borrower's income and creditworthiness, as well as the value of the underlying collateral. Each of these underwriting criteria has a strong cyclical component, weakening in recessions and strengthening in boom years. Moreover, the stringency of underwriting requirements is procyclical as well, as lenders dealing with cyclical deterioration in loan performance tighten standards on extending new credit.

All of these phenomena played out in the extreme during the Great Recession, and can help explain weak postcrisis refinancing volumes (Figures 4 and 5). Earlier literature, based on data from the 1980s and 1990s, showed that income constraints, whether measured at the individual household level (Archer, Ling & McGill 1996) or proxied by local unemployment rate (Pavlov 2001), indeed have an important negative effect on mortgage refinancing. Although all recessions are characterized by job losses, the unemployment rate during the Great Recession reached a peak

¹⁵Examining refinancing behavior in Italy, Bajo & Barbi (2018) use unique measures of financial expertise or knowledge (e.g., a degree in finance or economics) to show that take-up of refinancing opportunities is driven by financial sophistication.

of 10% and an average duration of nearly 40 weeks (Farber & Valletta 2015), making it exceedingly difficult for affected borrowers to demonstrate their ability to pay back a loan.

Income shocks generated by job loss also put stress on borrowers' ability to service their debt, often leading to outright delinquency. Using data from the 2009–2013 Panel Study of Income Dynamics (PSID) surveys, Gerardi et al. (2018) show that the effect of job loss on mortgage delinquency is equivalent to a 35% decline in home equity. As a practical matter, lenders are generally reluctant to refinance delinquent mortgages, making loan modification the only possible avenue for transmission of stimulus measures. However, since modifications are driven primarily by lenders' willingness to restructure nonperforming debt and by government incentives, as opposed to monetary policy actions per se, we leave them out of the present discussion.¹⁶

Even when homeowners manage to stay current on their mortgages, income shocks can trigger delinquencies on their other obligations, from student loans to credit cards. These delinquencies have an immediate and lasting effect on credit scores, potentially pushing borrowers outside lenders' acceptable credit score ranges.

Moreover, recessions are often accompanied by tightening in credit score standards. The evidence from the Great Recession showcases a swift response from both private-market investors and government-backed mortgage guarantors, or GSEs. Starting in April 2008, the GSEs added surcharges for borrowers with credit scores below 740. For instance, a borrower with a credit score of 670 and 20% equity faced an additional up-front charge of 2.5% of the value of the loan. Folding this surcharge into the loan would typically add about 60 basis points to the loan interest rate, reducing the benefits of refinancing.¹⁷

Although on paper GSEs continued to allow origination of mortgages to borrowers with FICO scores as low as 620, lenders superimposed their own, stricter set of credit conditions.¹⁸ All told, nearly 70% of Fannie Mae–backed mortgages originated between 2008 and 2013 were for borrowers with FICO scores above 750, compared with 36% of borrowers in 2007 and 32.4% from 1999 to 2004 (Urban Inst. 2013). In addition, the virtually overnight disappearance of private mortgage securitization markets represented a particularly dramatic supply-side response to the financial crisis. These markets accounted for the lion's share of funding for low-FICO-score and other risky borrowers, and their collapse left those borrowers with few refinancing options. In general, reductions in mortgage origination capacity impair refinancing and drive a wedge between MBS yields and mortgage rates post crisis (Fuster et al. 2013).

In addition to tightening credit standards, lenders and the GSEs started enforcing ability-to-pay requirements typically measured as share of mortgage payments to income (PTI). Precrisis mortgage underwriting allowed low-documentation or even no-documentation loans (Jiang,

¹⁶A substantial literature on loan modifications during the Great Recession covers the evolution and take-up of different approaches to modification, the effectiveness of private and government-sponsored programs, and their success in preventing redefault and stimulating consumption. Some of the papers in this literature include those by Piskorski, Seru & Vig (2010); Agarwal et al. (2011, 2017a); Adelino, Gerardi & Willen (2013); and Mayer et al. (2014).

¹⁷For more on these surcharges, also known as loan-level pricing adjustments, see <https://selling-guide.fanniemae.com/Selling-Guide/Selling-Securitizing-Delivering-Loans/Subpart-C1-General-Info-Execution-Options-Loan-Delivery/Chapter-C1-1-Execution-Options-Overview/1121260591/When-is-a-loan-level-price-adjustment-required.htm>.

¹⁸Such lender overlays arose because of put-back risk. In every mortgage transaction, the originator certifies that the underwriting data, namely borrower's income, assets, and house value, are truthful. This certification is known as representations and warranties (R&W). Any mortgage found to be in violation of its R&W has to be bought back by the originator, who bears all credit losses. In the aftermath of the financial crisis, GSEs conducted aggressive audits for possible R&W violations for every defaulted loan. As a result, mortgage originators that securitized their loans through the GSEs regarded R&W as a major liability.

