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 gaining broad acceptance and popularity in many countries. Large-scale programs, such as 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 the threat of foreclosure.[1] Consistent with their growing popularity, recent research documents the macroeconomic benefits of forbearance policies, focusing on borrower-driven aggregate demand externalities. However, we uncover a negative side effect: these policies can contract credit supply.

In this paper, we examine how one of the largest mortgage forbearance programs, 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 upon request for 12 to 18 months without penalty, with missed payments to be repaid through various options, including repaying the remaining principal at the end of the loan term. Because the default risk on these mortgages is borne by the Government-Sponsored Enterprises (GSEs) or other federal agencies, changes in the pricing of these loans are not directly observable in primary mortgage rates. The innovation of this paper is to study the secondary market for Credit Risk Transfers (CRTs), which are bonds linked to GSE-backed mortgages. Daily trading of CRTs provides a unique setting to examine how credit risk is priced in response to policy changes. In effect, private investors in the CRT market are the marginal suppliers of credit. Their willingness to bear risk directly influences the extent to which GSEs can offload credit risk from their balance sheets.

We document that CRT spreads increased by about 4 times on the day mortgage forbearance was mandated as part of the CARES Act. This means lending costs increased and investors expected forbearance to worsen, rather than improve, future default outcomes. The jump in CRT spreads coincided perfectly with the introduction of the CARES Act, not with the declaration of a global pandemic or any other major news related to Covid-19. This strongly indicates that the effect on spreads is related to the provisions under the CARES Act. The CARES Act allowed for no-questions-asked forbearance for delinquent borrowers, resulting in delinquency losses being borne by the GSEs and investors in CRTs.[2]

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

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

[2]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.

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 of the CARES Act was expected to increase (reduce) overall foreclosure losses, then the extended time to foreclose in judicial states would have become more (less) relevant. Consequently, the spreads of CRTs with high exposure to judicial states would have increased (declined) relative to the rest.

We find that the spreads of CRTs with high judicial exposure increased more than the rest. Therefore, based on the above reasoning, the forbearance introduced in the CARES Act was expected to increase future default losses. The CARES forbearance made judicial states even more "judicial" in the sense that the longer foreclosure timeline became more relevant for investors.

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. Falsification and other robustness tests reported below provide further support that the documented relationship is causal.

Our findings extend the literature, which finds that forbearance either improves or has no impact on loan outcomes, by revealing a negative side effect. 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. Using data from post-2020 delinquent loans, Goodman and Zhu (2024) show that loans in forbearance experienced only a quarter of the liquidation rate of the loans not in forbearance. Fout et al. (2017) document no effect of forbearance on subsequent loan outcomes. The above studies are representative of the broader literature, which finds either positive or neutral effects of forbearance on subsequent default outcomes.

Prior forbearance studies focus on the eventual loan outcomes or credit availability, which are measured months, even years, after the introduction of the forbearance. While the above studies are valuable and make the best possible use of the available data, they 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.

Next, we develop a model that links mortgage rates to default risk, allowing us to estimate investors' expectations of mortgage default following the enactment of the forbearance policy. Deploying a zero-profit condition for mortgage lenders, we infer default probabilities based on market-implied mortgage rates and the legal framework governing foreclosure—whether the property is in a judicial or non-judicial state. Our model quantifies the shift in investors' default expectations that aligns with the observed increase in CRT spreads after the passage of the CARES Act.

The model simulations show that the expected default probability in judicial states soared to 13.7%, representing a 4.5-fold increase from the baseline rate of 3.0%. In non-judicial states, the model estimates an expected monthly probability of 11.7%, representing a 3.9-fold increase relative to the baseline.

Finally, to evaluate whether the initial CRT investor reaction was justified by subsequent loan experience we investigate the ex-post loan performance. We find that the 90-day delinquency increases substantially 90 days after the introduction of the CARES Act. This increase is particularly high in judicial states. Delinquency rates increase by 4 times their pre-CARES Act levels, which is consistent with the increase in spreads we estimate.

We proceed as follows. Section 2 reviews the broader literature on forbearance, in addition to the key studies already mentioned above. Section 3 presents our theoretical considerations that link CRT spreads to expectations of future default losses. Section 4 provides basic information on the CRT securities and their exposure to future default losses. We review the forbearance program introduced in the CARES Act in Section 5 and describe the data in Section 6. Section 7 presents the main empirical analysis and results, with robustness checks presented in Section 7.2. Utilizing a model of mortgage default we derive the expected probabilities of default implied by the CRT spread increases in Section 8. We offer a discussion and review of actual default results in Section 9. Section 10 concludes.

2 Related Literature

This paper contributes to several research streams. First, our work extends the recent literature on the effects of COVID-19 and the 2020 CARES Act on mortgage delinquency and forbearance. Studying the CARES Act forbearance program, Kim et al. (2024) find that access to forbearance provided significant liquidity to households and substantially reduced delinquencies outside of forbearance. Gerardi, Lambie-Hanson, and Willen (2022) found that COVID-19 forbearance policies were highly beneficial to borrowers. Analyzing seriously delinquent loans at the onset of the COVID-19 pandemic in 2020, Goodman and Zhu (2024) found that the average transition rate to foreclosure liquidation for loans granted forbearance was five times lower compared to loans without forbearance. The literature shows how forbearance introduced by the CARES Act assisted borrowers by increasing temporary liquidity, and how federal stimulus policies and Federal Reserve action helped borrowers to repay forborne debt. We document how the CRT market reacted to these policies.

First, focusing on heterogeneous effects of the CARES Act forbearance program, An et al. (2022) find that, although forbearance provided temporary relief to borrowers, minority and lower-income borrowers were more likely to fall into delinquency and default after exiting forbearance. Similarly, Gerardi, Lambie-Hanson and Willen (2021) find that minority borrowers were significantly less likely to exit forbearance and resume making payments relative to White borrowers, following the CARES Act forbearance provisions. Goodman and Zhu (2023) show that the CARES Act forbearance policy had a more substantial positive impact on assisting single borrowers in exiting delinquency and becoming current, compared with households with multiple borrowers during the COVID-19 pandemic. We focus on heterogeneous effects based on the location of the mortgages, specifically whether judicial or nonjudicial foreclosure processes apply.

Second, our work contributes more generally to the literature on debt relief programs. Studying the the 2020 student loan payment freeze that the US federal government provided as relief during the coronavirus pandemic, Dinerstein, Yannelis and Chen (2024) find that the student debt payment pause immediately increased consumption, as borrowers used the new liquidity to increase borrowing on mortgages, auto loans, and credit cards rather than avoid delinquencies. The authors find that the effects are driven by an increase in credit demand due to increased liquidity.

