Forbearance and the Cost of Credit.*

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Abstract

Forbearance policies are designed to stabilize demand during downturns, but we uncover an important unintended consequence: a contraction in credit supply. Using novel data from the GSE Credit Risk Transfer market and the 2020 CARES Act as a natural experiment, we show that private investors significantly reduced credit supply following the Act's enactment. This effect was most pronounced in judicial states, where foreclosure costs are higher for lenders. Our difference-in-differences strategy, extensive robustness checks and model simulations reveal a key trade-off in forbearance design: policies that aid borrowers may simultaneously discourage private lending.

Keywords: Fannie Mae, Freddie Mac, GSEs, Mortgages, Investors, Credit Risk, Forbearance, Delinquencies.

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1 Introduction

Mortgage forbearance policies are increasingly popular across many countries. For example, the 2020 Coronavirus Aid, Relief, and Economic Security (CARES) Act in the United States and the 2023 Guideline to Prevent Mortgage Defaults in Canada allowed borrowers facing financial hardship to delay payments without risking foreclosure.[1] Recent research supports borrower-friendly housing finance policies by showing their aggregate demand externalities during economic downturns (see, e.g., Agarwal et al. 2017; Gabriel, Iacoviello and Lutz 2021; Gete and Zecchetto 2024). In this paper, we uncover a negative side effect: forbearance policies may contract credit supply. Thus, their positive aggregate demand effects must be weighed against the negative effects on credit supply.

We examine how one of the largest mortgage forbearance programs in history—the 2020 CARES Act in the United States—affected the pricing of mortgage credit. The CARES Act allowed borrowers with federally backed mortgages to pause payments for 12 to 18 months upon request, without penalty. Missed payments could be repaid through several options, including deferral until the end of the loan term. Because the credit risk on these mortgages is borne by Government-Sponsored Enterprises (GSEs) or other federal agencies, the impact of this policy is not directly reflected in primary mortgage rates. In other words, agency mortgage data do not allow us to observe how credit supply responded to the CARES Act. To address this, we turn to an alternative market where this question can be examined: the Credit Risk Transfer (CRT) market.

We manually compile a comprehensive dataset on the CRT market to analyze the effects of the CARES Act on credit supply. The GSEs created the Credit Risk Transfer (CRT) market in the aftermath of the 2008 financial crisis to transfer a portion of mortgage credit risk from taxpayers to private investors. In this market, private investors take on exposure to U.S. mortgage credit risk by purchasing CRT securities from the GSEs and trading them in a secondary market. Thus, CRTs provide a direct measure of how private markets price mortgage credit risk.

Our novel dataset focuses on the two largest CRT programs: Connecticut Avenue Securities (CAS) from Fannie Mae and Structured Agency Credit Risk (STACR) from Freddie Mac, both launched with the first CRT issuances in 2013. We analyze daily trading data from the secondary market for these CRTs around the enactment of the 2020 CARES Act forbearance program. In this market, private investors effectively serve as the marginal suppliers of mortgage

[1] https://oig.treasury.gov/cares-act. https://www.canada.ca/en/financial-consumer-agency/services/industry/commissioner-guidance/mortgage-loans-exceptional-circumstances.html

credit by assuming default risk that would otherwise remain on the GSEs' balance sheets. Investors' risk assessments are reflected in CRT spreads over the risk-free rate. CRT spreads offer a market-based measure of how the CARES Act's forbearance program influenced the cost and availability of mortgage credit.

We document that CRT spreads increased by approximately a factor of four on the day mortgage forbearance was mandated under the CARES Act, as borrowers were extended a put option effectively borne by CRT investors.[2] This sharp rise indicates that lending costs increased as investors anticipated that forbearance would exacerbate, rather than mitigate, future default risks. Notably, the jump in CRT spreads aligns precisely with the introduction of the CARES Act, rather than with the declaration of a global pandemic or other major Covid-19-related news. This timing strongly suggests that the spread changes were driven specifically by the CARES Act provisions. Under this legislation, borrowers could access no-questions-asked forbearance, shifting all delinquency-related losses to the GSEs and CRT investors.[3]

Furthermore, we investigate the differential spread response of securities with high and low exposure to states with judicial foreclosure requirement ("judicial states"). To foreclose a mortgage in a judicial state, a lender must provide evidence of default to a court and every step of the process requires judicial approval, which substantially lengthens the foreclosure timeline. In contrast, in non-judicial states, upon default, lenders can immediately notify a borrower about the foreclosure and begin liquidation of the property without judicial oversight. Thus, while mortgage default is costly to CRT investors across locations, credit risk is systematically higher in judicial states compared to non-judicial states because borrowers have greater incentives to default, and lenders incur higher administrative and legal costs during foreclosure (Gerardi, Lambie-Hanson, and Willen 2013, McGowan and Nguyen 2023). If the blanket forbearance under the CARES Act was anticipated to increase (decrease) overall foreclosure losses, then the longer foreclosure timelines in judicial states would have become more (less) relevant. As a result, CRT spreads for securities with higher exposure to judicial states would have risen (fallen) relative to others.

We find that CRT spreads for securities with high judicial exposure increased more than those with lower exposure. This key and novel finding implies that the forbearance introduced under the CARES Act was expected to raise future default losses. The policy effectively made judicial states even more "judicial" in the eyes of investors, as the longer foreclosure timelines became increasingly relevant under the forbearance regime. Our difference-in-differences strat-

[2]In an analogous setting, Acharya et al. (2024) argue that the sharp decline in bank stock prices in March 2020 was due to banks writing put options on aggregate risk through the provision of credit lines.

[3]Loans exit forbearance when they become current, modified, liquidated or after 18 months, whichever occurs first. This eventual exit from forbearance exposes CRT investors to default losses.

egy, along with placebo tests, provides robust evidence of a causal response by CRT investors to the CARES Act.

The initial reaction of CRT investors appears justified by subsequent loan performance. We find that 90-day mortgage delinquency rates increased substantially within 90 days following the enactment of the CARES Act, with the rise especially pronounced in judicial states. These increases in delinquencies, most of which occurred within the forbearance program, are consistent with the rise in CRT spreads documented in our analysis.

To rationalize the empirical findings, we derive a zero-profit condition for mortgage lenders that serves as a model of mortgage credit supply. This framework links mortgage rates to expected default risk. Implicit in the model is the assumption that CRT investors represent the marginal suppliers of mortgage credit, as they bear the credit risk transferred from the GSEs. We show that the sharp rise in CRT spreads following the enactment of the CARES Act corresponds, within the model, to a substantial leftward shift and a steepening of the credit supply curve. In other words, the CARES Act raised expectations of mortgage defaults, which translated into a pronounced increase in the cost of credit for borrowers, especially those with higher loan-to-value (LTV) ratios. Thus, although the forbearance program was intended to support financially distressed homeowners, it inadvertently tightened credit conditions by altering investor risk perceptions and reshaping the market pricing of mortgage credit.

Model simulations calibrated to match the observed rise in CRT spreads following the CARES Act indicate that the expected mortgage default probability in judicial states surged to 13.4%, representing a 4.4-fold increase from the baseline rate of 3.0%. In non-judicial states, the model estimates an expected default probability of 11.0%, corresponding to a 3.6-fold increase relative to the same baseline.

The previous findings have important policy implications. Although forbearance policies are intended to provide short-term relief to financially distressed homeowners, they may also generate unintended consequences by tightening credit conditions through their effects on market perceptions and pricing. The resulting increase in the cost of credit is likely to disproportionately affect borrowers with high loan-to-value ratios, potentially limiting their access to refinancing or new mortgage credit during a period when liquidity is most needed.

We proceed as follows. Section 2 reviews the related literature. Section 3 provides an overview of CRT securities and outlines the theoretical framework linking CRT spreads to expectations of future defaults. Section 4 reviews the 2020 CARES Act and Section 5 presents the novel database. Section 6 presents the main empirical analysis and results, with robustness checks detailed in Section 6.3. Utilizing a model of mortgage default, Section 7 derives the expected probabilities of default as well as the implied shift in the credit supply curve based on the observed increases in CRT spreads. Section 8 discusses and reviews actual loan outcomes. Finally, Section 9 concludes.

2 Related Literature

This paper contributes to several strands of research. First, we extend the growing literature on the effects of COVID-19 and the 2020 CARES Act on mortgage performance, particularly delinquency and forbearance outcomes. Kim et al. (2024) find that access to forbearance provided substantial liquidity support to households, significantly reducing delinquencies outside of formal forbearance. Gerardi, Lambie-Hanson, and Willen (2022) show that the forbearance provisions enacted during the pandemic were highly beneficial to borrowers. Analyzing seriously delinquent loans at the onset of COVID-19, Goodman and Zhu (2024) document that loans granted forbearance had foreclosure rates five times lower than comparable loans without forbearance. This literature emphasizes the borrower-side benefits of forbearance and highlights the role of federal stimulus policies and Federal Reserve interventions in facilitating repayment of suspended debt. In contrast, we contribute new evidence on the investor-side response by examining how the CRT market priced these policies, providing a complementary perspective on the broader equilibrium effects of mortgage forbearance.

Second, our study contributes to the literature on the heterogeneous effects of the CARES Act forbearance program. An et al. (2022) find that, while forbearance offered temporary relief, minority and lower-income borrowers were more likely to enter delinquency or default after exiting the program. Similarly, Gerardi, Lambie-Hanson, and Willen (2021) show that minority borrowers were significantly less likely than White borrowers to exit forbearance and resume making payments. In contrast, Goodman and Zhu (2023) document that the policy had a more positive effect on helping single borrowers resolve delinquency and return to current status compared to households with multiple borrowers. We extend this line of inquiry by examining heterogeneity arising from the legal framework governing mortgage enforcement—specifically, the distinction between judicial and nonjudicial foreclosure regimes. This institutional variation in foreclosure cost and timeline plays a pivotal role in shaping investor expectations. By showing how these legal differences drive differential responses in credit markets, our study contributes new evidence on how foreclosure laws influence asset pricing and financial market reactions to large-scale borrower relief policies.

Third, our study makes a novel contribution to the broader literature on debt relief programs by offering new evidence on how financial markets *ex-ante* priced the risks associated with large-scale forbearance. While much of the existing work focuses on ex-post borrower outcomes, we highlight how investors in the CRT market reassessed and repriced credit risk in real time following the enactment of the CARES Act. For example, Dinerstein, Yannelis, and Chen (2024) show that the federal student loan payment pause during COVID-19 boosted consumption as borrowers redirected liquidity toward mortgages, auto loans, and credit cards. They attribute these effects primarily to increased credit demand. Similarly, Mian, Sufi, and Trebbi (2014) find that judicial foreclosure rules mitigated house price declines but heightened moral hazard during the Global Financial Crisis, resulting in no net improvement in default outcomes. Gabriel, Iacoviello and Lutz (2021) find that the California Foreclosure Prevention Laws (CFPL) generated a 20% reduction in foreclosures during the 2008 financial crisis, with minimal adverse side effects on the availability of mortgage credit for new borrowers. Fout et al. (2017) document no effect of forbearance on subsequent loan outcomes. However, the previous studies assess the consequences of debt relief after the fact. In contrast, our analysis reveals how CRT investors, acting as forward-looking, risk-sensitive market participants, immediately priced in the anticipated costs of the CARES Act's forbearance provisions. By documenting a sharp and heterogeneous response in spreads, followed by rising delinquencies, we provide unique insights into how markets anticipate and internalize the the trade-offs of borrower relief policies during crises.

Our findings extend the literature, which finds that forbearance either improves or has no impact on loan outcomes, by revealing a negative side effect. Prior forbearance studies focus on the eventual loan outcomes or credit availability, which are measured months, even years, after the introduction of the forbearance. These studies are forced to use ex-post outcomes to approximate ex-ante expectations. As Goodman and Zhu (2024) point out, this is particularly problematic for investigations of the CARES forbearance program because the economy benefited from unprecedented stimulus and property price increases. Our method, on the other hand, directly measures the change of forward-looking investor expectations on a very precise date, rather than over an extended period. Therefore, the relevance of our results for the effect of future forbearance on capital markets' pricing of mortgage risk is not compromised by look-ahead bias.

Fourth, our study contributes to the emerging literature on the Credit Risk Transfer (CRT) market, a key innovation in housing finance that allows private investors to bear mortgage credit risk previously held by the federal government. Recent work by Gete, Tsouderou, and Wachter (2024) shows that CRT spreads respond sharply to catastrophic hurricanes, quantifying the impact of natural disasters on credit risk pricing. Other studies, such as Finkelstein, Strzodka, and Vickery (2018) and Golding and Lucas (2022), assess the effectiveness of CRTs in transferring risk away from taxpayers. Compared to markets like CDS, the CRT market offers a cleaner setting to study the pricing of mortgage credit risk, free of counterparty concerns and more transparently linked to credit risk. We build on this literature by documenting how CRT investors reacted in real time to the borrower forbearance provisions of the CARES Act, extending our understanding of how this market prices policy-driven credit risk.

Finally, this paper contributes to the broader literature on housing finance and the role of Government-Sponsored Enterprises (GSEs). Prior studies have examined various aspects of the GSEs' function and risk exposure, including pricing guarantees (Lucas and McDonald 2010), macroeconomic implications (Jeske, Krueger, and Mitman 2013), regulatory challenges (Frame, Wall, and White 2013), and the effects of reform proposals (Elenev, Landvoigt, and Van Nieuwerburgh 2016; Hurst et al. 2016; Gete and Zecchetto 2018). Notably, Pavlov, Schwartz, and Wachter (2021) and Stanton and Wallace (2011) demonstrate that traditional credit risk transfer instruments like credit default swaps failed to adequately reflect mortgage risk during the 2008 financial crisis, limiting the effectiveness of risk transfer to private markets. By documenting how policy-induced shifts in mortgage credit risk were immediately incorporated into CRT pricing, our study sheds light on the evolving role of CRTs in risk-sharing between the GSEs and private investors.

3 The CRT Market

3.1 Background

The GSEs began issuing Credit Risk Transfer (CRT) securities in July 2013. By the end of 2022, CRT securities had afforded the GSEs loss protection on approximately $6.2 trillion in mortgage loans (FHFA 2023).

CRTs are notes with a final maturity of 10 or 12.5 years, granting investors rights to cash flows from a reference pool of mortgages underlying recently securitized agency mortgage-backed securities. These notes provide investors with monthly payments comprising both a share of the mortgage principal and interest. The mortgage reference pools include mortgages from all U.S. states. These pools are categorized based on loan-to-value (LTV) ratios into high LTV pools (80.01% to 97%) and low LTV pools (60.01% to 80%). CRT securities pay interest based on the one-month US Dollar LIBOR plus a floating spread.[4] This spread's fluctuations reflect the

[4]On December 22, 2022, the GSEs announced their SOFR-based replacement rates for legacy LIBOR prod-

private capital market's pricing for sharing the credit risk borne by the GSEs (Wachter 2018).

At issuance, the outstanding principal balance of the mortgages in the pool is divided into tranches of varying seniority. The most senior tranche is fully retained by the GSEs. Below this, there are two or three mezzanine tranches, followed by a subordinated (junior) tranche, all of which are sold to investors. Initially, the GSEs retained a second subordinated tranche (*First Loss*) in early CRT transactions, but since 2016, this tranche has also been sold to investors. Cash flows from the reference pool mortgages repay the tranches according to a hierarchy of seniority. The most senior tranche is paid off first, followed by the subsequent tranches in order of seniority. Losses from the reference pool mortgages reduce the principal balance, beginning with the most subordinated tranches (a process known as the "cash flow waterfall"). Conversely, prepayments of mortgages in the pool are first applied to the most senior tranche.

3.2 CRT Pricing

Unlike credit default swaps, the CRT securities are structured in a way that precludes investor default even in the case of extreme loan losses. Therefore, the price and yield of CRTs are driven by the expectations of mortgage default, recovery, and prepayment, not by the credit worthiness of the issuer or the investor. Given our focus on the most junior tranches available to investors, the primary driver of CRT pricing is expected default losses.

Zandi et al. (2017) and Golding and Lucas (2022) develop and calibrate CRT pricing models. One of their main conclusions is that an increase in the default rate or the loss given default, or both, reduces the price of CRTs. This, in turn, increases the CRT yield. Therefore, there is a direct mapping of expectations about future default losses to current CRT yields. When CRT investors expect high future losses the yield on CRT securities increases. This is especially true for the most junior traded tranches, as they are the first to absorb any default losses.[5] If investors expect forbearance to decrease future losses, then yields would fall, and vice versa.

Equally important is the different response of securities with exposure to "judicial" versus "non-judicial" states. Foreclosure in states that require judicial review is particularly painful for lenders because of the longer time required, higher cost, and likely higher loss severity because the asset is likely to deteriorate during the foreclosure procedures. Therefore, any event that increases the expected future default losses would have a disproportionately large

ucts, based on the benchmark replacements selected by the Board of Governors of the Federal Reserve System in its regulation implementing the Adjustable Interest Rate (LIBOR) Act.76. We use LIBOR rates as they prevailed during the period we study.