Nelson & Vytlačil 2014). As starkly illustrated by Greenwald (2018), even fully documented loans securitized by the GSEs displayed no meaningful PTI limit. These practices changed quickly with the onset of the financial crisis—full documentation became necessary, and PTI limits (45% in case of the GSEs) were enforced. Moreover, the Dodd–Frank Wall Street Reform and Consumer Protection Act stipulated hard PTI bounds and put limits on what constitutes acceptable sources of income.¹⁹ Taken together, these responses clearly demonstrate how erosion in borrower credit scores and/or income shocks, common in recessions, can either severely curtail the benefits of refinancing or eliminate access to refinancing altogether.

Aside from credit impairment and income losses, insufficient home equity represents a major barrier to borrowers' ability to refinance. Erosion of home equity became a particularly potent friction during the Great Recession, driven both by the magnitude and scope of house price declines and by substantial equity extraction in the years leading up to the recession (Mian & Sufi 2011, Bhutta & Keys 2016). Aggregate housing wealth plunged by nearly \$7 trillion, wiping out all of the housing equity of nearly a quarter of mortgage borrowers (CEA 2012).

These underwater households, who owed more on their homes than their market value, were often shut out of refinancing opportunities. Mortgages on homes with little or negative equity were considered unsecured credit for banks, triggering prohibitive capital charges if they were to be kept on the lending institution's balance sheet. This severely limited the availability of bank portfolio lending for mortgage refinancing. Similarly, the GSEs' charters explicitly prohibited securitizing loans with less than 20% equity in the absence of third-party credit enhancements.

Under normal market conditions, these enhancements are provided by private mortgage insurance (PMI) firms, which take the first-loss position on default-related costs. By typically covering 20% to 30% of the loan balance, PMI firms enable the GSE to securitize loans with higher-than-80% loan-to-value (LTV) ratios while fulfilling their charter requirements. Far from providing stability during the financial crisis, PMI proved to be exposed to the catastrophic risk of nationwide housing declines (Bhutta & Keys 2018). Three of the eight active PMI companies went bankrupt, while others were forced to rescind existing policies and to rely on regulatory forbearance to stay in business. As a result, borrowers with insufficient equity in their homes could not rely on PMI policies to make them eligible for refinancing.

The final refinancing friction arises in the presence of multiple loans collateralized by the same property. The practice of taking out junior lien loans, whether at the time of first mortgage origination to serve as *de facto* down payments (piggybacks) or as subsequent lines of credit, became fairly widespread in the years leading up to the financial crisis (Bhutta & Keys 2018). Having these junior lien loans can complicate refinancing of the first mortgage because of the legal feature that grants seniority to the oldest mortgage on the house in some (but not all) states. To retain its seniority upon refinancing, the first mortgage lender thus has to demand that the junior lien lender agree to subordinate its claim. Arming junior lenders with such blocking power can be expected to impede refinancing. Bond et al. (2017) exploit differences in state laws to show that for borrowers with limited equity who depend on junior lender cooperation, the blocking power of junior lenders lowers refinancing rates by 10%.

5.3. Policies to Ease Refinancing Frictions

Although many of the refinancing frictions discussed in the previous section have always been present, the severity of the Great Recession generated a wide range of novel policy responses.

¹⁹Full details on the new qualified mortgage rules are available at https://files.consumerfinance.gov/f/201301_cfpb_final-rule_ability-to-repay.pdf. The so-called DTI patch made the Dodd–Frank limits on DTI (debt-to-income ratio) less meaningful for GSE loans.

Some of the policy actions directly expanded the already sizable government footprint in mortgage markets. Other actions centered on aligning incentives of private financial intermediaries to convert lower mortgage rates into actionable stimulus for households.

This section discusses some key lessons learned from the policy makers' experience. Among them is the utmost importance of institutional arrangements, the need to balance public interest and private actors' incentives, and the need for continuous refinement of policy parameters. Each of the policies described below—from GSE conservatorship to large-scale refinancing efforts—involved many choices that influenced the pass-through of monetary policy.

The first and, arguably, the most important policy action was the de facto nationalization of Fannie Mae and Freddie Mac in September 2008 after the two GSEs suffered severe credit losses and exhausted their capital. The resulting conservatorship structure made explicit the US Government backing of GSE guarantees and allowed the GSEs to guarantee new loan issues, among them newly refinanced mortgages. The importance of this action in preserving the mortgage market is underscored in **Figure 3**, which shows a sharp spike in the share of government-backed mortgages during the financial crisis.