Third, comparing outcomes in judicial states with greater borrower protections similar to forbearance to nonjudicial states, Mian, Sufi and Trebbi (2014) concludes that housing price decline mitigation due to forbearance was balanced by higher moral hazard, so that overall default risk was similar across the two sets of states during the GFC. But this literature, as noted, is based on ex post results. Here we show how CRT investors weighed these risks and how their pricing of CRTs responded to forbearance introduced by the CARES Act and the evolution of delinquency and default over time, thereby contributing to the Covid-19 literature.

Fourth, this paper contributes to the literature on housing finance and the GSEs. Papers like Lucas and McDonald (2010), Jeske, Krueger and Mitman (2013), Frame, Wall and White (2013), Elenev, Landvoigt and Van Nieuwerburgh (2016), Hurst et al. (2016) and Gete and Zecchetto (2018) have analyzed different topics related to the GSEs. Pavlov, Schwartz and Wachter (2021) and Stanton and Wallace (2011) study how mortgage credit risk was not reflected in the cost of credit default swaps during the 2008 financial crisis, pointing out the failure of transferring credit risk to the market.

Fifth, our paper contributes to this literature by examining the CRT market. Gete, Tsouderou and Wachter (2024) study how CRT spreads react to catastrophic hurricanes and quantify the effects for the price of credit risk. Finkelstein, Strzodka and Vickery (2018) and Golding and Lucas (2022) explore whether the CRTs are an effective and efficient means of reducing the exposure of the federal government to mortgage credit risk. The CRT market, as described below, is far more transparently dependent on credit risk than the CDS market and lacks counterparty risk. The literature has shown that CRT pricing does reflect heightened delinquency risk in natural hazards (Gete, Tsouderou and Wachter 2024) and more generally (Golding and Lucas 2022). Here we extend this literature to consider the CRT market response to the CARES Act.

3 Theory and 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, presented in Golding and Lucas (2022) Table 6, 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. Zandi et al. (2017) also establishes the same relationship.

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.[3] 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 effect in judicial states (Ghent 2011).

Neither of the above models is able to identify whether yields respond to an increased probability of default or loss severity. However, this is not required for our purposes. 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.[4] We document that the CRT market anticipated the rise in delinquency. The Covid stimulus response to what was a historic health crisis was not anticipated ex ante; however, we document how the trajectory of the impact of stimulus on mortgage repayment affected CRT pricing.

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.

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

[4]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).

4 CRT Market Background

Under the directive of the Federal Housing Finance Administration (FHFA), the GSEs began issuing Credit Risk Transfer (CRT) securities in July 2013. This initiative aimed to mitigate the credit risk associated with the guarantees provided to mortgage-backed securities. 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 GSEs transparently disclose the characteristics and performance over time of the underlying mortgage pools as well as individual loans, ensuring that investors have complete information.

The mortgage reference pools include mortgages from all U.S. states, with the highest concentrations typically found in California, Texas, Florida, Illinois, Georgia, and Virginia. 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%).

At issuance, the outstanding principal balance of these mortgages is divided into tranches of varying seniority. The most senior tranche is fully retained by the GSEs. Below this 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. Typically, the allocation of the outstanding principal balance is as follows: 94.5–96% to the most senior tranche retained by the GSEs, 3.5–4% to the mezzanine tranches, and 0.5–1.5% to the junior tranches. Additionally, the GSEs retain a vertical slice of each tranche to mitigate moral hazard in mortgage selection.

The performance of CRTs is intrinsically linked to the default risk of the underlying mortgages. 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.

CRT securities pay interest based on the one-month US Dollar LIBOR plus a floating spread.[5] This spread's fluctuations reflect the private capital market's pricing for sharing the credit risk borne by the GSEs (Wachter 2018).

5 The 2020 CARES Act

The first recorded case of coronavirus in the United States was announced on January 21, 2020. Subsequently, the World Health Organization declared a global health emergency on January 31, 2020. Following these developments, the U.S. government declared a public health emergency on February 3, 2020, in response to the Covid-19 outbreak. On March 13, 2020, the U.S. government further declared Covid-19 a national emergency, which unlocked federal funding to combat the spread of the virus.

The Covid-19 outbreak was a significant and unexpected shock to both U.S. public health and the economy. The pandemic led to unprecedented levels of unemployment and health-related expenses. Despite these developments, CRT spreads did not exhibit significant reactions in January and February 2020.

The Coronavirus Aid, Relief, and Economic Security (CARES) Act, signed into law on March 27, 2020, had a substantial impact on CRT investors. 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.

[5] On December 22, 2022, the GSEs announced their SOFR-based replacement rates for legacy LIBOR products, 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.

6 Data

We study how the CRT market reacted to the CARES Act. 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 follow Fout et al. (2017) to identify states with judicial and non-judicial foreclosure requirements. Figure 1 displays this categorization. From the GSE disclosures about the reference pool of mortgages of the CRTs, we extract the percentage of unpaid principal balance at origination that corresponds to each state. We create the variable judicial exposure to be the percentage of unpaid principal balance at origination of each CRT mortgage pool that is located in judicial states. Finally, we merge with our database the daily values of the 10-year treasury rate from FRED.

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, inclusive. Prior to 2017, default exposure was based on modeled losses, whereas from 2017 onward, CRT payouts have been tied to actual default losses, making these securities more suitable for our analysis. Table 1 reports the summary statistics for the key variables in our study.

The sample includes 75 securities, totaling 2,918 observations over a 30-day window before and after the introduction of the CARES Act. The weighted average loan-to-value (LTV) ratio is 83 percent, and the weighted average FICO score is 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 generates significant differences in spread responses.

7 Empirical Analysis

The theoretical framework outlined in Section 3 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 first employ a standard event study comparing spreads before and after the CARES Act. We then examine the differential spread response between judicial and non-judicial states. These two tests are critical because they minimize the likelihood of a confounding factor driving the observed effect. Any such factor would need to coincide precisely with the event and affect judicial and non-judicial states differentially.

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.

Figure A4 in the Appendix corroborates our previous findings using aggregate CRT spread data from the Federal Reserve Bank of St. Louis. Figures A2 and A3 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.