[5]The GSEs retain the most junior tranche of each security. Here we mean the most junior tranche available to investors.

effect in judicial states (Ghent 2011).

Our main question is whether investors expect forbearance to increase or decrease future default losses, regardless of whether the expectation is about the default rate or the loss severity. The literature identifies delinquency as a precursor to default. Delinquency is necessary but not sufficient for default. Foreclosure depends not only on payment difficulties which cause delinquency but also on mortgage balances which determine whether borrowers can short sell the property to cover missed mortgage payments. Whether forbearance spikes lead to foreclosure spikes will depend on the trajectory of housing prices. As the empirical literature shows, this depends on the equity position of borrowers prior to the economic shock and the policy response to the shock.[6]

In short, CRT spreads, especially for junior tranches, reflect future ex ante default loss expectations. Therefore, the change in CRT spreads when a forbearance program is introduced reflect the changing investor expectations about future default losses.

4 The 2020 CARES Act

The Coronavirus Aid, Relief, and Economic Security (CARES) Act was signed into law on March 27, 2020. Section 4022 of the CARES Act allowed borrowers of federally backed mortgages, primarily those backed by the GSEs, to request forbearance for up to 12 months without incurring fees, penalties, or additional interest beyond what was scheduled. This forbearance was widely adopted during the pandemic, with minimal requirements for borrowers; they only needed to request it without providing proof of financial hardship or inability to pay. Cherry et al. (2022) estimate that a total of $16.6 billion in GSE-backed mortgage principal balance was in forbearance by the first quarter of 2021, in addition to $10.2 billion in FHA-backed mortgage principal balance.

The CARES Act provided a grace period of 12 months, later extended to 18 months. However, when loans exit forbearance they can easily generate losses for the CRT holders. Loans exit forbearance when they become current, modified, liquidated or after 18 months, whichever occurs first.

[6]Historically, delinquency and defaults have increased along with rising unemployment as housing prices fall. Cherry et al. (2021) attribute "missing defaults" to the fiscal and monetary policies implemented during Covid-19. See also Gerardi, Lambie-Hanson and Willen (2022) and Wachter (2021).

5 Data

We assemble a comprehensive database by combining information at the security level from multiple data sources. First, we collect data of the CRT securities from the GSEs (Fannie Mae 2024, Freddie Mac 2024). The securities by Fannie are called Connecticut Avenue Securities (CAS), and by Freddie are called Structured Agency Credit Risk (STACR). Specifically, for all CRTs issued between 2017 and 2019, we collect the deal name, issuance date and the level of the tranches.

We collect data for the underlying mortgages in these CRTs, also from the GSE websites. We collect the average loan-to-value ratio, FICO score, debt-to-income ratio and a composite risk measure that the GSEs publish, called risk layers.

We also utilize the complete history of yields in the secondary CRT market from Refinitiv Eikon (now part of the LSEG Workspace), which we merge with the CRT characteristics using the deal and tranche names. We use the 1-month US Dollar Libor rates from Refinitiv Eikon to calculate the spread over Libor. We use the panel data of daily CRT yields for regression estimations, over different time windows around March 30, 2020, the first trading date the CARES Act went into effect.

Moreover, we calculate the *judicial exposure* of each CRT mortgage pool to be the percentage of unpaid principal balance in March 2020 that is located in judicial states. To do so, we utilize data of the location of the loans in the CRT pools from the GSEs. We merge with our main database the daily values of the 10-year treasury rate from FRED. Figure 1 displays a map of the U.S., showing each state classified as either judicial or non-judicial based on its foreclosure process.

The baseline analysis focuses on the junior tranches, which absorb credit losses from delinquencies and defaults first but are insulated from prepayments, as senior tranches bear prepayment risk initially. We restrict the sample to securities issued between January 2017 and December 2019, as these are better suited to our analysis. At the time the CARES Act was enacted, the majority of their principal and interest payments were still outstanding. In addition, for some securities issued prior to 2016, default exposure was based on modeled losses, whereas for newer CRTs, all payouts are tied to actual default losses, a key feature for our analysis. Table 1 presents summary statistics for the key variables used in our analysis, while Table 2 provides summary statistics separately for securities with high and low loan-to-value (LTV) ratios.

The sample comprises 55 securities, totaling 2,088 observations within a 30-day window before and after the introduction of the CARES Act. The weighted average loan-to-value (LTV) ratio of the underlying mortgages is 83 percent, with a weighted average FICO score of 741. Exposure to judicial states ranges from 26 to 41 percent, reflecting the expected geographic diversification of CRT pools. This variation in judicial state exposure leads to significant differences in spread responses.

6 Empirical Analysis

The theoretical framework outlined in Section 3.2 suggests that our empirical analysis should capture how CRT spreads respond to the introduction of forbearance. As discussed, changes in CRT spreads reflect shifts in investor expectations about future default losses, addressing our central question—whether forbearance is expected to increase or decrease ultimate default losses.

To estimate the change in CRT spreads following the introduction of forbearance, we employ two complementary tests. First, we conduct a standard event study comparing spreads before and after the enactment of the CARES Act to capture the overall impact on spreads. Second, we examine the differential spread response between judicial and non-judicial states, leveraging variation in legal environments to isolate the effect of forbearance. These two tests are critical because they provide rigorous checks against confounding factors. Any alternative explanation would need to coincide precisely with the timing of the CARES Act and produce different effects across judicial and non-judicial states, making it unlikely that such factors drive our results.

Figure 2 presents our first key finding. In response to the question of whether the market anticipates higher or lower defaults due to the forbearance program, the answer is a clear expectation of higher defaults. In the months leading up to the CARES Act, CRT spreads were generally stable and exhibited a slight downward trend. However, on the first trading day following the CARES Act, CRT spreads experienced a substantial jump. These elevated spread levels persisted for approximately two months before declining somewhat, though they never returned to pre-CARES Act levels. Instead, spreads remained elevated for more than a year after the implementation of the forbearance program. Furthermore, Figure 2 shows that the First Loss (B2) tranche exhibited the largest spread reaction compared to the junior tranche (B1), which has seniority just above B2. This pattern is consistent with the increase in CRT spreads reflecting heightened expectations of mortgage default losses, which are primarily absorbed by the First Loss (B2) tranche.

Appendix Figure A1 reinforces the previous result by showing that, although the increase in spreads was smaller for mezzanine tranches compared to junior tranches, it still reflects heightened expectations of mortgage default losses. The CRT spread response was strongest for the most junior mezzanine tranche (M3) and was the lowest for the most senior (M1), consistent with more subordinate tranches absorbing greater default risk. Appendix Figure A2 corroborates our previous findings using aggregate CRT spread data from the Federal Reserve Bank of St. Louis.

Figure 3 illustrates the dynamics of CRT spreads around the introduction of the CARES Act for different levels of exposure to judicial states. It reports average spreads for securities with judicial exposure above the 75th percentile and below the 25th percentile. The figure shows a sharp increase in CRT spreads on the first trading day after the CARES Act. Securities with judicial exposure above the 75th percentile saw an immediate rise in average spreads from 4.2% to 19.5%, while those below the 25th percentile experienced a smaller but still significant increase, from 3.5% to 12.7%. Spreads remained elevated for two to three months before declining, though they remained above pre-CARES Act levels.

Figure 4 shows the dynamics of CRT spreads for securities referencing loans with high and low LTV ratios. The top panel shows spreads for CRTs referencing loans with LTV ratios between 80.01% and 97%, while the bottom panel shows spreads for CRTs referencing loans with LTV ratios between 60.01% and 80%. Both CRT groups exhibit similar dynamics, with spreads increasing after the CARES Act, particularly in areas with high judicial exposure. Due to their higher default risk, high-LTV CRTs show a stronger response.

Figures A3 and A4 replicate Figures 3 and 4, but split the CRT securities by median exposure to judicial states. These figures confirm the dynamics we described.

The figures clearly illustrate that investors expected the forbearance program introduced with the CARES Act to lead to an increase in future default losses. This expectation was especially pronounced in judicial states, where foreclosure timelines were already longer than in non-judicial states. The longer foreclosure process in these states would likely result in higher costs for investors in the event of defaults, making them more sensitive to any factors that could prolong the resolution of delinquencies.

If forbearance had been expected to reduce defaults, the observed spread changes would have been different. Specifically, spreads would not only have failed to increase, but they might have even decreased in judicial states relative to non-judicial states. This is because the additional costs associated with default in judicial states would have become less relevant to CRT investors, as forbearance would be expected to reduce the overall default rate.

6.1 Event Study

To estimate the effect of the CARES Act forbearance program on CRT spreads, we conduct an event study comparing spread levels before and after the policy's introduction. Specifically, we estimate the following regression:

$$Spread_{i,t} = \beta_1 + \beta_2 PostCARES_t + \alpha_i + \delta_t + \epsilon_{i,t}, \tag{1}$$

where $Spread_{i,t}$ denotes the spread of CRT tranche i at time t, computed as the yield to maturity minus the 1-month LIBOR rate. We use the 1-month LIBOR rate because this is the reference rate used in the CRT documentation at the time. α_i are security fixed effects, and δ_t are day fixed effects to control for aggregate market conditions. The variable $PostCARES_{i,t}$ is an indicator variable that takes the value of 1 on March 30, 2020 and thereafter. The CARES Act became law on March 27, 2020, which falls on a Friday. March 30 is the first trading day following the CARES Act. The coefficient β_2 captures the average change in spreads attributable to the policy intervention.

We estimate the regression across alternative symmetric windows of 14, 30, 60, and 90 days before and after the event date. Standard errors are clustered at the security level to account for serial correlation in spreads. This specification isolates the discontinuous shift in spreads at the time of the policy enactment, under the assumption that no other contemporaneous shocks differentially affected CRT spreads across securities in this narrow window.

Table 3 reports the results from the event study. The coefficient on the Post-CARES indicator is positive and highly statistically significant across all windows, indicating a robust increase in CRT spreads following the forbearance policy. The estimated effect is 12.16 percentage points over the 2-week window (column 1), and remains above 10 percentage points in the 30- and 60-day windows (columns 2 and 3). Even in the 90-day window (column 4), the estimated increase in spreads is 3.65 percentage points and remains statistically significant.

These results suggest a sharp and persistent upward shift in CRT spreads in response to the forbearance program, consistent with a market-perceived increase in expected default losses. The declining magnitude across longer windows reflects both the concentration of the market response immediately following the event and the growing influence of other factors over time, which we discuss later.

6.2 Differences-in-Differences

We conduct a differences-in-differences (DiD) analysis using panel data of daily CRT spreads. The treatment period begins on the first trading day after the introduction of the CARES Act. The treatment group consists of CRTs with high geographical exposure to judicial states, while the control group includes CRTs with low geographical exposure to judicial states. By comparing the changes in CRT spreads between these two groups, we can isolate the effect of the CARES Act on spreads, accounting for pre-existing differences in exposure to judicial state dynamics.

The identification assumption underlying our DiD analysis is that, in the absence of the treatment (i.e., the forbearance program introduced with the 2020 CARES Act), the treatment and control groups would have followed parallel trends in their CRT spreads. This parallel trends assumption implies that any differential change in CRT spreads between the two groups after the introduction of the CARES Act can be attributed to the effect of the Act itself, rather than to other factors. We perform tests for parallel trends that validate the assumption. We estimate the following regression:

$$\begin{aligned} Spread_{i,t} = {} & \beta_1 + \beta_2 PostCARES_t + \beta_3 Exposure_i \times PostCARES_t \\ & + \beta_4 Exposure_i + \beta_5 Tranche_i + \beta_6 RiskLayers_i + \beta_7 Issuer_i \\ & + \beta_8 Issuer_i \times PostCARES_t + \beta_9 Treasury_t + \epsilon_{i,t}, \end{aligned} \tag{2}$$

where $Spread_{i,t}$ denotes the spread of CRT tranche i at time t. $PostCARES_t$ is an indicator equal to 1 on March 30, 2020 and thereafter, and 0 otherwise. $Exposure_i$ measures the share of the underlying mortgage balance in judicial states for security i, based on data as of the end of March 2020. The variable $Exposure_i$ is demeaned in the regressions. The interaction term $Exposure_i \times PostCARES_t$ captures differential spread responses based on judicial state exposure following the policy announcement. $Issuer_i$ and $Tranche_i$ are indicator variables for each issuer (Fannie Mae or Freddie Mac) and for each tranche (B1 or B2), respectively. The variable $RiskLayers_i$ is a summary measure of the weighted average risk layer for the loans underlying security i. The risk layer is computed at the loan level by the issuer and reflects the presence of high-risk characteristics, such as a low FICO score, high debt-to-income (DTI) ratio, and/or high loan-to-value (LTV) ratio.[7] The interaction term $Issuer_i \times PostCARES_t$ captures potential differences in how issuers implemented the forbearance program, following the policy announcement. The variable $Treasury_t$ is the 10-year treasury rate on each date.

[7]Table A1 in the Appendix demonstrates that the risk layers variable is very highly correlated with FICO, DTI, and LTV thus making it an appropriate summary statistic for all risk factors.

The coefficients of primary interest are β_2 and β_3. The coefficient β_2 captures the average increase in spreads at the introduction of the CARES Act, while β_3 captures the increase of the judicial-exposed spreads relative to the rest at the CARES Act introduction.

Tables 4 through 7 report the estimated coefficients from equation (2). We report the results for different windows of 14, 30, 60, and 90 days around the CARES Act introduction. Model (1) includes the full set of controls. Model (2) estimates the same model as model (1) by clustering the standard errors by CRT security. Model (3) includes CRT fixed effects and model (4) combines CRT fixed effects with clustered standard errors. Models (5) and (6) include CRT and day fixed effects, with model (6) clustering the standard errors by CRT security.

The results in Tables 4 through 7 show that both the post-CARES coefficient and the interaction between judicial exposure and post-CARES remain positive and robust across all event windows. Spreads increase more sharply in states with judicial foreclosure processes due to the inherently longer and more uncertain resolution timelines these states impose on defaulted mortgages. Judicial foreclosure requires lender approval through the court system, which prolongs the foreclosure timeline and increases legal and administrative costs. This extended uncertainty raises the expected losses for investors, as recovery of loan value is delayed and more costly. Consequently, investors demand higher risk premia on Credit Risk Transfers (CRTs) linked to mortgages in judicial states, causing CRT spreads to jump more significantly compared to non-judicial states where foreclosures are typically faster and less costly.

In Model (1) of Table 4, the post-CARES Act coefficient of 14.51 indicates that CRT spreads rose by 14.51 percentage points following the CARES Act announcement at the end of March 2020. Judicial exposure is demeaned by subtracting the mean exposure, so the interaction term has no effect on securities with average judicial exposure. For each additional one percentage point increase in judicial exposure, spreads increased by approximately 0.61 percentage points at the time of the CARES Act introduction.

Both the post-CARES base effect and the interaction effect decrease in magnitude while remaining statistically significant over longer event windows. This pattern reflects the sharp increase in CRT spreads on the event date followed by a gradual decline over time.

The results that allow for clustering of standard errors by CRT security remain significant. Although clustering the errors in Models (2), (4), and (6) addresses potential serial correlation in the residuals, we note that this approach may have limitations given the number of securities in our sample, which totals 55. As Abadie et al. (2023, p. 1-2) state “when the number of clusters in the sample is a non negligible fraction of the number of clusters in the population, conventional clustered standard errors can be severely inflated.” This applies to our analysis, since the securities in our sample correspond exactly to those in the population. Furthermore, Cameron and Miller (2015) show that within-cluster serial correlation can be captured by explanatory variables. This applies to our analysis, as the time fixed effects and security fixed effects or security characteristics, capture potential serial correlation. Therefore, we present the clustering results primarily as a robustness check.

The above findings establish a causal response of CRT investors to the CARES Act. An alternative event that could have caused the observed response must have occurred at the same time as the CARES Act introduction and it must have impacted CRTs with high exposure to judicial states differently. The existence of such an event is unlikely, especially since there were no major COVID- or economy-related events on that day, let alone events that deferentially impact judicial states. Below, we report falsification and other robustness tests that provide further support that the documented relationship is causal.

6.3 Parallel Trends and Robustness Checks

Table 8 presents a placebo test of our base specification for the two-week window. In this test we set the event date to different (placebo) dates dates before and after the introduction of the CARES Act. The results show that in none of those dates the exposure to judicial states had an effect on the CRT spreads after the event date. This analysis shows that the parallel trends assumption is validated.

Table A2 in the Appendix shows similar results for 30-day windows around the placebo event dates. Overall, the positive and significant effects on CRT spreads, especially when exposure to judicial state is high, occur on the day of CARES introduction, and only on that day.

