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Inequality in the Time of COVID-19: Evidence from Mortgage Delinquency and Forbearance*

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Abstract

Using novel data, we show that during the COVID-19 pandemic minority and lower-income borrowers experienced significantly more financial distress. We quantify how much the pandemic has exacerbated inequalities with a difference-in-differences analysis. We then show that forbearance programs mitigated inequalities as minority and lower-income borrowers took up forbearances at higher rates, reducing their delinquency rates more than White and higher-income borrowers in 2020. Finally, we show that minority and lower-income borrowers are more likely to fall into delinquency and default after exiting forbearance and that fast-tracking FHA modifications with 40-year terms could best help these borrowers obtain longer term debt relief.

Keywords: mortgage forbearance, mortgage delinquency, inequality, COVID-19, loan modification

JEL Classifications: D12, D63, G21, G50

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1 Introduction

It is well documented that the COVID-19 pandemic as a health crisis has had a disparate impact on minority and lower-income groups (see, e.g., van Dorn et al. (2020); Chakrabarti and Nober (2020); Polyakova et al. (2020)). The extent to which the pandemic has exacerbated economic inequality is less obvious. On the one hand, the Federal Reserve Bank of Philadelphia's *COVID-19 Survey of Consumers* shows that minority and lower-income individuals reported higher rates of job and income disruptions during the pandemic.[1] On the other hand, various forms of government income support targeted at lower-income families offset these adverse impacts. Therefore, it is an empirical question as to what the economic impact of the pandemic is on minority and lower-income groups in the presence of government assistance. In this paper, we study this question through the lens of mortgage loan performance.

We examine economic inequality among mortgage borrowers for at least two reasons. First, as we will show, the pandemic has had an especially severe impact on minority and lower-income mortgage borrowers. Second, forbearance programs facilitated by the Coronavirus Aid, Relief, and Economic Security (CARES) Act has been unprecedented in size and scope: by last count, over 8.2 million borrowers holding $1.7 trillion of mortgage loans received forbearances during the pandemic, allowing borrowers to defer some $80 billion of mortgage payments. Our novel administrative data matched with borrower race, income and credit-bureau data gives us a unique opportunity to examine the demographic effects of the pandemic and the effects forbearance and subsequent home-retention programs have had on mitigating disparities.[2]

The database we constructed combines the confidential Home Mortgage Disclosure Act (CHMDA) data that contains borrower race and income information at loan application with a unique administrative database from the largest mortgage service bureau specifically designed to track servicer activities related to mortgage forbearance and loss mitigation. We further augment our data with credit-bureau data and a full array of borrower, market, and loan-performance data.

We try to answer a number of questions in this paper. First, what is the extent of racial and income disparities in payment behavior among mortgage borrowers, and

[1] https://www.philadelphiafed.org/consumer-finance/consumer-credit/cfi-covid-19-survey-of-consumers-wave-5-updates.

[2] For a broad discussion of forbearance programs across all major types of consumer lending during the pandemic, see Cherry et al. (2021).

how has the pandemic affected these disparities?

Second, conditional on distress, who took up forbearance and who missed this opportunity? The requirement to receive mortgage forbearances during the pandemic is minimal; borrowers need only request it. It is puzzling that a significant number of delinquent borrowers never took up forbearance. In that regard, did minority and lower-income borrowers fall further behind in obtaining debt relief?

Third, for those who entered forbearance during the pandemic, what is the racial and income composition of those still in forbearance and in post-forbearance nonpayment? Since forbearance relief is temporary, how are these borrowers performing as these forbearance programs and foreclosure moratoria tied to these mortgages expire?

Finally, federal agencies and private investors have adopted various home-retention programs. How effective are these programs in achieving their goals? Will these programs continue to help those most in need?

Our main findings are as follows. We find that between April 2020 and December 2020, minority and lower-income borrowers had twice the nonpayment rates of White and higher-income borrowers. Even after controlling for conventional risk factors, Black borrowers have about 40% higher rates of nonpayment, the lowest-income borrowers around 80% higher. Using difference-in-differences (DID) estimation, we find that income and racial disparities in nonpayment, which were extremely small in 2016-2019, have been exacerbated during the pandemic. These results confirm that the pandemic has indeed worsened economic inequality among mortgage borrowers.

Another main finding is that forbearance programs were successful in *temporarily* alleviating disparities brought on by the pandemic. We find that minority and lower-income borrowers took up forbearance at significantly higher rates. Given higher rates of nonpayment, it is unsurprising that minority and lower-income borrowers entered forbearance at higher rates. However, even conditional on nonpayment, we find minority and lower-income borrowers have higher forbearance take-up rates, which remains true even after controlling for conventional risk factors. These higher take-up rates have mitigated the effects of large gaps in payment difficulties experienced by minority and low-income mortgage borrowers during the pandemic, even if only in the short term. Indeed, we find that delinquency rates (not paying and not in forbearance) have actually reversed during the pandemic when taking into account forbearance take-up rates.

Finally, as of November 2021, among borrowers who have entered into forbearance due to the pandemic, around 14% are still not making payments, either under

forbearance or after exiting forbearance. We find that Black borrowers are more likely to remain in forbearance while less likely to have exited into delinquency. However, relative to higher-income borrowers, lower-income borrowers are more likely to both remain in forbearance and exit into delinquency without benefit of loss mitigation. These factors highlight the importance of evaluating long-term post-forbearance workout programs.

To that end, we explore housing market conditions and current loss mitigation programs. Unlike during the Great Recession, most borrowers in forbearance today have significant equity in their homes. By our estimates, 84% of borrowers still in forbearance have mark-to-market loan-to-value (MTM LTV) ratios of 80% or less; differences in this figure for minority and lower-income borrowers are small. For this reason, many borrowers will be able to resolve their forbearances without a loss to the government or private investors. However, borrowers looking to stay in their homes will need longer-term debt relief.

As for long-term solutions, industry professionals and academics have found that reducing mortgage payments is the most cost-effective loss-mitigation tool for borrowers unable to resume timely mortgage payments.[3] Our analysis shows that the current loan modification programs adopted by federal housing agencies will significantly lower monthly payments of those who are in financial distress and thus help many borrowers remain in their homes. However, minority and lower-income borrowers are at a higher risk of foreclosure. We show that fast-tracking Federal Housing Administration (FHA) modifications with 40-year terms could better help those borrowers avoid foreclosure and obtain longer-term debt relief at lower cost. Therefore, refining the current programs could further alleviate inequality.

Our paper contributes to the literature in a number of ways. First, we provide novel evidence that the pandemic has exacerbated economic inequality. Every crisis is different. While the decades following the Great Depression substantially improved the economic well-being of many workers, the Great Recession of 2008-10 made income and wealth inequality worse (see, e.g., Meyer and Sullivan (2013); Pfeffer et al. (2013); Piketty and Saez (2003).[4] Our findings here, together with those in Davydiuk and Gupta (2020), Chetty et al. (2020), and others, show that the pandemic has a similar

[3]This is a central finding in Ganong and Noel (2020), who report that JPMorgan's 30% payment-reduction mods after the Great Recession were the most cost effective and that Freddie Mac found 25% payment reductions to be most effective. Similarly, industry sources at Wells Fargo told us that payment reductions of 20% to 30% after the Great Recession were the most effective.

[4]Also, see, Ken-Hou Lin and Megan Tobias Neely, "Why the Great Recession made inequality worse," OUPblog, Feburary 10, 2020.

effect to the Great Recession in exacerbating economic inequality.

Moreover, we show that mortgage market interventions can play an important role in mitigating economic inequality brought on by crises. There is a concern that the costs of the pandemic are being borne disproportionately by minority and lower-income groups.[5] Mongey et al. (2020) show that renters and less-educated, lower-income individuals with fewer liquid assets bear heavier burdens from social distancing practices. Agarwal et al. (2020) show that a side effect of the pandemic-induced interest rate cut is that it exacerbates income inequality as higher-income mortgage borrowers were able to benefit significantly more from refinancing during the pandemic. Gerardi et al. (2021) also document that minority borrowers were significantly less likely to refinance to take advantage of the large decline in interest rates during the pandemic. In contrast, we show that mortgage forbearance programs have helped alleviate inequalities in the short term with targeted forbearance programs.

Third, we add to the large literature on consumer debt relief. Post-financial crisis, an oft-studied area is mortgage loan modifications (see, e.g., Agarwal et al. (2011); Ghent (2011); Adelino et al. (2013); Mayer et al. (2014); Agarwal et al. (2017); Ganong and Noel (2020)). Cherry et al. (2021) is among the first to systematically examine how mortgage forbearances have provided targeted, temporary relief to consumers during the pandemic. McManus and Yannopoulos (2021) compare forbearances during the pandemic and those during natural disasters. Bandyopadhyay (2020) analyzes borrower responses to mortgage forbearance programs. We conduct new analyses that help us understand how forbearance programs have reached borrowers and where gaps exist.[6]

Finally, our analysis helps inform ongoing policy development. During the pandemic, various federal agencies are closely monitoring forbearance programs and developing loss-mitigation policies and home-retention programs. These include the Consumer Financial Protection Bureau (CFPB), the Federal Housing Finance Agency (FHFA), the Department of Housing and Urban Development (HUD), the Federal Housing Administration (FHA) and Veterans Affairs (VA). Our findings on the home-equity situation of mortgage borrowers in forbearance as well as our analysis of the most at-risk populations can help inform these policy deliberations.[7] Furthermore, we

[5] See, e.g., Zia Qureshi, "Tackling the inequality pandemic: Is there a cure?" Brookings Institution Report, November 17, 2020.

[6] Zhao et al. (2020) also study income and asset trends of borrowers who received COVID-19 forbearance using JPMorgan Chase data.

[7] We are involved in an inter-agency group of banking regulators closely monitoring financial risk and consumer compliance.

assess in this paper the effectiveness of current home-retention plans in meeting their goals for assistance to homeowners and discuss possible refinements to those plans. In addition, we showcase a mapping tool jointly developed by the Federal Reserve Banks of Atlanta and Philadelphia that will assist servicers and community groups in identifying areas with high shares of delinquencies and forbearances to help their efforts reaching out to troubled borrowers needing longer-term debt relief.

The remainder of this paper is organized as follows. In Section 2, we provide a brief background of the CARES Act and private-sector forbearance programs as well as subsequent actions by federal regulators to extend protections to mortgage borrowers. In Section 3, we explain our data and methodology. We report the results of our forbearance and delinquency analyses in Section 4. In Section 5, we assess the effectiveness of federal loan modification programs in meeting their goals and their costs. We conclude in Section 6.

2 CARES Act Forbearances and Foreclosure Relief

A mortgage loan is in forbearance when a servicer allows a borrower to temporarily pause paying or pay a lower amount, with the understanding that borrowers will pay back all arrears later.[8] Forbearance has long been used for hurricane relief and short-term credit card debt relief (see Agarwal et al. (2005); Billings et al. (2019)).[9] Mortgage forbearance during the pandemic has taken the form of paused payments instead of reduced payments.

Section 4022 (§4022) of the CARES Act mandates that borrowers of federally backed mortgages may be granted forbearances for up to 12 months. These include mainly loans insured by FHA, VA, and the two Government-Sponsored Enterprises (GSEs), Fannie Mae and Freddie Mac. No fees, penalties, or additional interest accrues on the loan beyond what is scheduled. Moreover, §4021 mandates special reporting by credit bureaus for loans in pandemic-related forbearance. If an account was current prior to the pandemic, it shall be reported as current during forbearance. If an account is delinquent, its status shall remain unchanged during forbearance unless the borrower brings the account current and then it shall be reported as current. Servicers of private-sector mortgages, mainly portfolio loans and loans in private-label mortgage-backed securities (PLMBS), largely adopted these same forbearance

[8] https://www.consumerfinance.gov/ask-cfpb/what-is-forbearance-en-289/.

[9] See also Daniel Hartley, Eleni Packis, and Ben Weintraut, "Flooding and finances: Hurricane Harvey's impact on consumer credit," *Chicago Fed Letter*, 2019, No. 415.

practices.

What is unique, and critical to the widespread adoption of forbearances during the pandemic, is that requirements to obtain them are negligible: Borrowers need only request them; no specific financial hardship or proof of inability to pay need be provided. This stands in sharp contrast to the federal Home Affordable Modification Program (HAMP) implemented during the Great Recession of 2008-09, which required proof of hardship and income documentation.[10] By latest estimates, forbearances have been made on over 8.2 million first-lien mortgages, over 15% of the U.S. mortgage market.[11] Liberal forbearance requirements received broad acceptance among lenders in part because forbearance is a temporary suspension of payments, not a permanent modification of loan terms.

Another significant protection provided by the CARES Act was a blanket foreclosure moratorium on all federally insured mortgage loans, except for vacant or abandoned properties, not limited to COVID-19 hardships. The effects of this and other moratoria were immediate and profound. As shown in Figure 1, despite sharply rising delinquencies, virtually all foreclosure activity ground to a halt starting in April 2020. This level of inactivity is unprecedented in recent history.[12] As with forbearances, widespread acceptance of foreclosure moratoria came from the perceived temporary nature of the recession, an exceptionally strong housing market, and reputational effects of foreclosing on borrowers during the pandemic.[13] Note that while investor reporting in McDash showed an unprecedented single month rise in serious delinquency rates, suspension of delinquency reporting to credit bureaus mandated by the CARES Act showed a *decline* in serious delinquency rates to credit bureaus reflected in reporting to the Equifax credit bureau.[14]

As for the duration of federal forbearance programs, §4022 initially granted forbearances for up to 12 months and also stated that forbearances would be available during a "covered period," but did not specify its length. The Biden administration

[10] As described by Agarwal et al. (2017) and Ganong and Noel (2020), reporting and program requirements were so extensive that many servicers adopted their own private programs.

[11] See Appendix Table A5 for our method of extrapolating to the full mortgage market.

[12] Even during the "robo-signing" scandal of 2010, when the largest servicers froze foreclosures, foreclosures still numbered in the hundreds of thousands. See An and Cordell (2021).

[13] The importance of reputational effects is revealed by the absence of foreclosure starts even after the federal moratorium ended on July 31, 2021. CFPB temporary safeguards enacted later allowed for foreclosures to resume for "unresponsive borrowers" servicers could not establish "right-party contact" with, but foreclosure starts stayed muted all through 2021.

[14] Cherry et al. (2021) show that this reporting gap is made up of loans in forbearance reported as current and picked up by "narrative codes."

and federal agencies subsequently extended forbearance terms up to 18 months for most federally insured mortgages.[15] Neither the CARES Act nor any subsequent legislation specifies how forbearances will be resolved once forbearance periods expire, leaving that for the federal agencies and mortgage servicers to resolve.

As for the federal foreclosure moratorium, it was scheduled to end June 30, 2021. The Biden administration extended it another month to July 31. Meanwhile, the CFPB amended Regulation X, effective August 31, to provide "temporary procedural safeguards" for most mortgages to delay foreclosure starts until January 1, 2022.[16] As a result, foreclosure starts all but ceased from March 2020 through all of 2021.

As we will show, the timing of these actions means that millions of mortgage borrowers will see their mortgage forbearance terms expire near year-end 2021 and the first half of 2022, making them and a million or so other delinquent mortgages exposed to potential foreclosure after safeguards against foreclosure end at year-end 2021. Home-retention policies developed by federal regulators and widely adopted by the mortgage industry are analyzed in Section 5.

3 Data and Research Design

Our primary data source is McDash Flash data, a proprietary database from Black Knight Data & Analytics, LLC. McDash Flash data are assembled from Black Knight's Mortgage Servicing Platform (MSP),[17] which processes payments for around two-thirds of all mortgages in the U.S., including many of the large bank and non-bank servicers and subservicers. The data cover the full spectrum of mortgage products, including portfolio loans, PLMBS, FHA/VA,[18] and GSE loans. The McDash Flash database was specially designed to track forbearance and loss mitigation activities during the pandemic. In addition to standard performance variables, McDash Flash includes variables like the monthly dollar amounts of actual payments and scheduled payments,[19] forbearance and loss mitigation start and scheduled end dates, the

[15] https://www.consumerfinance.gov/coronavirus/mortgage-and-housing-assistance/help-for-homeowners/learn-about-forbearance/

[16] https://files.consumerfinance.gov/f/documents/cfpb_covid-mortgage-servicing_final-rule_2021-06.pdf.

[17] For more information, see https://www.blackknightinc.com/what-we-do/data-services/.

[18] We classify all government-insured loans as FHA/VA, as they encompass loans in Government National Mortgage Association (GNMA) securities and "GNMA buybacks," which are loans pulled out of GNMA securities and brought on balance sheet at servicers as early as 90 days of delinquency.

[19] Credit bureau and other databases typically only include scheduled payments, if they include any at all. As we will show, having actual payments is critical for determining how forbearances are

type of forbearance or loss mitigation activity being pursued, and bankruptcies and bankruptcy chapter.

We merge McDash Flash data with three other databases to get a comprehensive view of borrowers' demographic information and financial condition, ideal for analyzing how these forbearances will play out. These include the Black Knight McDash data, the Credit Risk Insights Servicing McDash (CRISM) data, and the Confidential Home Mortgage Disclosure Act (CHMDA) data. The Black Knight McDash data contain performance history on over 200 million loans and a full array of loan, product, borrower, and property information for each loan in McDash Flash. CRISM contains anonymized borrower-level credit bureau data from Equifax matched to the Black Knight McDash data and contain mortgage and other debt information from borrowers' credit reports from Equifax. CHMDA data provide mortgage application information and include borrowers' race, sex, and household income at loan application. For joint loans, we pull only primary borrower information from both CRISM and CHMDA for first mortgage loans and incorporate Black Knight McDash's mortgage performance data and McDash Flash forbearance data, creating a borrower-level dataset. Appendix A explains the matching algorithm and related match statistics, and Appendix Table A1 details the representativeness of our sample throughout the matching process.