With sharp house price declines pushing many homeowners into negative equity, government intervention became crucial for their ability to take advantage of dropping interest rates by refinancing.²⁰ As discussed above, the GSE charter restrictions on purchasing high-LTV loans, coupled with disarray in the PMI industry, kept the GSEs from passing through lower interest rates to households. In response, the government launched the Home Affordable Refinance Program (HARP) in 2009. Under HARP, the GSEs were permitted to purchase refinance loans with LTV ratios up to 125%, with no requirement for obtaining new PMI.²¹

That said, the program was not explicitly intended to support monetary policy transmission; instead, it was part of a broader financial rescue package to promote macroeconomic stabilization by mitigating foreclosures, and thus limited by design.²² Rather than follow the blueprint of the Great Depression, when the federal government committed sizable capital to buying up and refinancing private mortgages through the Home Owners' Loan Corporation (Rose 2011), HARP's reach was restricted to loans already guaranteed by the GSEs. Furthermore, the government tried to limit risks to taxpayers and to avoid the appearance of a bailout by making only nondelinquent (performing) mortgages eligible for HARP. Finally, as an enticement to investors, eligible mortgages could be refinanced through HARP only once, which significantly lowered prepayment risk.

After HARP got off to a slow start, it became apparent that simply relaxing the LTV rules still left out many details that hindered both borrower and lender incentives to participate. As one example, HARP offered murky treatment of representations and warranties (R&W) of refinanced mortgages.²³ In particular, HARP allowed existing lenders to leave in place old R&W,

²⁰In private markets, lenders generally are unwilling to refinance underwater borrowers, given the elevated risk of default losses when borrowers have no equity cushion. Moreover, the lack of outside refinancing options undermines competition that would incentivize lenders to refinance their existing borrowers. During the crisis period, the only notable source of refinancing for low-equity and underwater borrowers aside from government-based programs was approximately 50,000 low-equity refinances under the National Mortgage Settlement (Agarwal et al. 2017b).

²¹If a loan already had PMI, no new coverage was required. If a mortgage did not carry PMI (i.e., was originated with at least 20% equity), no new enhancement was required, even if equity was below 20% at refinancing.

²²At the time of HARP design, there was no firm empirical support for whether the marginal propensity to consume (MPC) of underwater borrowers was necessarily higher than that of MBS investors, which contributed to its stated focus on foreclosure prevention.

²³See footnote 18 for a description of R&W. Amherst Securities (2010) provides details on frictions in the original HARP.

while requiring new lenders to face a stringent set of new R&W conditions. This feature of the program had a chilling effect on competition.

Agarwal et al. (2017b) use a variety of identification strategies to show that competitive frictions in HARP partly hampered the program's impact, reducing the take-up rate and annual savings by 10% to 20%, with stronger effects among the most indebted borrowers, the key target of the program. This friction also had an effect on terms of refinanced loans. Amromin & Kearns (2014) use the discontinuity in HARP eligibility at an LTV of 80% to find a sharp increase in the share of mortgages refinanced with the same lender at the eligibility threshold, as well as an increase in rate spread of approximately 11 basis points.

HARP 2.0, unveiled in November 2011, addressed some of the program's frictions but tilted the playing field even further in favor of existing lenders.²⁴ Amromin & Kearns (2014) show that this nearly doubled the HARP spread to 20 basis points. Only in January 2013 did the next set of HARP iterations partially address this distortion. Using a difference-in-differences approach around this date, Agarwal et al. (2017b) find a sharp improvement in interest rates on HARP mortgages and a concurrent increase in refinancing rates.²⁵

Unlike Fannie Mae and Freddie Mac, the FHA had allowed refinancing of its existing mortgages regardless of equity position for decades prior to the Great Recession. The streamlined refinancing program (SLR) did not require an updated appraisal, credit score, or even employment. However, faced with massive credit losses, the FHA changed its SLR requirements in September 2009. Now borrowers had to verify employment and were not allowed to roll up-front insurance and closing costs into a new loan without agreeing to a new appraisal. DeFusco & Mondragon (2020) show that these measures had a profoundly negative effect on the refinancing ability of FHA borrowers who either were unemployed or had little or no equity in their homes—the most vulnerable population insured by the FHA.

The FHA subsequently stopped requiring employment verification for SLR in June 2011, and in June 2012 it further increased the appeal of the program by effectively eliminating up-front insurance premiums. Since this change applied only to loans originated prior to 2009, Ehrlich & Perry (2017) are able to use a regression discontinuity framework to show a near doubling of refinancing volumes for eligible loans.