In addition to measuring the exposure of each security to judicial states as a continuous variable we consider an indicator variable that take the value of 1 if exposure is above the median exposure and 0 otherwise. These results are presented in Tables A3 and A4 and are robust to this alternative definition of exposure.

7 CRT Spreads and Default Risk

We develop a model that maps mortgage rates into mortgage default risk to derive an estimate of the investors' expectation of default risk and pricing of mortgage credit after the forbearance policy was enacted. We model mortgages as long-term, fixed-rate loans, as in

Campbell and Cocco (2015) and Garriga, Kydland and Šustek (2017).

The key element of our approach is a zero-profit condition for mortgage lenders. Using this condition, we solve for default probabilities, given market-implied mortgage rates and whether the property is located in a judicial or non-judicial foreclosure state. In other words, the model allows us to infer the magnitude of the change in investors' default expectations that is consistent with the observed increase in CRT spreads following the CARES Act.

Then, using the calibrated model we derive the credit supply curve of the CRT investors. Gete and Zecchetto (2018) in a model with heterogeneous borrowers, derive a credit supply curve with a slope very similar to ours. The credit supply curve links loan-to-value ratios to the model-implied mortgage rates. Since the CRT investors are effectively the suppliers of credit, the supply curves shows at what prices they are willing to invest. By incorporating in the model the estimations from the DiD analysis, we derive the shifted supply curve after the forbearance policy, based on the updated expectations of investors.

7.1 Setup

Mortgage lenders are risk neutral and compete loan by loan. They originate mortgages at time $t = 0$, with a fixed term k. We denote by M_t the loan balance, by r^m the mortgage rate and by x the fixed payment. Thus, the annuity formula implies that the loan amount at origination is

$$M_0 = \frac{x}{r^m}\left(1 - (1 + r^m)^{-k}\right). \tag{3}$$

Borrowers default each period with probability $0 \leq \pi_t \leq 1$. In case of default the borrower makes no more payments and the lender recovers a fraction $0 \leq (1-\delta) \leq 1$ of the present value of the remaining mortgage payments. If the value of the house posted as collateral $\left(P^H\right)$ is lower than the present value of the remaining payments, the lender recovers $(1-\delta)P^H$ in case of default. The parameter δ is the expected deadweight loss from default. This foreclosure cost captures various expenses that lenders incur throughout the process. We can write recursively the value at t of an outstanding mortgage right after a payment is been made as

$$M_t = (1 + r^d + r^w)^{-1}[(1-\pi_t)(x + M_{t+1}) + \pi_t(1-\delta)\min\left\{x + M_{t+1}, P^H\right\}], \tag{4}$$

where the first term on the right-hand side is the expected loan balance if the borrower makes the next payment. That is the probability of repayment $(1 - \pi_t)$, multiplied by the discounted value of the next period payment (x) and the loan balance the following period (M_{t+1}). We discount using the funding cost rate r^d (deposits or warehouse funding) and operating cost rate r^w (origination and servicing costs). The second term is the discounted probability of borrower's default (π_t) multiplied by the recovery value of the minimum between the next period payment plus the loan balance of the next period and the house value $\left(\min\left\{x + M_{t+1}, P^H\right\}\right)$.[8]

Competition among lenders ensures that mortgage rates are set so the expected revenue from lending covers the lender's costs. We assume that lenders need to cover every period the constant funding cost rate r^d and constant operating costs rate r^w on the loan balance. The zero-profit condition implies that, if there is no default risk ($\pi_t = 0, \forall t$), the lenders would charge $r^m = r^d + r^w$. That is, the mortgage rate would cover exactly the funding and operating costs.

In the presence of a positive probability of default, the lenders charge an additional fee (r^g) above funding and operating costs, to cover the expected loss. That is,

$$r^g = r^m - r^d - r^w. \tag{5}$$

We refer to r^g as the *market-implied guarantee fee (g-fee).* The g-fee is the part of the mortgage rate that compensates for the credit risk. Our definition assumes that the total g-fee is ongoing and there is no upfront g-fee.

Similarly, we refer to r^m as the *market-implied mortgage rate*, since its dynamics are determined by the spreads in the CRT market. The goal of the model is to solve endogenously for default probabilities. We assume as exogenous the mortgage size, mortgage rates, home values and funding and operating costs.

7.2 Model Parameters

Table 11 summarizes the calibration of the model parameters. We set the mortgage term $k = 10$ years to approximate the term of the CRT securities. Our key results are robust to different mortgage terms. We set the loan-to-value ratio to be 83.2%, which is the average ratio for the loans we study and we standardize the loan size to 1.

We set the pre-CARES Act mortgage rate to be $r^m = 3.47\%$, the average 30-year fixed mortgage rate in February 2020 (Freddie Mac 2025). Moreover, we select the level of default

[8] During the period of the study (2017–2021) the U.S. housing market experienced notable appreciation, which we assume offset the usual housing depreciation rate. In effect, based on our model, the lender always recovers present value of the remaining mortgage payments in case of default, given that the original loan-to-value ratio is less than 1 and the housing structures do not depreciate.

probability pre-CARES Act to be constant each period. We set the default rate $\pi = 3.02\%$, consistent with the average defaults of fixed-rate agency mortgages originated between 1999 and 2019.[9]

We set two different parameters for the deadweight loss, δ_j and δ_n, for judicial and non-judicial states respectively, to capture the different cost of foreclosure. The judicial requirement raises the lender foreclosure cost by as much as 10% of the loan balance (Pence 2006). That is, $\delta_j = 1.1(\delta_n)$. Moreover, 35.0% of the mortgage loan balance in our data is situated in judicial states, and we set the weighted average deadweight loss to be 22% of the original house price (Pennington-Cross 2006). Thus, $0.35(\delta_j) + 0.65(\delta_n) = 0.22$. Solving the last two equations, we obtain $\delta_j = 23.4\%$ and $\delta_n = 21.3\%$.

Lenders' costs $\left(r^d \text{ and } r^w\right)$ are constant as these costs are likely not affected by the CARES Act. Keeping them constant allows us to isolate and focus on the cost of credit risk. We set the cost of funds $r^d = 1.50\%$ that is the 10-year U.S. government bond yield in February 2020, the month before the CARES Act was enacted. We calibrate the operating cost to generate the discount rate of the lenders that satisfies the recursive equation (4). The calibration yields $r_j^w = 1.239\%$ for judicial states, and $r_n^w = 1.304\%$ for non-judicial states.

7.3 Market-Implied Default Risk

Based on the previous calibration, the market implied g-fee in judicial states, pre-CARES Act is $r_j^g = 3.47\% - 1.50\% - 1.24\% = 0.73\%$ (from equation (5)). The market implied g-fee in non-judicial states, pre-CARES Act is $r_n^g = 3.47\% - 1.50\% - 1.30\% = 0.67\%$. These fees compensate for credit risk, and increase to $r_j^g = 3.33\%$ and $r_n^g = 2.47\%$ post-CARES Act. These increases are estimated to be proportional to the CRT spread increase from our difference-in-difference analysis (Model (3) in Table 5).

The CRT spread during the 30 days before the enactment of the CARES Act was 3.78% on average.[10] Our estimation shows that this spread increased by 4.55 times after the enactment of the forbearance policy, assuming a level of exposure to judicial states at the 75th percentile, and by 3.71 times assuming a level of exposure to judicial states at the 25th percentile. We use the 75th percentile to represent loans in judicial states and the 25th percentile to represent loans in non-judicial states, in order to avoid out-of-sample, extreme values of exposure and fitted

[9] https://capitalmarkets.fanniemae.com/tools-applications/data-dynamics, https://capitalmarkets.freddiemac.com/clarity.

[10] This is the fitted value of Model (3) in Table 5 for Post-CARES = 0. The judicial exposure level does not affect this value, since the exposure is absorbed by the fixed effects.

CRT spreads. The corresponding mortgage rates are $r^m_{j,\ post} = 1.50\% + 1.24\% + 3.33\% = 6.07\%$ in judicial states and $r^m_{n,\ post} = 1.50\% + 1.30\% + 2.47\% = 5.27\%$ in non-judicial states.

Table 12 shows how the expected probabilities of default in judicial and non-judicial states increased, based on the changes in the market-implied mortgage rates caused by the CARES Act. The model-implied expected probability of default in judicial states is 13.42%. This is a 4.4 times increase from the baseline probability of default of 3.02%. The model-implied expected probability of default in non-judicial states is 11.01%, which is 3.6 times higher than the baseline.

7.4 Credit Supply

CRT investors effectively supply credit to GSE mortgage borrowers. By trading CRTs, they help determine the market price of credit. Our difference-in-differences (DiD) analysis and credit supply model enable us to recover the credit supply curve implied by the CRT market. Importantly, they also allow us to quantify how the forbearance program shifts this supply curve.

We focus on the loan-to-value (LTV) ratio as the key driver of mortgage default. Figure 5 illustrates how default rates rise with LTV for single-family loans owned by Fannie Mae and originated between January 1999 and December 2019. Using our model, we translate these estimated default trends across LTVs into market-implied mortgage rates.

To do so, we input the default probabilities by LTV bucket from Figure 5 into our credit supply model. For each LTV interval, we use the midpoint as the representative LTV, except for the (0,60] bucket, where we use 57.5%. Holding all other parameters fixed (as shown in Table 11), we compute the market-implied mortgage rate for each LTV.

The solid line in Figure 6 depicts the credit supply curve in judicial states, derived using the long-term average default probabilities. We interpret this curve as the pre-forbearance supply curve. The implied mortgage rate at an LTV of 60% is approximately 2.9%. As LTV increases, the implied mortgage rate rises gradually, reaching 3.8% at an LTV of 100%. For reference, the baseline mortgage rate used in our model was 3.47%, corresponding to an average LTV of 83.2%. Figure 7 shows the analogous pre-forbearance supply curve for non-judicial states, which closely resembles that of judicial states. Minor differences reflect slight variations in the deadweight loss and operating cost parameters.

To estimate the supply curve after the forbearance policy, we leverage a key feature of CRT securities: loan pools are segmented by the LTV of the underlying mortgages. We categorize the

CRTs into two groups—"high LTV" (weighted average LTV of 92.6%) and "low LTV" (weighted average LTV of 75.4%). As shown in Table 10, the market response to the forbearance policy was significantly larger for high-LTV securities.

We calibrate our model separately for high-LTV and low-LTV loans, as summarized in Table 13. The derived g-fees, which reflect the compensation for default risk, are 0.92% for high-LTV loans and 0.44% for low-LTV loans in judicial states prior to the forbearance policy. After the policy, the implied g-fees rise substantially—to 4.48% for high-LTV loans and 1.93% for low-LTV loans in judicial states. These post-forbearance g-fees are derived under the assumption that they increase proportionally with CRT spreads in the secondary market, as estimated by our DiD specification with CRT fixed effects (Model (5) in Table 10).

In non-judicial states, the pre-forbearance g-fees are slightly lower: 0.84% for high-LTV loans and 0.40% for low-LTV loans. Post-forbearance, they rise to 3.35% and 1.39%, respectively.

Using these market-implied g-fees, we compute the corresponding mortgage rates using equation (5) and plot the resulting credit supply curves after the forbearance policy. The dashed line in Figure 6 shows the post-forbearance supply curve for judicial states; Figure 7 presents the equivalent for non-judicial states. The supply curves shift significantly following the introduction of forbearance, especially for high-LTV loans. In judicial states, the implied mortgage rate at an LTV of 80% increases from approximately 3.5% to 5.8%. At an LTV of 100%, the rate rises from about 3.8% to 7.9%. The shifts are also substantial in non-judicial states, with the implied mortgage rate increasing to 4.9% at LTV = 80% and to 6.6% at LTV = 100%.

The substantial shift in the credit supply curve documented above reflects a significant and unintended consequence of the CARES Act's implementation. Our analysis shows that, within the context of an active and liquid CRT market, rising expectations of mortgage defaults are quickly priced in by investors. This rapid adjustment in CRT spreads translates directly into an immediate increase in the cost of credit faced by borrowers, particularly those with higher LTV loans. Thus, while the forbearance policy aimed to provide relief to struggling homeowners, it also inadvertently tightened credit conditions through its effect on investor perceptions and market pricing.

8 Ex Post Mortgage Performance

8.1 Delinquency Experience

In this section, we examine the impact of the CARES Act's introduction on mortgage delinquencies. Our outcome variable is the share of mortgages in CRT pools that become exactly 90 days delinquent in a given month. We define a loan as delinquent if it misses three consecutive monthly payments, regardless of whether it is participating in the forbearance program. Because the delinquency rate is measured at a monthly frequency, we aggregate the data at the security-month level for this analysis.

Figure 8 illustrates the dynamics of 90-day mortgage delinquencies in the CRT pools around the introduction of the CARES Act for different levels of exposure to judicial states. The figure plots the monthly share of loans that become exactly 90 days delinquent within CRT pools with judicial exposure above the 75th percentile and below the 25th percentile. A sharp increase in delinquencies emerges exactly three months after the enactment of the CARES Act, with a significantly larger rise among pools with higher judicial exposure. Delinquency rates remained persistently high for at least one year following the initial surge.

Figure 9 presents the dynamics of 90-day mortgage delinquencies for loans with high and low loan-to-value (LTV) ratios. The top panel displays delinquency rates for CRT pools referencing loans with LTV ratios between 80.01% and 97%, while the bottom panel corresponds to pools referencing loans with LTV ratios between 60.01% and 80%. Both groups exhibit similar temporal patterns, with delinquencies rising following the enactment of the CARES Act—particularly in regions with greater judicial exposure. Consistent with their higher credit risk, loans with high LTV ratios exhibit significantly higher delinquency rates in response to the policy shock.[11]

We formalize the analysis of delinquency rates, by estimating the following regression:

$$\begin{aligned} DelinquencyRate_{i,t+3} = \beta_1 + \beta_2 postCARES_t + \beta_3 Exposure_i \times postCARES_t \\ + \beta_4 Issuer_i \times postCARES_t + \beta_5 Treasury_t + \alpha_i + \epsilon_{i,t}, \end{aligned} \tag{6}$$

where $DelinquencyRate_{i,t+3}$ is the share of mortgages in the pool of CRT t becoming exactly 90-day delinquent in the month $t + 3$. $PostCARES_t$ is an indicator equal to 1 on April 2020 and thereafter, and 0 otherwise. $Exposure_i$ measures the share of the underlying mortgage bal-

[11]Figures A5 and A6 in the Appendix replicate the previous figures, but split the CRT securities by median exposure to judicial states. These figures confirm the dynamics we described.

ance in judicial states for security i, based on data as of the end of March 2020. The variable $Exposure_i$ is demeaned in the regressions. The interaction term $Exposure_i \times PostCARES_t$ captures differential spread responses based on judicial state exposure following the policy announcement. $Issuer_i$ is an indicator variables that takes the value of 1 for Fannie Mae and zero for Freddie Mac. The interaction term $Issuer_i \times PostCARES_t$ captures potential differences in how issuers implemented the forbearance program, following the policy announcement. The symbol α_i denotes CRT security fixed effects. The variable $Treasury_t$ is the average 10-year treasury rate in each month.

Table 14 shows the results of the estimation of equation (6) for event windows of 2 to 6 months around March 2020, when the CARES Act was enacted. The delinquency rates increased substantially 3 months after the introduction of CARES Act. That is, many borrowers stopped making mortgage payments right after the policy implementation and became 3-months delinquent exactly 3 months later. The majority of the delinquent mortgages was part of the forbearance program, thus there were no direct negative consequences for these borrowers missing their payments.

The results are significant in all event windows. On average, the CARES Act increased delinquencies by about 5 percentage points. The economic significance of this result is substantial, taking into account that the average monthly delinquency rate, three months before the CARES Act was 0.24%.

Consistent with the reaction of CRT spreads, delinquencies increased even more in areas with high exposure to judicial regimes. One standard deviation increase in exposure to judicial states (3.62%) increases delinquencies by 0.57 percentage points (3.62×0.158) in the 3-month window.

Table A5 shows the results of a placebo analysis that uses event dates in 2018. Since the outcome variable is measured 3 months after the event date, we use dates in 2018 to avoid the delinquencies being driven by the effects of COVID-19. The placebo analysis shows no substantial differences in delinquencies in 3-months windows around June to December 2018. Moreover, the judicial exposure did not affect those changes in delinquencies.

The results above indicate that the CARES Act had a significant impact not only on immediate CRT spreads but also on subsequent mortgage delinquencies. This pattern suggests that CRT investors did not simply overreact to the policy announcement. Rather, they correctly anticipated a rise in delinquencies, particularly in judicial states where foreclosure timelines are longer and costlier. Ultimately, realized default rates were dampened by the strong increase in house prices and a swift recovery in economic conditions. These developments were not foreseeable by CRT investors at the time of the CARES Act's enactment on March 27, 2020.