Due in part to the ease of obtaining forbearances, more than 8 million mortgages have entered forbearance since the onset of the pandemic. As shown in Figure 2, we classify borrowers into three groups: those who are delinquent but not in forbearance (the red area in Figure 2); those in forbearance and not making payments (the blue area); and those reported in forbearance but making timely payments (the purple area).[20] The share of all loans delinquent or reported in forbearance peaked at 12.3% in May 2020, declining to 5.4% by November 2021. Despite this improvement, over 2.6 million mortgages are still past due.

We are most interested in borrowers in distress. Therefore, we focus on the group of borrowers who are delinquent or in forbearance and not paying on their mortgages (the combined blue and red areas in Figure 2). These two groups combined represent about 9% of all mortgage balances. Given the ease and low costs of obtaining forbearances, it is striking to see that over 2.5 million borrowers did not take advantage of forbearances right away and fell into delinquency.[21] Therefore, in addition to ex-

resolved.

[20] We believe many of these borrowers take forbearance for precautionary purposes.

[21] Some of those 2.5 million applied for forbearance later, but they could have avoided any delin-

amining who fell into mortgage distress, we examine borrowers who fell into mortgage distress but missed forbearance opportunities.

We examine a number of outcomes. First, we explore which borrowers were most likely to fall into nonpayment, a proxy of financial distress, during the pandemic by defining the outcome variable as ever falling into nonpayment during the pandemic:[22]

$$EverNonpayment = \begin{cases} 1 & \text{if ever missed payment during the pandemic} \\ 0 & \text{if never missed payment during the pandemic.} \end{cases} \tag{1}$$

As long as borrowers missed a payment, whether in forbearance or not, they will be identified as having been in nonpayment during the pandemic. This can be considered a measure of financial distress *net of* forbearance as it captures the true underlying payment behavior if forbearance was not available.[23]

Second, we explore which borrowers were most likely to miss forbearance opportunities by examining the likelihood of ever entering forbearance, given that they have been in nonpayment sometime during the pandemic:

$$EverMissOpportunity = \begin{cases} 1 & \text{if never taken forbearance AND} \\ & \quad \text{ever in nonpayment during pandemic} \\ 0 & \text{if ever taken forbearance AND} \\ & \quad \text{ever in nonpayment during pandemic.} \end{cases} \tag{2}$$

Note that we do not consider borrowers as ever having missed an opportunity if they first enter nonpayment and then enter forbearance at a later date, or if they enter forbearance and nonpayment but exit forbearance while maintaining nonpayment status.[24] Also note that the CARES Act forbearance was only extended to federally

quency by doing so sooner.

[22] We define the pandemic time period for our sample as April-December 2020, as the lockdown of the economy began in March and the brunt of the pandemic's effect on the economy occurred through December, as well as most forbearance entry happening in the early part of the pandemic (see Figure 6).

[23] Among those in forbearance and not paying, it is possible that borrowers do not have real payment difficulties ("strategic forbearance"). We believe this is a small share because forbearance precludes refinance opportunities in the current low interest-rate environment. Related, see An et al. (2021) and Mayer et al. (2014) for discussions about strategic mortgage default.

[24] We exclude these groups for two reasons. First, many borrowers have forbearance status reported in the month after they enter delinquency, suggesting that there may be a reporting lag. Second, borrowers who exit forbearance while still being delinquent usually enter into loss mitigation, which means that they are still receiving some assistance.

backed mortgages. So some of the "missed opportunity" borrowers of portfolio or PLMBS loans could have lenders who did not offer this forbearance. We therefore also explore this outcome only on a sample of GSE and FHA/VA loans.

Next, we examine how long the borrowers are in forbearance from April 2020 to May 2021 for loans that have entered forbearance between April-December 2020. Here, we define the outcome as the log of the number of months in forbearance:

$$\log(NumMoForb) = \log(\text{Number of Months in Forbearance}). \tag{3}$$

For this outcome, we estimate an Accelerated Failure Time (AFT) model that we will detail later in the section.

Moreover, we separately study mortgage delinquency—that is, being in nonpayment and not utilizing forbearance. This allows us to look directly at the effect of the pandemic on borrower's financial distress *inclusive of* government forbearance programs. Additionally, this outcome examines true financial distress, whereas one may argue that borrowers may enter nonpayment with forbearance as a strategic move and not necessarily due to true financial distress. We define the outcome variable as "ever falling into delinquency" during the pandemic:

$$EverDelinquent = \begin{cases} 1 & \text{if ever missed payment AND} \\ & \quad \text{never in forbearance during the pandemic} \\ 0 & \text{if never missed payment OR} \\ & \quad \text{ever in forbearance during the pandemic.} \end{cases} \tag{4}$$

Finally, we examine the most recently observed (November 2021) status of borrowers who have ever entered forbearance during the pandemic. A borrower who has entered forbearance during the pandemic may have the following status:

$$ExitStatus = \begin{cases} 1 \text{ if performing, paid off, or on trial mod} \\ 2 \text{ if still in forbearance} \\ 3 \text{ if defaulted or delinquent and not on trial mod.} \end{cases} \tag{5}$$

For outcomes defined in equations (1), (2), and (4), our research design is as follows. We examine the differential rates of nonpayment and missed forbearance opportunities during the pandemic and latest observed rates of nonpayment status

with respect to borrower demographic, income, and financial conditions using a linear probability model. Our specification is:

$$Y_{iz} = \alpha + D'_{iz}\boldsymbol{\beta} + X'_{iz}\boldsymbol{\Gamma} + Z'_{z}\boldsymbol{\Psi} + \varepsilon_{iz}, \tag{6}$$

where Y_{iz} is $EverNonpayment$, $EverMissOpportunity$, or $EverDelinquent$ for borrower i in zip code z; D_{iz} is a vector of demographic and income characteristics; X_{iz} is the loan characteristics and borrower credit profiles; Z_z is zip code or county characteristics, which in some specifications we replace with τ_z, zip code fixed effect; and ε_{iz} is the error term. We are interested in the vector of coefficients $\boldsymbol{\beta}$, which estimates the differential probability of a borrower with certain demographic or income characteristics falling into nonpayment, missing a forbearance opportunity during the pandemic, or staying in nonpayment by May 2021.

For outcomes defined in equation (3), we estimate an AFT model with censoring and log-normal distribution of the time variable, similar to that in An and Cordell (2021) and Cordell et al. (2015):

$$log(T_{iz}) = \kappa + D'_{iz}\boldsymbol{\gamma} + X'_{iz}\boldsymbol{\Theta} + Z'_{z}\boldsymbol{\Phi} + \sigma\eta_{iz}, \tag{7}$$

where T_{iz} is $NumMoForb$ and σ is the scale factor on the normally distributed error term η_{iz} to be jointly estimated. Here, it is important to handle censoring as we only observe the forbearance length (failure time) up to November 2021. Therefore, we estimate the model using maximum likelihood, taking censoring into consideration. The vector of coefficient $\boldsymbol{\gamma}$ is our coefficient of interest. In some specifications we also include zip code random effects.

Our main demographic variables are age, race, Hispanic status, and household income at application.[25] To make household income at application comparable across metropolitan statistical areas (MSAs) and origination years, we calculate the income relative to MSA median family income at application by dividing CHMDA-reported household income by MSA median family income at loan application using Census Bureau data. Then we divide income data into 4 quartiles, with the 1st quartile being the lowest income one. In addition, we include gender and split age into bins (age less than 35, 35-44, 45-54, 55-64, and 65 and older).

For loan and borrower attributes, we include various characteristics as of loan

[25]Note that we do not observe borrower's relative household income over time, only at the time of application.

origination and as of January 2020 (the observation just before the onset of the pandemic). Characteristics include loan origination year fixed effects, log origination amount, origination credit score (in bins of below 620, 620-719, and 720 and above), original loan-to-value (LTV) ratio, investor type, the log of monthly payments in January 2020, whether delinquent before March (with categories of 30-90 days past due, 120+ days past due, and foreclosure initiated), credit score in January 2020, updated LTV[26] in January 2020 in bins of less than or equal to 40, (40,60], (60,80], (80,100], and greater than 100, and mortgage interest rates in January 2020.

Moreover, we include information pertinent to the borrower's other credit accounts, including total number of accounts, number of accounts past due, whether more than one account is past due, and log of past due amount of non-first-mortgage accounts. Finally, we include an indicator variable for whether the loan is serviced by a bank.[27] For all our specifications, our reference group is White, non-Hispanic, male borrowers less than 35 years old, with relative household income in the 4th quartile, credit score in January 2020 between 620 and 719, credit score at origination between 620 and 719, and updated LTV bin of 60-80.

Finally, we include neighborhood characteristics or zip code fixed effects to control for any local determinants of housing and mortgage market outcomes. We include 2020 peak-to-trough county unemployment rates from the Bureau of Labor Statistics and other zip code level characteristics from the American Community Survey 2015-2019 Summary Files, which include log of population, share of adults with a college degree or higher, share of Black residents, log of median income, vacant housing shares, log of median house values, and mortgage shares of owner-occupied housing.

To further examine the impact of the pandemic on financial distress, we compare borrower loan performance before and during the pandemic for nonpayment and delinquency (defined in (1)) (4), respectively) outcomes. To do this, we include data in 2019 from January to December.[28] We use a difference-in-differences (DID)

[26]We calculate updated LTV in January by taking the principal remaining in January 2020 and dividing it by the house value at origination multiplied by the CoreLogic House Price Index (HPI) growth rate in the property's zip code from origination to January 2020. For zip codes missing CoreLogic HPI, we use county HPI instead.

[27]For regressions pertaining to our sample in 2020, we use the most recently observed servicer type by November 2020. For other regressions including samples before 2020, we include the servicer type first observed.

[28]To ensure comparability, we measure nonpayment status from April to December of the sample year when examining our samples prior to 2020.

specification with the 2019 and 2020 data:

$$Y_{izt} = \alpha_0 + \alpha_1 P_{izt} + \sum_j \gamma_j T_{j,izt} + \sum_j \beta_j \left(T_{j,izt} * P_{izt}\right) + X'_{izt}\mathbf{\Gamma} + \tau_z + \varepsilon_{izt}, \quad (8)$$

where Y_{izt} is either $EverNonpayment$ or $EverDelinquent$. The variable P_{izt} is equal to 1 for borrower i in zip code z at time t from the 2020 sample, $T_{j,izt}$ are demographic or income characteristic j, $\mathbf{X}$ is a vector of other characteristics of the borrower, and τ_z is a zip code fixed effect. Therefore, the coefficient β_j is the DID estimate for characteristic j. This is the additional likelihood of falling into nonpayment during the pandemic vis-à-vis 2019 for borrowers with characteristic j compared to the reference group. In a robustness test, we run the regressions in a Logit form so that coefficients capture the proportional impacts.

Our sample is a 20% random sample of our matched data, resulting in a sample of 1.93 million borrowers, around 1 million of which report whether the loan is in forbearance. We use the former, larger sample, to examine nonpayment rates and the latter, around 1 million borrowers, to examine forbearance opportunities. Table 1 shows summary statistics on the rich array of data from our sample of borrowers and mortgage loans in different states of forbearance and nonpayment status from April to December 2020. The first column shows the sample averages of various characteristics for all mortgages in our sample, and the next three columns show sample averages for loans broken down by 1) those current through the whole sample period, 2) borrowers who miss at least one payment and enter forbearance, and 3) borrowers who miss at least one payment and miss, or were not granted, forbearance by their servicer.

Comparing the sample of borrowers in the second column to those in the third and the fourth columns, a higher share of minority borrowers are in missed payment status during the pandemic. Black borrowers make up 5.2% of borrowers who were current on their mortgages through the pandemic and about 13% of the two groups that missed payments. Hispanic borrowers make up 8.2% of borrowers who never missed a payment, 16% of those in forbearance, and 11.5% of delinquent borrowers who missed forbearance opportunities. Credit scores are much lower for our two groups of borrowers who missed payments both at origination and in January 2020, just before the onset of the pandemic. We also observe that borrowers who missed at least one payment during the pandemic had much lower average household income at

application.

Among mortgage loan characteristics and performance, a far higher share of FHA/VA loans missed payments, opposite that for GSE and portfolio loans. Origination LTVs were higher for borrowers who missed payments; updated LTVs were higher too, but all three groups showed significant equity, something we will explore in Section 5. Pre-pandemic delinquency rates were higher for our two groups who were delinquent during the pandemic.

Overall, borrowers in more financially vulnerable groups, i.e., minority and lower-income borrowers, have suffered a higher rate of missed payments and took up forbearance at higher rates. However, we also know that many demographic, loan, and credit characteristics are correlated with each other. Thanks to our rich array of data from our large-sample merges, we can explore these relationships in a more systematic way, which we do next.

4 Forbearance and Delinquency

4.1 Mortgage Nonpayment

Table 2 presents cross-sectional nonpayment regression results. Column (1) shows results from a specification that includes only the racial composition of borrowers in our sample, indicator variables for borrowers being Black, Asian, Other, or Missing Race, and for borrowers of Hispanic Origin, compared against a White borrower reference group. Column (2) shows results from a specification with only income-related variables: three indicator variables for belonging to the 1st, 2nd, and 3rd quartile of borrower income relative to MSA median family income, referenced against the 4th, highest-income quartile. The specification in Column (3) includes both race and income variables as well as credit characteristics of borrowers. The specification in Column (4) includes local characteristics described in Section 3. Finally, Column (5) includes zip code fixed effects in lieu of local characteristics.

From Columns (1) and (2), we see very strong bivariate differences in nonpayment rates during the pandemic by race and income group. In particular, Black and Hispanic borrowers have significantly higher rates of nonpayment: Black borrowers have 10.7 percentage point higher rates and Hispanic borrowers have 6.9 percentage point higher rates than their White counterparts, who have a 6.8% rate of nonpayment. We see that borrowers in the 1st quartile of relative income are 5.5 percentage points more likely to be in nonpayment than those in the 4th quartile, and the differences

are monotonically decreasing for borrowers in higher-income quartiles. Those in the 2nd quartile are 4.0 percentage points more likely and those in the 3rd quartile are 1.9 percentage points more likely to be in nonpayment than those in the 4th quartile, who have a 4.5% rate of nonpayment.

Column (3) shows that a large portion of these differences for Black and Hispanic borrowers can be explained by borrower credit profile such as credit score and pre-pandemic delinquency status. But differences for income remain elevated after controlling for borrower credit profile.

Moving from Column (3) to Columns (4) and (5), we see substantial disparities remain even when including a full set of neighborhood controls and zip code fixed effects. In Column (5), we see that Black borrowers are 3.0 percentage points more likely to be in nonpayment than White borrowers, Asian borrowers 1.7 percentage points more likely, and Hispanic borrowers 2.3 percentage points more likely. For Black and Hispanic borrowers, the results represent about a 44% increase in nonpayment rates compared to the average for White borrowers. The bivariate differences with respect to income persist as well. The coefficients on income quartile indicators in Column (5) with all controls are at a similar magnitude to Columns (1)-(4), with the coefficient on the 1st quartile of borrower income actually increasing slightly to 4.5 percentage points, while decreasing slightly for the 2nd and 3rd quartiles to 2.8 and 1.4 percentage points, respectively. For those in the first relative income quartile, the results represent 83% higher rates compared to the raw rates for the 4th quartile.

Other important covariates are included in Table 2. The pre-pandemic credit score is a significant predictor of nonpayment during the pandemic and stable across specifications. In Column (5), those in the lowest credit score bin are 12.4 percentage points more likely to fall into nonpayment status than those in the credit score 620-719 bin reference group, while those in the highest credit score bin are 6.5 percentage points less likely to fall into nonpayment status. Those with higher loan balances, higher monthly payments, and higher numbers of delinquent other credit bureau accounts are more likely to be in nonpayment during the pandemic. Relative to GSE loans, FHA/VA loans have higher nonpayment rates, while PLMBS and portfolio loans have slightly lower rates. Finally, we note that individual credit characteristics seem to contribute the most to the R^2 across specifications. Moreover, zip code fixed effects capture additional variation that is not captured well from observable local characteristics, indicating that unobserved neighborhood characteristics play a part in explaining nonpayment rates.

The racial and income differences in nonpayment rates are stark. However, it is possible that minority and lower-income borrowers also had a higher likelihood of entering into nonpayment during pre-pandemic times. To test that hypothesis, we run the same regression over the same months in 2019. We see only very minor differences in nonpayment rates by racial and income characteristics (Appendix Table A2).[29]

To examine this question more systematically, we turn to the DID specification described in equation (8). Table 3 presents the results using our 2019 and 2020 sample of borrowers. The results in Column (1) show that Black borrowers are 5.7 percentage points more likely to fall into nonpayment during the pandemic compared to White borrowers, even *after* taking into account the baseline nonpayment rate differences during 2019. This is also true for Asian and Hispanic borrowers, with 2.2 percentage points and 5.6 percentage points higher rates, respectively. These results change very little even after including controls, as shown in Columns (3)-(5). Borrower income at application is also correlated with nonpayment rates when controlling for the baseline differences in 2019. Those in the 1st, 2nd, and 3rd income quartiles are 2.8 percentage points, 2.2 percentage points, and 1.1 percentage points more likely to fall into nonpayment, respectively, relative to the highest-income 4th quartile. These coefficients fall only modestly when including the full set of controls to 2.1 percentage points, 1.7 percentage points, and 0.9 percentage points, respectively.

We also use a multiperiod DID regression specification using years from 2016-2020 and the same controls as Column (5) of Table 3. We present the results on our key demographic variables in Figure 3 with 2019 as the baseline. We see that the differential nonpayment rates we describe above only arise between 2019 and 2020 for every demographic variable, confirming that our DID results are capturing the deviation from the 2016-2019 non-recessionary trends in nonpayment rates.[30]

Overall, our results show that racial and income disparities in mortgage distress were very small in the 2016-19 pre-pandemic years, after controlling for conventional risk factors. But our DID results show they increased significantly in 2020, contribut-

[29] Given our very large sample sizes, statistical significance is virtually assured. What is surprising about our 2019 results, which we further corroborate with earlier years, is how small in magnitude these pre-pandemic differences are.