7.1 Specification

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:

$$\begin{aligned} Spread_{i,t} = {} & \beta_1 + \beta_2 PostCARES_t + \beta_3 Exposure_i \times PostCARES_t \\ & + \beta_4 Treasury_t + \beta_5 Issuer_i + \beta_6 Issuer_i \times PostCARES_t + \beta_7 Tranche_i \\ & + \beta_8 Tranche_i \times PostCARES_t + \beta_9 RiskLayers_{i,t} + \beta_{10} Exposure_i \end{aligned} \tag{1}$$

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. $Exposure_i$ denotes the percent of the outstanding mortgage balance that is in judicial states for security i at the end of March 2020. $PostCARES_{i,t}$ 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 and 31 are the first trading days following the CARES Act. $Issuer_i$ and $Tranche_i$ are indicator variables that encode each issuer and tranche. The issuer is either Fredie Mac or Fannie Mae. Tranche encodes one of the following two categories that describe the tranche: B1 or B2. One of the issuers has tranches that have slightly different designations. We convert those to B1 or B2 based on their subordination level.

Finally, the variable $RiskLayers$ is a summary measure of the weighted average risk layer for each loan. The loan-level risk layer is computed by the issuer and captures risk characteristics such as low FICO, high DTI, and/or high LTV. Table A1 in the Appendix demonstrates that the risk layers variable is nearly perfectly correlated with FICO, DTI, and LTV thus making it an appropriate summary statistic for all risk factors. We interact issuer and tranche with the post-CARES indicator variable to account for potential differences in how issuers implemented the forbearance program and the different exposure of different tranches.

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

Tables 3 through 6 report the estimated coefficients from equation (1). We report the results for different windows of two weeks, 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 3 through 6 show that both the post-CARES coefficient and the interaction between judicial exposure and post-CARES are highly significant in all event windows. The estimated coefficient for post-CARES Act of 12.89 in model (1) in Table 2, for instance, means that spreads increased by 12.89 percentage points on the introduction of the CARES Act at the end of March 2020. The judicial exposure is demeaned (subtracting the mean exposure), so the interaction has no impact for the average exposure security. For each additional 1 percentage point increase in judicial exposure, the spread increases approximately 0.57 percentage points on the CARES introduction.

Although clustering the errors in Models 2, 4, and 6 handles potential serial correlation in the residuals, we note that this is unlikely to work well given that our data contains only 75 securities. Moreover, as Abadie et al. (2023) 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 is the case in our analysis, as the securities in the sample are the same as the securities in the population. Furthermore, Cameron and Miller (2015) show that within cluster serial correlation can be captured by explanatory variables. We believe is the case in our analysis since the time fixed effects and the security fixed effects or security characteristics capture potential serial correlation. Therefore, we provide the clustering results primarily as a robustness check.

In addition to the high level of significance of the coefficient estimates of interest, the results in Tables 3 through 6 display an important pattern. Both the post-CARES base effect and the interaction effect decline in magnitude (not significance) for longer event windows. This pattern captures the fact that the CRT spreads increased very substantially on the event date but slowly declined over time.

7.2 Parallel Trends and Robustness Checks

Table 7 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 indicator variables that take the value of 1 if exposure is above the median exposure and 0 otherwise. These results are presented in Table A4.

We also consider specifications in which the indicator variable takes the value of 1 if the security's exposure to judicial states is above the 75th percentile and 0 if below the 25th percentile. Securities with exposure between the 25th and 75th percentiles are excluded in these specifications. Table ?? presents those results.

All robustness specifications considered show some variation in point estimates, but the overall sign and significance of the post-CARES and the interaction coefficients remains unchanged. This gives us confidence that the findings reported in our main analysis are robust to model specification and data selection.

8 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 after the forbearance policy was enacted. Using a zero-profit condition for mortgage lenders, we solve for default probabilities, given market-implied mortgage rates and the location of the house in a judicial or non-judicial state. We use the model to infer the magnitude of the change in investors' default expectations that is consistent with the CRT spread increase after the CARES Act.

8.1 Setup

We model mortgages as long-term, fixed-rate loans, as in Campbell and Cocco (2015) and Garriga, Kydland and Šustek (2017). 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

$$M_0 = \frac{x}{r^m}\left(1 - (1 + r^m)^{-k}\right). \tag{2}$$

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 value of the house posted as collateral (PH). The parameter δ is the expected deadweight loss from default. This foreclosure cost captures various expenses that lenders incur throughout the process. Moreover, foreclosed properties usually appreciate less than the area average and they are sold at a price lower than the market value, which is a source of loss for the lender.[6] We can write recursively the value at t of an outstanding mortgage right after a payment is been

[6]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. Thus, the model does not include a separate parameter for annual depreciation of the housing structures.

made as

$$M_t = (1 + r^d + r^w)^{-1}[(1 - \pi_t)(x + M_{t+1}) + \pi_t(1 - \delta)\min\{PH, x + M_{t+1}\}], \tag{3}$$

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 and operating cost rate $r^d + r^w$. The second term is the discounted probability of borrower's default multiplied by the recovery value of the house $(1 - \delta)PH$. Since the recovery value of the house might be larger than the mortgage balance, the minimum operator ensures that borrowers in default do not overpay. In other words, in case of default the maximum received by the lender is the the outstanding mortgage balance.

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 a constant funding cost r^d (e.g. deposits or warehouse funding) and constant operating costs r^w (e.g. origination and servicing costs) that are proportional to the outstanding mortgage. The zero-profit condition implies that, if there is no default risk $(\pi = 0)$, 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.

The goal of the model is to solve endogenously for default probabilities. We assume as exogenous the mortgage size, mortgage rates, home values and discount rates. We refer to the mortgage rates as *market-implied* mortgage rates, since their dynamics are determined by the yields in the CRT market. We also define the market-implied guarantee fee (g-fee or r^g) as the excess of the mortgage rate over the cost of funds and operating cost of the lender. That is,

$$r^g = r^m - r^d - r^w. \tag{4}$$

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.

8.2 Model Parameters

Table 10 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 probability pre-CARES Act to be constant each period. We set $\pi_{monthly} = 0.83\%$, consistent with the average defaults of fixed-rate agency mortgages originated between 1999 and 2019. We convert the default rate to an annual rate, using $\pi = \sum_{i=1}^{12} \pi_{monthly}(1 - \pi_{monthly})^{i-1}$.

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, 37.2% 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, $0.372(\delta_j) + 0.628(\delta_n) = 0.22$. Solving the last two equations, we obtain $\delta_j = 23.3\%$ and $\delta_n = 21.2\%$.

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 (3). The calibration yields $r_j^w = 1.690\%$ for judicial states, and $r_n^w = 1.788\%$ for non-judicial states.