8.2 Default Experience

The increase in mortgage defaults and foreclosures that was anticipated *ex ante* by CRT investors did not materialize *ex post*. Although the share of mortgages that temporarily ceased payments rose sharply following the introduction of the 2020 CARES Act, delinquency rates outside forbearance returned close to pre-COVID levels after the program ended. This stabilization coincided with an unprecedented surge in fiscal support that helped restore household income and unemployment rates to their pre-pandemic levels.

Fiscal support through enhanced unemployment benefits helped to mitigate income losses by mid-2020, as documented by Gerardi, Lambie-Hanson and Willen (2022). Following this recovery in income, the sharp rise in CRT spreads began to ease, although spreads remained elevated relative to pre-pandemic levels. The spike in unemployment was largely reversed by the end of 2020, allowing many borrowers to resume mortgage payments. Had elevated unemployment and reduced income persisted—potentially leading to declines in housing prices and negative feedback effects—delinquencies may well have translated into the defaults anticipated by the market.

The GSEs and the Federal Reserve played a critical role in supporting the recovery. In response to the March 2020 liquidity crisis, the Federal Reserve acted to increase liquidity and reduce both interest rates and mortgage rates. This intervention helped stabilize mortgage and financial markets by lowering borrowing costs (Gerardi, Lambie-Hanson, and Willen 2022). At the same time, the GSEs maintained stable guarantee fees (g-fees), choosing not to pass through the increase in CRT spreads to primary mortgage rates. Had g-fees risen in line with CRT spreads, further destabilization of mortgage markets would likely have followed. Although fiscal support was delayed, it eventually provided sufficient relief for many delinquent borrowers in forbearance, who substantially resumed repayment.

Table 15 presents the impact of the 2020 forbearance program on loan performance, including mortgage delinquencies and foreclosures. For this analysis, we utilize data of monthly loan performance from the Fannie Mae Single-Family Historical Loan Performance Dataset. The sample contains the mortgages originated in 2019, and their subsequent performance until December 2023.

The top panel of the table shows the performance of the loans that entered the 2020 CARES Act forbearance program, while the bottom panel shows the performance of loans that did not enter the forbearance program. The first line shows the number of loans that became exactly 90 days delinquent in each month of 2020. Following the CARES Act, a significant number of loans entered forbearance and missed payments for 90 days. Loans that entered the forbearance program exhibited significantly lower rates of delinquency and foreclosure through December 2023.

In a privatized system, GSEs likely could not have provided liquidity without risking further mortgage market instability before fiscal support arrived. During this national crisis, forbearance was paired with fiscal stimulus—similar to disaster aid after natural catastrophes. Under government conservatorship, the GSEs subsidized borrowers and helped stabilize the mortgage market, paving the way for fiscal measures to ultimately reverse rising delinquencies.

This level of federal support was unprecedented, but it does not guarantee a similar response to future credit shocks. Our findings—highlighting the sharp rise in delinquency and CRT spreads—underscore the risk of market destabilization through negative feedback effects that could be reflected in mortgage pricing.

9 Conclusions

Our study presents robust evidence that CRT spreads increased markedly following the introduction of the CARES Act, with the most pronounced effects occurring in securities with high exposure to judicial states. This pattern aligns closely with the theoretical considerations discussed in Section 3.2, which suggest that such increases in spreads reflect heightened investor expectations of future default losses. By calibrating our model for high and low LTV loans and observing the shifts in credit supply curves, we demonstrate that the forbearance program induced a significant upward shift in the cost of credit, particularly for riskier borrowers.

These elevated spreads signal that investors adjusted their pricing to incorporate the anticipated increase in credit risk triggered by the forbearance policy. This reaction was not merely speculative; our empirical analysis confirms that borrower outcomes aligned with these expectations. Specifically, we document a significant rise in 90-day mortgage delinquencies within 90 days after the CARES Act implementation, providing clear evidence that the program was associated with an actual increase in borrower distress.

Together, these findings reveal an important and previously underappreciated cost of large-scale forbearance initiatives. While such policies are designed to offer short-term relief to financially strained homeowners, they also carry the unintended consequence of tightening credit conditions through their effect on market perceptions and pricing. This elevated cost of credit may disproportionately affect borrowers with high loan-to-value ratios, potentially limiting access to refinancing or new mortgage credit during a critical period.

To our knowledge, prior research has neither identified nor quantified this indirect cost, highlighting the critical need for a deeper and more nuanced assessment of the trade-offs involved in forbearance programs. Our work highlights the importance of considering both the immediate benefits and the longer-term financial market responses when evaluating the design and impact of large-scale credit interventions.

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Figures

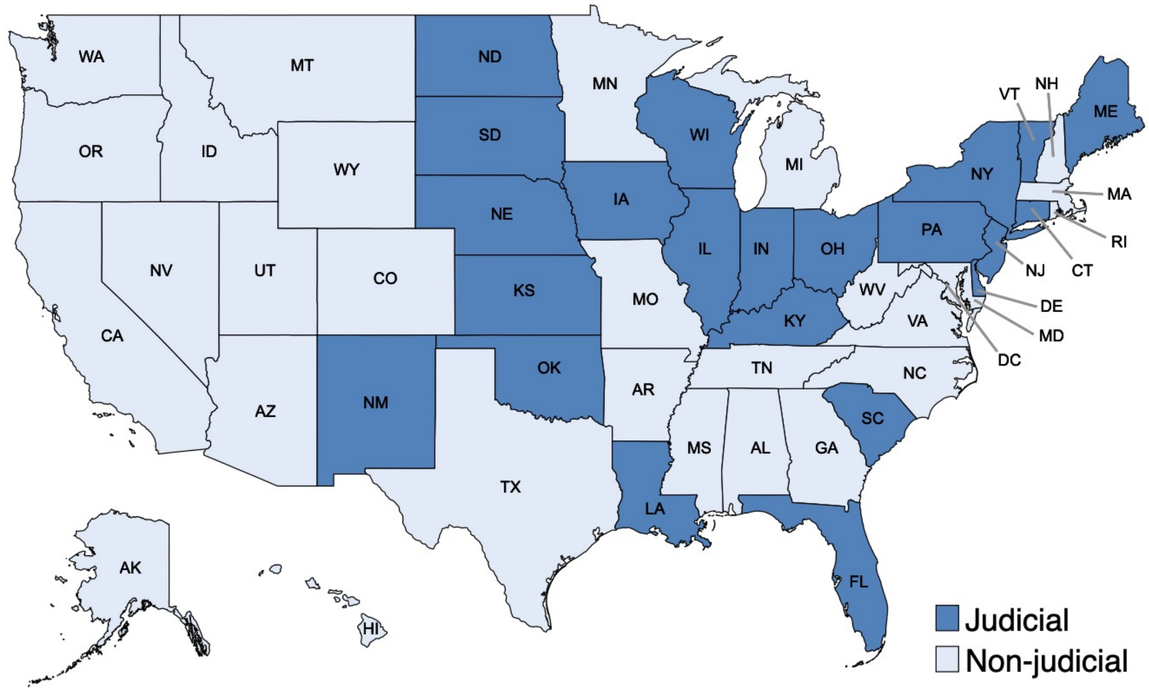


Figure 1. States With Judicial and Non-Judicial Foreclosure Requirements. The map show the states with judicial and non-judicial foreclosure requirements. Our classification of the states follows Fout et al. (2017).

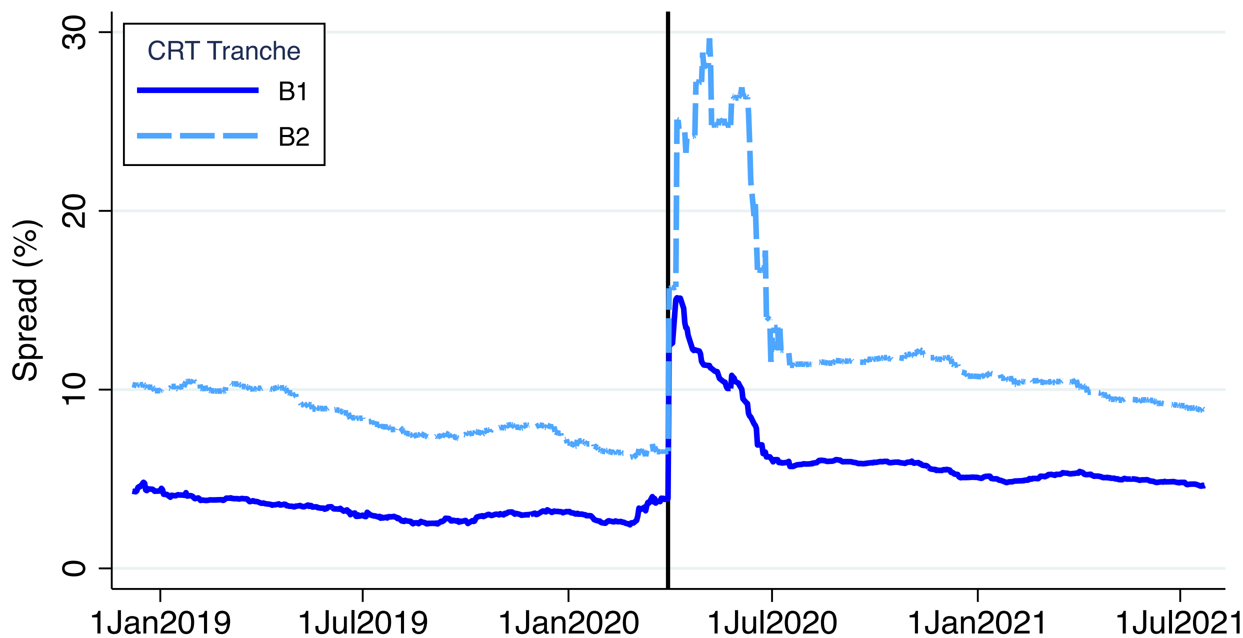


Figure 2. CRT Spreads and the CARES Act. The figure plots the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities. B2 is the *First Loss* most junior tranche, and B1 is the junior tranche with seniority just above B2. The 1-month LIBOR rate is the reference rate used in the CRT documentation at the time. These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction. Figure A1 in the Appendix shows a more moderate reaction of the CRT mezzanine tranches.

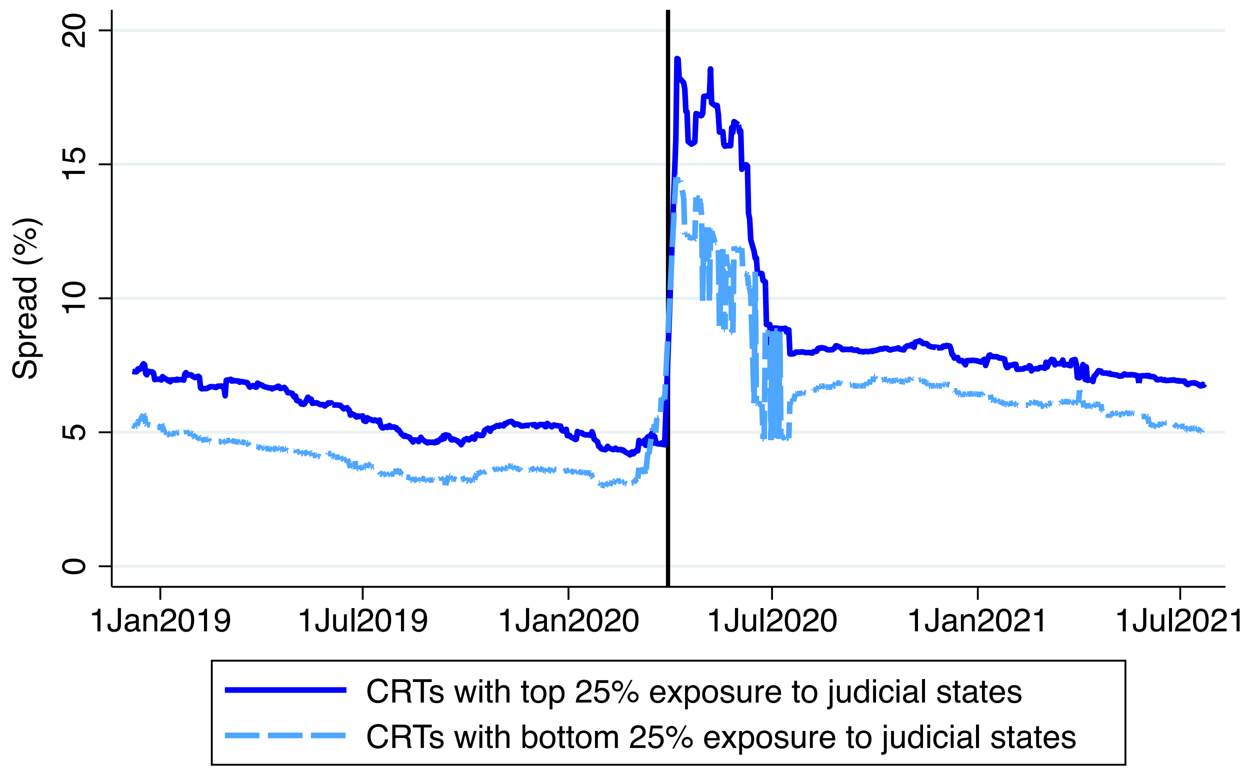
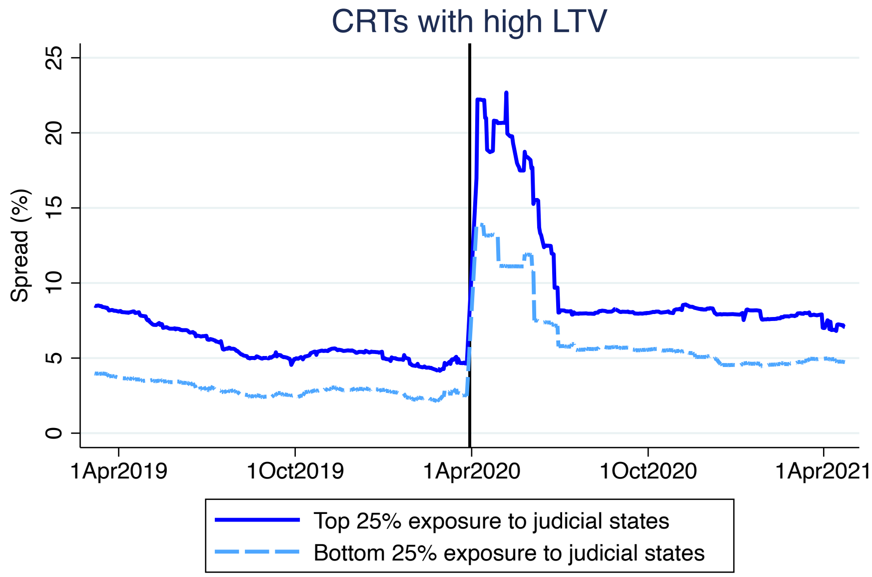


Figure 3. CRT Spreads by Exposure to Judicial States. The figure plots the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities, with mortgage pools that have the top 25% and the bottom 25% geographical exposure to judicial states. The 1-month LIBOR rate is the reference rate used in the CRT documentation at the time. These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The judicial exposure is measured as the percentage of unpaid principal balance within each CRT mortgage pool that is located in judicial states. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction. The Appendix presents an analogous figure, showing the average spreads for above and below median judicial exposure.



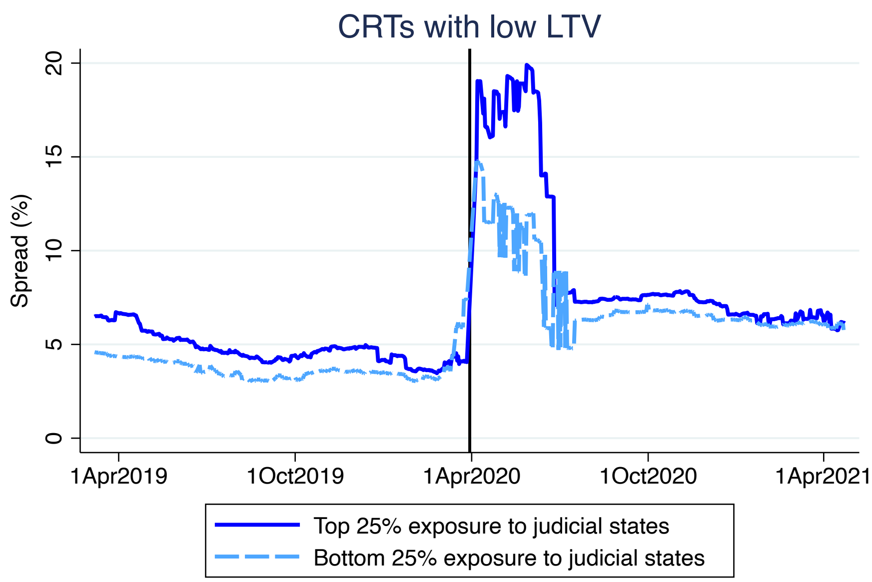


Figure 4. CRT Daily Spreads by LTV Group and by Exposure to Judicial States. The figures plot the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities, with mortgage pools that have the top 25% and the bottom 25% geographical exposure to judicial states. The top figure shows CRTs with reference mortgage pools of high loan-to-value ratios (80.01% – 97%) and the bottom figure low loan-to-value ratios (60.01% – 80%). These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction.