In summary, the postcrisis experience showed that policy actions can be effective in resolving some of the most severe cyclical frictions. However, even small policy details can be consequential, highlighting the need for policy makers' continuous learning and for their ongoing ability to implement necessary changes.

6. REFINANCING, MORTGAGE PAYMENT SIZE, AND CONSUMPTION

This section explores the micro- and macroeconomic consequences of refinancing. While there are several impediments to refinancing, as discussed above, here we consider how refinancing affects household consumption and investment conditional on having refinanced.

Selection issues complicate the estimation of the causal effect of refinancing on consumption. Households must make an active decision to refinance, and this decision will reflect generally unobserved individual factors such as liquidity, time preferences, and financial literacy. Further complicating matters, variation across households in their marginal propensity to consume (MPC)

²⁴The revised HARP lowered up-front loan charges, allowed some solicitation by new lenders, and removed the LTV limit, among other things.

²⁵As of 2019 Q1, HARP has refinanced 3.5 million mortgages, more than a million of which had LTV ratios in excess of 105% (see https://www.fhfa.gov/AboutUs/Reports/ReportDocuments/Refi_1Q2019.pdf).

may be correlated with these factors. For example, financially savvy households that are more likely to refinance when rates drop may have relatively low MPCs.

Two recent studies exploit variation in eligibility for HARP refinancing to help circumvent these identification issues. Agarwal et al. (2017b) take advantage of the fact that only GSE-securitized loans were eligible for HARP, while similar but privately securitized loans were not eligible. After confirming the sizable impact of HARP on refinancing in the eligible group, the study shows that treated borrowers increased their consumption of durables (autos) following refinancing, with the strongest effects for the most indebted borrowers. The study also uses the ex ante share of HARP-eligible loans in a ZIP code as an instrument to find that regions more exposed to HARP experienced relative increases in durable (autos) and nondurable (credit card spending) consumption.²⁶

Abel & Fuster (2018) use a different strategy of looking within GSE-securitized loans and exploiting the fact that only borrowers with loans that were purchased by the GSEs before June 1, 2009, were eligible for HARP. They find that in response to refinancing through HARP, household balance sheets improved by shifting their composition away from high-cost credit card borrowing and into home equity line of credit and auto loan debt, with approximately 20% of the amount of decreased mortgage payments going toward increased nonmortgage debt.

A related strand of research estimates the consumption effects of reductions in monthly mortgage payments due to downward interest rate resets on ARMs, which became more prevalent during the housing boom years (**Figure 1**). ARMs in the USA typically have initial fixed periods of 2, 3, 5, or 7 years, after which rates are adjusted annually. As loans exited their fixed period in the crisis years, monthly payments declined sharply for many ARM borrowers. This identification strategy was initially introduced by Tracy & Wright (2016) and Fuster & Willen (2017) to show that payment size has a substantial effect on mortgage default.²⁷ Complementing and extending these studies, Di Maggio et al. (2017) find that a 50% decrease in mortgage payments led to a significant 35% increase in car purchases. The effect size is much higher for borrowers with lower incomes and less housing wealth whose liquidity constraints are likely relaxed by the reduction in monthly payments.²⁸ These studies clearly demonstrate the countercyclical benefits of ARMs.

Another key factor in borrowers' decision to refinance is the opportunity to simultaneously access accumulated home equity. In fact, households may refinance even when interest rates have not declined, purely to extract equity to fund an investment opportunity or to smooth consumption (Hurst & Stafford 2004; Chen, Michaux & Roussanov 2020). But a drop in interest rates can further incentivize equity extraction, freeing up large amounts of cash for consumption and investment. Also, a decline in rates can boost equity extraction by easing borrowing constraints due to PTI limits (Greenwald 2018). Indeed, Bhutta & Keys (2016) document that the likelihood of extracting equity peaked in 2003 as mortgage rates fell to historic lows, with approximately \$40,000

²⁶Agarwal et al. (2017b) also find that regions with higher HARP exposure saw a decline in foreclosure rates and a faster recovery in house prices.

²⁷Countercyclical income support, such as extended unemployment insurance, has similarly been shown to lower defaults. Hsu, Matsa & Melzer (2018) estimate that unemployment insurance extensions during the Great Recession prevented 1.3 million foreclosures.

²⁸DiMaggio et al. (2017) further explore the impact of lower mortgage rates on regional economic activity. They find that regions with an ex ante higher share of outstanding ARMs in 2006 experienced greater interest rate pass-through from 2007 to 2012. This greater pass-through to consumers was associated with lower default rates, less severe house price declines, increased consumption (auto purchases), and relatively more nontradable employment growth. This result is especially compelling evidence of the importance of monetary policy and how it reaches the real economy through the mortgage market.

of equity freed up on average.²⁹ They estimate a strong effect of rate drops on the likelihood of equity extraction, especially in cities where house prices have been rising rapidly.