8.3 Market-implied default risk

Based on the previous calibration, the market implied g-fee in judicial states, pre-CARES Act is $r_j^g = 3.47\% - 1.50\% - 1.69\% = 0.28\%$ (from equation (4)). The market implied g-fee in non-judicial states, pre-CARES Act is $r_n^g = 3.47\% - 1.50\% - 1.79\% = 0.18\%$. These fees compensate for credit risk, and increase to $r_j^g = 1.21\%$ and $r_n^g = 0.37\%$ 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 4).

The CRT spread during the 30 days before the enactment of the CARES Act was 3.17% on average[7]. Our estimation shows that this spread increased by 4.33 times after the enactment of the forbearance policy, assuming the maximum level of exposure to judicial states, and by 2.01 times assuming the minimum level of exposure. The corresponding mortgage rates are $r^m_{j,\ post} =$

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

$1.50\% + 1.69\% + 1.21\% = 4.40\%$ in judicial states and $r^m_{n,\ post} = 1.50\% + 1.79\% + 0.37\% = 3.65\%$ in non-judicial states.

We input the mortgage rates implied by the CRT market reaction into the calibrated model to compute the expected probability of default caused by the CARES Act. Table 11 shows the model-implied expected probabilities of default in judicial and non-judicial states.

The model-implied expected monthly probability of default in judicial states is 2.71%. This is a 226.5% increase from the baseline probability of default of 0.83%. The model-implied expected monthly probability of default in non-judicial states is 1.49%, which is 79.5% higher than the baseline.

9 Actual Default Experience

The default increase expected by CRT investors did not materialize. Forbearance increased immediately and in parallel to increases in delinquency through the first quarter and part of the second quarter of 2020. By the second half of 2020, delinquency rates had mostly returned to pre-COVID levels at the same time as an unprecedented surge in fiscal support returned income and unemployment to pre-COVID levels.

As documented by Gerardi, Lambie-Hanson and Willen (2022), fiscal support through additional unemployment benefits entirely compensated for income declines by mid-year 2020, by which point CRT spreads had mostly normalized. The sharpest rise in unemployment rates recorded reversed by May 2020, with the result that mortgage payments were resumed. If unemployment increases and income decreases had persisted and led to lower housing prices with potential negative feedback effects, delinquencies may have well led to default markets anticipated.

The GSEs and the Federal Reserve also played a role in this recovery. The Fed stepped in to increase liquidity and lower interest rates and mortgage rates in the immediate aftermath of the March 2020 liquidity crisis. Gerardi, Lambie-Hanson and Willen (2022) show that this intervention lowered mortgage rates and helped to stabilize mortgage and financial markets. The GSEs maintained stable g-fees, which did not reflect the increase in CRT rates. If GSEs had increased g-fees, there undoubtedly would have been further destabilization of markets (Gete, Tsourderou, and Wachter 2024). As it was, substantial fiscal support which came with a delay enabled those delinquent borrowers with loans in forbearance to repay, which they substantially did in May 2020. Table 12 shows recovery rates and the impact of the forbearance program on recovery rates. Recoveries of loans that were in forbearance skyrocketed in May 2020 as fiscal support surged.

We follow Goodman and Zhu (2024) to capture the loan outcomes reported in Table 12. The table reports the outcome of this analysis for loans that were 90 days delinquent in each month of 2020 and originated in 2019. This data selection shows results from loans originated with similar underwriting requirements, and a borrower equity position that had not materially changed due to property price movement and amortization. We select loans that were exactly 90 days delinquent at the end of each month and follow those loans through December 2023. Recovery is defined as having 6 months of current payments and we measure it at the start of the 6-month period. Prepaid loans are included in the "recovery" group, even if they do not have 6 months of current payments.

The last row in each group, "Liquidation + delinquent" is analogous to the Goodman and Zhu (2024) definition of liquidation, which included loans that were 6-months delinquent at the end of their data sample. Our preferred definition is reported on the second line of each category, "Liquidation rate," which uses the liquidation definition in the data. Loans that left the data because of repurchase or sale are reported on the third line, "Removal rate," and loans that were still delinquent as of December 2023 are reported in the fourth line.

Regardless of the exact specification, this table shows the spike in 90-day delinquencies but the very muted ultimate liquidation rates. This positive outcome occurred due to the fiscal support, high housing prices and equity, and the structure of the mortgage industry at the time of the COVID shock. The GSEs were able to offer forbearance, absorbing the loss in income due to the nonpayment of delinquent loans without raising their g-fees. In a privatized system, the liquidity provisions of the GSEs might not have been possible with the potential for further destabilization of the mortgage market, prior to the provision of fiscal support. Fiscal stimulus policies were put into place along with forbearance in this national health crisis, similar to the way forbearance followed by insurance and FEMA assistance supports borrowers in default in natural disasters. The GSEs subsidized borrowers in this period. In conservatorship under government ownership they were able to help stabilize the mortgage market before the federal government stepped in with fiscal stimulus to ultimately reverse the rise in delinquencies.

This level of federal support was unprecedented. The precedent, however, does not establish a future likely outcome in response to a credit shock. The results of this paper showing the sharp rise in delinquency in CRT rates point to the potential of destabilization through negative feedback effects of rising CRT risk spreads, which could very well be incorporated into mortgage pricing.

10 Conclusions

Our work presents evidence that CRT spreads vastly increased at the time of the CARES Act introduction, especially for securities with high exposure to judicial states. The theoretical considerations discussed in Section 3 imply that the increase in spreads reflects an expectation of increased future default losses. Therefore, our work shows that the forbearance program introduced with the CARES Act increased the expectation of future default losses.

We also document that this expectation was correct at least in terms of future delinquencies. We find that the 90-day delinquencies significantly increased 90 days after the introduction of the CARES Act.

Taken together, our findings identify a cost to large-scale forbearance programs. This cost has not been identified or estimated in the prior literature.