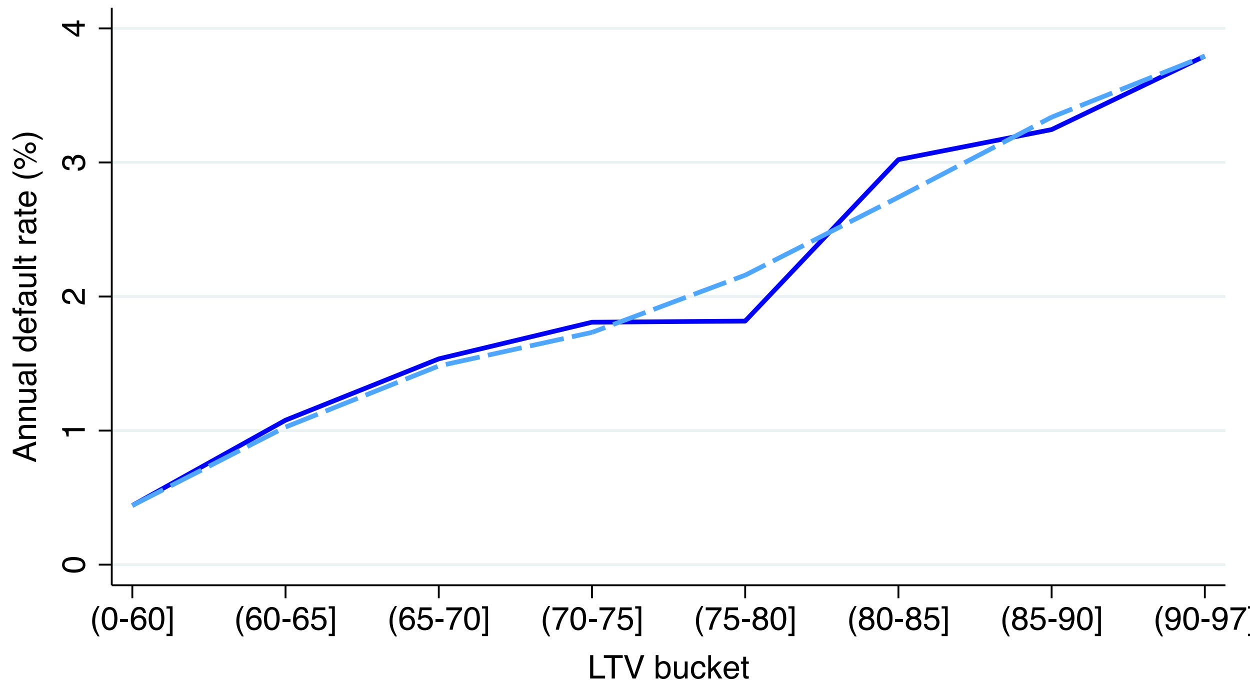


Figure 5. Default Rate by LTV. The solid line shows the average annual default rate for single-family loans owned by Fannie Mae, by loan-to-value bucket. The dashed line illustrates the estimated trend in the data. The sample contains loans originated between January 1999 and December 2019, and the annual default rate is calculated as the average of the default rate within each loan-to-value bucket from 1999 to 2019. Source: Fannie Mae Data Dynamics.

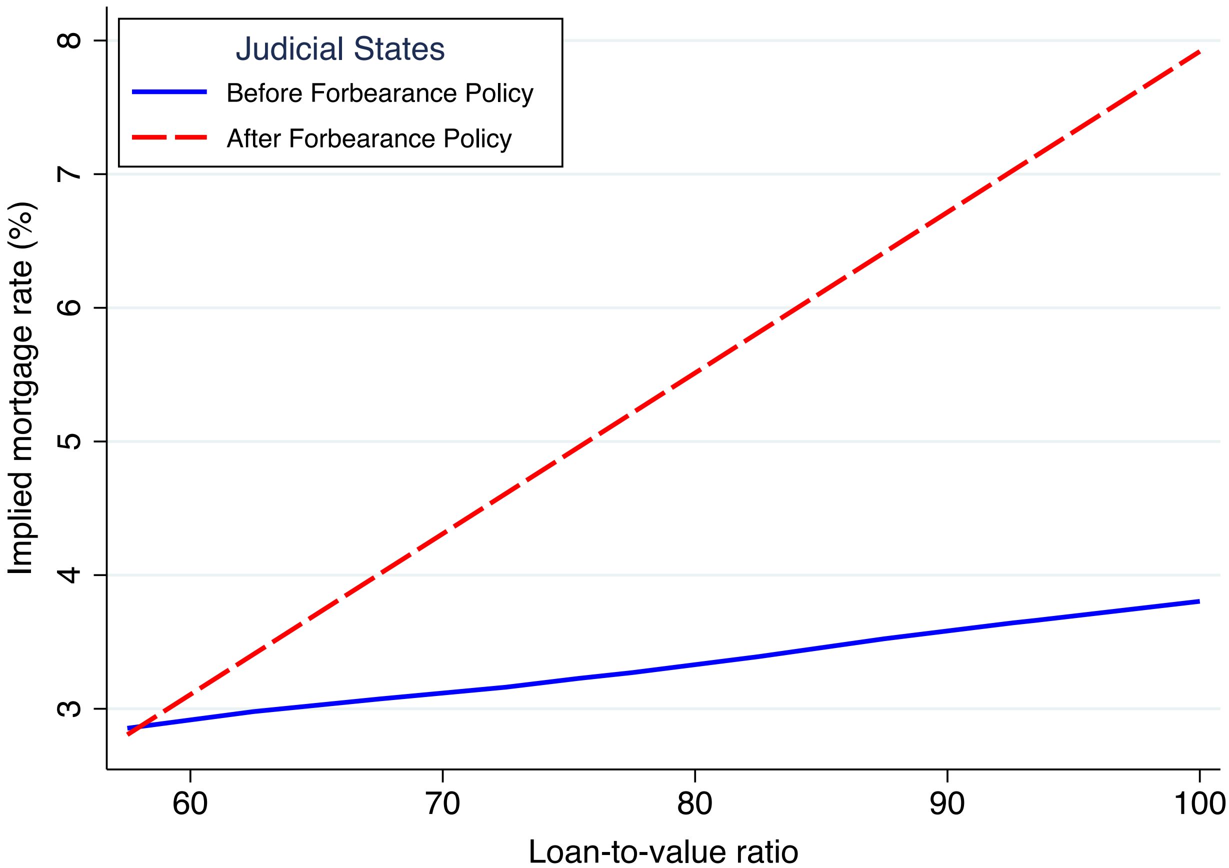


Figure 6. Credit Supply in Judicial States. The solid line shows the mortgage rate implied by our model across different loan-to-value ratios, prior to the implementation of the CARES Act forbearance policy in judicial states. The dashed line shows the implied mortgage rate after the implementation of the policy in judicial states. The shift in the line is consistent with the estimated increase in spreads for CRTs with high and low loan-to-value ratios (Table 10).

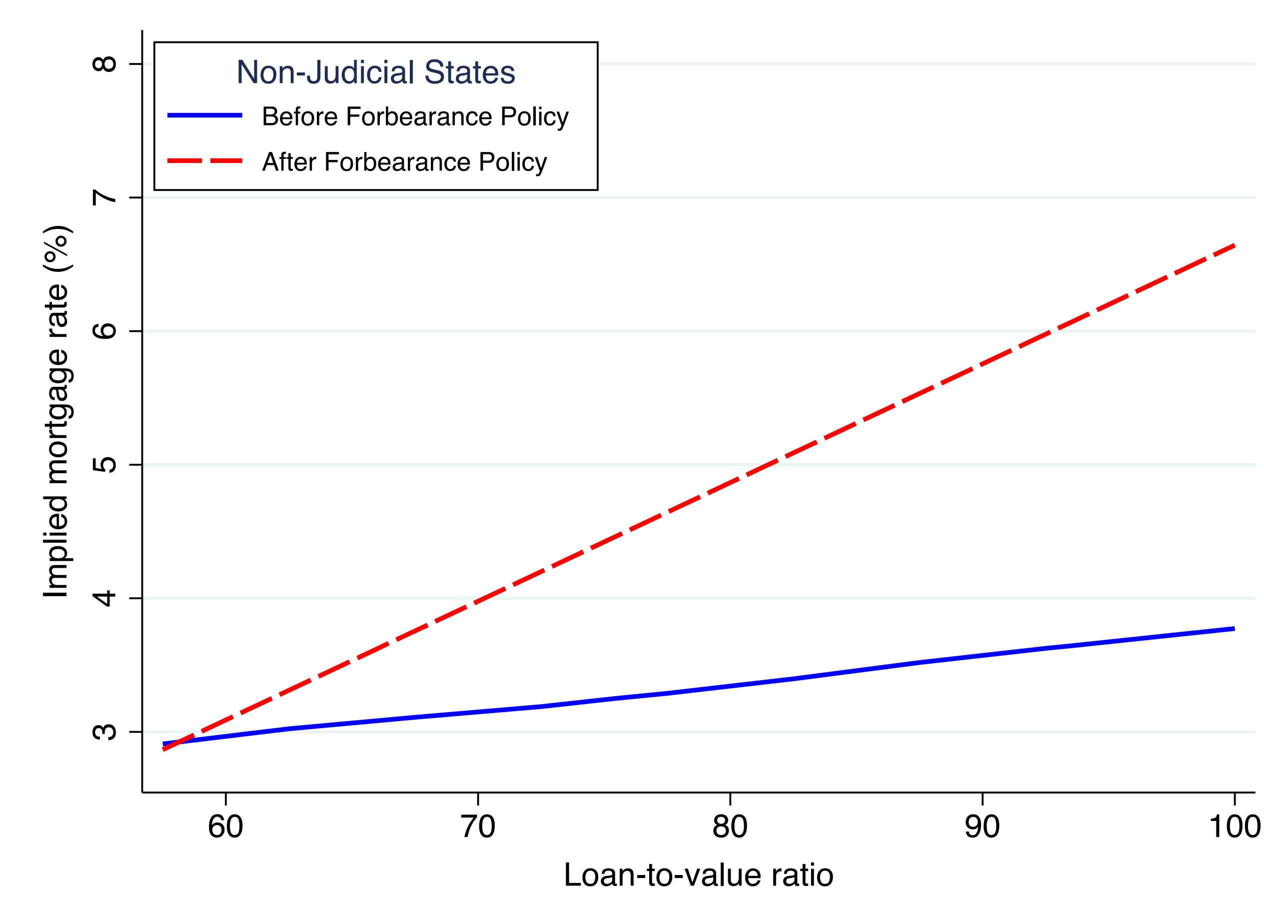


Figure 7. Credit Supply in Non-Judicial States. The solid line shows the mortgage rate implied by our model across different loan-to-value ratios, prior to the implementation of the CARES Act forbearance policy in non-judicial states. The dashed line shows the implied mortgage rate after the implementation of the policy in non-judicial states. The shift in the line is consistent with the estimated increase in spreads for CRTs with high and low loan-to-value ratios (Table 10).

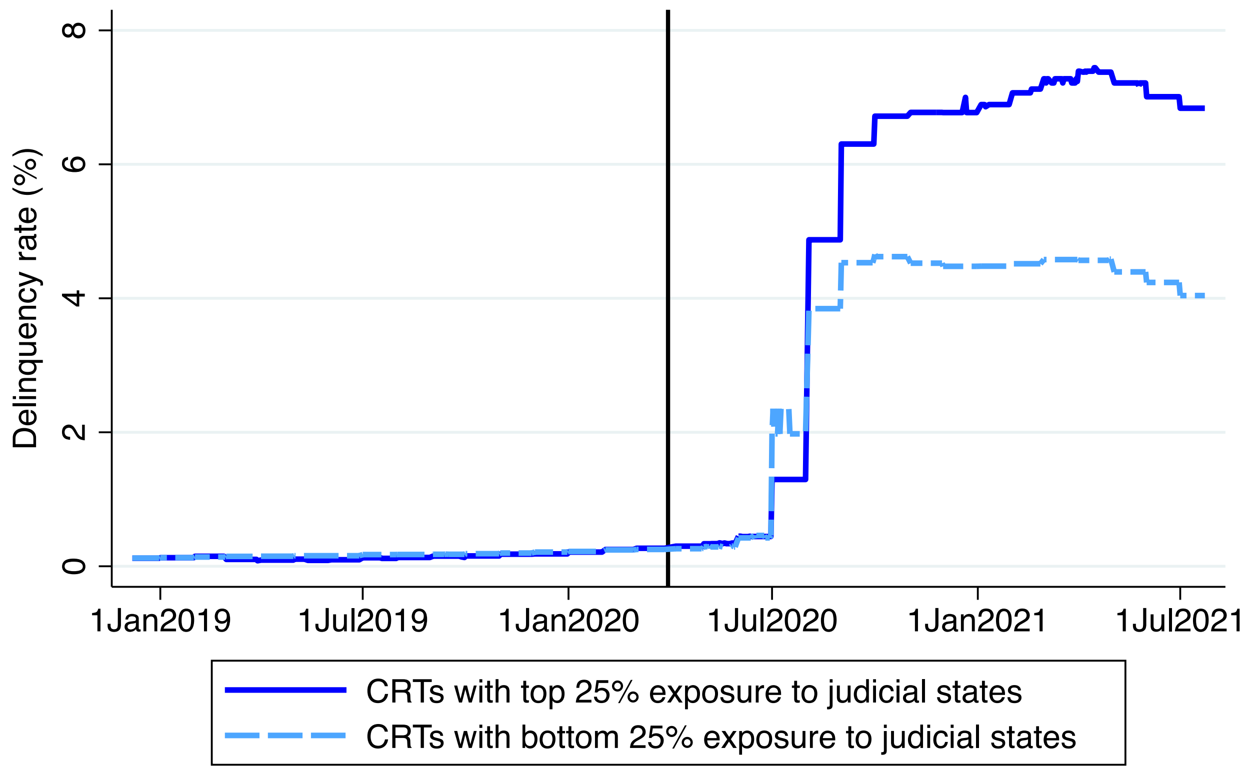


Figure 8. CRT Delinquencies by Exposure to Judicial States. The figure plots the 90-day delinquency rate within the mortgage pools of CRT securities with the top 25% and the bottom 25% geographical exposure to judicial states. These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The delinquency rate is measured as the share of principal balance that is 90-day or more past due in each month. The judicial exposure is measured as the percentage of unpaid principal balance within each CRT mortgage pool that is located in judicial states. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction. The Appendix presents an analogous figure, showing the 90-day delinquency rate for above and below median judicial exposure.

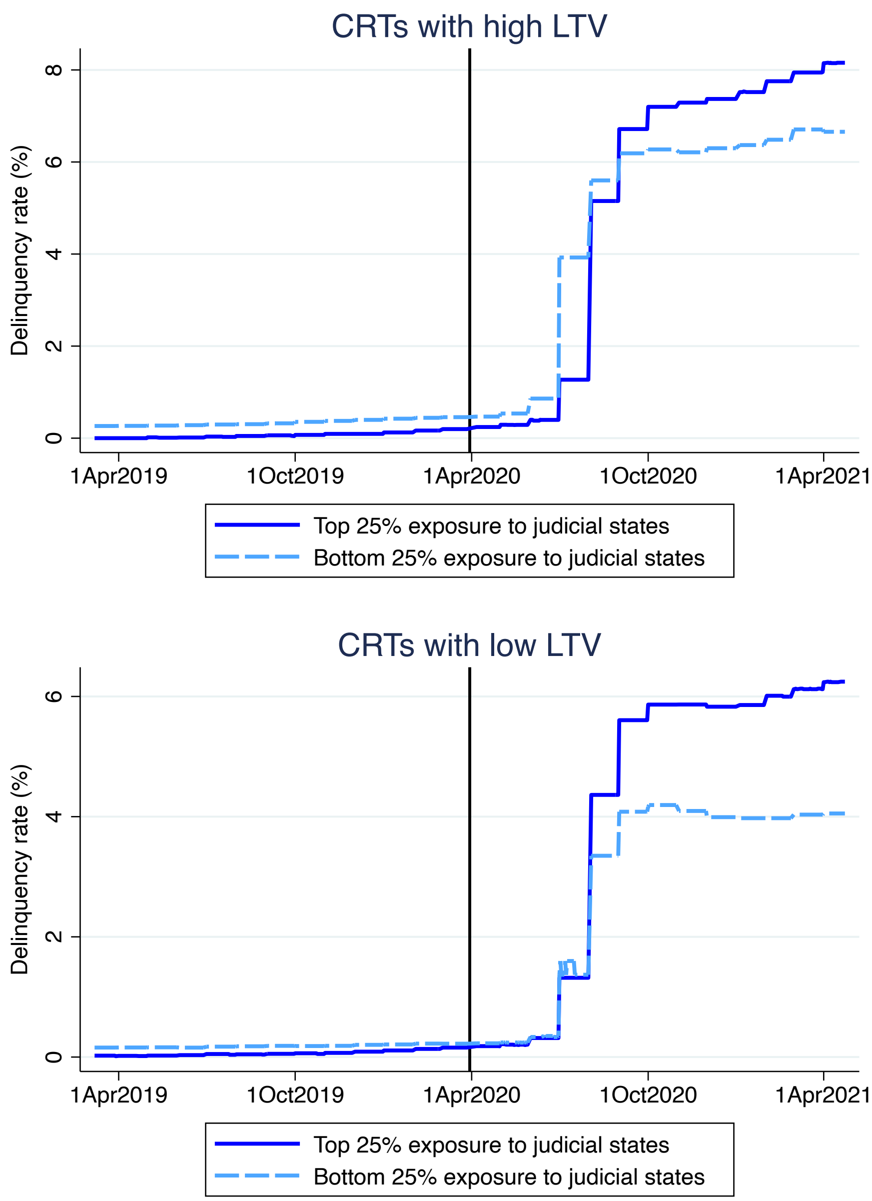


Figure 9. CRT Delinquencies by LTV Group and by Exposure to Judicial States. The figure plots the 90-day delinquency rate within the mortgage pools of CRT securities with the top 25% and the bottom 25% geographical exposure to judicial states. The top figure shows CRTs with reference mortgage pools of high loan-to-value ratios (80.01% – 97%) and the bottom figure low loan-to-value ratios (60.01% – 80%). These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The delinquency rate is measured as the share of principal balance that is 90-day or more past due in each month. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction.