Di Maggio, Kermani & Palmer (2020) and Beraja et al. (2019) show that QE-induced mortgage rate declines spurred refinancing, equity extraction activity, and durable goods spending. However, the latter authors also emphasize that this monetary stimulus was most effective in regions where the housing bust was least severe and thus where stimulus may have been least needed [a similar conclusion is drawn in earlier research by Caplin, Freeman & Tracy (1997)].

How do borrowers use extracted equity? Canner, Dynan & Passmore (2002) draw on a special survey of mortgage borrowers and find that the most common reported uses are home improvements (35%), paying off debts (26%), consumer expenditures (16%, including vehicles, education, or medical expenses), and real estate or business investments (10%). Earlier waves of the survey, examined by both Canner, Lueckett & Durkin (1990) and Brady, Canner & Maki (2000), as well as research by Cooper (2010) using the PSID, find an overall similar distribution of uses.

Bhutta & Keys (2016) provide indirect evidence that extracted equity is likely used for consumption, as opposed to optimizing household balance sheets, by showing that extraction is associated with substantial increases in defaults on both mortgages and consumer loans. Both Beraja et al. (2019) and Di Maggio, Kermani & Palmer (2020) show that equity extraction (and possibly pure refinancings) leads to more car purchases.³⁰ Related research, such as that by Lovenheim (2011), examines the usage of liquid housing wealth on other household expenditures, such as paying for college.

In countries that rely more on floating-rate mortgages, such as the United Kingdom, Spain, and Italy, monetary policy transmission via mortgage markets is more automatic and immediate. For instance, Cumming & Dettling (2020) report that in the United Kingdom in 2008–2009, borrowers whose rates were floating saw their mortgage payments fall by £1,000 per quarter, a 42% near-instantaneous decline. Moreover, they show that stimulus via adjustable mortgages increased birth rates and, in contrast to the USA, helped prevent a “baby bust” in the United Kingdom. Cloyne, Ferreira & Surico (2020) also show that mortgage payments fall considerably more in the United Kingdom than in the USA after a rate shock, while Hughson et al. (2016) and Flodén et al. (2019) examine the transmission channel through the mortgage market in Australia and Sweden, respectively. See Calza, Monacelli & Stracca (2013) for an international survey on the connections between mortgage finance system design and the strength and speed of monetary policy transmission.

It is worth noting, of course, that mortgage investors receive correspondingly lower interest income when households refinance. Thus, the aggregate effect of the refinancing channel on the economy depends on the relative MPCs by households versus investors and bank shareholders. This point is emphasized more generally by Auclert (2019), who argues that a key channel of monetary expansions is through redistribution toward agents with higher MPCs. Additionally, Boyce et al. (2012) estimate that during the housing bust 14% of all MBS were held abroad, creating an additional incentive for domestic policy action.

7. PATH DEPENDENCE IN REFINANCING AND MONETARY POLICY

To this point, we have discussed the refinancing decision as largely static, but the dynamic aspects of both households’ refinancing and the Federal Reserve’s monetary policy actions deserve further

²⁹More generally, equity extraction as home prices boomed during the early 2000s contributed substantially to the growth in household debt (Mian & Sufi 2011, Bhutta 2015).

³⁰Results obtained by McCully, Pence & Vine (2019) suggest that extraction may be used for down payments rather than substituting for auto loans.