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Figures

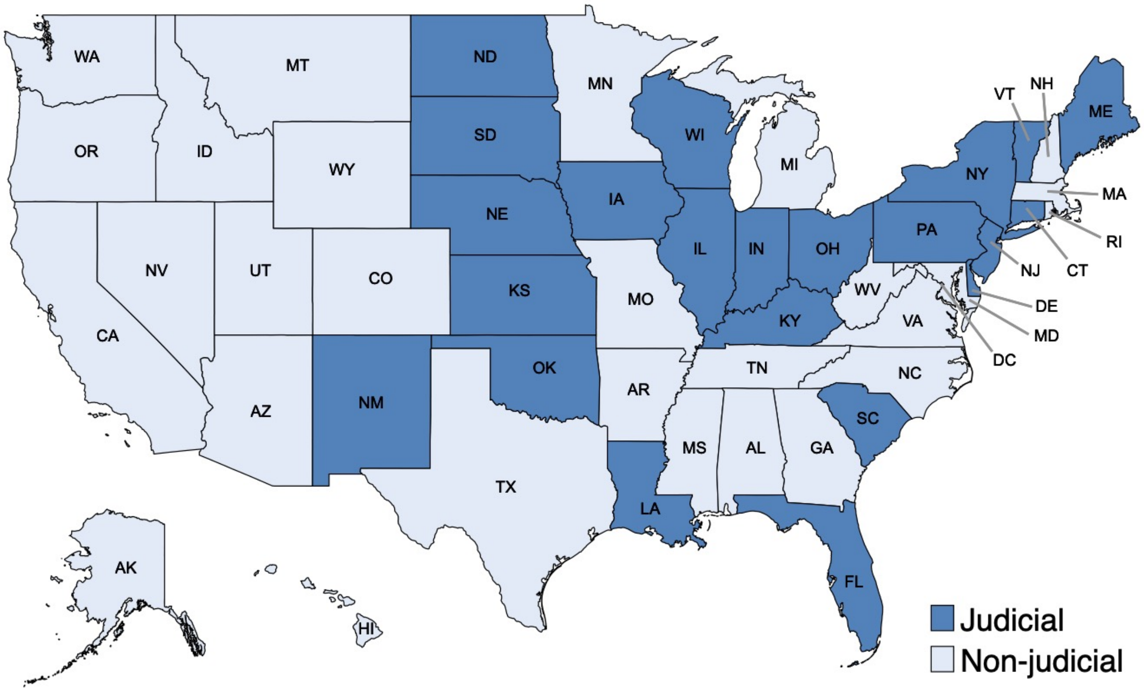


Figure 1. States With Judicial and Non-Judicial Foreclosure Requirements. The map show the states with judicial and non-judicial foreclosure requirements. Our classification of the states follows Fout et al. (2017).

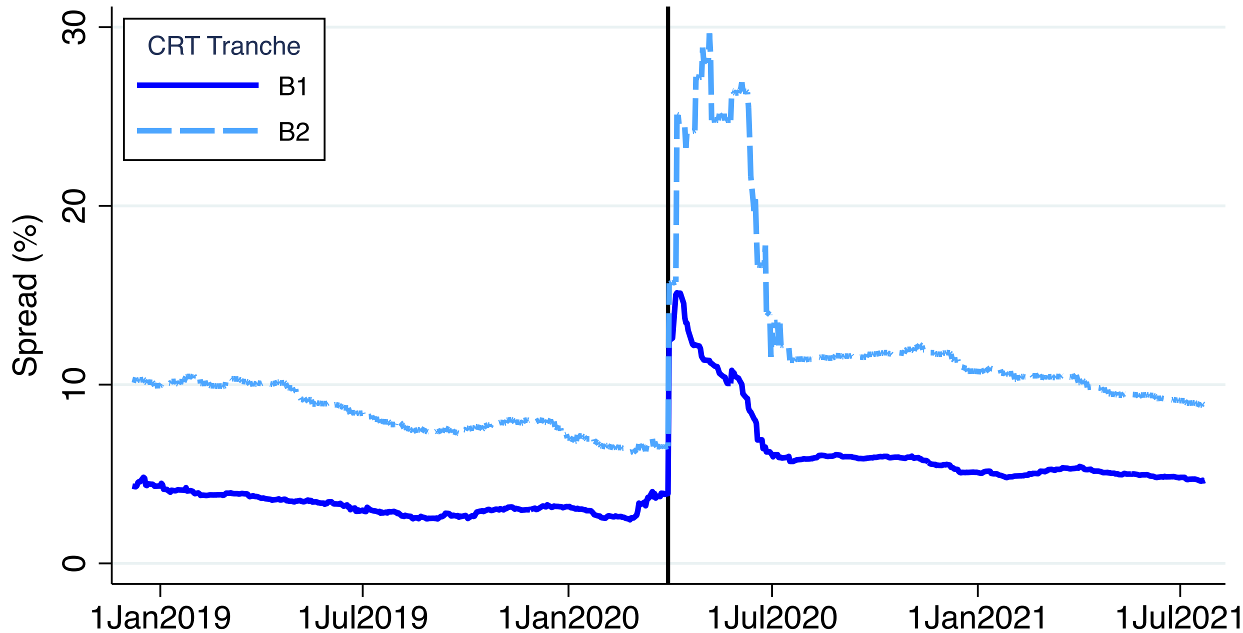


Figure 2. CRT Spreads and the CARES Act. The figure plots the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities. B2 is the *First Loss* most junior tranche, and B1 is the junior tranche with seniority just above B2. The 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.