[30] In order to examine whether the differences in our multiperiod DID is coming from constant proportionality increases in nonpayment rates by race and income characteristics, Appendix Figure A2 presents results with the coefficients normalized by the overall mean of each year. We see that results on race hold, displaying elevated rates of nonpayment even compared to the overall rates. For income, the results are mixed, with the lowest income group displaying decreased rates but 2nd and 3rd income groups displaying higher rates.

ing to economic inequality during the pandemic. In that regard, our findings here show that the pandemic has a similar effect to the Great Recession in exacerbating economic inequality.

4.2 Missed Forbearance Opportunities

We now explore how well minority or lower-income borrowers that fall into nonpayment use forbearance programs available to them by examining take-up rates, or missed opportunity rates, for these borrowers. Table 4 presents results from the cross-sectional regressions described in equation (6) for a sample of borrowers in 2020 who have ever experienced mortgage nonpayment during the pandemic. Column (1) only includes race variables, Column (2) only includes income variables, Column (3) includes both race and income variables as well as adding credit characteristics, Column (4) adds zip code fixed effects, and Column (5) shows the results for only federally insured loans (i.e., FHA/VA- and GSE-insured) mandated to provide forbearances under the CARES Act. We see that Columns (4) and (5) show very similar results, suggesting that private-sector forbearance programs were executed similarly to government-mandated ones.[31]

We see encouraging results regarding forbearance take-up rates by minorities and lower-income borrowers. While these borrowers are more likely to fall into nonpayment, as shown in Section 4.1, these borrowers are less likely to miss forbearance opportunities, suggesting short-term relief programs reached populations most in need. First, Column (1) of Table 4 shows that Black, Asian, and Hispanic borrowers are 0.7 percentage points, 5.7 percentage points, and 3.3 percentage points, respectively, less likely to miss forbearance opportunities compared to their White counterparts. Those in the lower-income quartiles are more likely to miss forbearance as shown in Column (2), but these differences are very small once controlling for various demographic and credit characteristics, as shown in Columns (3) and (4).

Column (3) suggests lower rates of missed opportunities for minority borrowers relative to White borrowers, once controlling for borrower credit risk profile. The magnitude of these differences fall by a third when adding in zip code fixed effects. Column (4) shows that Black borrowers are 1.9 percentage points less likely to miss forbearance opportunities than their White counterparts. Compared to the average missed opportunity rate of 9.9 for White borrowers, Black borrowers have a 20%

[31] One reason for this similarity is that pooling and servicing agreements generally require that third-party servicers service loans from other investors similar to their own loans.

lower rate of missed forbearance opportunity. Likewise, Hispanic borrowers are 2.1 percentage points less likely to miss forbearance opportunities. The small coefficients among the income groups indicate that all income groups take up forbearance at about the same rate.

Those with credit scores less than 620 in January 2020 are 3.2 percentage points more likely to miss forbearance opportunities compared to those with 620-719 credit scores, while those with credit scores greater than 720 are 2.3 percentage points less likely to miss forbearance opportunities. This is concerning, as borrowers with lower credit scores are also significantly more likely to fall into nonpayment.[32]

Another important finding is that borrowers delinquent pre-pandemic are more likely to miss forbearance opportunities, and these increase by depth of delinquency. Mortgages are 12.4, 17.6, and 32.0 percentage points more likely to miss forbearance opportunities when they were 30-90 days past due, 120 days past due or in foreclosure, respectively, prior to the pandemic. This shows that although the CARES Act granted forbearances to all borrowers in federally insured loans who requested it, borrowers in delinquency prior to the pandemic were either less likely to apply for or receive forbearance. These coefficients are very similar even when restricting our sample to federally insured GSE and FHA/VA borrowers, providing further evidence that mortgages were serviced similarly whether privately or federally insured.

4.3 Length of Forbearance

For borrowers who entered forbearance, we examine next the duration of forbearance for its demographic and credit characteristics. Figure 5 shows forbearance survival curves by vintage month between April 2020 and December 2021. We see that there is a consistent, near-linear decline in monthly forbearance survival curves with some cross-sectional variation along when loans first entered forbearance.

In Table 5, we present results from the AFT model defined in equation (7). Consistent with other specifications, Columns (1) and (2) only include race or income variables, Column (3) adds credit characteristics, Column (4) adds local economic characteristics, and Column (5) replaces local characteristics with zip code random effects.

In Column (1), we see that minority borrowers on average remain in forbearance

[32] Another interesting finding is that borrowers with loans serviced by banks are 4.1 percentage points less likely to miss forbearance than those not serviced by nonbanks. Part of the difference is likely due to liquidity constraints of nonbanks early in the pandemic. These subsided over time so that nonbanks and banks have similar take-up rates today.

longer. On an overall average rate of about 8.38 months, Black, Asian, and Hispanic borrowers are in forbearance 9.7%, 5.5% and 3.5% months longer, respectively. That translates to about 1.5-3 weeks more time in forbearance for these groups. In Column (2), we see small or no differences in forbearance time by income quartiles, with only the first quartile having longer spells in forbearance, by 3.7%. As we add covariates in Columns (3) to (5), we see that race coefficients decrease in magnitude, but income coefficients increase and become significant for the top two lowest income quartiles. With our most complete specification in Column (5), we see that Black and Asian borrowers have about 5.5% and 5.6% longer forbearance spells, respectively. In this specification, income now comes in significant, as those in the 1st, 2nd, and 3rd income quartile have 7.0%, 3.3%, and 0.9% longer forbearance spells, respectively.

Of the other covariates, one interesting finding is that mortgages delinquent pre-pandemic are in forbearance for significantly shorter times. This follows results in Section 4.2, which show these mortgages were more likely to miss forbearance opportunities, possibly due to servicer actions, providing more evidence that these mortgages were serviced differently from those that became delinquent during the pandemic. Relative to GSE loans, FHA/VA and Portfolio loans stay in forbearance longer, PLMBS loans shorter. Interestingly, even though lenders were not required to extend forbearance to portfolio loans, portfolio loans tend to stay in forbearance the longest. This is possibly because private lender forbearances are voluntary, granted to those most in need.

4.4 Delinquency in the Context of Forbearance

In this section, we examine further how effective COVID-19 forbearance programs have been in helping borrowers avoid delinquency. Toward that end, we examine the characteristics of borrowers who never take forbearance after entering delinquency during the pandemic.

In Appendix Table A3, we present static results for year 2020. In this section, we focus on our DID specification presented in Table 6.[33] In Column (1) we include just borrower race. Consistent with our results on nonpayment and missed opportunities, Black and Hispanic borrowers experienced 3.9 and 1.0 percentage point lower changes in their rates of delinquency compared to what White borrowers experienced from

[33]In Appendix Table A3, we find that with our full set of controls, Black, Hispanic, and lower-income borrowers have slightly lower (around -0.1 to -0.3 percentage points) or similar rates of delinquency during the pandemic. Compared to their elevated nonpayment rates, this indicates that forbearance provided financial relief for minority and lower-income borrowers.

2019-2020.[34] This indicates that even though the pandemic caused a higher rate of financial distress among minority borrowers, forbearance greatly reduced this burden and actually decreased their probability of becoming delinquent. This pattern also holds in Column (2), where we only include income quartiles of the borrowers. Borrowers in the 1st, 2nd, and 3rd income quartiles experienced about 1.6, 1.2, and 0.5 percentage point lower changes in delinquency rates, respectively, from 2019 to 2020.

Similar to our DID specification on nonpayment rates, adding additional credit and other controls has little effect on the coefficients. In Column (3), adding credit controls decreases the coefficient for Black borrowers from 3.9 percentage points to 3.1 percentage points and the coefficient on the 1st quartile of borrowers from 1.6 percentage points to 1.2 percentage points. Adding additional controls does not change the coefficients further.

We also present results for the multiperiod DID specification on delinquencies in Figure 4, which confirms the findings from Table 6. We see that indeed the pandemic was an unusual period when examining delinquencies in conjunction with forbearances. Unlike Figure 3, which showed a large adverse effect on financial distress from the pandemic in the context of 2016-2020, Figure 4 shows the opposite effect, as minority and lower-income borrowers experienced a decline in delinquency rates.

On the whole, these results show that CARES Act forbearances—a blanket government policy with no specific target to reduce inequality—was effective in mitigating the adverse, skewed impact of the pandemic on minority and lower-income borrowers. This has provided short-term relief. As we discuss in the next section, how forbearances get resolved in the coming months will determine whether these reductions in inequality will be sustained for the long term.

5 Forbearance Resolution and Long-Term Relief

While forbearance relief has been provided for an estimated 8.2 million mortgages, that relief is temporary. Borrowers must resolve their past due arrears and resume making payments or risk foreclosure. Figure 7 shows our projections of forbearance

[34]Note that the delinquency rate overall decreased from around 2.3% to 0.8% from 2019 to 2020, so the coefficients represent an additional decrease in delinquency rate changes. This is perhaps due to how the CARES Act dealt with prior delinquencies, as borrowers of federally insured mortgages were granted forbearance if they requested it, without having to verify hardship. In practice, this meant that borrowers with delinquencies unrelated to the pandemic could also receive forbearances.

expirations.[35] Based on these figures, most remaining forbearances will reach their maximum terms in early 2022. Temporary foreclosure protections ran out at the start of 2022.

The CARES Act does not prescribe a resolution for forbearance. The Agencies, including the FHFA and HUD, devised home-retention programs to avoid foreclosure. The central goal of these programs is to give borrowers flexibility to repay forborne arrears[36] and, if needed, to modify loan terms to lower monthly payments.[37] In this section, we examine how forbearances are getting resolved, examine loan modification programs adopted by the federal agencies and private lenders, and assess foreclosure risk. We also discuss obstacles to longer-term debt relief.

5.1 Forbearance Exits

Using our unique data, we can track actual payment amounts made on each mortgage and how servicers classify loss mitigation outcomes. We then exploit this information to categorize forbearance outcomes by their relative risk of foreclosure: 1) have exited forbearance and are performing, have paid off, or are still delinquent but are on a trial modification; 2) are still in forbearance; or 3) have exited forbearance and have either defaulted, are delinquent and are not in loss mitigation; or are in loss mitigation but still not paying (i.e., are not on a trial mod).[38] In Table 7, we provide a detailed breakdown of the disposition of each loan as of the latest performance period, which we collapse into our three performance categories for our multivariate analysis.

For a sample of borrowers who have ever entered forbearance, we examine their performance with the variable *ExitStatus*, described in equation (5). We examine how the exit status differs by demographic, income, and credit profiles via a cross-sectional multinomial logit regression with *ExitStatus* as the dependent variable. We include variables that we included in the linear regressions described in equation (6)

[35] For each loan, we gathered forbearance start times from our McDash Flash sample, then matched it with the Agency rules on forbearances terms, which can extend for up to 18 months.

[36] For borrowers who can resume their regular payments, repayment options include repaying past due arrears as a lump sum, with a repayment plan, or deferring past due arrears with a non-interest bearing subordinated lien due at loan payoff.

[37] Industry experience found payment reduction to be effective in loan modification. Fuster and Willen (2017) shows that payment size has an economically large effect on repayment behavior, e.g., cutting required monthly payment in half reduces the delinquency hazard by about 55 percent. Ganong and Noel (2020) also argue that payment-reduction targets are more effective than debt-to-income targets used by federal programs during the Great Recession and more cost effective than principal forgiveness.

[38] Trial modifications involve borrowers making at least three consecutive payments at their reduced amounts before finalizing new loan terms.

except zip FE. Table 8 shows the results from the regression with $ExitStatus = 1$ as the base category.

First, note that, as of this writing, over 87% of borrowers are in *ExitStatus* 1, while 6.6% of borrowers are still in forbearance and 7.3% are in *ExitStatus* 3. In table 8, Columns (1) and (2) only include race variables and present results on the relative likelihood of being in active forbearance or in delinquency. Columns (3) and (4) do the same with borrower income, while Columns (5) and (6) add all our credit and local characteristics as controls.

Along racial dimensions, our bivariate correlations in Columns (1) and (2) of Table 8 show that, compared to Whites, Black borrowers are more likely to either remain in a Category 2 forbearance or transition into Category 3 over transitioning to a Category 1 outcome. From a relative risk perspective, the rates are 39% and 58% higher, respectively. Hispanic borrowers are more likely to transition to Category 3 over Category 1 by 12%, while Asian borrowers are less likely than Whites to transition to either state by significant amounts.

These bivariate differences change as we include our credit and local controls in Columns (5) and (6), with Black borrowers more likely to remain in Category 2 forbearance over Category 1 by around 10%, but showing no significant difference of transitioning into Category 3. Hispanic borrowers are actually *less* likely to be in either Category 2 or 3. With Asian borrowers, differences with Whites go away altogether.

Along income dimensions, lower-income borrowers seem to be struggling to exit forbearance positively. Columns (3) and (4) indicate that lower-income borrowers are much more likely to remain in Category 2 forbearance or exit into Category 3, with these effects highly significant and monotonic. Especially concerning is that the relative risk to exit to a Category 3 outcome is significantly higher than staying in forbearance. Even after controls are added, lower-income groups still show higher rates of forbearance and delinquency, albeit with smaller effects than with the bivariate results.

It is noteworthy that borrowers with FHA/VA or PLMBS loans are less likely to be in forbearance while being more likely to transition to Category 3 compared to their likelihood of transitioning to Category 1. In Appendix Table A4, we confirm that adding investor types actually decreases the coefficient on Blacks by slightly more than half and reverses the positive Hispanic coefficient to negative for the Category 3 outcome while not changing the coefficient for the forbearance outcome. This suggests

that a large part of the raw differences in transitioning to delinquency for minority borrowers can be attributed to their over-representation in FHA/VA or PLMBS loans. We will discuss in the next section a unique feature of FHA/VA loan modifications that might be hindering FHA/VA borrowers of achieving a more favorable outcome in the modification process upon forbearance exit.

Overall, these results show that Black and Hispanic borrowers are more likely to remain in forbearance or transition into one of the Category 3 outcomes rathter than transition to one of the Category 1 outcomes. when not controlling for other factors, but are only marginally more, or even less, likely to be in a Category 3 outcome after adding controls. These findings assuage some concerns that forbearance was merely "kicking the can down the road" in terms of mitigating racial inequality during the pandemic-induced recession. Risks remain greatest with borrowers whose credit is impaired pre-pandemic, a factor that informs our risk assessment of borrowers most at risk of foreclosure in the next section.

5.2 Risk of Foreclosure and Long-Term Relief

How about future resolution of borrowers most at risk of foreclosure? In this section, we provide evidence that only a small share of borrowers are at risk of foreclosure. Since much of the residual risk is concentrated in FHA mortgages that serve larger shares of minority and lower-income borrowers, we show how fast-tracking the proposed 40-year mortgage in FHA's COVID-19 Recovery Modification Program could provide more relief at lower cost for cash-strapped borrowers.

First, the strong housing market will help most borrowers in forbearance avoid foreclosure. As shown in Figure 8, house prices increased by 20% in the 16 months following of the pandemic-induced recession. By comparison, house prices fell by 21% in the first 16 months of the Great Recession and remained low for another two years. As a result, unlike during the Great Recession, most borrowers in forbearance today are not in a negative equity position and are not at risk of losing their homes.[39] As shown in Table 9, today only 2% of all seriously delinquent mortgages in forbearance have estimated MTM LTVs greater than 100%, while 84% have substantial equity in their homes with MTM LTVs of 80% or less. When we did the same calculations for seriously delinquent borrowers at the same point in the Great Recession, 45% of our

[39]In Table 7, we show that of the 24% of mortgages that exited forbearance and paid off, 34% of these paid off directly out of forbearance or delinquency, behavior consistent with selling to extract equity rather than refinancing. See Fuster et al. (2021).

sample were underwater while only 34% had substantial equity.

When we examine borrower equity along demographic dimensions, we see that Black and Hispanic borrowers and the lowest-income borrowers have statistically significantly higher MTM LTVs based on simple p values. Moreover, White and Asian borrowers have about 4-8 percentage point higher shares of loans with substantial equity in their homes compared to Black and Hispanic borrowers. Most concerning are FHA mortgages, which have about 11-14 percentage points lower share of those with substantial equity relative to GSE, Private-Label, and Portfolio ones. This last finding is important in determining which borrowers are most at risk of foreclosure.

Combining the large share of reperforming loans exiting forbearance with their strong MTM LTV positions, we can see why only a very small share of borrowers are at risk of foreclosure. Table 10 summarizes mortgage performance and the equity positions of borrowers based on our sample extrapolated to the whole U.S. mortgage market. Along the rows of Table 10, we categorize risk based on mortgage performance, with a high-risk category representing only around 2% of mortgages, or around a million mortgages.[40]

Along the columns, we categorize loans by their MTM LTVs, with the low-risk category comprising borrowers with substantial equity. Based on the equity position breakout in the columns, around three quarters of high-risk mortgages have substantial equity in their homes. Thus, our cross tabulation in Table 10 shows that only about 122,000 loans (0.2% of the market) are at high risk of foreclosure. By comparison, over 4 millions homes were foreclosed on during the Great Recession. So overall, very few borrowers are at high risk of losing their homes to foreclosure.

Finally, for those still in forbearance, we analyze who are either benefiting or will likely benefit from home-retention programs on offer. We start by looking at the distribution of principal and interest (P&I) and principal, interest, taxes and insurance (PITI) payment reductions for seriously delinquent borrowers eligible for loans modifications under the FHA, FHFA, and, by extension, private-sector programs.[41] Table 11 Panel A shows that while the average P&I reductions ranges from 29% to 40%, reductions on the full PITI payment range from 18% to 30%, with the latter having a very wide distribution. Additionally, we see that the FHA 40-year Flex Mods reduce

[40]Note that our High Risk category combines the Category 3 loans from the previous section with mortgages seriously delinquent pre-pandemic, as our regression results show these to be of highest risk.

[41]Industry sources report that portfolio and PLMBS servicers are modifying loans similarly to FHFA.

the P&I payment by about 8 percentage points more on average than mods with a 30-year mortgage (37% versus 29%).