Tables

Table 1. Descriptive Statistics

	Observations	Mean	Std. Dev.	Min	Max
CRT Spread (%)	2,088	9.399	8.946	2.055	62.18
Post CARES Indicator	2,088	0.474	0.499	0	1
Judicial Exposure (%)	2,088	35.04	3.622	25.82	41.19
Loan-to-Value Ratio	2,088	0.832	0.086	0.747	0.933
Debt-to-Income Ratio	2,088	0.367	0.014	0.336	0.389
FICO Credit Score	2,088	741.2	5.742	728.6	753.8
Risk Layers	2,088	0.477	0.258	0.085	0.944
Issuer (1 = Fannie)	2,088	0.418	0.493	0	1
10-Year Treasury Rate (%)	2,088	0.783	0.162	0.540	1.180

This table reports summary statistics for the key variables in the study. The sample includes the junior tranches of 55 securities issued between 2017 and 2019. The daily observations for the CRT spreads in the secondary market (on trading dates) are within a window of 30 days before and after March 30, 2020. The CRT spread is calculated as the yield to maturity minus the one-month US Dollar Libor. The post CARES indicator is a dummy variable that takes the value of one on and after March 30, 2020, the first trading day after the 2020 Coronavirus Aid, Relief, and Economic Security (CARES) Act was signed into law, and zero otherwise. The judicial exposure is the percentage of unpaid principal balance within each CRT mortgage pool, in March 2020, that is located in judicial states. The Risk Layer is computed by the issuers and is a summary risk score that incorporates the FICO score, the debt-to-income (DTI) ratio and the loan-to-value (LTV) ratio of the loans in the CRT reference pools.

Table 2. Descriptive Statistics by Loan-to-Value Ratio

	Mean	Std. Dev.	Min	Max
All CRT Bonds				
CRT Spread **Pre-CARES Act** (%)	3.960	1.680	2.055	12.94
CRT Spread **Post-CARES Act** (%)	15.44	9.821	3.149	62.18
CRTs with high LTV				
CRT Spread **Pre-CARES Act** (%)	3.856	1.688	2.055	8.603
CRT Spread **Post-CARES Act** (%)	15.99	9.924	8.427	59.46
Judicial Exposure (%)	37.61	2.064	32.70	41.19
Loan-to-Value Ratio	0.926	0.005	0.916	0.933
Debt-to-Income Ratio	0.370	0.014	0.344	0.389
FICO Credit Score	739.7	4.655	731.0	747.5
Risk Layers	0.226	0.093	0.085	0.381
CRTs with low LTV				
CRT Spread **Pre-CARES Act** (%)	4.048	1.670	2.139	12.94
CRT Spread **Post-CARES Act** (%)	14.99	9.719	3.149	62.18
Judicial Exposure (%)	32.89	3.219	25.82	38.10
Loan-to-Value Ratio	0.754	0.003	0.747	0.759
Debt-to-Income Ratio	0.363	0.013	0.336	0.386
FICO Credit Score	742.5	6.237	728.6	753.8
Risk Layers	0.686	0.136	0.465	0.944

This table reports the CRT spreads 30 days before and 30 days after the CARES Act was signed into law and various credit risk measures. The top panel contains the summary statistics for all CRT junior tranches in the sample (N = 2,088), the middle panel for CRT junior tranches that reference mortgage pools of high loan-to-value ratios 80.01% – 97% (N = 950), and the bottom panel CRT junior tranches that reference mortgage pools of low loan-to-value ratios 60.01% – 80% (N = 1,138).

Table 3. CARES Act Impact on CRT Spreads

	Dependent Variable: CRT Spread			
	(1)	(2)	(3)	(4)
Event Window	2 Weeks	30 Days	60 Days	90 Days
Post-CARES	12.155***	11.218***	10.951***	3.654***
	(1.386)	(1.315)	(1.268)	(0.575)
CRT Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Clustered Errors	Yes	Yes	Yes	Yes
Observations	880	2,088	4,451	6,724
Adj R Squared	0.670	0.670	0.668	0.652

This table reports the results from estimating equation (1) across alternative event windows of 14, 30, 60, and 90 days. The CRT spread is measured in percentage points. Post-CARES is the treatment variable that takes the value of one from March 30, 2020, the first trading date after the CARES Act was signed into law, and zero otherwise. All models include CRT and day fixed effects. Standard errors, in parentheses, are clustered by CRT security. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019. ***$p<0.01$.

Table 4. CARES Act Impact on CRT Spreads and Judicial Exposure: 2-Week Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	14.512***	14.512***	14.512***	14.512***		
	(0.675)	(1.480)	(0.572)	(1.524)		
Exposure × Post-CARES	0.612***	0.612**	0.612***	0.612**	0.612***	0.612**
	(0.114)	(0.264)	(0.096)	(0.272)	(0.097)	(0.274)
Treasury Rate	Yes	Yes	Yes	Yes	No	No
CRT Features	Yes	Yes	No	No	No	No
CRT Fixed Effects	No	No	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	Yes
Clustered Errors	No	Yes	No	Yes	No	Yes
Observations	880	880	880	880	880	880
Adj R Squared	0.570	0.570	0.691	0.691	0.688	0.688
Event Window	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks

This table reports the results from the estimation of equation (2), for a 2-week event window. The spread and exposure are measured in percentage points. Post-CARES is the treatment variable that takes the value of one from the first trading date after the CARES Act was signed into law, and zero otherwise. Exposure is the percentage of unpaid principal balance within each CRT mortgage pool that is located in judicial states. The CRT features control for the following: issuer, tranche seniority (junior or first loss), risk layer (a continuous variable that combines the weighted average loan-to-value, debt-to-income and FICO score of the CRT pool), and their interactions with the post-CARES indicator. The event window shows the number of days before and after March 30, 2020. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019. We present the results with robust or security-clustered errors. ***$p<0.01$; **$p<0.05$.

Table 5. CARES Act Impact On CRT Spreads and Judicial Exposure: 30-Day Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	12.525***	12.525***	12.517***	12.517***		
	(0.504)	(0.980)	(0.407)	(0.992)		
Exposure × Post-CARES	0.520***	0.520**	0.520***	0.520**	0.520***	0.520**
	(0.080)	(0.240)	(0.064)	(0.243)	(0.064)	(0.245)
Treasury Rate	Yes	Yes	Yes	Yes	No	No
CRT Features	Yes	Yes	No	No	No	No
CRT Fixed Effects	No	No	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	Yes
Clustered Errors	No	Yes	No	Yes	No	Yes
Observations	2,088	2,088	2,088	2,088	2,088	2,088
Adj R Squared	0.507	0.507	0.679	0.679	0.681	0.681
Event Window	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days

This table reports the results from the estimation of equation (2), for a 30-day event window. The spread and exposure are measured in percentage points. Post-CARES is the treatment variable that takes the value of one from the first trading date after the CARES Act was signed into law, and zero otherwise. Exposure is the percentage of unpaid principal balance within each CRT mortgage pool that is located in judicial states. The CRT features control for the following: issuer, tranche seniority (junior or first loss), risk layer (a continuous variable that combines the weighted average loan-to-value, debt-to-income and FICO score of the CRT pool), and their interactions with the post-CARES indicator. The event window shows the number of days before and after March 30, 2020. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019. We present the results with robust or security-clustered errors. ***$p<0.01$; **$p<0.05$.

Table 6. CARES Act Impact On CRT Spreads and Judicial Exposure: 60-Day Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	10.074***	10.074***	10.053***	10.053***		
	(0.337)	(0.627)	(0.288)	(0.630)		
Exposure × Post-CARES	0.483***	0.483**	0.471***	0.471**	0.471***	0.471**
	(0.051)	(0.190)	(0.044)	(0.192)	(0.044)	(0.192)
Treasury Rate	Yes	Yes	Yes	Yes	No	No
CRT Features	Yes	Yes	No	No	No	No
CRT Fixed Effects	No	No	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	Yes
Clustered Errors	No	Yes	No	Yes	No	Yes
Observations	4,451	4,451	4,451	4,451	4,451	4,451
Adj R Squared	0.561	0.561	0.679	0.679	0.681	0.681
Event Window	60 Days	60 Days	60 Days	60 Days	60 Days	60 Days

This table reports the results from the estimation of equation (2), for a 60-day event window. The spread and exposure are measured in percentage points. Post-CARES is the treatment variable that takes the value of one from the first trading date after the CARES Act was signed into law, and zero otherwise. Exposure is the percentage of unpaid principal balance within each CRT mortgage pool that is located in judicial states. The CRT features control for the following: issuer, tranche seniority (junior or first loss), risk layer (a continuous variable that combines the weighted average loan-to-value, debt-to-income and FICO score of the CRT pool), and their interactions with the post-CARES indicator. The event window shows the number of days before and after March 30, 2020. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019. We present the results with robust or security-clustered errors. ***$p<0.01$; **$p<0.05$.

Table 7. CARES Act Impact On CRT Spreads and Judicial Exposure: 90-Day Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	8.328***	8.328***	8.303***	8.303***		
	(0.289)	(0.460)	(0.252)	(0.462)		
Exposure × Post-CARES	0.376***	0.376**	0.362***	0.362*	0.374***	0.374**
	(0.042)	(0.181)	(0.037)	(0.183)	(0.035)	(0.181)
Treasury Rate	Yes	Yes	Yes	Yes	No	No
CRT Features	Yes	Yes	No	No	No	No
CRT Fixed Effects	No	No	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	Yes
Clustered Errors	No	Yes	No	Yes	No	Yes
Observations	6,724	6,724	6,724	6,724	6,724	6,724
Adj R Squared	0.522	0.522	0.637	0.637	0.666	0.666
Event Window	90 Days	90 Days	90 Days	90 Days	90 Days	90 Days

This table reports the results from the estimation of equation (2), for a 90-day event window. The spread and exposure are measured in percentage points. Post-CARES is the treatment variable that takes the value of one from the first trading date after the CARES Act was signed into law, and zero otherwise. Exposure is the percentage of unpaid principal balance within each CRT mortgage pool that is located in judicial states. The CRT features control for the following: issuer, tranche seniority (junior or first loss), risk layer (a continuous variable that combines the weighted average loan-to-value, debt-to-income and FICO score of the CRT pool), and their interactions with the post-CARES indicator. The event window shows the number of days before and after March 30, 2020. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019. We present the results with robust or security-clustered errors. ***$p<0.01$; **$p<0.05$.

Table 8. Placebo Test – Alternative Event Dates Impact on CRT Spreads: 2-Week Windows

	Dependent Variable: CRT Spread							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	**(8)**
Event Date:	Aug2018	Nov2018	Jan2019	May2019	Aug2019	Nov2019	Jan2020	**Mar2020 CARES Act**
Post-Event	-0.269***	-0.108***	-0.270***	0.014	-0.001	0.056***	-0.025	**14.512*****
	(0.049)	(0.031)	(0.030)	(0.017)	(0.013)	(0.008)	(0.058)	**(1.524)**
Exposure × Post-Event	-0.005	-0.002	-0.010	-0.005	0.002	0.004	-0.015	**0.612****
	(0.009)	(0.005)	(0.011)	(0.005)	(0.004)	(0.003)	(0.013)	**(0.272)**
Treasury Rate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
CRT Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Clustered Errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Observations	496	654	694	903	978	1,080	1,155	**880**
Adj R Squared	0.997	0.997	0.993	0.998	0.997	0.999	0.970	**0.691**
Event Window	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	**2 Weeks**

This table reports the results from the estimation of equation (2), for alternative event dates, for 2-week event windows around those dates. Post-Event is the placebo treatment variable that takes the value of one on or after the event date, and zero otherwise. The event dates are on the 30th of the month. Exposure to judicial states is calculated as in Table 4. The last column, Model (8), reports the results for the actual CARES Act introduction. All models include controls for the 10-year treasury rate and CRT security fixed effects. The robust standard errors (in parentheses) are clustered by CRT security. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019. Table A2 reports the results for 30-day event windows. ***p<0.01; **p<0.05.

Table 9. CARES Act Impact on CRT Spreads by LTV: 2-Week and 30-Day Windows

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
CRTs with high LTV						
Post-CARES	16.504***	16.504***		14.563***	14.563***	
	(1.092)	(0.925)		(0.814)	(0.652)	
Exposure × Post-CARES	0.902***	0.902***	0.902***	1.004***	1.004***	1.004***
	(0.333)	(0.282)	(0.286)	(0.236)	(0.189)	(0.190)
Observations	400	400	400	950	950	950
Adj R Squared	0.607	0.718	0.711	0.529	0.698	0.694
CRTs with low LTV						
Post-CARES	13.341***	13.341***		11.547***	11.533***	
	(0.896)	(0.761)		(0.662)	(0.539)	
Exposure × Post-CARES	0.773***	0.773***	0.773***	0.672***	0.672***	0.672***
	(0.172)	(0.146)	(0.148)	(0.119)	(0.097)	(0.097)
Observations	480	480	480	1,138	1,138	1,138
Adj R Squared	0.538	0.666	0.659	0.496	0.666	0.664
Treasury Rate	Yes	Yes	No	Yes	Yes	No
CRT Features	Yes	No	No	Yes	No	No
CRT Fixed Effects	No	Yes	Yes	No	Yes	Yes
Time Fixed Effects	No	No	Yes	No	No	Yes
Event Window	2 Weeks	2 Weeks	2 Weeks	30 Days	30 Days	30 Days

This table reports the results from the estimation of equation (2), for a 2-week and a 30-day event window. The top panel shows the estimation for the sample of CRTs with reference mortgage pools of high loan-to-value ratios (80.01% – 97%) and the bottom panel low loan-to-value ratios (60.01% – 80%). These CRTs were issued between between 2017 and 2019. The controls are as in Table 4. Robust standard errors are in parentheses. ***p<0.01.

Table 10. CARES Act Impact on CRT Spreads by LTV: 60- and 90-Day Windows

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
CRTs with high LTV						
Post-CARES	12.313***	12.235***		10.126***	10.044***	
	(0.487)	(0.438)		(0.389)	(0.362)	
Exposure × Post-CARES	1.153***	1.096***	1.078***	0.915***	0.860***	0.856***
	(0.136)	(0.123)	(0.123)	(0.104)	(0.097)	(0.092)
Observations	2,027	2,027	2,027	3,063	3,063	3,063
Adj R Squared	0.614	0.688	0.685	0.589	0.644	0.682
CRTs with low LTV						
Post-CARES	9.133***	9.125***		7.667***	7.661***	
	(0.474)	(0.392)		(0.423)	(0.356)	
Exposure × Post-CARES	0.677***	0.670***	0.672***	0.618***	0.614***	0.631***
	(0.081)	(0.068)	(0.068)	(0.069)	(0.058)	(0.057)
Observations	2,424	2,424	2,424	3,661	3,661	3,661
Adj R Squared	0.537	0.682	0.678	0.497	0.644	0.659
Treasury Rate	Yes	Yes	No	Yes	Yes	No
CRT Features	Yes	No	No	Yes	No	No
CRT Fixed Effects	No	Yes	Yes	No	Yes	Yes
Time Fixed Effects	No	No	Yes	No	No	Yes
Event Window	60 Days	60 Days	60 Days	90 Days	90 Days	90 Days

This table reports the results from the estimation of equation (2), for a 60-day and a 90-day event window. The top panel shows the estimation for the sample of CRTs with reference mortgage pools of high loan-to-value ratios (80.01% – 97%) and the bottom panel low loan-to-value ratios (60.01% – 80%). These CRTs were issued between between 2017 and 2019. The controls are as in Table 4. Robust standard errors are in parentheses. ***p<0.01.