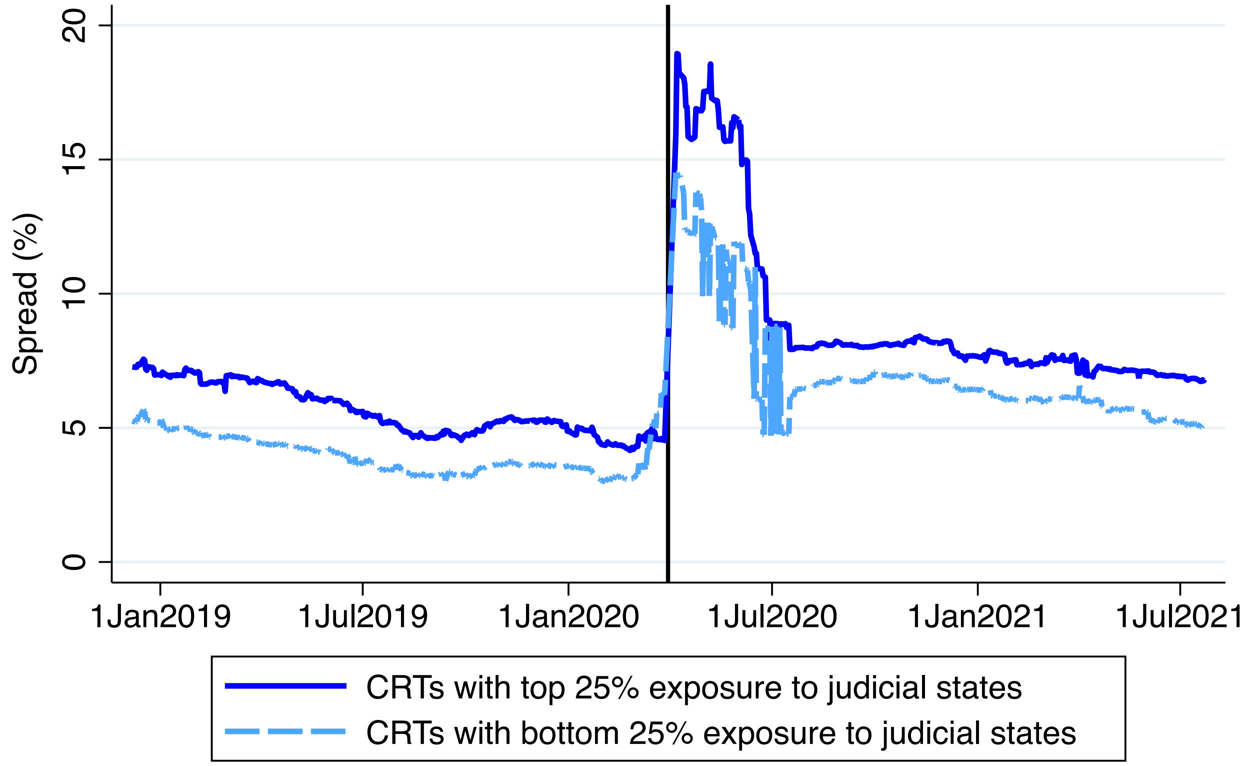


Figure 3. CRT Spreads by Exposure to Judicial States. The figure plots the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities, with mortgage pools that have the top 25% and the bottom 25% geographical exposure to judicial 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.

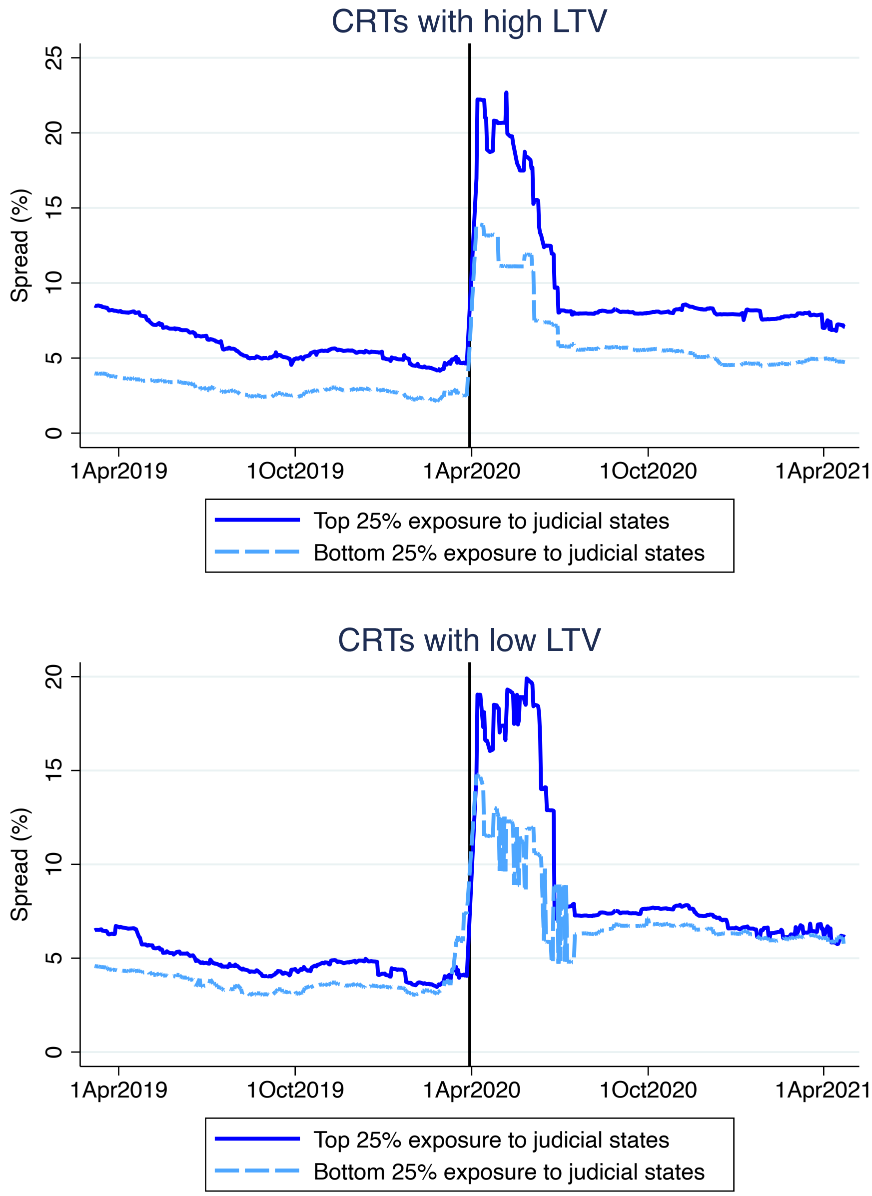


Figure 4. CRT Daily Spreads by LTV Group and by Exposure to Judicial States. The figures plot the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities, with mortgage pools that have the top 25% and the bottom 25% geographical 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.