Panel B of Table 11 reports our findings for the costs of different loan-mod plans.[42] Based on our relative present value (PV) calculations, the costs of the GSE Flex Mod are on average around $15,000 to $19,000 per loan. If all borrowers were to choose modifications, the costs to the GSEs would range from $7.5 billion to $9.9 billion. Obviously not all borrowers will opt for loan modifications, but many borrowers are deeply delinquent. If even a large share of mortgages opt for a loan modification, the costs would be substantial.

For the FHA COVID-19 Recovery Mods, the costs are much higher, mainly driven by deferring missed payments in a subordinated lien instead of capitalizing payment arrears in the loan balance. If all FHA borrowers were to opt for a modification, costs to the FHA would range from $12 billion to almost $16 billion with the 30-year modification.

Table 11 makes the case for fast-tracking 40-year FHA Flex Mods because it results in lower payments for borrowers at a lower cost to the government than does the FHA Flex Mod with a 30-year mortgage.[43] This is driven by the fact that extending loan terms from 30 to 40 years has no PV costs, results in fewer loans needing principal deferrals, and results in much larger payment reductions. With a 40-year term, average costs per loan are about $1,000 less (Panel B), while the average P&I reduction increases by 8 percentage points (Panel A).[44]

In examining the distributions of PITI payments, we see that fewer than 25% of FHA COVID-19 Flex Mods meet a 20% PITI goal, while over half do with the 40-year term.[45] Taken together with results in Table 8, since a larger portion of Black, lower-income, and worse credit profile borrowers are FHA borrowers, the 40-year FHA Flex Mod can more cost effectively achieve longer-term debt relief for minority and lower-income borrowers.

[42] See Appendix B for details on modification programs and cost calculations.

[43] As of this writing, the Government National Mortgage Association (GNMA), which is the securitizer for FHA/VA mortgages, has yet to securitize a pool of 40-year mortgages.

[44] To illustrate the cost differences, we provide in Appendix Table A7 an example of a 40-year term mod and a 30-year term one, which shows the cost savings of the 40-year term mod more clearly.

[45] By setting a P&I-reduction target of 25%, HUD officials were targeting a 20% PITI reduction.

6 Conclusions and Discussion

The COVID-19 pandemic produced unprecedented financial distress for households and businesses. According to Black Knight Data & Analytics, LLC (Black Knight),[46] nearly 3.6 million serious delinquencies occurred in 2020, the largest number since the height of the Great Recession in 2009. However, through the CARES Act, the federal government embarked on a massive program of mortgage forbearances and foreclosure moratoria that, along with private-sector participation, provided relief to some 15% of the $11 trillion mortgage market. Our study is the first to empirically examine the impact of the pandemic on racial and income inequality among homeowners, both *inclusive* and *exclusive* of government fiscal assistance, and the efficacy of home-retention programs in avoiding foreclosures, along with a recommendation for making these programs even more effective.

We document that the COVID-19 pandemic had a significant disparate impact on payment behaviors of minorities and lower-income borrowers. A DID analysis suggests that the pandemic significantly worsened racial and income disparities in the U.S. mortgage market. We also show that federal and private forbearance programs have provided a lifeline to millions of struggling mortgage holders, as minority and lower-income borrowers took up forbearances at significantly higher rates.

As the pandemic subsides and an estimated 8.2 million mortgages in forbearance find their way out, we analyze which borrowers came out successfully and which are at risk of foreclosure. In contrast to the Great Recession, we show that most borrowers in forbearance today have significant equity in their homes. For this reason, most will be able to avoid foreclosure. However, since we do not have information on current income, borrowers with significant disruptions to their income who wish to stay in their homes will need longer-term debt relief. Due to industry experience from the last recession, relief is coming in the form of loan modification programs aimed at reducing borrowers' P&I payments by at least 20% to 25%. These programs also require little or no documentation or even contact with distressed borrowers, so they can be offered to millions of past due borrowers. For this reason, the last part of our analysis evaluates the effectiveness of these programs in achieving this goal and their relative program costs.

Our analysis shows that GSE Flex Modifications, which lower rates to market rates and extend terms to 40 years, largely achieves its 20% payment-reduction target

[46] https://www.blackknightinc.com/black-knights-December-2020-mortgage-monitor.

for most borrowers. The FHA COVID-19 Recovery Mods currently offered reduce payments by less due to only offering a 30-year term on the modified mortgages. Once GNMA is able to securitize FHA 40-year mortgages, these mods will achieve the FHA's 25% payment reduction target for most borrowers, and do so at significantly lower cost. This makes a strong case for fast-tracking adoption of a 40-year GNMA mortgage security.

Finally, reaching out to troubled borrowers can be challenging. Based on conversations with loan servicers, some borrowers who missed forbearance opportunities could simply be unaware of forbearance options. To better identify communities that are missing forbearance opportunities, the Federal Reserve Banks of Atlanta and Philadelphia developed map tools to help policymakers, community groups, and servicers identify where mortgage borrowers in forbearance are concentrated.[47] Appendix Figure A3 shows two example maps generated from the map tool, with Panel (a) showing the map of the United States and Panel (b) showing the map of the Chicago-Naperville-Elgin, Core-Based Statistical Area (CBSA).

There are many questions that we are not able to answer in this paper. For example, how do we explain the residual difference between minority and White borrowers in terms of nonpayments, even after controlling for conventional risk factors? One explanation could be that minorities have less financial support from family or kin networks to deal with emergencies (Sarkisian and Gerstel (2004)).

Another question: What are the reasons behind borrowers not taking up forbearances? A National Housing Resource Center survey shows some borrowers believe they would be obligated to make a full lump-sum payment when forbearance expires, a misunderstanding of the program. Using Federal Reserve Bank of Philadelphia's *COVID-19 Survey of Consumers*, Lambie-Hanson et al. (2021) also find that, among those not using but potentially needing forbearance, two thirds were unsure or pessimistic about whether they would qualify. Some borrowers are not even aware of forbearance opportunities.

Finally, a significant finding from our analysis is that, controlling for income and other borrower characteristics, low-credit score borrowers not only have higher nonpayment rates but also are more likely to miss forbearance opportunities. Questions remain as to how much of the difference is due to financial literacy and how to help these borrowers. We leave these questions to future research.

[47] https://www.frbatlanta.org/center-for-housing-and-policy/data-and-tools/mortgage-analytics-and-performance-dashboard.aspx.

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Figure 1. Serious Delinquency Rates and Foreclosure Starts

Notes: This figure plots the delinquency rates (left axis) and number of loans in foreclosure starts (right axis) for January 2005 to September 2021.
Data source: Black Knight Data & Analytics, LLC, FRBNY/Equifax Consumer Credit Panel.

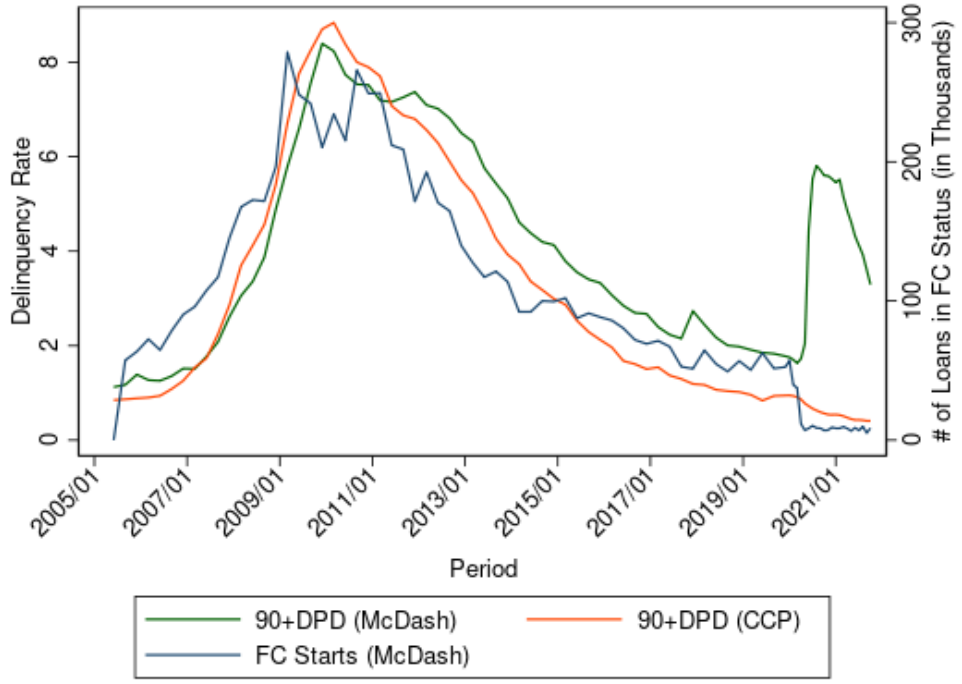


Figure 2. Delinquency and Forbearance Status of Loans

Notes: This figure plots percentages of loans that are delinquent or in forbearance based on data from Black Knight Data & Analytics, LLC. The red area depicts loans delinquent and not in forbearance, the blue area loans in forbearance and in nonpayment, and the purple area loans that are in forbearance and current on their mortgages.

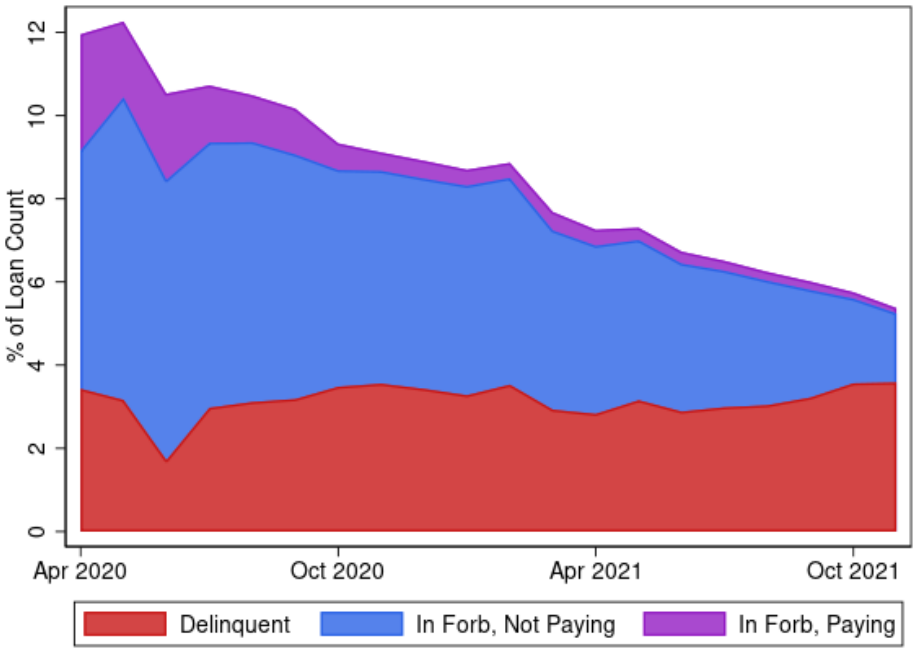
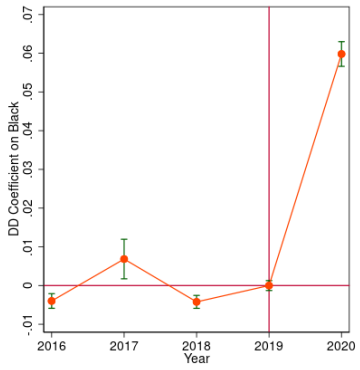
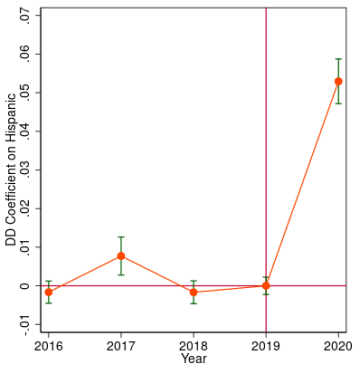


Figure 3. Nonpayment Diff-in-Diff Coefficients, 2016-2020

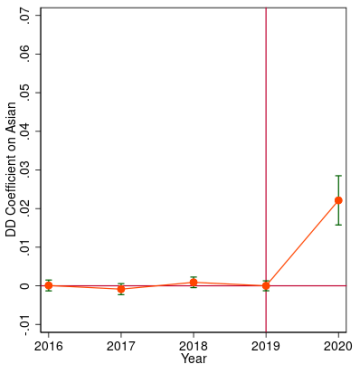
Notes: This figure plots the coefficients and 95% confidence intervals from the multiperiod Difference-in-Differences (DID) regressions on the outcome of whether the borrower is in nonpayment with our most complete specification (all controls in Column (4) of Table 2) using 2019 as the baseline. Each panel plots coefficients on (a) Black indicator, (b) Hispanic indicator, (c) Asian indicator, (d) 1st Quartile of Income Relative to MSA Median, (e) 2nd Quartile of Relative Income, and (f) 3rd Quartile of Relative Income. Data sources include Black Knight McDash Flash, Equifax Credit Risk Insights Servicing McDash (CRISM), and Confidential Home Mortgage Disclosure Act (CHMDA). Race, Hispanic, and Asian statuses, and borrower income quartiles are at application from CHMDA.



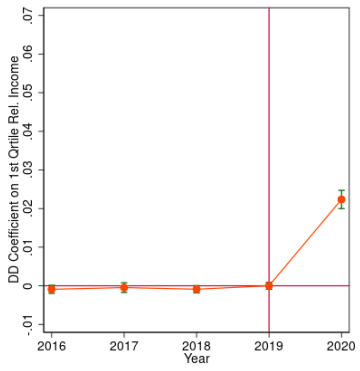
(a) Black



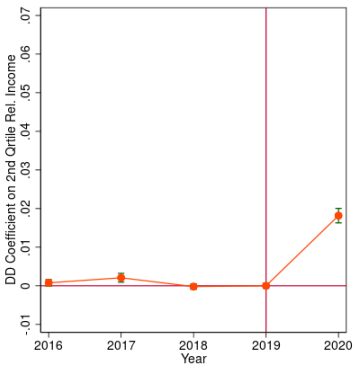
(b) Hispanic



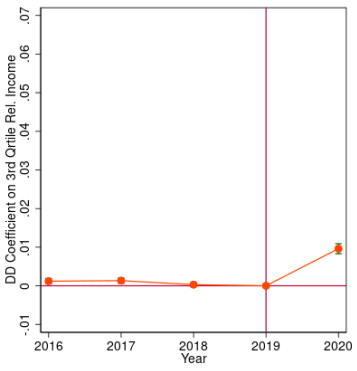
(c) Asian



(d) 1st Qrtile Rel. Income



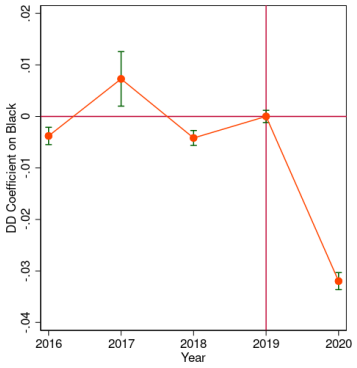
(e) 2nd Qrtile Rel. Income



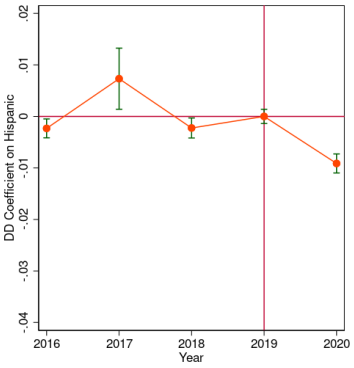
(f) 3rd Qrtile Rel. Income

Figure 4. Delinquency Diff-in-Diff Coefficients, 2016-2020

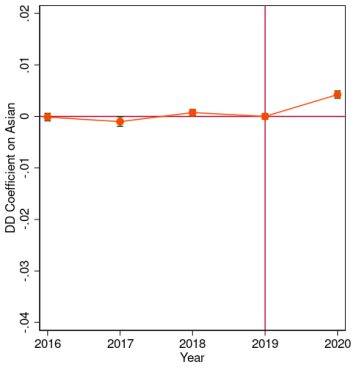
Notes: This figure plots the coefficients and 95% confidence intervals from the multiperiod Difference-in-Differences (DID) regressions on the outcome of whether the borrower is delinquent, with our most complete specification (all controls in Column (4) of Table 6) using 2019 as the baseline. Each panel plots coefficients on (a) Black indicator, (b) Hispanic indicator, (c) Asian indicator, (d) 1st Quartile of Income Relative to MSA Median, (e) 2nd Quartile of Relative Income, and (f) 3rd Quartile of Relative Income. Data sources include Black Knight McDash Flash, Equifax Credit Risk Insights Servicing McDash (CRISM), and Confidential Home Mortgage Disclosure Act (CHMDA). Race, Hispanic, and Asian statuses, and borrower income quartiles are at application from CHMDA.



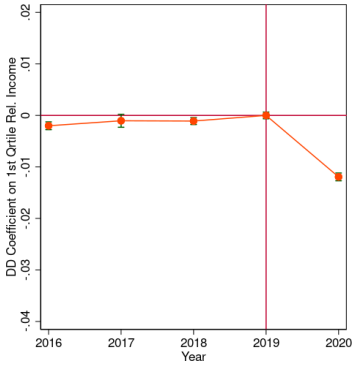
(a) Black



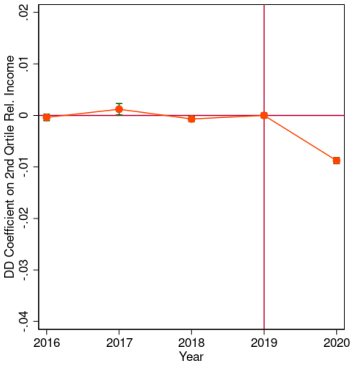
(b) Hispanic



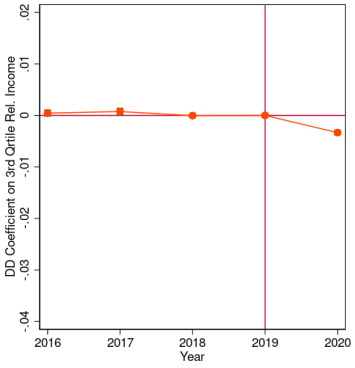
(c) Asian



(d) 1st Qrtile Rel. Income



(e) 2nd Qrtile Rel. Income



(f) 3rd Qrtile Rel. Income

Figure 5. Survival Rates of Forbearance Spells By Entry Month

Notes: This figure plots the share of loans in forbearance for each month after entering forbearance, separately for each monthly vintage from April 2020 to August 2021.
Data source: Black Knight Data & Analytics, LLC.