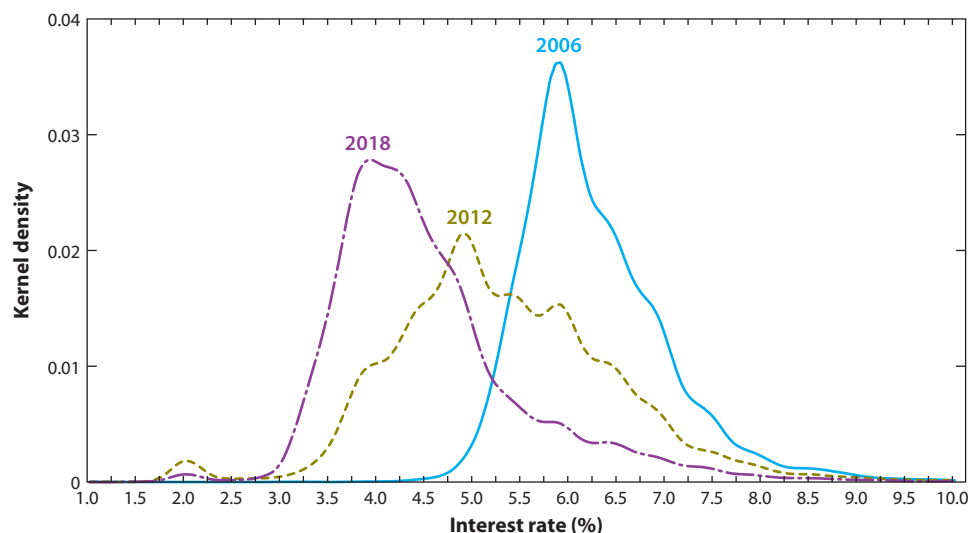


Figure 6

Distribution of interest rates on outstanding 30-year fixed-rate mortgage contracts. Kernel densities are estimated on a value-weighted sample of 30-year fixed-rate mortgages. Figure based on Black Knight McDash data (see the **Figure 1** caption for additional information about the McDash data).

scrutiny and yield additional insights into their interaction. For households, while the decision can be made contract by contract (or call option by call option), borrowers' long-term goal should be to minimize lifetime interest payments and transaction costs (see Yang & Maris 1993 for a model that allows for borrowers to sequentially refinance). For investors, the market value of a mortgage depends on the likelihood of prepayment: Multiple recent refinancing waves should increase the expected duration of the new mortgages and thereby increase the value of their associated MBS.

A dynamic perspective helps to reconcile why an interest rate cut of a particular size may have a different impact on the macroeconomy in different settings. For example, **Figure 6** shows the distribution of outstanding 30-year mortgage interest rates in 2006, 2012, and 2018. Whereas in 2006 94% of mortgages had rates above 5%, by 2018, after multiple refinancing waves, the median outstanding rate had dropped to approximately 4%, with only 17% of mortgage debt having rates above 5%.³¹ As of March 2020, because the Federal Reserve had aggressively eased in response to the COVID-19 pandemic, mortgage rates returned to the low levels of 2012, but a relatively low fraction of existing borrowers would appear to potentially benefit by refinancing (**Figures 3** and **4a**). Both Berger et al. (2018) and Eichenbaum, Rebelo & Wong (2018) provide macro models that support the view that the efficacy of monetary policy depends on the potential savings from an interest rate cut. The size of the pool of potential refinancers—those whose call option is sufficiently in the money—depends crucially on the past path of rates.

While the case for the importance of a dynamic framework for understanding the stimulative effects of monetary policy is persuasive, it is worth reemphasizing that the largest response on consumption frequently comes not only from rate refinancing but also from cash-out refinancing and other equity extraction decisions [Greenwald (2018) emphasizes the importance of equity

³¹The 2012 distribution offers yet another example of the importance of frictions: Even though the reference mortgage rate had dropped to 4% by then, nearly 40% of mortgages had rates above 5.5%.

extraction for monetary policy transmission]. Even if homeowners have locked in low rates on their existing mortgages, they may nonetheless want to extract equity through cash-out refinancing, or extract through a home equity loan or line of credit (and avoid resetting their primary mortgage rate), when rates are relatively low (**Figure 4**).³² The interaction of interest rates and house prices in the context of dynamic models along these lines is thus an area worthy of further investigation.³³

8. MORTGAGE DESIGN

In this section, we briefly touch on an emerging literature that reimagines mortgage design in the USA in light of the lessons learned during the financial crisis. Our starting point is the recognition—among many economists, at least—of the shortcomings of the 30-year FRM and its role in exacerbating the crisis. The rigidity of this contract, while perhaps a boon to households during good times, became a serious drag during bad times, stifling monetary policy aimed at stimulating household consumption and preventing mortgage defaults (Calza, Monacelli & Stracca 2013; Auclert 2019). Wong (2019) estimates that the effect of monetary policy on consumption would be substantially enhanced by moving to a variable-rate mortgage structure.

To be sure, advocating alternative mortgage contracts will face an uphill battle against the broader public's love of the 30-year self-amortizing FRM. Risk aversion seems to play a central role in borrowers' preference for FRMs, such that ARMs are chosen only when the FRM–ARM spread widens substantially (Coulibaly & Li 2009). Importantly, the lack of ARM use may suggest an excessive fear of rising rates and too little appreciation for the risk of recessions—a bias that, if true, policy ought to address.