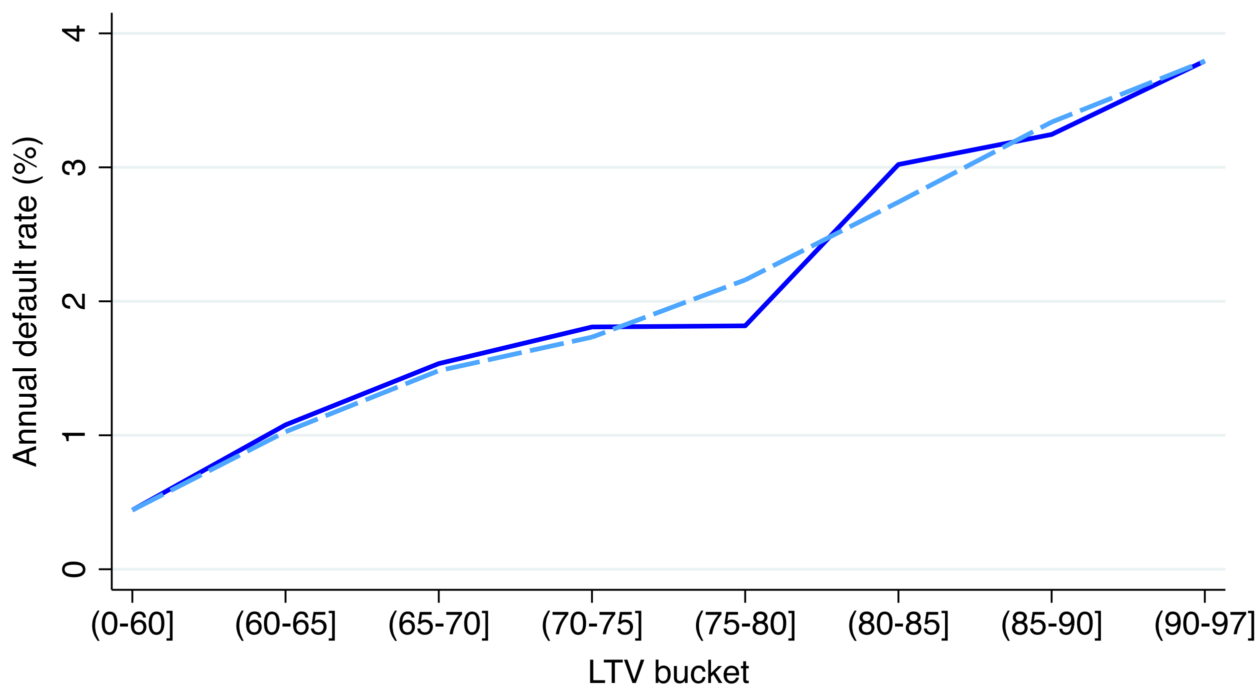


Figure 5. Default Rate by LTV. The solid line shows the average annual default rate for single-family loans owned by Fannie Mae, by loan-to-value bucket. The dashed line illustrates the estimated trend in the data. The sample contains loans originated between January 1999 and December 2019, and the annual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

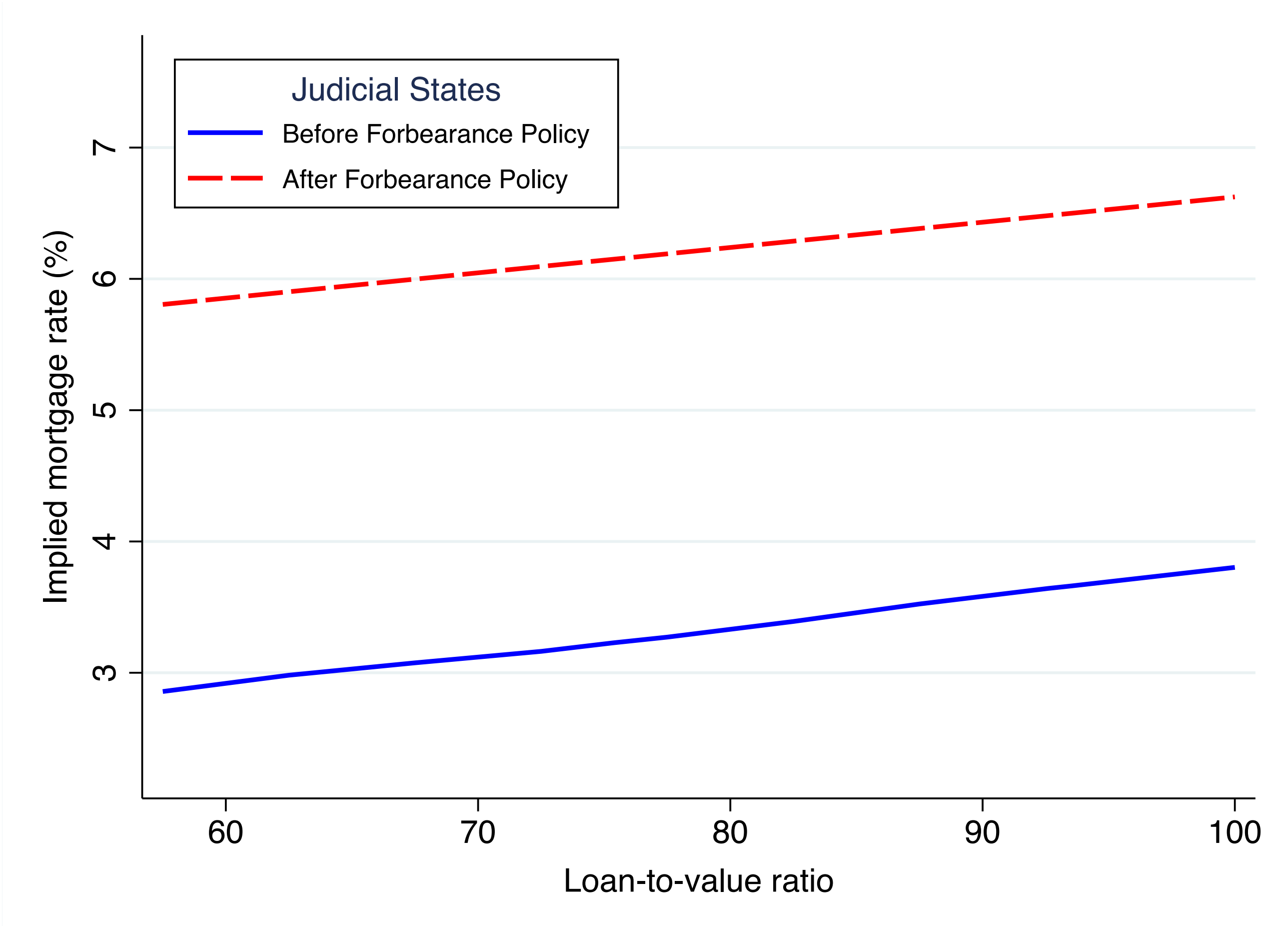


Figure 6. Credit Supply in Judicial States. The solid line shows the mortgage rate implied by our model across different loan-to-value ratios, prior to the implementation of the CARES Act forbearance policy in judicial states. The dashed line shows the implied mortgage rate after the implementation of 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 9).