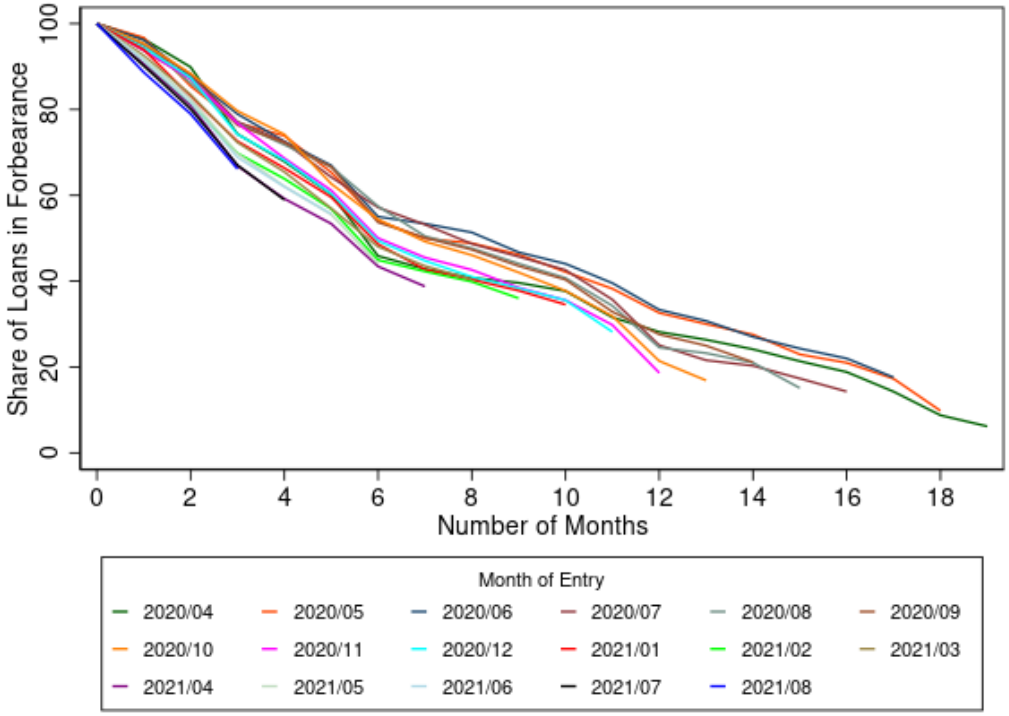


Figure 6. Share of Mortgage Loans Entering Delinquency and Forbearance

Notes: This figure plots shares of active loans by month in our McDash Flash sample that entered forbearance or entered delinquency without a forbearance for the first time.
Data source: Black Knight Data & Analytics, LLC.

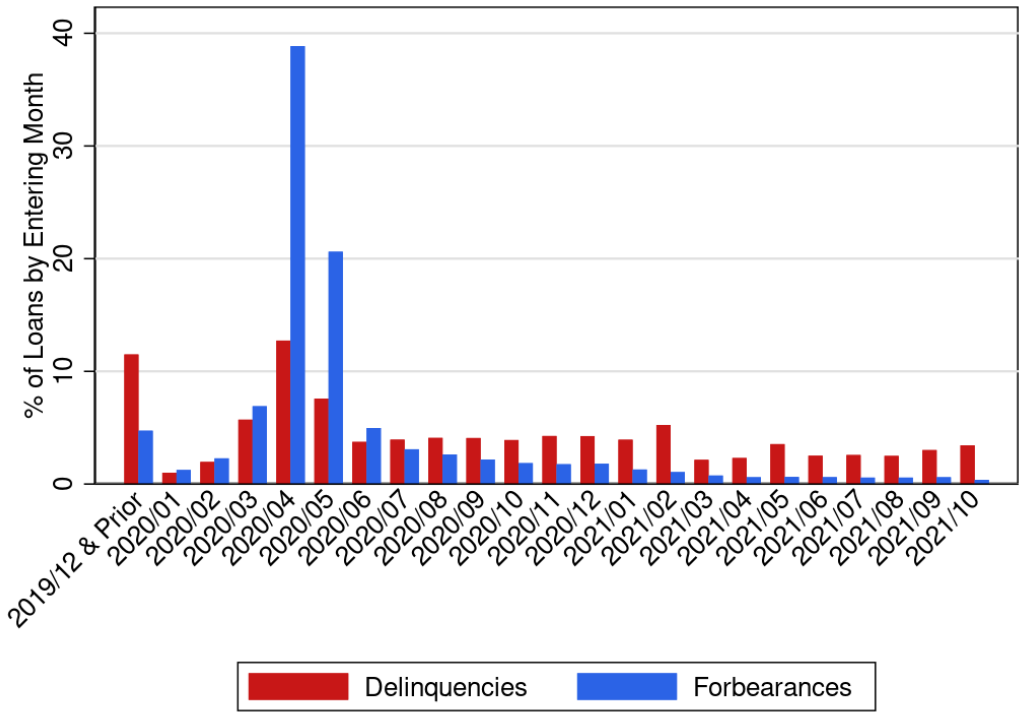


Figure 7. Projected Forbearance Exits

Notes: This figure plots counts of loans in forbearance by their projected exit dates. Projected exit dates are calculated as if the borrower is taking full advantage of the maximum number of months allowed under the CARES Act and subsequent executive actions for federally insured loans (i.e., those by FHA/VA and the GSEs). We assume loans in PLMBS and portfolio follow the same forbearance extension rules as the GSEs.
Data sources: Black Knight Data & Analytics, LLC.

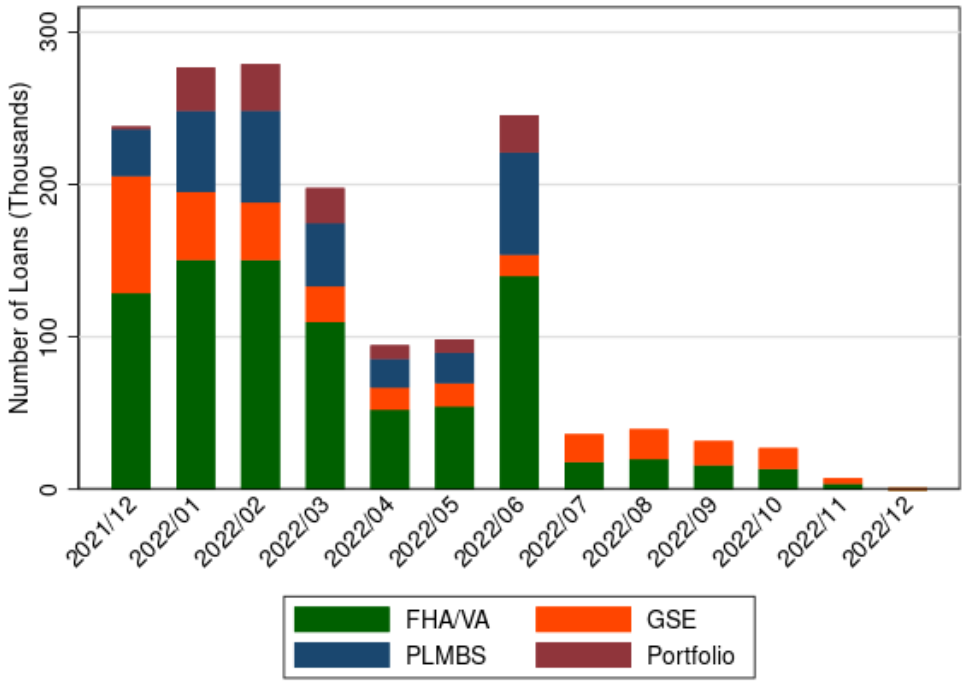


Figure 8. House Price Appreciation After Start of Recessions, 2007 and 2020

Notes: This figure plots home price appreciation since the month recession began during the Great Recession and the COVID-19 pandemic. The date of recession was determined by the NBER's Business Cycle Dating Committee. For the most recent recession, we stop the series at 2021/08, which is our last observed data point. Data source: CoreLogic Home Price Index, Single-Family Combined.

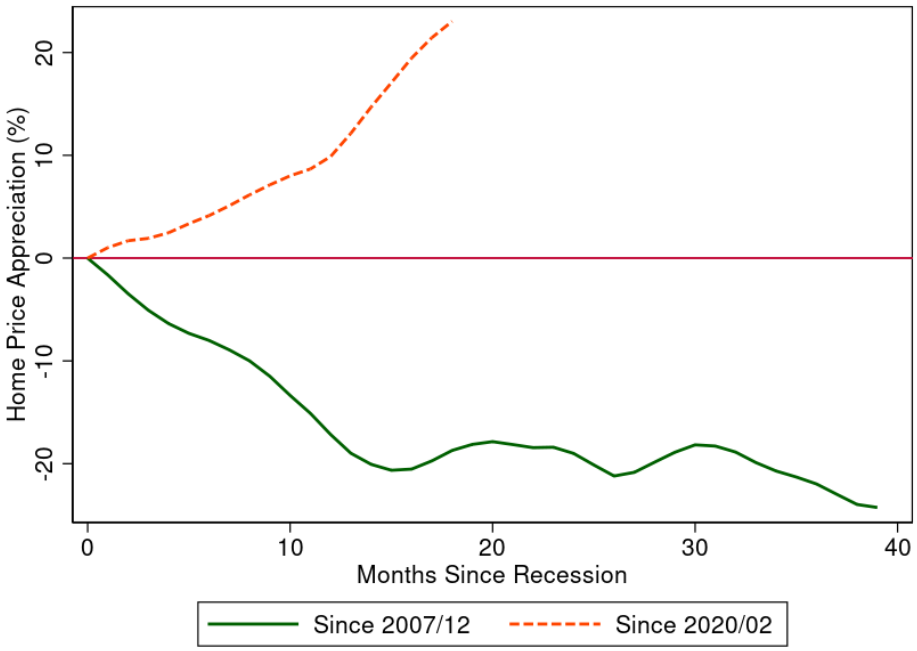


Table 1. Sample Means of Our Sample and Subsamples

Notes: This table shows sample means for our full sample as well as from a subsample of mortgages with forbearance reporting further broken down into mortgages that: never missed a payment (Column (2)), ever missed a payment but remains in forbearance (Column (3)), and Ever missed a payment and was never in forbearance (Column (4)).
Data sources: Black Knight Data & Analytics, LLC; Credit Risk Insights Servicing McDash (CRISM); and Confidential Home Mortgage Disclosure Act (CHMDA).

	(1)	(2)	(3)	(4)
	Full	*Never*	*Ever Miss,*	*Ever Miss,*
Variable	*Sample*	*Miss Pay*	*Ever Forb*	*Never Forb*
Ever in Nonpayment	0.083	-	-	-
Ever in Forbearance	0.101	0.034	-	-
Primary Borrower Characteristics				
White	0.777	0.798	0.718	0.755
Black	0.064	0.052	0.128	0.133
Asian	0.057	0.052	0.058	0.026
Hispanic	0.094	0.082	0.16	0.115
Avg. Household Income	106,769	106,698	88,008	67,039
Age	51.0	51.5	47.2	48.0
Origination Credit Score	737	743	700	679
Credit Score in Jan 2020	749	767	679	607
Mortgage Loan Characteristics and Performance				
GSE Loan	0.632	0.688	0.516	0.331
FHA/VA Loan	0.255	0.214	0.426	0.602
Private Label MBS Loan	0.014	0.005	0.010	0.015
Portfolio Loan	0.099	0.093	0.049	0.053
Origination LTV	79	77	86	89
Updated LTV Jan 2020	48	45	55	55
Delinquent Pre-Pandemic	0.013	0.002	0.086	0.345
Foreclosure Pre-Pandemic	0.002	0.000	0.005	0.045
Large Servicer	0.975	0.962	0.963	0.946
Avg. Loan Amount	240,988	233,352	230,856	173,032
Current Interest Rate	4.13	4.09	4.30	4.46
Equifax Credit Bureau Characteristics				
Total Nonmortgage Debt	33,882	32,337	47,804	32,122
Total Monthly Payments	2,961	2,864	3,281	2,316
Share with Auto Debt	0.551	0.538	0.638	0.578
Share with Student Loan Debt	0.170	0.160	0.249	0.205
Share with Credit Card Debt	0.951	0.952	0.940	0.832
Credit Card Utilization	0.271	0.243	0.486	0.621
More Than 1 Account Past Due	0.016	0.008	0.077	0.179
Observations	1,957,724	975,356	89,991	8,728

Table 2. Mortgage Nonpayment Rate Regression Results

Notes: Clustered standard errors at the county-level in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The reference group for the categorical variables is White, male, age below 35, GSE loan holders with credit scores 620-719, 4th quartile in relative borrower income, and updated LTV 60-80. Other control variables include missing or other race, sex and age bins, loan origination year FE, LTV ratio, log origination amount, credit score at origination, whether servicer is a bank, log monthly payment amount, updated LTV bins, number of DPD credit accounts, more than 1 account DPD, and delinquency status before march for Column 3. Column 4 includes peak-to-trough county unemployment rate in 2020 and zip code log of population, college share, Black share, log median income, vacant housing share, log median housing value, and mortgage share of owner-occupied housing. Column 5 replaces local characteristics with zip-code fixed effects. See Table 1 for data sources.

	(1)	(2)	(3)	(4)	(5)
Dep Var: Ever in Nonpayment	*Race*	*Income*	*Credit Chars*	*Local Chars*	*Zip FE*
Black	0.107***		0.038***	0.032***	0.030***
	(0.002)		(0.002)	(0.002)	(0.002)
Asian	0.011**		0.019***	0.017***	0.017***
	(0.004)		(0.003)	(0.003)	(0.002)
Hispanic	0.069***		0.033***	0.030***	0.023***
	(0.004)		(0.003)	(0.003)	(0.002)
Borrower Income: 1st Qrtile.		0.055***	0.042***	0.042***	0.045***
		(0.002)	(0.001)	(0.001)	(0.001)
Borrower Income: 2nd Qrtile.		0.040***	0.026***	0.026***	0.028***
		(0.002)	(0.001)	(0.001)	(0.001)
Borrower Income: 3rd Qrtile.		0.019***	0.012***	0.012***	0.014***
		(0.001)	(0.001)	(0.001)	(0.001)
Credit Score in Jan 2020 < 620			0.125***	0.125***	0.124***
			(0.002)	(0.002)	(0.002)
Credit Score in Jan 2020 ≥ 720			-0.066***	-0.065***	-0.065***
			(0.001)	(0.001)	(0.001)
30-90 DPD Before March 2020			0.461***	0.461***	0.460***
			(0.004)	(0.004)	(0.004)
120 DPD Before March 2020			0.451***	0.451***	0.450***
			(0.009)	(0.009)	(0.009)
Foreclosure Before March 2020			0.384***	0.383***	0.381***
			(0.008)	(0.008)	(0.008)
FHA/VA Loan			0.018***	0.018***	0.019***
			(0.001)	(0.001)	(0.001)
PLMBS Loan			-0.003	-0.005**	-0.004**
			(0.002)	(0.002)	(0.002)
Portfolio Loan			-0.031***	-0.032***	-0.030***
			(0.001)	(0.001)	(0.001)
Constant	0.068***	0.054***	-0.325***	-0.455***	-0.303***
	(0.001)	(0.002)	(0.016)	(0.034)	(0.012)
Observations	1,957,724	1,957,724	1,957,724	1,957,724	1,957,724
R-squared	0.013	0.006	0.146	0.147	0.163
Average Rate	0.083	0.083	0.083	0.083	0.083
Zip Code FE	N	N	N	N	Y

Table 3. Diff-in-Diff Estimates of Nonpayment Rates, 2019-2020

Notes: Clustered standard errors at the county-level in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. See Table 2 for other control variables and reference groups and Table 1 for data sources.

	(1)	(2)	(3)	(4)	(5)
Dep Var: Ever in Nonpayment	*Race*	*Income*	*Credit Chars*	*Local Chars*	*Zip FE*
Black	0.057***		0.059***	0.059***	0.059***
	(0.002)		(0.002)	(0.002)	(0.002)
Asian	0.022***		0.023***	0.023***	0.022***
	(0.004)		(0.003)	(0.003)	(0.003)
Hispanic	0.056***		0.053***	0.053***	0.052***
	(0.004)		(0.004)	(0.004)	(0.003)
Borrower Income: 1st Qrtile.		0.028***	0.022***	0.022***	0.021***
		(0.002)	(0.001)	(0.001)	(0.001)
Borrower Income: 2nd Qrtile.		0.022***	0.017***	0.017***	0.017***
		(0.002)	(0.001)	(0.001)	(0.001)
Borrower Income: 3rd Qrtile.		0.011***	0.009***	0.009***	0.009***
		(0.001)	(0.001)	(0.001)	(0.001)
Credit Score in Jan 2020 < 620				0.096***	0.095***
				(0.001)	(0.001)
Credit Score in Jan 2020 ≥ 720				-0.039***	-0.039***
				(0.000)	(0.000)
FHA/VA Loan				0.013***	0.014***
				(0.000)	(0.000)
PLMBS Loan				0.007***	0.007***
				(0.001)	(0.001)
Portfolio Loan				-0.016***	-0.015***
				(0.001)	(0.001)
Log Orig Amt				0.008***	0.009***
				(0.000)	(0.000)
Num of DPD All Accts			0.020***	0.020***	0.020***
			(0.001)	(0.001)	(0.001)
Observations	3,800,964	3,800,964	3,800,964	3,800,964	3,800,964
R-squared	0.029	0.023	0.212	0.212	0.220
Average Rate	0.040	0.040	0.040	0.040	0.040
Zip Code FE	N	N	N	N	Y

Table 4. Missed Forbearance Opportunity Rate Regression Results

Notes: Clustered standard errors at the county-level in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. See Table 2 for other control variables and reference groups and Table 1 for data sources.