Table 11. Model Calibration

Parameter	Value	Description
Exogenous parameters		
k	10	Mortgage term in years
ltv	0.832	Loan-to-value ratio
r^d	1.50%	Lender's cost of funds: 10y government bond rate (February 2020)
δ_j	23.4%	Deadweight loss in judicial states
δ_n	21.3%	Deadweight loss in non-judicial states
r^m	3.47%	Mortgage rate before CARES Act (February 2020)
π	3.02%	Default rate before CARES Act
Endogenous parameters		
r_j^w	1.239%	Lender's operating cost in judicial states
r_n^w	1.304%	Lender's operating cost in non-judicial states
Derived g-fees		
$r_{j,Pre}^g$	0.731%	G-fee pre-CARES Act in judicial states
$r_{n,Pre}^g$	0.666%	G-fee pre-CARES Act in non-judicial states
Targets		
$r_{j,Post}^g$	3.331%	G-fee post-CARES Act in judicial states
$r_{n,Post}^g$	2.469%	G-fee post-CARES Act in non-judicial states

This table lists the parameters used in Section 7.

Table 12. Simulation results

State forbearance proceedings	Market-implied mortgage rate (%) r^m	Market-implied g-fee (%) r^g	Default probability π	Change in default probability (%)
Baseline values pre-CARES Act				
Judicial	3.470	0.731	3.021	
Non-judicial	3.470	0.666	3.021	
Post-CARES Act				
Judicial	6.070	3.331	13.422	$\times 4.4$
Non-judicial	5.274	2.469	11.014	$\times 3.6$

This table shows the results of the simulation using the model with the probability of defaults as inputs as described in Section 7 and the calibration from Table 11.

Table 13. Model Calibration by Loan-to-Value Ratio

Parameter	Value High LTV	Value Low LTV	Description
Exogenous parameters			
k	10	10	Mortgage term in years
ltv	0.926	0.754	Loan-to-value ratio
r^d	1.50%	1.50%	Lender's cost of funds: 10y government bond rate
δ_j	23.4%	23.4%	Deadweight loss in judicial states
δ_n	21.3%	21.3%	Deadweight loss in non-judicial states
r^m	3.47%	3.47%	Average mortgage rate before CARES Act
π	3.79%	1.82%	Default rate before CARES Act
Endogenous parameters			
r_j^w	1.051%	1.530%	Lender's operating cost in judicial states
r_n^w	1.134%	1.570%	Lender's operating cost in non-judicial states
Derived g-fees			
$r_{j,Pre}^g$	0.919%	0.440%	G-fee pre-CARES Act in judicial states
$r_{n,Pre}^g$	0.836%	0.400%	G-fee pre-CARES Act in non-judicial states
Targets			
$r_{j,Post}^g$	4.477%	1.929%	G-fee post-CARES Act in judicial states
$r_{n,Post}^g$	3.352%	1.388%	G-fee post-CARES Act in non-judicial states

This table lists the parameters for the calibration of the model for loans with high and low loan-to-value ratio, as described in Section 7.4.

Table 14. Probability of 90 Days Delinquency After the Event Date

	Dependent Variable: 90-Day Delinquency Rate				
	(1)	(2)	(3)	(4)	(5)
Event Window (months)	2	3	4	5	6
Post-CARES	4.496***	5.025***	5.105***	5.179***	5.296***
	(0.181)	(0.187)	(0.186)	(0.188)	(0.192)
Exposure × Post-CARES	0.107***	0.138***	0.158***	0.173***	0.186***
	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)
Treasury Rate	Yes	Yes	Yes	Yes	Yes
CRT Fixed Effects	Yes	Yes	Yes	Yes	Yes
Clustered Errors	Yes	Yes	Yes	Yes	Yes
Observations	275	385	493	600	704
Adj R Squared	0.727	0.734	0.767	0.798	0.822

This table reports the results from the estimation of equation (6), for event windows of 2 to 6 months. The delinquency rate, measured in percentage points, is the share of mortgages that become 90-days delinquent after 3 months from the observation month. Post-CARES is the treatment variable that takes the value of one from April 2021, the first months after the CARES Act was signed into law, and zero otherwise. Exposure is the percentage of unpaid principal balance within each CRT mortgage pool that is located in judicial states. The event window shows the number of months before and after March 2020. Robust standard errors (in parentheses) are clustered by CRT security. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019, and has monthly observations of the delinquency rate in the respective mortgage pools. ***p<0.01.

Table 15. Monthly Mortgage Outcomes

	Month in 2020:	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	**Total**
Forbearance in 2020-2023	Number of loans 90-day delinquent	257	304	362	590	2,760	41,130	26,266	12,349	8,012	6,671	5,449	4,627	**108,777**
	Foreclosure rate (%)	3.89	2.32	3.31	1.53	1.05	0.15	0.15	0.24	0.43	0.28	0.32	0.38	**0.26**
	Removal rate (%)	8.17	9.93	10.22	8.31	3.31	0.64	0.46	0.59	0.65	0.62	0.57	0.47	**0.76**
	Still delinquent (Dec 2023, %)	15.95	23.51	19.89	17.46	11.41	1.69	1.65	2.32	3.11	3.26	4.27	4.25	**2.68**
Not in Forbearance in 2020-2023	Number of loans 90-day delinquent	248	305	270	224	186	241	196	183	191	215	190	224	**2,673**
	Foreclosure rate (%)	8.87	9.45	12.22	12.95	11.40	3.32	2.58	2.81	4.44	5.92	5.11	6.39	**7.39**
	Removal rate (%)	5.65	6.84	8.89	6.70	8.29	2.15	1.85	0.88	1.01	0.71	3.41	1.47	**4.23**
	Still delinquent (Dec 2023, %)	6.05	4.89	6.30	6.70	6.74	2.34	3.32	2.81	4.65	5.92	7.39	7.62	**5.41**

This table presents the outcomes of loans that became exactly 90 days delinquent in each month of 2020, categorized by forbearance status. Each loan is tracked until it exits the dataset or until December 2023, whichever occurs first. The foreclosure rate represents the percentage of delinquent loans that transitioned into foreclosure or liquidation. The removal rate indicates the percentage of delinquent loans removed from the dataset due to repurchase or sale. The "still delinquent" category reflects the share of loans remaining delinquent as of December 2023. The final column summarizes the outcomes for the entire cohort of loans that became 90 days delinquent in 2020.

APPENDIX

Figures for the Appendix

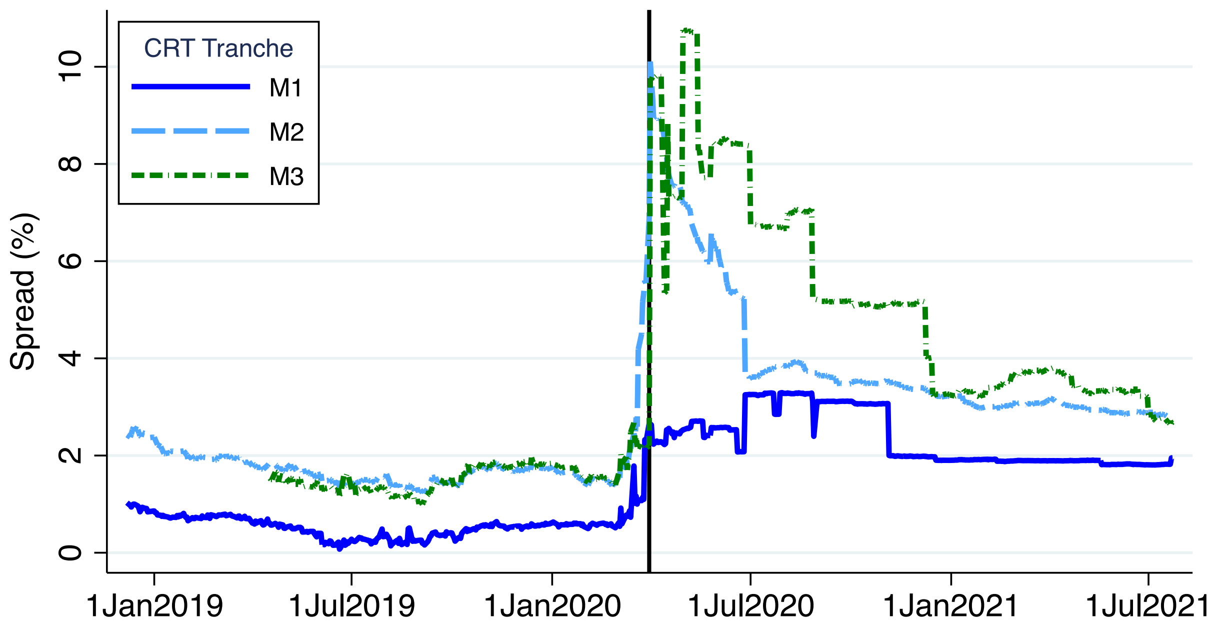
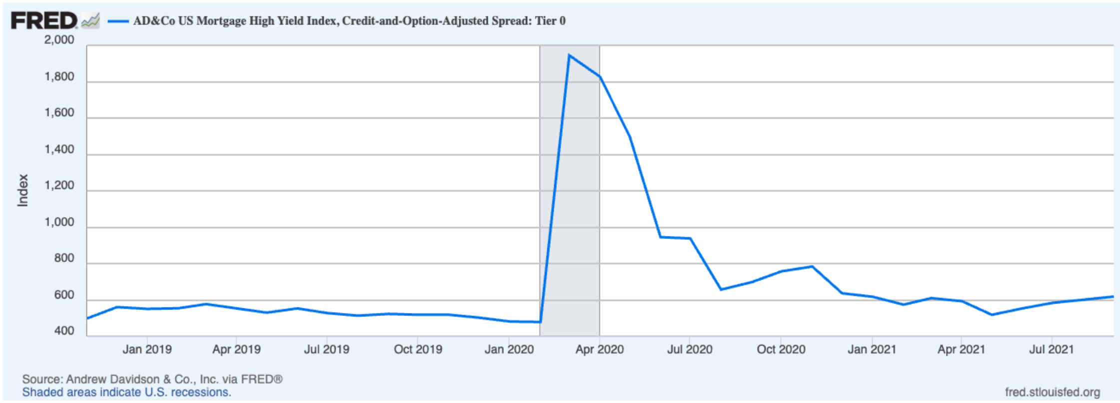


Figure A1. CRT Spreads and the CARES Act: Mezzanine Tranches. The figure plots the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of mezzanine tranches of CRT securities. M1 is the upper mezzanine, M2 the middle mezzanine and M3 the lower mezzanine tranche. The 1-month LIBOR rate is the reference rate used in the CRT documentation at the time. These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction.



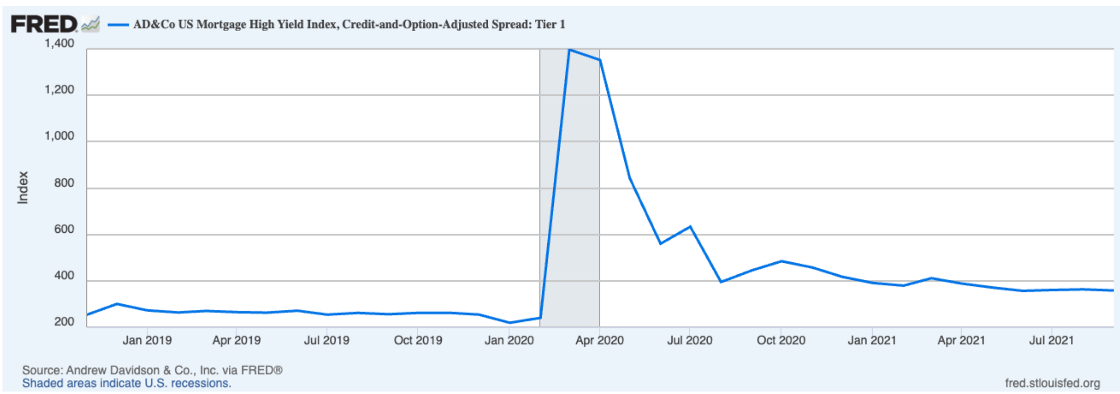


Figure A2. CRT Spreads. These figures plot the AD&Co US Mortgage High Yield Index crOAS, credit-and-option-adjusted spread. The indices include the cash CRT bonds CAS from Fannie Mae and STACR from Freddie Mac offered to the public, whether they are exchangeable or not, that have or have had IDC prices. To be included in the index the bond factor should be ¿= 0.25, the bonds should be floating rate and have 30-year residential mortgage collateral. Tier 0 (top figure) plots the CRT junior tranches B and B2. Tier 1 (bottom figure) plots the CRT junior tranche B1. On a set of 20 standardized, probabilistically weighted, market-and-model stress scenarios, AD&Co computes a discount rate that equates expected present value of tranche's cash flows to the observed market price; the cash flows are loss-adjusted using AD&Co's LoanDynamics Model (LDM). Investors and fund managers can use the index to assess the broad market returns, risks and opportunities available through investing in a market-weighted, passive portfolio of US mortgage credit risk transfer instruments. Until February of 2022, AD&Co has been computing crOAS relative to the Libor-swap rate curve before it was set to retire in 2023. Source: Andrew Davidson & Co., Inc., AD&Co US Mortgage High Yield Index, Credit-and-Option-Adjusted Spread: Tier 0 [CROASTIER0] and Tier 1 [CROASTIER1], retrieved from FRED, Federal Reserve Bank of St. Louis.

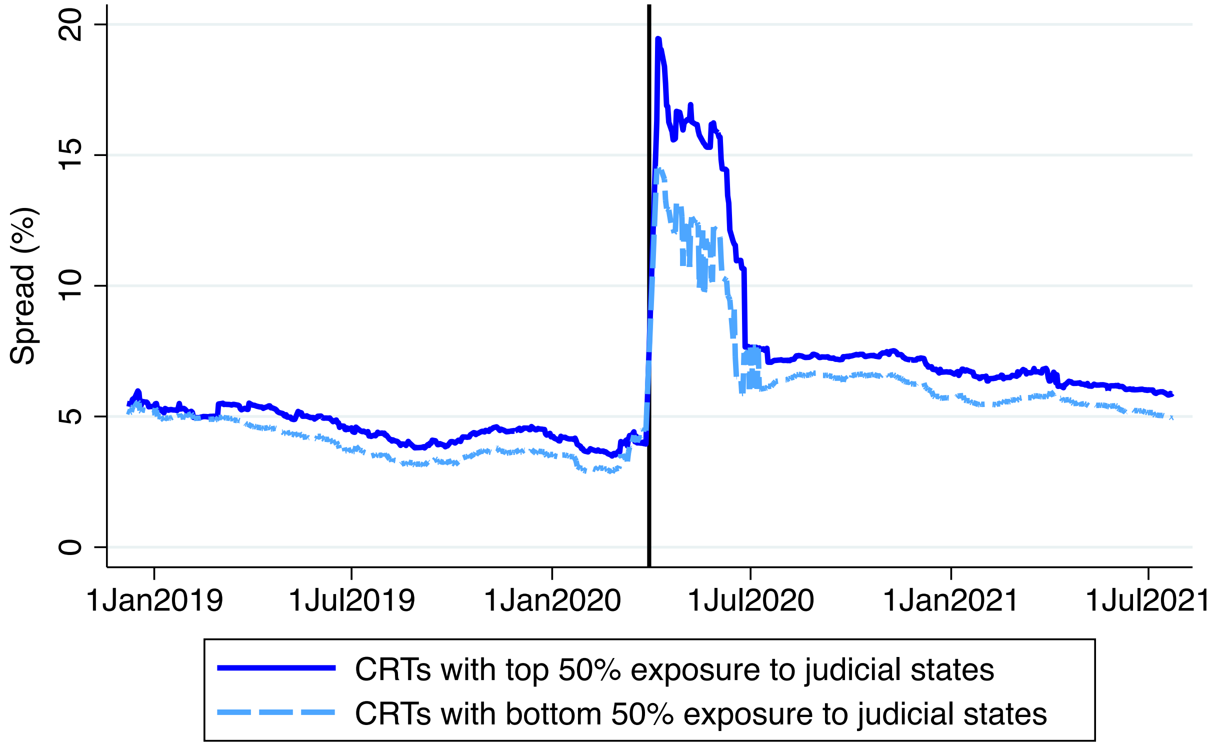


Figure A3. CRT Spreads by Exposure to Judicial States. The figure plots the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities, with mortgage pools that have the top 50% and the bottom 50% geographical exposure to judicial states. These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction. The Appendix presents an analogous figure, showing the average spreads for above and below median judicial exposure.