Notably, fear of ARMs seems to have grown since the crisis, perhaps reflecting the unfounded “exploding-ARM” narrative of the crisis (Foote, Gerardi & Willen 2012). Amortizing (hybrid) ARMs are eligible for purchase by the GSEs and can be insured by the FHA—and thus receive the same credit risk subsidy as FRMs—yet there has been scant use of ARMs since the crisis (**Figure 1**).³⁴ Pricing for ARMs does not seem to fully explain this trend. The spread between long and short mortgage rates—historically a good predictor of ARM use (Kojen, Van Hemert & Van Nieuwerburgh 2009; Moench, Vickery & Aragon 2010)—widened considerably at times after 2009, but ARM use remained subdued.³⁵

Recognizing the strengths of both FRMs and ARMs, Eberly & Krishnamurthy (2014) propose a convertible mortgage: an FRM with a one-time option to convert into a floating-rate mortgage. In follow-up research, Guren, Krishnamurthy & McQuade (2018) build a general equilibrium model to evaluate the benefits of this so-called EK convertible mortgage, versus pure ARMs and

³²Low rates can also facilitate moving to a new home, which can be thought of as another form of equity extraction, promoting mobility and labor reallocation.

³³Beraja et al. (2019) look at variations in refinancing that arise from regional differences in house price movements and resulting home equity, while Bhutta & Keys (2016) specifically examine the interaction between rates and prices driving extraction decisions during the early 2000s.

³⁴FRMs may enjoy a slight subsidy not available to ARMs, stemming from FRMs' eligibility for securitization through the agency to-be-announced forward market, which can improve liquidity and pricing (Vickery & Wright 2013).

³⁵ARMs are more prevalent in the jumbo market than in the conforming market (Moench, Vickery & Aragon 2010). This could reflect supply-side effects, as banks and credit unions often hold jumbo mortgages in portfolio and thus may not offer long-term fixed-rate contracts. It could also reflect demand-side effects, as jumbo borrowers may be more price sensitive and financially savvy (Bhutta, Fuster & Hizmo 2019).

pure FRMs, and find that the EK mortgage provides most of the benefits of an ARM during a downturn, while also providing significant protection against the risk of rising rates.³⁶

Starting borrowers with an FRM—and with no obligation to ever convert to a floating rate—is an intriguing idea, and may help to endear this contract to borrowers who fear rising rates. That said, the conversion option would make this contract more expensive than a standard 30-year FRM, by approximately 17 basis points (as estimated in Guren, Krishnamurthy & McQuade 2018). The key upside, though, is the considerable protection offered in a downturn (see the discussion in Section 6, above, on the consumption effects of downward-adjusting ARMs).

Another potential downside of an EK-type contract is that households may convert to an ARM during a downturn only when absolutely necessary to avoid default. This type of behavior could impede monetary policy transmission relative to an all-ARM economy during a downturn. A useful exercise for future research would be to evaluate ARMs that have rate-adjustment caps, which limit households' exposure to rate risk but can still provide some automatic downward adjustment during crises.³⁷ Finally, there are also likely to be benefits from other forms of indexation that take into account local economic conditions (Piskorski & Seru 2018), including labor income risk. Future research should additionally consider contracts that give individual borrowers some payment optionality to deal with idiosyncratic income volatility (Piskorski & Tchistyi 2010; Mayer, Piskorski & Tchistyi 2013). That said, it is important to note that in periods of widespread economic disruption, the large-scale exercise of such options may place considerable pressure on the housing finance system. For example, extensive use of mortgage forbearance during the early stages of the COVID-19 pandemic threatened a liquidity crisis for mortgage servicers who had to replace borrower payments to investors. A well-designed system should be robust to such systemic events, perhaps with better-capitalized servicers and/or investors sharing in the risk of payment disruptions.

9. APPLYING LESSONS LEARNED AND QUESTIONS FOR FUTURE RESEARCH

The residential mortgage market represents a critical channel for monetary policy to stimulate household consumption. In this article, we have reviewed the literature on the existence and importance of the refinancing channel, described the frictions that inhibit the functioning of this channel, assessed policy responses to these frictions, and examined potential innovations to reduce frictions. In essence, these frictions represent *de facto* prepayment penalties that function as barriers to refinancing. Further research is needed to estimate how much prepayment speeds would change if borrowers were highly sophisticated and/or transaction costs were sharply reduced, and what impact such a change in prepayment patterns would have on mortgage rates.

We document the prevalence of refinancing over the 2000s, highlighting the spikes in refinancing in 2003 and 2012 and the differences between cash-out and rate refinancing between high- and low-score borrowers. Despite these spikes, many mortgage holders whose refinancing option appears to be in the money fail to take advantage. We discuss both behavioral and cyclical impediments to refinancing. As a growing literature has documented dispersion in interest rates and

³⁶Piskorski & Tchistyi (2017) also build an equilibrium model to study alternative mortgage contracts, and highlight potential welfare benefits of ARMs relative to FRMs. Another recent proposal focuses on helping borrowers more quickly pay down equity, but maintain fixed payment contracts (Passmore & von Hafften 2020).