Dep Var: Ever Miss Forbearance Opportunity	(1) *Race*	(2) *Income*	(3) *Credit Chars*	(4) *Zip FE All Loans*	(5) *Zip FE GSE,FHA/VA*
Black	-0.007**		-0.032***	-0.019***	-0.019***
	(0.003)		(0.003)	(0.004)	(0.004)
Asian	-0.057***		-0.018***	-0.011***	-0.013***
	(0.003)		(0.003)	(0.004)	(0.004)
Hispanic	-0.033***		-0.036***	-0.021***	-0.021***
	(0.003)		(0.003)	(0.003)	(0.003)
Borrower Income: 1st Qrtile.		0.066***	-0.004	-0.004	-0.005
		(0.003)	(0.003)	(0.004)	(0.004)
Borrower Income: 2nd Qrtile.		0.035***	-0.009***	-0.010***	-0.011***
		(0.003)	(0.003)	(0.003)	(0.004)
Borrower Income: 3rd Qrtile.		0.019***	-0.004*	-0.005	-0.005
		(0.002)	(0.002)	(0.003)	(0.003)
Credit Score in Jan 2020 < 620			0.036***	0.033***	0.032***
			(0.003)	(0.004)	(0.004)
Credit Score in Jan 2020 ≥ 720			-0.023***	-0.024***	-0.023***
			(0.002)	(0.002)	(0.002)
30-90 DPD Before March 2020			0.127***	0.125***	0.124***
			(0.005)	(0.006)	(0.006)
120 DPD Before March 2020			0.178***	0.176***	0.176***
			(0.012)	(0.014)	(0.015)
Foreclosure Before March 2020			0.316***	0.327***	0.320***
			(0.019)	(0.022)	(0.023)
FHA/VA Loan			0.014***	0.016***	0.014***
			(0.002)	(0.003)	(0.003)
PLMBS Loan			-0.014	-0.018	-
			(0.012)	(0.013)	
Portfolio Loan			0.035***	0.032***	-
			(0.005)	(0.005)	
Bank Servicer Flag			-0.042***	-0.043***	-0.041***
			(0.004)	(0.004)	(0.004)
Log Orig Amt			-0.030***	-0.023***	-0.024***
			(0.003)	(0.004)	(0.004)
Log Monthly Payment			-0.015***	-0.014***	-0.014***
			(0.002)	(0.003)	(0.003)
Num of All Accts			-0.004***	-0.003***	-0.003***
			(0.000)	(0.000)	(0.000)
Num of DPD All Accts			0.012***	0.010***	0.011***
			(0.002)	(0.002)	(0.002)
Constant	0.099***	0.052***	0.662***	0.554***	0.562***
	(0.002)	(0.002)	(0.033)	(0.043)	(0.047)
Observations	98,719	98,719	98,719	98,719	92,905
R-squared	0.003	0.007	0.097	0.277	0.280
Average Rate	0.088	0.088	0.088	0.088	0.088
Zip Code FE	N	N	N	Y	Y

Table 5. Accelerated Failure Time Model Estimates of Forbearance Length

Notes: Clustered standard errors at the county-level in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. See Table 2 for other control variables and reference groups and Table 1 for data sources. The specification assumes log-normal errors, allows for censoring, and is estimated using maximum likelihood.

Dep Var:	(1)	(2)	(3)	(4)	(5)
Log(Months in Forbearance)	*Race*	*Income*	*Credit Chars*	*Local Chars*	*Zip RE*
Black	0.097***		0.056***	0.044***	0.055***
	(0.007)		(0.007)	(0.009)	(0.007)
Asian	0.055***		0.057***	0.052***	0.056***
	(0.011)		(0.011)	(0.010)	(0.011)
Hispanic	0.035***		0.009	0.012	0.008
	(0.009)		(0.008)	(0.009)	(0.008)
Borrower Income: 1st Qrtile.		0.037***	0.069***	0.075***	0.070***
		(0.010)	(0.010)	(0.010)	(0.010)
Borrower Income: 2nd Qrtile.		0.013	0.032***	0.038***	0.033***
		(0.011)	(0.009)	(0.009)	(0.009)
Borrower Income: 3rd Qrtile.		-0.010	0.009	0.013*	0.009
		(0.009)	(0.008)	(0.008)	(0.008)
Credit Score in Jan < 620			0.066***	0.066***	0.066***
			(0.007)	(0.007)	(0.007)
Credit Score in Jan ≥ 720			-0.133***	-0.135***	-0.133***
			(0.006)	(0.006)	(0.006)
30-90 DPD Before March			-0.152***	-0.150***	-0.152***
			(0.011)	(0.011)	(0.011)
120 DPD Before March			-0.309***	-0.308***	-0.309***
			(0.027)	(0.027)	(0.027)
Foreclosure Before March			-0.472***	-0.470***	-0.472***
			(0.042)	(0.042)	(0.042)
FHA/VA Loan			0.050***	0.055***	0.050***
			(0.007)	(0.006)	(0.007)
PLMBS Loan			-0.123***	-0.126***	-0.123***
			(0.026)	(0.026)	(0.026)
Portfolio Loan			0.269***	0.261***	0.268***
			(0.015)	(0.015)	(0.015)
Bank Servicer Flag			-0.136***	-0.137***	-0.136***
			(0.011)	(0.011)	(0.011)
Log Orig Amt			0.050***	0.042***	0.050***
			(0.007)	(0.008)	(0.007)
Log Monthly Payment			0.005	0.003	0.005
			(0.006)	(0.006)	(0.006)
Num of All Accts			0.001***	0.002***	0.002***
			(0.001)	(0.001)	(0.001)
Num of DPD All Accts			0.010***	0.010***	0.010***
			(0.004)	(0.004)	(0.004)
Constant	1.935***	1.947***	1.263***	1.481***	1.260***
	(0.005)	(0.010)	(0.090)	(0.177)	(0.089)
Observations	89,991	89,991	89,991	89,991	89,991
Average Rate	8.377	8.377	8.377	8.377	8.377
Zip Code RE	N	N	N	N	Y

Table 6. Diff-in-Diff Estimates of Delinquency Rates, 2019-2020

Notes: Standard errors in parentheses are clustered at the county level, with * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. See Table 2 for other control variables and reference groups and Table 1 for data sources.

Dep Var: *=1 if Delinquent and Never in Forb.*	(1) *Race*	(2) *Income*	(3) *Credit Chars*	(4) *Local Chars*	(5) *Zip FE*
Black	-0.039***		-0.031***	-0.031***	-0.031***
	(0.001)		(0.001)	(0.001)	(0.001)
Asian	0.007***		0.005***	0.004***	0.004***
	(0.000)		(0.000)	(0.000)	(0.000)
Hispanic	-0.010***		-0.008***	-0.009***	-0.009***
	(0.000)		(0.001)	(0.001)	(0.001)
Borrower Income: 1st Qrtile.		-0.016***	-0.012***	-0.011***	-0.011***
		(0.000)	(0.000)	(0.000)	(0.000)
Borrower Income: 2nd Qrtile.		-0.012***	-0.009***	-0.009***	-0.009***
		(0.000)	(0.000)	(0.000)	(0.000)
Borrower Income: 3rd Qrtile.		-0.005***	-0.003***	-0.003***	-0.004***
		(0.000)	(0.000)	(0.000)	(0.000)
Credit Score in Jan 2020 < 620				0.044***	0.044***
				(0.001)	(0.001)
Credit Score in Jan 2020 ≥ 720				-0.010***	-0.010***
				(0.000)	(0.000)
FHA/VA Loan				0.004***	0.004***
				(0.000)	(0.000)
PLMBS Loan				0.013***	0.013***
				(0.001)	(0.001)
Portfolio Loan				0.000	-0.000
				(0.000)	(0.000)
Log Orig Amt				0.000	0.000
				(0.000)	(0.000)
Num of DPD All Accts			0.010***	0.010***	0.010***
			(0.001)	(0.001)	(0.001)
Observations	2,917,315	2,917,315	2,917,315	2,917,315	2,917,315
R-squared	0.009	0.007	0.345	0.345	0.354
Average Rate	0.022	0.022	0.022	0.022	0.022
Zip Code FE	N	N	N	N	Y

Table 7. COVID-19 Forbearance Exits by Category

Notes: This table summarizes from our McDash Flash sample the disposition of all loans that entered forbearance into the three categories defined in Section 5.1. and reports other statistics on forbearances. Dispositions were determined by gathering servicers' classifications and examining monthly payment patterns compared against scheduled payments. Servicing transfers are loans sold where a status could not be determined.

Category 1: Performing or Paid Off		
Performing	**1,250,780**	**49%**
Always Performing	211,816	8%
Lump Sum Payment	290,965	12%
Repayment plan	275,872	11%
Arrears Deferral	199,060	8%
Modification	224,251	9%
Trial Modification	48,816	2%
Paid Off	**604,481**	**24%**
From Delinquency or Forbearance	206,613	8%
From Current Status	397,868	16%
Category 2: Still in Forbearance		
Active Forbearances	**274,343**	**11%**
Category 3: Delinquent, Defaulted, or in Loss Mitigation But Not Paying		
Delinquent–In Loss Mitigation Not Paying	**125,069**	**5%**
Delinquent–Not In Loss Mitigation	**107,880**	**4%**
Default	**3,380**	**0%**
Servicing Transfer	**161,522**	**6%**
Total	**2,527,455**	**100%**
Share Paid Off out of Forbearance or Delinquency		34%
Share Performing or Paid Off		71%
Share of Loans Delinquent in Loss Mitigation Not Paying		72%

Table 8. Nonpayment Status Regression for Loans Ever in Forbearance

Notes: This table presents coefficients of multinomial logit regression on borrowers being in 1) performing, paid off, or trial mods (base category), 2) forbearance, or 3) delinquency. Loan status is as of December 7, 2021. Each column labeled "Forb" are results on the category of forbearance and "Del" are on category of delinquency. Clustered standard errors at the county-level in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. See Table 2 for other control variables and reference groups and Table 1 for data sources. MTM LTV stands for mark-to-market loan-to-value ratio.

	(1)	(2)	(3)	(4)	(5)	(6)
Specification	*Race*		*Income*		*Credit + Local Chars*	
Category	**Forb**	**Del**	**Forb**	**Del**	**Forb**	**Del**
Black	0.394***	0.584***			0.097**	-0.020
	(0.036)	(0.038)			(0.041)	(0.042)
Asian	-0.183***	-0.641***			-0.031	-0.072
	(0.057)	(0.069)			(0.057)	(0.066)
Hispanic	-0.027	0.119**			-0.118***	-0.104***
	(0.043)	(0.052)			(0.041)	(0.036)
Borrower Income: 1st Qrtile.			0.500***	1.109***	0.332***	0.299***
			(0.041)	(0.049)	(0.052)	(0.059)
Borrower Income: 2nd Qrtile.			0.332***	0.824***	0.189***	0.196***
			(0.039)	(0.048)	(0.046)	(0.054)
Borrower Income: 3rd Qrtile.			0.248***	0.517***	0.156***	0.148***
			(0.041)	(0.047)	(0.043)	(0.052)
MTM LTV in Jan 2020 $\leq$ 40					-0.119**	-0.436***
					(0.046)	(0.052)
MTM LTV in Jan 2020 (40,60]					-0.056*	-0.232***
					(0.031)	(0.034)
MTM LTV in Jan 2020 (80,100]					0.084	0.108**
					(0.053)	(0.053)
MTM LTV in Jan 2020 > 100					-0.221	0.125
					(0.311)	(0.304)
Credit Score in Jan 2020 < 620					0.489***	0.541***
					(0.035)	(0.032)
Credit Score in Jan 2020 $\geq$ 720					-0.642***	-0.926***
					(0.039)	(0.042)
30-90 DPD Before March 2020					0.582***	0.801***
					(0.051)	(0.040)
120 DPD Before March 2020					0.777***	1.099***
					(0.098)	(0.078)
Foreclosure Before March 2020					0.885***	1.306***
					(0.145)	(0.117)
FHA/VA Loan					-0.543***	0.870***
					(0.035)	(0.040)
PLMBS Loan					-0.692***	0.457***
					(0.145)	(0.119)
Portfolio Loan					-0.016	0.536***
					(0.064)	(0.066)
Constant	-2.617***	-2.549***	-2.889***	-3.224***	-1.457*	-1.272
	(0.019)	(0.028)	(0.034)	(0.046)	(0.859)	(0.966)
Observations	107,928	107,928	107,928	107,928	107,928	107,928
Pseudo R-Squared	0.005	0.005	0.010	0.010	0.109	0.109
Average Rate	0.066	0.073	0.066	0.073	0.066	0.073

Table 9. Mark-to-Market LTVs of Seriously Delinquent Loans During the Great Recession and COVID-19 Pandemic

Notes: This table calculates market-to-market loan-to-value (MTM LTV) ratios of a sample of mortgages 90 or more days delinquent (90+ DQ) in April 2009 and our McDash Flash sample of loans in forbearance and 90+ DQ in June 2021, using the CoreLogic Home Price Repeat Sales Indexes at the most localized level available to adjust the origination house values of all loans. The last column displays p-values from a t-test on difference in means to a reference group noted in the table. Data sources: Black Knight McDash Data; Black Knight Data & Analytics, LLC; and CoreLogic House Price Indexes.

Category	*MTM LTV Ranges*			*Percentiles*				*P Value of*
	<80%	*80-100%*	*≥100%*	*Mean*	*p10*	*p50*	*p90*	*Diff in Means*
90+ DQ, 2009/04	0.34	0.21	0.45	104	31	96	147	<.001
90+ DQ and Forb., 2021/06	0.84	0.15	0.02	62	35	61	85	Reference
Black	0.80	0.18	0.02	63	37	64	87	0.011
White	0.84	0.14	0.02	62	35	61	84	Reference
Asian	0.86	0.13	0.01	61	30	59	84	0.210
Hispanic	0.80	0.17	0.02	63	35	64	87	0.032
Income: 1st Quartile (Lowest)	0.83	0.16	0.02	62	37	63	85	0.003
Income: 2nd Quartile	0.80	0.18	0.02	64	39	65	87	0.178
Income: 3rd Quartile	0.81	0.17	0.02	63	37	64	86	0.082
Income: 4th Quartile (Highest)	0.86	0.12	0.02	66	33	59	83	Reference
GSE Loans	0.89	0.10	0.01	57	31	57	81	Reference
FHA Loans	0.78	0.20	0.02	66	43	67	87	<.001
Private Label MBS Loans	0.92	0.05	0.03	49	25	45	77	<.001
Portfolio Loans	0.92	0.06	0.02	70	23	50	77	<.001

Table 10. Mortgages at Risk of Foreclosure by Payment Behavior and MTM LTVs

Notes: This tables calculates mark-to-market loan-to-value ratios (MTM LTVs) of our McDash Flash loan sample and extrapolates it out to the whole market by the method described in Appendix Table A5. House values are marked-to-market using CoreLogic Repeat Sales Indexes at the most localized geography. FB = forbearance; DPD = days past due.

	Mark-to-Market LTVs				
Payment Behavior	<80%	80-90%	>90%	Missing	Total
High Risk					
90+ DPD & not in FB or loss mit	785,396	95,837	122,125	59,534	1,062,891
In FB & 90+ DPD prior to FB	1.5%	0.2%	0.2%	0.1%	2.0%
90+ DPD & In Loss Mit & Not Paying					
Moderate Risk					
COVID-19 FB	1,188,714	93,034	47,899	28,318	1,357,966
30-89 DPD & not in FB or loss mit	2.2%	0.2%	0.1%	0.1%	2.6%
90+ DPD & In Loss Mit & Paying					
Low Risk					
30-60 DPD or in loss mit & not in FB	45,583,454	2,072,683	1,070,739	1,852,268	50,579,143
Current	86.0%	3.9%	2.0%	3.5%	95.4%
Total	47,557,563	2,261,554	1,240,763	1,940,120	53,000,000
	89.7%	4.3%	2.3%	3.7%	100%

Table 11. Analysis of Agency Loan Modification Programs

Notes: Panel A presents the reductions in principal and interest (P&I) and the full mortgage payment of principal, interest, taxes, and insurance (PITI) and their distributions with the three loan modification programs described in Appendix Table A6. Data are from our McDash Flash sample of seriously delinquent mortgage loans in forbearance. Panel B shows the numbers, shares, and present value (PV) costs described in Appendix B, assuming all borrowers 90 or more days past due and in forbearance opt for loan modifications under their respective programs. Private-sector loans (portfolio loans and private label MBS) are assumed to follow the GSE Flex Mod Program. GSE = Government Sponsored Enterprises, FHA = Federal Housing Administration, MBS = mortgage-backed security.

Data source: Black Knight Data & Analytics, LLC.

Panel A: Distribution of PITI Reduction

	GSE Flex Mod	FHA Recovery 30 Yr.	FHA Recovery 40 Yr.	Private Loan Mods	All Loans
Average P&I Reduction	32%	29%	37%	40%	35%
Average PITI Reduction	23%	18%	23%	30%	24%
Distribution of PITI Reductions					
1st	11%	10%	12%	11%	11%
5th	13%	12%	15%	14%	14%
25th	17%	15%	19%	20%	18%
Median	21%	17%	22%	27%	22%
75th	26%	19%	26%	39%	27%
95th	40%	33%	39%	55%	42%
99th	53%	45%	49%	65%	55%

Panel B: Workout Costs

Loan Counts	509,712	664,664	664,664	328,224	1,502,600
Loan Balance ($Bil)	113.8	139.0	139.0	60.2	313.0
PV Loss ($Bil) - Loan Life 5 Yrs	7.5	12.1	11.3	3.3	22.1
Per Loan ($)	14,708	18,165	17,073	9,920	14,708
PV Loss ($Bil) - Loan Life 7 Yrs	9.9	15.9	15.1	4.3	29.2
Per Loan ($)	19,421	23,997	22,648	13,040	19,455

Appendix A Data Matching Procedure

In this section, we describe the matching procedure across our datasets. The datasets we use are described in detail in Section 3 and are McDash Flash, Black Knight McDash Data, CRISM, and CHMDA data.