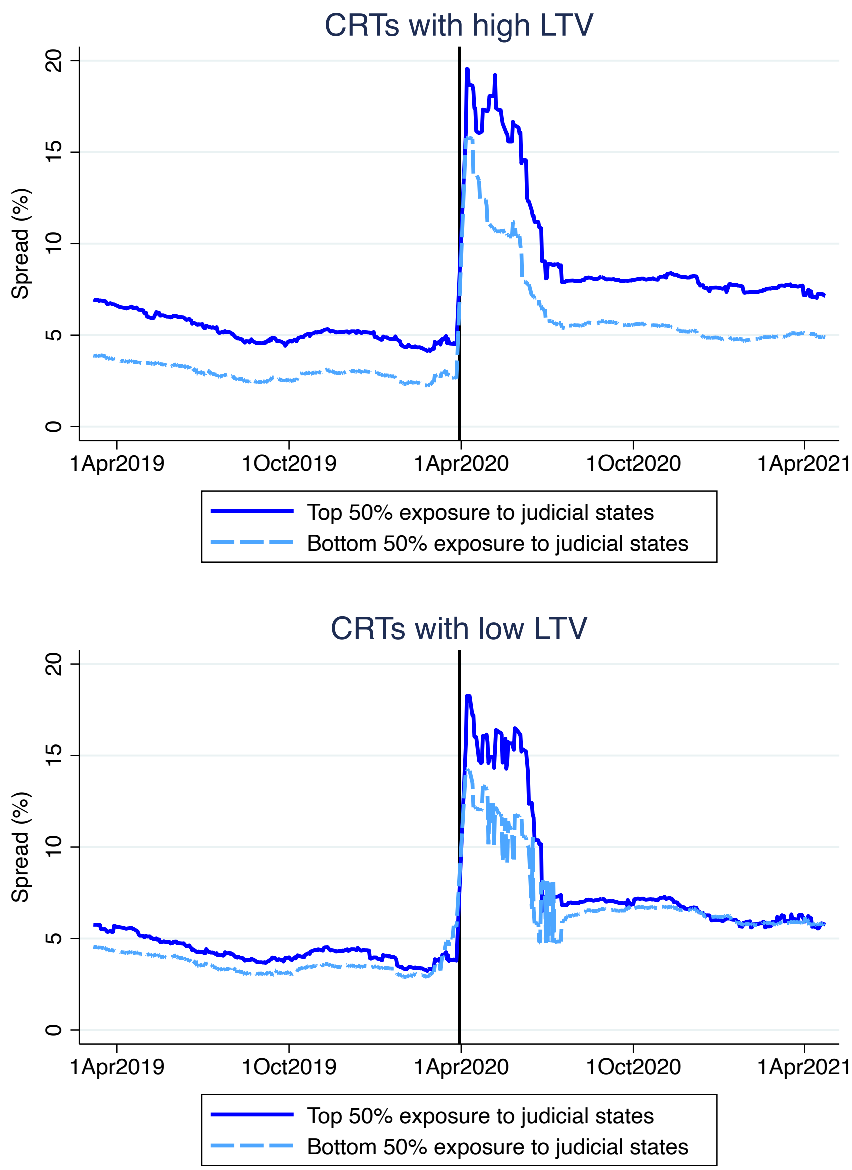


Figure A4. CRT Daily Spreads by LTV Group and by Exposure to Judicial States. The figures plot the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities, with mortgage pools that have the top 50% and the bottom 50% geographical exposure to judicial states. The top figure shows CRTs with reference mortgage pools of high loan-to-value ratios (80.01% – 97%) and the bottom figure low loan-to-value ratios (60.01% – 80%). These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction.

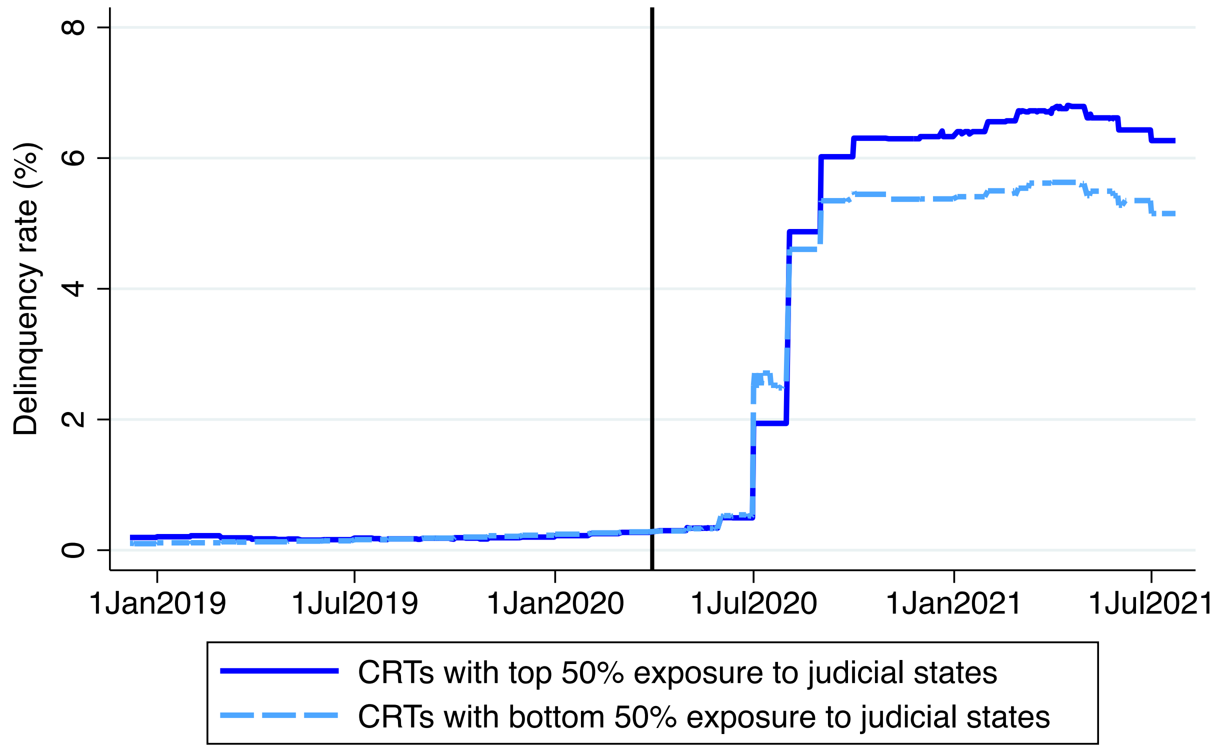


Figure A5. CRT Delinquencies by Exposure to Judicial States. The figure plots the 90-day delinquency rate within the mortgage pools of CRT securities with the top 50% and the bottom 50% geographical exposure to judicial states. These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The delinquency rate is measured as the share of principal balance that is 90-day or more past due in each month. The judicial exposure is measured as the percentage of unpaid principal balance within each CRT mortgage pool that is located in judicial states. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction. The Appendix presents an analogous figure, showing the 90-day delinquency rate for above and below median judicial exposure.

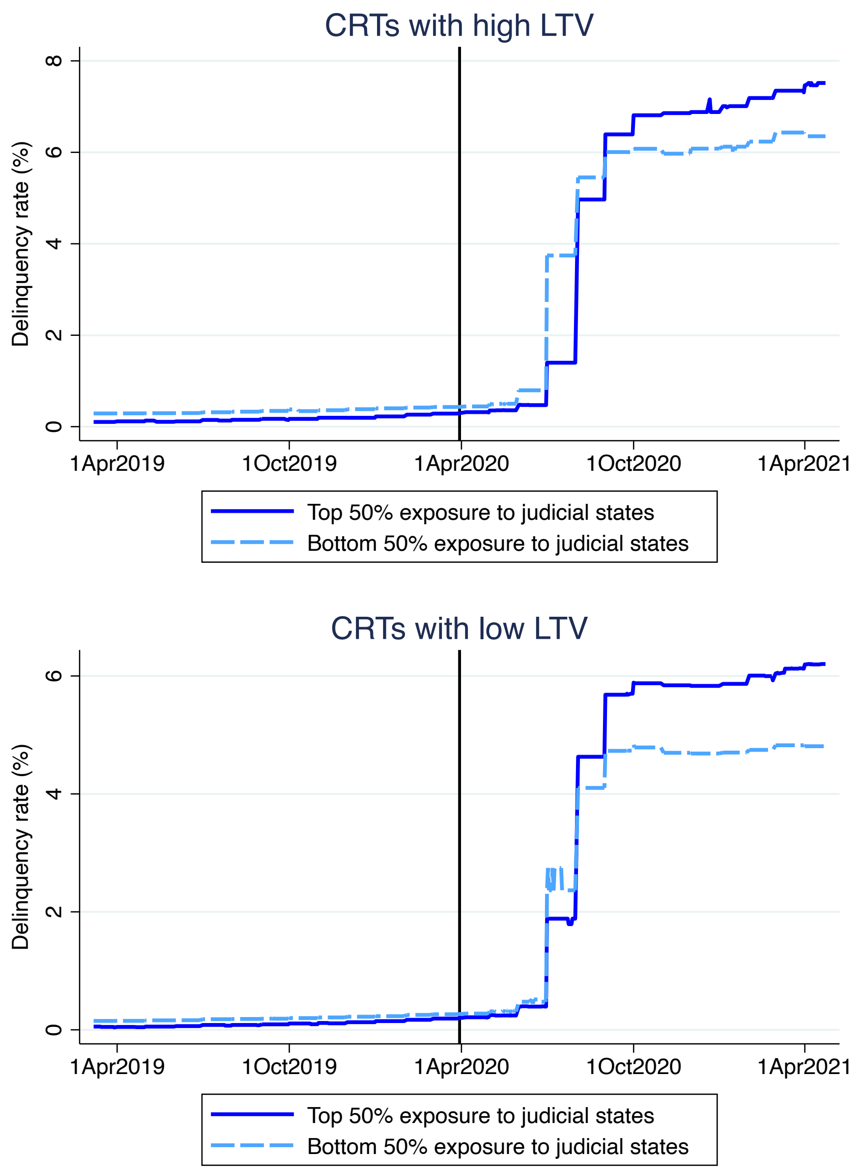


Figure A6. CRT Delinquencies by LTV Group and by Exposure to Judicial States. The figure plots the 90-day delinquency rate within the mortgage pools of CRT securities with the top 50% and the bottom 50% geographical exposure to judicial states. The top figure shows CRTs with reference mortgage pools of high loan-to-value ratios (80.01% – 97%) and the bottom figure low loan-to-value ratios (60.01% – 80%). These CRTs were issued between January 2017 and December 2019 by Fannie Mae and Freddie Mac. The delinquency rate is measured as the share of principal balance that is 90-day or more past due in each month. The vertical line indicates March 30, 2020, the first trading day following the CARES Act introduction.

Tables for the Appendix

Table A1. Correlation Matrix of Mortgage Credit Risk Characteristics

	FICO	LTV	CLTV	DTI	Risk Layers
FICO	1				
LTV	-0.28	1			
CLTV	-0.28	1	1		
DTI	-0.90	0.24	0.24	1	
Risk Layers	-0.20	-0.87	-0.87	0.25	1

Correlation matrix for the credit risk measures of the mortgages in the CRT pools in our sample. The sample contains data on all CRT deals issued between January 2017 and December 2019. The Risk Layer variable is computed by the issuers and is a summary risk score that incorporates the FICO score, the debt-to-income (DTI) ratio and the loan-to-value (LTV) ratio.

Table A2. Placebo Test – Alternative Event Dates Impact on CRT Spreads: 30-Day Windows

	Dependent Variable: CRT Spread							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	**(8)**
Event Date:	Aug2018	Nov2018	Jan2019	May2019	Aug2019	Nov2019	Jan2020	**Mar2020 CARES Act**
Post-Event	-0.327***	-0.069	-0.378***	0.213***	-0.032**	-0.008	-0.198***	**12.517*****
	(0.049)	(0.049)	(0.041)	(0.043)	(0.013)	(0.012)	(0.057)	**(0.992)**
Exposure × Post-Event	-0.002	0.004	-0.005	-0.009	-0.002	0.003	-0.013	**0.520****
	(0.010)	(0.007)	(0.012)	(0.006)	(0.007)	(0.005)	(0.017)	**(0.243)**
Treasury Rate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
CRT Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Clustered Errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Observations	1,066	1,346	1,456	1,833	2,001	2,313	2,365	**2,088**
Adj R Squared	0.997	0.994	0.993	0.995	0.995	0.992	0.965	**0.679**
Event Window	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	**2 Weeks**

This table reports the results from the estimation of equation (2), for alternative event dates, for 30-day event windows around those dates. Post-Event is the placebo treatment variable that takes the value of one on or after the event date, and zero otherwise. The event dates are on the 30th of the month. Exposure to judicial states is calculated as in Table 5. The last column, Model (8), reports the results for the actual CARES Act introduction. All models include controls for the 10-year treasury rate and CRT security fixed effects. The robust standard errors (in parentheses) are clustered by CRT security. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019. ***p<0.01; **p<0.05.

Table A3. Alternative Exposure Definition: 2-Week Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	11.859***	11.859***	11.859***	11.859***		
	(0.707)	(1.331)	(0.603)	(1.371)		
High Exposure × Post-CARES	5.395***	5.395**	5.395***	5.395**	5.395***	5.395**
	(0.812)	(2.051)	(0.692)	(2.113)	(0.695)	(2.130)
Treasury Rate	Yes	Yes	Yes	Yes	No	No
CRT Features	Yes	Yes	No	No	No	No
CRT Fixed Effects	No	No	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	Yes
Clustered Errors	No	Yes	No	Yes	No	Yes
Observations	880	880	880	880	880	880
Adj R Squared	0.584	0.584	0.698	0.698	0.695	0.695
Event Window	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks

This table replicates Table 4, but defines judicial exposure using a binary indicator equal to one if exposure is above the median, and zero otherwise. ***p<0.01; **p<0.05.

Table A4. Alternative Exposure Definition: 30-Day Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	10.284***	10.284***	10.279***	10.279***		
	(0.539)	(1.068)	(0.436)	(1.080)		
High Exposure × Post-CARES	4.036***	4.036**	4.033***	4.033**	4.031***	4.031**
	(0.569)	(1.849)	(0.461)	(1.868)	(0.460)	(1.885)
Treasury Rate	Yes	Yes	Yes	Yes	No	No
CRT Features	Yes	Yes	No	No	No	No
CRT Fixed Effects	No	No	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	No	Yes	Yes
Clustered Errors	No	Yes	No	Yes	No	Yes
Observations	2,088	2,088	2,088	2,088	2,088	2,088
Adj R Squared	0.514	0.514	0.681	0.681	0.682	0.682
Event Window	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days

This table replicates Table 5, but defines judicial exposure using a binary indicator equal to one if exposure is above the median, and zero otherwise. ***p<0.01; **p<0.05.

Table A5. Placebo Test – Alternative Event Dates Impact on Delinquency Rate

	Dependent Variable: 90-Day Delinquency Rate							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	**(8)**
Event Date:	Jun2018	Jul2018	Aug2018	Sep2018	Oct2018	Nov2018	Dec2018	**Mar2020 CARES Act**
Post-Event	-0.013	0.007	0.005	0.057***	0.050***	0.064***	0.011	**5.025*****
	(0.021)	(0.016)	(0.017)	(0.013)	(0.011)	(0.013)	(0.008)	**(0.187)**
Exposure × Post-Event	-0.002	-0.000	0.001	0.002	0.003*	0.003*	0.003*	**0.138*****
	(0.005)	(0.004)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	**(0.025)**
Treasury Rate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
CRT Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Clustered Errors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
Observations	162	173	183	193	204	215	230	**385**
Adj R Squared	0.865	0.868	0.910	0.940	0.950	0.959	0.962	**0.734**
Event Window	3 Months	3 Months	3 Months	3 Months	3 Months	3 Months	3 Months	**3 Months**

This table reports the results from the estimation of equation (6), for alternative event dates, for 3-months event windows around those dates. The delinquency rate, measured in percentage points, is the share of mortgages that become 90-days delinquent after 3 months from the observation month. Post-Event is the placebo treatment variable that takes the value of one after the event month, and zero otherwise. Exposure to judicial states is calculated as in Table 14. The last column, Model (8), reports the results for the actual CARES Act introduction. All models include controls for the 10-year treasury rate and CRT security fixed effects. Robust standard errors (in parentheses) are clustered by CRT security. The sample consists of the junior tranches of CRT securities issued between 2017 and 2019, and has monthly observations of the delinquency rate in the respective mortgage pools. ***p<0.01; *p<0.10.