³⁷ARMs with a 15- or 20-year term, as proposed by Oliner, Peter & Pinto (2018), may help reduce the risk of payment shock and could be another type of mortgage to consider.

ineffective search, more analysis of heterogeneous search costs affecting the refinancing decision would enrich our understanding of impediments to refinancing.

Our review of the literature underscores the complicated interactions between monetary policy and house prices in determining the stimulative effect on household consumption. For instance, the 2003 refinancing boom was accentuated by rising house prices in many metro areas, which encouraged cash-out refinancing. Although this spike in refinancing reduced the pool of potential rate refinancers in subsequent years, house price appreciation led many homeowners, especially lower-credit-score households, to extract equity. Such households did so primarily through cash-outs, while higher-score households tapped into equity with home equity loans or lines of credit. Further examination of the interplay between home prices and interest rates, along with innovative contracts to reduce transaction costs, is a promising direction for further research.

Our exploration of policies to reduce frictions in policy transmission emphasizes the numerous barriers to ex post renegotiation in the mortgage market, as well as the limitations of federal policy for loans not backed by government agencies. Issues surrounding institutional barriers, R&W, and needlessly restrictive underwriting requirements all hindered refinancing activity at a time when government action could have been more sweeping and forceful in reducing mortgage interest rates. This research also points to the potential distorting effect of federal policy on competition in the mortgage market, as HARP disproportionately favored incumbent lenders.

A potential way to avoid these frictions is to encourage more borrowers to take up adjustable-rate or hybrid ARM products, which would automatically reset downward when the Fed cuts rates. For instance, few young homebuyers stay in their starter home for more than 10 years, and thus are unlikely to benefit from the full protection of a 30-year FRM. The benefits of existing hybrid contracts, as well as other flexible contract types that have recently been proposed, should be evaluated in general equilibrium models. More research should examine why ARM take-up rates are so low after the financial crisis, and identify ways that the FHA and other lenders could help educate first-time buyers on such alternatives to the 30-year FRM. Given the continued predominance of the 30-year FRM, having a HARP-like program permanently in place to be automatically triggered in a crisis may ease further frictions.

The lessons learned in the midst of an economic emergency enrich our understanding of market forces and policy mechanisms, hopefully leading to better outcomes and more effective monetary policy transmission in subsequent downturns. At the time of preparing this review, the COVID-19 pandemic has brought about an unprecedented disruption in economic activity. The immediate housing policy response to the pandemic consisted of streamlined forbearance actions by Congress and the GSEs. These actions have largely avoided the pitfalls of requiring time-consuming and conflicting documentation requirements that marred early versions of programs in previous financial crises. Prompt forbearance has the potential to provide substantial liquidity support to households in the near term and mitigate delinquency and housing price pressures. However, these actions create multiple stresses elsewhere in the housing finance ecosystem, as forborne cash flows must be absorbed by someone other than households.

As of April 2020, the monetary policy response to the pandemic included a rapid decrease in policy rates to the ZLB (**Figure 3**), as well as a wide range of programs to provide liquidity and direct lending to financial markets, firms, and municipalities. Unlike the financial crisis, transmission of traditional policy actions to households is impeded by income shortfalls, not insufficient home equity. It is also affected by capacity and liquidity constraints in mortgage origination, some of which stem from large-scale forbearance actions. In the short run, monetary policy transmission has also been impeded by turbulence in functioning of mortgage finance markets, which required the Fed to conduct large-scale asset purchases to restore stability and allow (partial) convergence of primary and secondary mortgage rates.

Although the forward path of the economy is highly uncertain, future policies will likely have to address conversion of forbearance actions into modifications, as well as enable access to longer-term relief through refinancing. Once again, conventional and unconventional monetary policy tools will be deployed alongside actions by housing finance regulators and private market participants to provide economic support to households and enable their access to mortgage finance. The success of these policy responses will depend on expanding the arsenal of policy tools given the limits of the ZLB, developing a coordinated housing and mortgage market response across policy-making bodies, and internalizing the lessons and insights provided by research examined in this review.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review. The views expressed here are only those of the authors and do not reflect those of the Federal Reserve Bank of Chicago or of the Board of Governors of the Federal Reserve System.

ACKNOWLEDGMENTS

We thank Jane Dokko, Lauren Lambie-Hanson, Michael Palumbo, Jonathan Rose, and Shane Sherlund for their comments on an earlier draft of this review. William Lee provided expert research assistance.

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