Matching loans in Black Knight's McDash Flash data to loans in Black Knight McDash data is straightforward as they are provided from the same source with unique loan identifiers. However, not all loans in the Black Knight McDash data are found in McDash Flash. Matching CRISM data with Black Knight McDash data is also straightforward, as Equifax uses loan performance data from McDash primary to match to mortgage loans held by borrowers in their credit history data and provide the unique loan identifier used in McDash. Equifax employs its own proprietary algorithm for matching loans in its credit histories with loans in the Black Knight McDash dataset, which uses loan information such as loan amount, zip code, origination date, and other criteria. Following Equifax guidance, we only take loans with a sufficiently high confidence on the match.

The bulk of our work is done to match loans in McDash to loans in CHMDA, which is information provided by the lenders at loan application. The matching algorithm is based on the work of Rosen (2011) and uses the following criteria:

1. Geography: CHMDA provides the Census Tract of the property, while McDash provides the zip code of the property. Therefore, we use a concordance between Census Tracts and zip codes provided by MABLE/Geocorr from the Missouri Census Data Center.[48] However, some Census Tracts may be matched to multiple zip codes, and vice versa. For these loans, we let them match to all possible combinations of zip code to Census Tract.

2. Loan origination characteristics: We match loans by their loan amount, lien status, occupancy, loan purpose, and loan type. For loan amounts prior to 2018, CHMDA required lenders to report loans in 1,000s of dollar amount, with rounding. As such, we only require loans to be within a $500 band between CHMDA and McDash. However, for loan amounts in 2018 and later, CHMDA provides the full amounts down to the dollar. Because there were some cases in which loans were reported to the nearest $10 amount, we allowed for differences of up to $10.

[48] https://mcdc.missouri.edu/applications/geocorr.html.

3. Closing date: Because there is some flexibility in how servicers and lenders report the closing date, we allow the most flexibility in this regard. First, the McDash data exhibits bunching on the 1st of the month, indicating the exact closing date is not recorded. Second, CHMDA allows some flexibility in reporting the closing date. Therefore, we first match loans using the exact dates as reported; then, for loans not matched using exact dates, we find loans that have closing dates within five days of each other; for loans still not matched, we allow any loan in the same month to be matched.

As can be seen from the procedure described above, it is possible that multiple matches for the same loan can occur. These cases include pure multiples, where two loans share the same characteristics. Or it could be an artifact of our inexact matching criteria. For example, multiple loans could be within the same loan amount band, or in Census Tracts that are large enough to have multiple zip codes. In order to avoid making judgments on these cases, we only use loans that were uniquely matched between McDash and CHMDA. Moreover, to preserve the anonymity of the data, we remove all identifying information for borrowers, servicers, and lenders.

Appendix Table A1 shows the match rates and means of various characteristics of loans and borrowers across our matches. Column (1) shows our baseline data to examine the match, which are borrowers in CRISM that has a matched McDash loan in June 2020. Going across the columns, we see that about 65% of the CRISM borrowers are matched to CHMDA (Column 2), 69% are matched to McDash Flash (Column 3), and 47% are matched to both (Column 4).

We also see that loans matched to CHMDA, Flash, or both datasets do not differ significantly in their borrower or loan characteristics. There seems to be some indication that those matched to Flash data are slightly better selected than those in our baseline CRISM data. For example, borrowers with loans matched to both CHMDA and Flash belong to the highest credit score group at a slighly higher rate (62%) compared to the full sample of CRISM borrowers (58%). However, other differences are small or zero.

Appendix B Formulas for Computing Present Value Costs of Deferral and Loan Modification Options

For the two main Agency investors (the GSEs and FHA), two types of home-retention options were designed by their federal regulators, the Federal Housing Finance Agency (FHFA) and Department of Housing and Urban Development (HUD), with the two private-sector investor groups (portfolio lenders and PLMBS), generally following FHFA rules.[49] These are:

1. For borrowers who can resume regular payments, missed payments can be paid back in a lump sum, with a repayment plan or with a payment deferral or partial claim,[50] in which missed payments are put into a noninterest-bearing subordinated lien to be paid when the loan is terminated.

2. For borrowers who cannot-or choose not to-resume regular payments, loan modifications that reduce monthly payments are available with plans announced by the FHFA for GSE loans and HUD for FHA and VA loans.

In Appendix Table A6, we lay out the latest Agency loan modification programs designed by the FHFA and HUD. Both plans adopt payment-reduction targets, with FHFA targeting a principal and interest (P&I) reduction of at least 20% for GSE loans, HUD targeting 25% for FHA loans.

The GSE Flex Mod Program has five steps. Steps 1-3 are executed together and include capitalizing all arrears in the loan balance, setting a "loan modification interest rate" tied to the Freddie Mac Primary Mortgage Market Survey (PMMS) rate, and extending loan terms to 40 years. The last two steps include additional principal deferrals for underwater borrowers and/or to help borrowers achieve a 20% payment reduction.[51] Our two main private-sector investors identified in the sample, portfolio lenders and PLMBS investors, are assumed to follow FHFA guidance.[52]

For the FHA COVID-19 Recovery Mod, the P&I reduction targets are higher at

[49] Our industry contacts informed us that servicers generally follow FHFA rules for their own and their non-government portfolios, so we assume private investors follow FHFA rules.

[50] Payment deferrals for GSE loans work where Fannie Mae or Freddie Mac reimburse servicers for any arrears advanced by the servicers and add in any arrears they advance to investors into a payment deferral. In a "partial claim," the FHA reimburses servicers for any advances. Private lenders can execute deferrals directly. Regulators have provided relief to portfolio lenders by not requiring they take troubled-debt restructurings (TDRs) on these and other pandemic-related workouts.

[51] There is also an additional 40% post-mod housing to income ratio (PMHTI) target, but this can be waived, and since we do not have the data to compute it, we do not factor it in here. Thus, these results are an upper bound on target goals.

[52] Because private loans are not in Agency MBS pools, they are not subject to their rules so have much more flexibility to design their own home-retention options, which we explore next.

25%. Like the GSE mods, the first three steps are executed together. Unlike the GSEs, instead of capitalizing payment arrears, the FHA funds a no-interest partial claim of past due payments up to 25% of the loan balance, due at loan payoff. For the loan-term extension, another difference is that, at this time, the FHA can only offer mods with a 30-year term. However, FHA announced an intention to create a 40-year mortgage for pools of reperforming, modified mortgages.[53] For this reason, we evaluate the FHA mods with both 30- and 40-year terms. Finally, if the payment-reduction target is not reached, additional principal can be added to the partial claim up to 25% of the post-mod loan balance.

In Table 11, we present the expected present value (PV) costs of the three major loan mod programs on offer from HUD and FHFA, as described in Appendix Table A6, and for the loan deferral option for borrowers that resume timely payment on their mortgages with all arrears deferred in a no-interest subordinated lien due at payoff. The PV cost for these options is the difference between the PV of the income stream at existing loan terms and the PV of the income streams from the modification and deferral options. The "baseline case" occurs when borrowers resume timely payment of their mortgages, paying back all arrears with no change in loan terms through a lump-sum payment (see Table 7). If we assume a borrower will pay off the loan in L years (the assumed loan life), the income stream to the note holder in the baseline case is the monthly payments for L years with any remaining balance paid back at the end of L years. Since the life of the loan is the one stochastic variable in our PV calculation, we express L as a range of expected loan lives of 5 to 7 years.[54] Since the income stream will be discounted by the current note rate, the PV of the income stream for the existing loan equals the loan balance, which is independent of L. The PV for the baseline case is then,

$$PV_b = UPB_b + (n * PITI_b), \tag{A1}$$

where PV_b is the present value of the income stream; UPB_b is the unpaid principal balance of the loan at t_0; n is the number of past due payments; $PITI_b$ is the scheduled loan payment, which includes principal, interest, tax, and insurance.[55]

[53] See All Participant Memorandum (APM) (ginniemae.gov). Unlike the GSEs or portfolio lenders, GNMA does not have a balance sheet to hold 40-year mortgages, and their mortgage servicers resisted holding them on their balance sheets.

[54] Our empirical analysis with loans originated from 1999-2015 in McDash data supports this assumption.

[55] The monthly payment is a mix of loans where mortgage escrows are paid monthly and those

For the deferral option, the income stream to the noteholder would be the monthly payments for L years at the existing note rate, the remaining balance paid back at the end of year L, with all past-due arrears paid at the end of year L. Since the income stream is discounted by the current note rate, the combination of PVs of the first two parts equals the loan balance. The PV for the deferral option is then,

$$PV_D = UPB_b + \frac{n * PITI_b}{(1 + R_b/12)^{12*L}}, \tag{A2}$$

where PV_D is the present value of the income stream, UPB_b is the unpaid principal balance of the loan, n is the number of past due payments, $PITI_b$ is the scheduled payment, R_b is the current note rate, and L is the expected loan life in years.

Per Appendix Table A6, for the GSE Flex Mod, the past due payments will be capitalized, loans will be re-amortized with interest rates reduced to the Loan Modification Interest Rate, and loan terms extended to 40 years. If the 20% target P&I reduction is not achieved, a balance deferral is offered up to 30% of the loan balance. The income stream to the noteholder is then the modified monthly principal and interest payments for L years, the remaining balance paid back in L years, and the deferred balance, if there is one, paid back by the end of L years. The PV for the GSE Flex Mod is,

$$PV_{GSE} = PI_m * \frac{1 - \frac{1}{(1+R_b/12)^{12*L}}}{R_b/12} + \frac{Bal_r + Bal_d}{(1 + R_b/12)^{12*L}}, \tag{A3}$$

where PV_{GSE} is the present value of the income stream, PI_m is the modified monthly principal and interest payment, L is the expected loan life in years, R_b is the current note rate, Bal_r is the remaining balance in L years, and Bal_d is the balance amount deferred and paid back at the end of year L.

Per Appendix Table A6, for the FHA COVID-19 Recovery MOD, the past due payments will be applied to a partial claim (i.e., a no-interest subordinated lien) up to 25% of the current UPB, with additional amounts added to the loan balance. Loans will be reamortized with interest rates reduced to the Freddie Mac Primary Market Mortgage Survey (PMMS) rate with loan terms extended to either 30 or 40 years. Balance deferrals may also be needed to meet the 25% payment reduction target. The income stream to the noteholder would be the modified monthly principal and

where the borrower pays taxes and insurance. We do not distinguish among them in our analysis, assuming whatever the lump-sum payment is whatever the borrower is responsible for in existing terms that prevail at t_0.

interest payments for L years, the remaining balance paid back at the end of year L, the partial claim and the deferred balances, if there is one, paid back at the end of year L. The PV for the FHA COVID-19 Recovery MOD is,

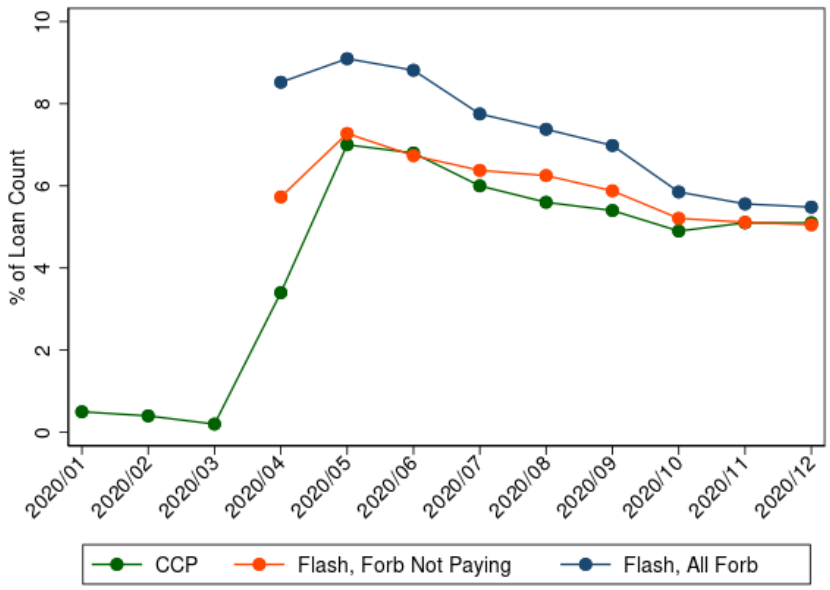
$$PV_{FHA} = PI_m * \frac{1 - \frac{1}{(1+R_b/12)^{12*L}}}{R_b/12} + \frac{Bal_r + Pclm + Bal_d}{(1+R_b/12)^{12*L}}, \tag{A4}$$

where PV_{FHA} is the present value of the income stream, PI_m is modified monthly principal and interest payment, L is the expected loan life in years, R_b is the current note rate, Bal_r is the remaining balance in L years, $Pclm$ is the partial claim amount deferred and paid back at the end of year L, and Bal_d is the balance amount deferred and paid back at the end of year L.

As an example, in Appendix Table A7, we demonstrate the loan modification and PV loss calculation with a loan with a pseudo loan identifier of LN000000000.

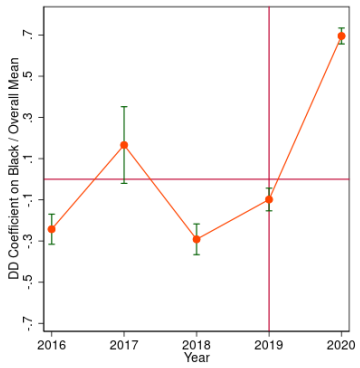
Appendix Figure A1. Mortgage Forbearance Rates Calculated Using Servicing and Credit-Bureau Data

Notes: This figure plots the forbearance rates of first lien mortgages in the Equifax/FRBNY Consumer Credit Panel (CCP) Data and the forbearance rate of mortgages in the Flash data from Black Knight Data & Analytics, LLC data, one for just those in forbearance and not paying and one for all in forbearance, regardless of their actual payment status. For the CCP rates, forbearance is identified using narrative codes in the credit reports.

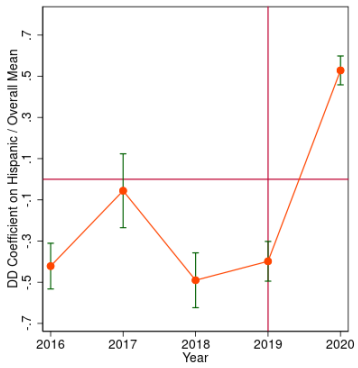


Appendix Figure A2. Nonpayment Diff-in-Diff Coefficients, Proportional Hazard Perspective, 2016-2020

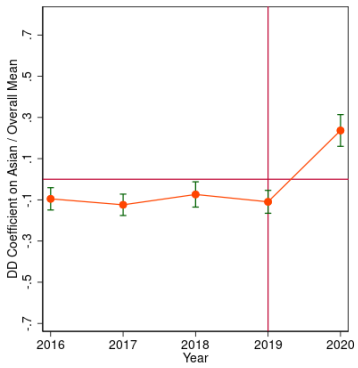
Notes: This figure plots the coefficients divided by overall means in each year and 95% confidence intervals from the multiperiod Difference-in-Differences (DID) regressions with our most complete specification (all controls in Column (4) of Table 2). Each panel plots coefficients on (a) Black indicator, (b) Hispanic indicator, (c) Asian indicator, (d) 1st Quartile of Income Relative to MSA Median, (e) 2nd Quartile of Relative Income, and (f) 3rd Quartile of Relative Income. Data sources include Black Knight McDash Flash, Equifax Credit Risk Insights Servicing McDash (CRISM), and Confidential Home Mortgage Disclosure Act (CHMDA). Race and borrower income quartiles are at application from CHMDA.



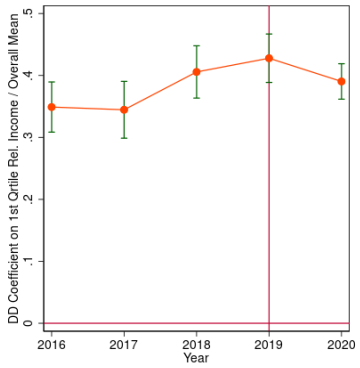
(a) Black



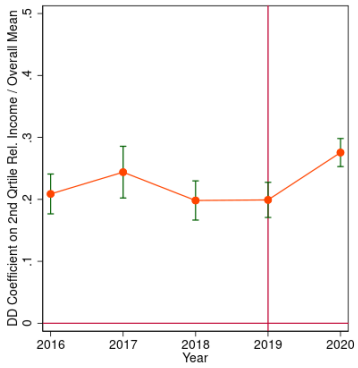
(b) Hispanic



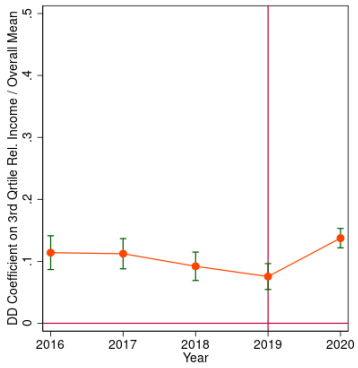
(c) Asian



(d) 1st Qrtile Rel. Income



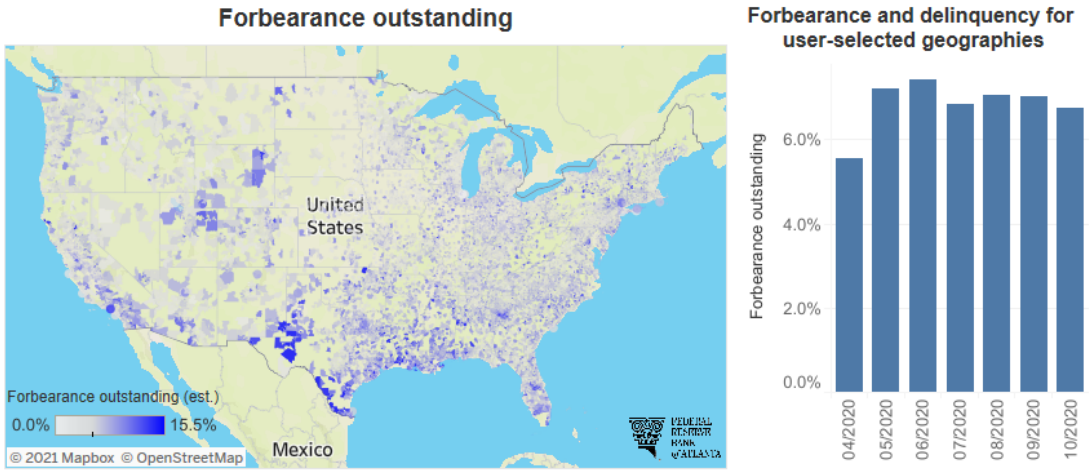
(e) 2nd Qrtile Rel. Income



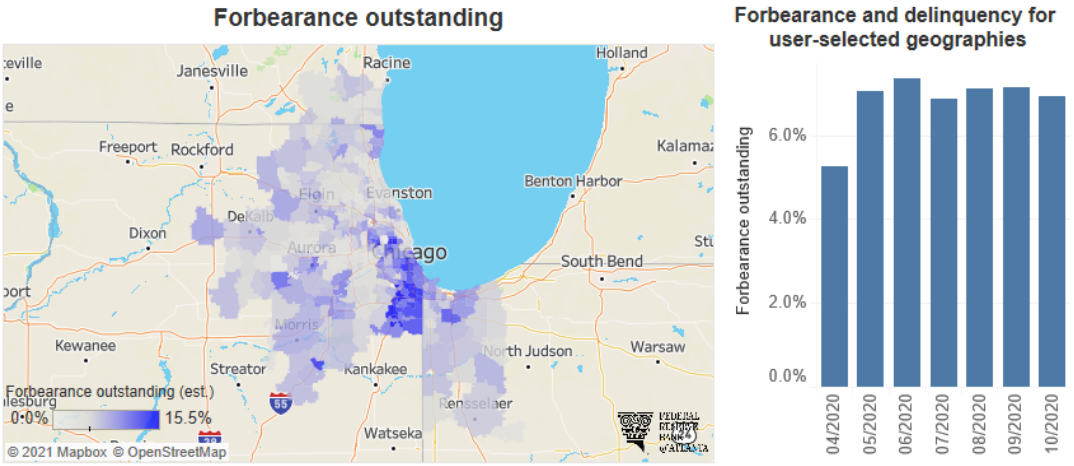
(f) 3rd Qrtile Rel. Income

Appendix Figure A3. Example Forbearance Map from the Federal Reserve Bank of Atlanta's Mortgage Analytics and Performance Dashboard

Notes: This figure plots example maps from the online map tool. Panel (a) plots the map for the entire United States, and Panel (b) plots the map for the Chicago-Naperville-Elgin, Core-Based Statistical Area (CBSA). Both maps show rates of forbearance at the zip code level. The map tool is available at https://www.frbatlanta.org/center-for-housing-and-policy/data-and-tools/mortgage-analytics-and-performance-dashboard.aspx. Data Sources: Federal Reserve Bank of Atlanta calculations using Black Knight McDash Flash data and Equifax Credit Risks Insight Servicing McDash (CRISM).



(a) Map of the United States



(b) Map of Chicago-Naperville-Elgin CBSA

Appendix Table A1. Match Rates and Characteristics

Notes: We start with a 20% sample of borrowers with first-mortgage loans in the CRISM data observed in June 2020. Column (2) are borrowers with loans matched to CHMDA data. Column (3) are borrowers with loans matched to McDash Flash data. Column (4) are loans matched to both. See Table 1 for data sources.

	(1) *All CRISM*	(2) *CHMDA-Matched*	(3) *Flash-Matched*	(4) *Both-Matched*
Match Rate	100%	65%	69%	47%
		Means		
Current Credit Score	746.30	748.57	754.46	755.60
Current Credit Score < 620	0.06	0.05	0.06	0.05
Current Credit Score 620-719	0.19	0.20	0.16	0.16
Current Credit Score ≥ 720	0.58	0.61	0.58	0.62
Current Credit Score Missing	0.17	0.14	0.20	0.17
Credit Score at Orig	728.55	730.95	729.64	732.47
Credit Score at Orig < 620	0.04	0.03	0.04	0.03
Credit Score at Orig 620-719	0.30	0.31	0.29	0.30
Credit Score at Orig ≥ 720	0.52	0.55	0.55	0.58
Credit Score at Orig Missing	0.15	0.11	0.12	0.09
Age	52.43	51.51	52.54	51.85
Age < 35	0.10	0.12	0.10	0.11
Age 35-44	0.22	0.23	0.22	0.23
Age 45-54	0.24	0.24	0.24	0.24
Age 55-64	0.23	0.22	0.24	0.23
Age ≥ 65	0.20	0.19	0.21	0.20
GSE Loan	0.61	0.61	0.63	0.64
FHA/VA Loan	0.27	0.28	0.25	0.25
PLMBS Loan	0.04	0.03	0.04	0.03
Portfolio Loan	0.08	0.09	0.08	0.09
Orig Amount	227068.14	230939.35	227620.43	229701.10
LTV Ratio	78.74	79.30	78.21	86.18
Monthly Payment	2875.76	2883.66	2879.48	2893.09
Closing Year	2013.38	2014.08	2013.33	2013.85
Current Interest Rate	4.28	4.20	4.26	4.20
Count of Accounts	7.46	7.50	7.41	7.44
Count of DPD Accounts	0.06	0.06	0.06	0.05
Non-FM Balance Past Due	33.65	27.80	33.28	29.28

Appendix Table A2. Mortgage Nonpayment Rates, 2019 and 2020

Notes: This table shows cross-sectional results separately for 2019 and 2020 samples. Standard errors in parentheses are clustered at the county level, with * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. See Table 2 for other control variables and reference groups and Table 1 for data sources.

	(1)	(2)
Dep Var: =1 if Ever in Nonpayment	*2019*	*2020*
Black	0.007***	0.030***
	(0.001)	(0.002)
Asian	-0.001***	0.017***
	(0.000)	(0.002)
Hispanic	-0.001**	0.023***
	(0.000)	(0.002)
Borrower Income: 1st Qrtile.	0.005***	0.045***
	(0.000)	(0.001)
Borrower Income: 2nd Qrtile.	0.003***	0.028***
	(0.000)	(0.001)
Borrower Income: 3rd Qrtile.	0.001**	0.014***
	(0.000)	(0.001)
Credit Score in Jan $<$ 620	0.065***	0.124***
	(0.001)	(0.002)
Credit Score in Jan $\geq$ 720	-0.011***	-0.065***
	(0.000)	(0.001)
FHA/VA Loan	0.007***	0.018***
	(0.000)	(0.001)
PLMBS Loan	0.009***	-0.003
	(0.001)	(0.002)
Portfolio Loan	0.000	-0.028***
	(0.000)	(0.001)
Log Orig Amt	0.001***	0.017***
	(0.000)	(0.001)
Log Monthly Payment	0.001***	0.018***
	(0.000)	(0.001)
Num of DPD All Accts	0.014***	0.025***
	(0.001)	(0.001)
Observations	1,843,240	1,957,724
R-squared	0.460	0.163
Average Rate	0.023	0.083
Zip Code FE	Y	Y

Appendix Table A3. Delinquency Rates

Notes: Standard errors in parentheses are clustered at the county level, with * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. See Table 2 for other control variables and reference groups and Table 1 for data sources.

Dep Var:	(1)	(2)	(3)	(4)	(5)
=1 if Never Forb, Delinq	*Race*	*Income*	*Credit Chars*	*Local Chars*	*Zip FE*
Black	0.007***		-0.003***	-0.003***	-0.003***
	(0.001)		(0.000)	(0.001)	(0.001)
Asian	-0.002***		-0.000	-0.000	-0.000
	(0.000)		(0.000)	(0.000)	(0.000)
Hispanic	0.002***		-0.002***	-0.002***	-0.002***
	(0.000)		(0.000)	(0.000)	(0.000)
Borrower Income: 1st Qrtile.		0.007***	0.001***	0.001***	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)
Borrower Income: 2nd Qrtile.		0.004***	-0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Borrower Income: 3rd Qrtile.		0.002***	-0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Credit Score in Jan < 620			0.016***	0.016***	0.016***
			(0.001)	(0.001)	(0.001)
Credit Score in Jan ≥ 720			-0.004***	-0.004***	-0.004***
			(0.000)	(0.000)	(0.000)
30-90 DPD Before March			0.173***	0.173***	0.173***
			(0.005)	(0.005)	(0.005)
120 DPD Before March			0.221***	0.221***	0.220***
			(0.012)	(0.012)	(0.012)
Foreclosure Before March			0.342***	0.342***	0.340***
			(0.017)	(0.017)	(0.018)
FHA/VA Loan			0.001***	0.001***	0.001***
			(0.000)	(0.000)	(0.000)
PLMBS Loan			0.001	0.001	0.001
			(0.002)	(0.002)	(0.002)
Portfolio Loan			0.001***	0.001***	0.001***
			(0.000)	(0.000)	(0.000)
Constant	0.005***	0.002***	0.028***	0.030***	0.025***
	(0.000)	(0.000)	(0.003)	(0.005)	(0.003)
Observations	819,038	819,038	819,038	819,038	819,038
R-squared	0.001	0.001	0.120	0.120	0.148
Average Rate	0.005	0.005	0.005	0.005	0.005
Zip Code FE	N	N	N	N	Y

Appendix Table A4. Nonpayment Status Regression for Loans Ever in Forbearance

Notes: This table presents coefficients of multinomial logit regression on borrowers being in 1) performing, paid off, or trial mods (base category), 2) forbearance, or 3) delinquency. Loan status is as of December 7, 2021. Each column labeled "Forb" are results on the category of forbearance and "Del" are on category of delinquency. Clustered standard errors at the county-level in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. See Table 2 for other control variables and reference groups and Table 1 for data sources.

	(1)	(2)	(3)	(4)	(5)	(6)
Specification	*Race*		*Race + Income*		*Add Investor*	
Category	**Forb**	**Del**	**Forb**	**Del**	**Forb**	**Del**
Black	0.394***	0.584***	0.338***	0.466***	0.356***	0.201***
	(0.036)	(0.038)	(0.035)	(0.038)	(0.035)	(0.036)
Asian	-0.183***	-0.641***	-0.176***	-0.624***	-0.190***	-0.375***
	(0.057)	(0.069)	(0.057)	(0.067)	(0.058)	(0.066)
Hispanic	-0.027	0.119**	-0.074*	0.020	-0.067	-0.102**
	(0.043)	(0.052)	(0.042)	(0.049)	(0.042)	(0.040)
Borrower Income: 1st Qrtile.			0.471***	1.047***	0.503***	0.608***
			(0.041)	(0.048)	(0.044)	(0.051)
Borrower Income: 2nd Qrtile.			0.309***	0.777***	0.334***	0.445***
			(0.039)	(0.047)	(0.042)	(0.052)
Borrower Income: 3rd Qrtile.			0.237***	0.493***	0.252***	0.310***
			(0.041)	(0.047)	(0.042)	(0.050)
FHA/VA Loan					-0.091***	1.498***
					(0.031)	(0.036)
PLMBS Loan					0.009	1.475***
					(0.132)	(0.101)
Portfolio Loan					0.012	0.714***
					(0.065)	(0.078)
Observations	107,928	107,928	107,928	107,928	107,928	107,928
Pseudo R-squared	0.005	0.005	0.010	0.010	0.010	0.010
Dep Mean	0.066	0.073	0.066	0.073	0.066	0.073

Appendix Table A5. Total U.S. Single Family Mortgage Market: Loan Counts and Balances

Notes: This table represents total counts and dollar balances of all first lien 1-4 family U.S. mortgages used to extrapolate our McDash Flash sample to the market. FHA/VA includes GNMA securities and portfolio loans that are GNMA buybacks purchased out of securities pools. Portfolio loans exclude from IMF figures home equity loans and GNMA buybacks. GNMA = Government National Mortgage Assn., FHA/VA = Federal Housing Administration/Veterans Affairs, GSE = Government-Sponsored Enterprise, and PLMBS = Private Label Mortgage Backed Securities. Counts are provided by Black Knight. Balances are as of 2021Q1 from *Inside Mortgage Finance*. For our extrapolation to the full market of forbearances, we first identify in the McDash Flash data the share of loans that are COVID-19 forbearances for each investor type above and calculate forbearance rates. The calculated forbearance rates from the data sample are then applied to the market for each investor/product segment to get the forbearances estimate for each investor/product type in the market.

Panel A. By Loan Counts

Investor/Product	*Total Market Size (Thousands)*	*Forbear Rate (Percent)*	*Extrapolated Counts in Forbear (Thousands)*
FHA/VA	12,100	6.90	834
GSE	27,900	2.21	616
Portfolio	10,500	3.35	352
PLMBS	2,500	10.26	257
Total	**53,000**		**2,059**

Panel B. By Loan Balance

Investor/Product	*Total Market Size ($ Billions)*	*Forbear Rate (Percent)*	*Extrapolated Balance in Forbear ($ Billions)*
FHA/VA	1,975	7.40	146
GSE	5,716	2.36	135
Portfolio	3,118	2.59	81
PLMBS	413	12.78	53
Total	**11,223**		**415**

Appendix Table A6. COVID-19 Modifications by FHFA and HUD

Notes: This table summarizes the five step-process for modifications implemented by the Federal Housing Finance Agency (FHFA) for the Government Sponsored Enterprise (GSE) Flex Mod and the Department of Housing and Urban Development (HUD) Federal Housing Administration (FHA) COVID-19 Recovery Modification, offered with a 30-year and 40-year mortgage. Steps 1-3 are offered together, while steps 4 and 5 include additional principal deferrals to lower payments further when specified targets are not met. All other loans, including all private-sector plans, are assumed to use the GSE Flex Mod Plan.

	GSE Flex Mod	FHA COVID-19 Recovery Modification 30-Year Term	FHA COVID-19 Recovery Modification 40-Year Terms
Target	Minimum 20% reduction in P&I payment	Minimum 25% reduction in P&I payment	Minimum 25% reduction in P&I payment
Step 1	Capitalize arrears in loan balance	Apply arrears to a partial claim up to 25% of current UPB	Apply arrears to a partial claim up to 25% of current UPB
Step 2	Set interest rate to lower of contractual rate or modification interest rate**	Set interest rate to lower of contractual rate or PMMS rate, rounded to nearest one-eighth	Set interest rate to lower of contractual rate or PMMS rate, rounded to nearest one-eighth
Step 3	Extend maturity to 480 months from mod effective date	Extend maturity to 360 months from mod effective date	Extend maturity to 480 months from mod effective date in future***
Step 4	If post-mod MTM LTV $>$ 100%, forbear principal until MTM LTV $=$ 100% up to 30% of post-capitalized UPB cap	If 25% P&I reduction not met, apply principal deferral until 25% reduction is reached up to 25% of current loan cap; place additional arrearages above cap into loan	If 25% P&I reduction not met, apply principal deferral until 25% reduction is reached up to 25% of current loan cap; place additional arrearages above cap into loan
Step 5	If 20% P&I reduction and PMHTI ratio $\leq$ 40% not met, forbear principal until these are met or 80% MTM LTV is achieved up to 30% post-capitalized UPB	If 25% payment reduction not met, offer borrower terms from Step 4	If 25% payment reduction not met, offer borrower terms from Step 4

**Modification interest rate:
https://sf.freddiemac.com/general/freddie-mac-modification-interest-rate.
***GNMA announced their intention to enable loan terms of 40 years:
https://ginniemae.gov/newsroom/Pages/PressReleaseDispPage.aspx?ParamID=209

Appendix Table A7. Demonstration of PV Costs of the GSE and FHA Loan Modification Programs

Notes: In this table, we use a representative loan to demonstrate the present value (PV) costs of the GSE and FHA loan mod programs described in Appendix Table A6 relative to a loan that comes current with a lump-sum payment. The loan is in a COVID-19 forbearance and seriously delinquent in June 2021, with all relevant loan terms in the Baseline column. We assume the loan will be paid off in five years in all cases. In the Baseline, the borrower pays off the $25,740 of arrears immediately as a lump sum. The PV of the income stream is $325,047. With the GSE Flex Mod, the arrears are capitalized with the interest rate reduced to 3% and the loan term extended to 480 months. Because the principal and interest (P&I) payment with these new terms cannot reduce the reamortized P%I payment to the 20% target, an additional $18,854 of principal is deferred to the end of year 5, which brings the balance down to $314,193 and the P&I payment down to $1,125. Using formulas described in Appendix B, the PV cost is $12,234. With the FHA COVID-19 Recovery Mod 30-Year Term, the total past due amount of $25,740 is deferred in a "Partial Claim" to year 5. The note rate is reduced to 2.75% with loan term extended to 360 months. An additional amount of $41,188 of the unpaid balance is deferred to meet the FHA 25% P&I reduction target. The re-amortized P&I payment is $1,054. The PV of the income stream is $302,479, resulting a PV cost of $22,550. With the FHA COVID-19 Recovery Mod 40- Year Term, the rate reduction and term extension reduce the P&I payment to $1,029, which is 26.8% lower than the current P&I of $1,045, so no additional deferral is needed. The PV of the income stream is $307,492, resulting in a PV cost of $17,555.

LN00000000	**Baseline**	**GSE Flex Mod**	**FHA COVID-19 Recovery Mod 30-Year Term**	**FHA COVID-19 Recovery Mod 40-Year Term**
Balance	$299,307	$314,193	$258,119	$299,307
Interest Rate	3.75%	3.00%	2.75%	2.75%
Remaining Term	252	480	360	480
Past Due Amount	$25,740	n/a	n/a	n/a
Partial Claim	n/a	n/a	$25,740	$25,740
Principal Deferred	n/a	$10,854	$41,188	$0
P&I	$1,405	$1,125	$1,054	$1,029
Expected Loan Life (months)	n/a	60	60	60
PV	$325,047	$312,813	$302,497	$307,492
P&I Reduction		20%	25%	27%
PV Costs		$12,234	$22,550	$17,555