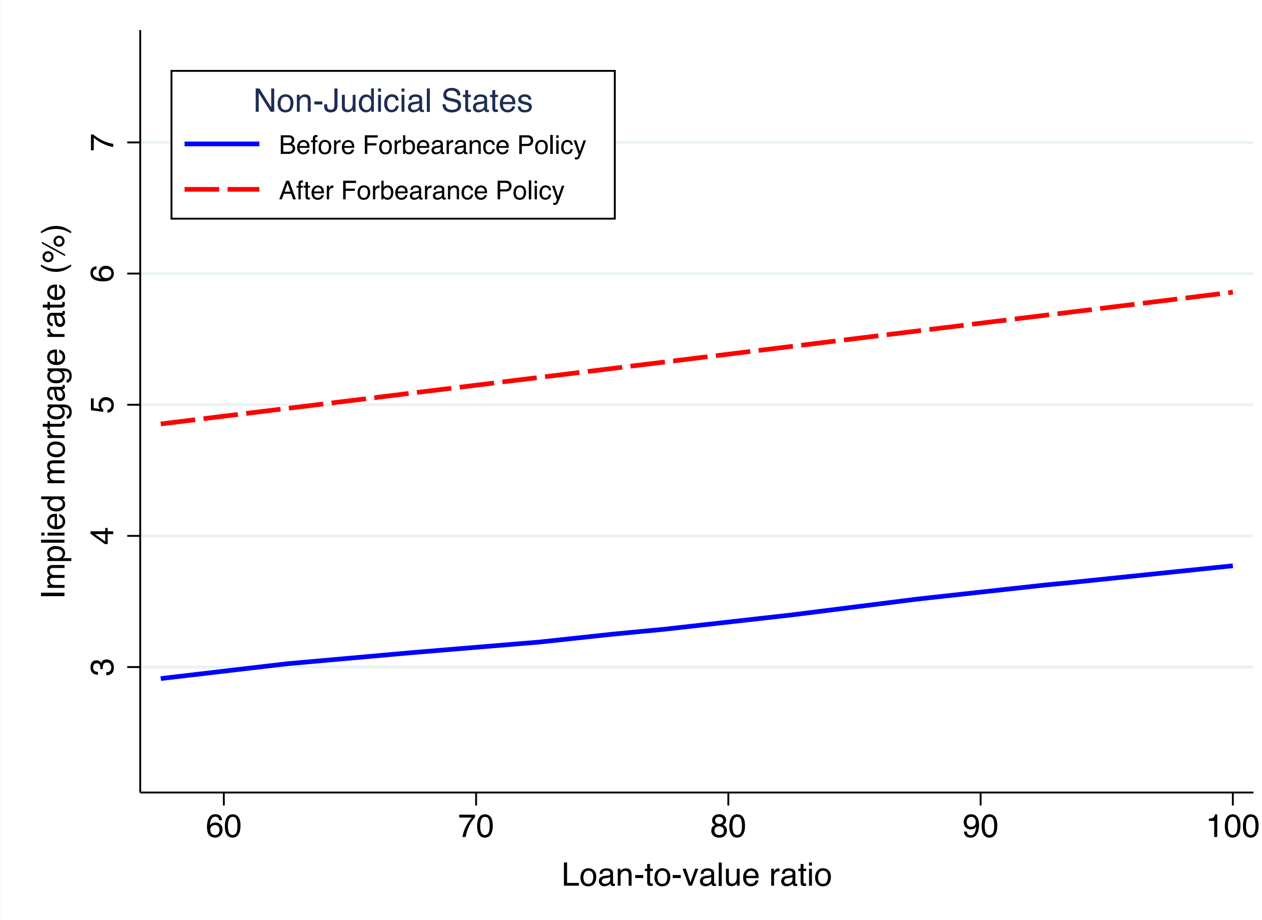


Figure 7. Credit Supply in Non-Judicial States. The solid line shows the mortgage rate implied by our model across different loan-to-value ratios, prior to the implementation of the CARES Act forbearance policy in non-judicial states. The dashed line shows the implied mortgage rate after the implementation 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 9).

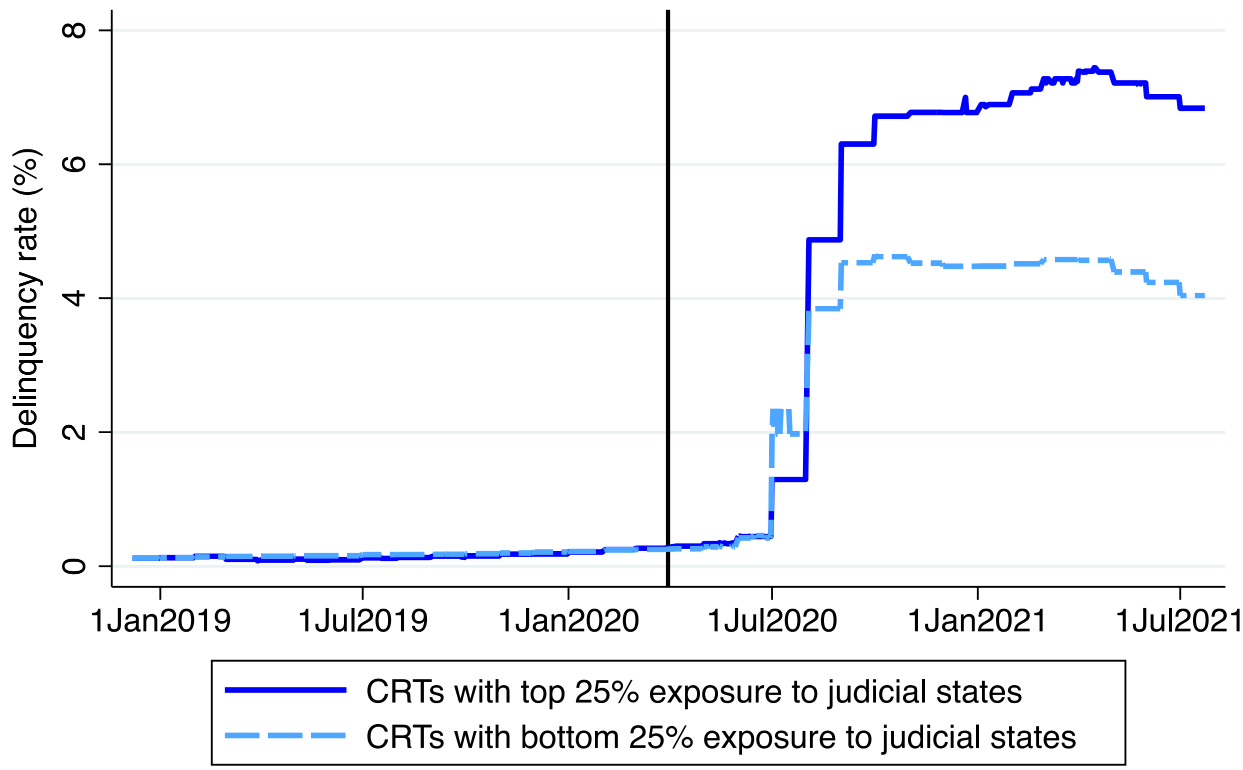


Figure 8. CRT Delinquencies by Exposure to Judicial States. The figure plots the 90-day delinquency rate within the mortgage pools of CRT securities with the top 25% and the bottom 25% geographical exposure to judicial states. These CRTs were issued between January 2017 and December 2019 by Fannie Mae 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.

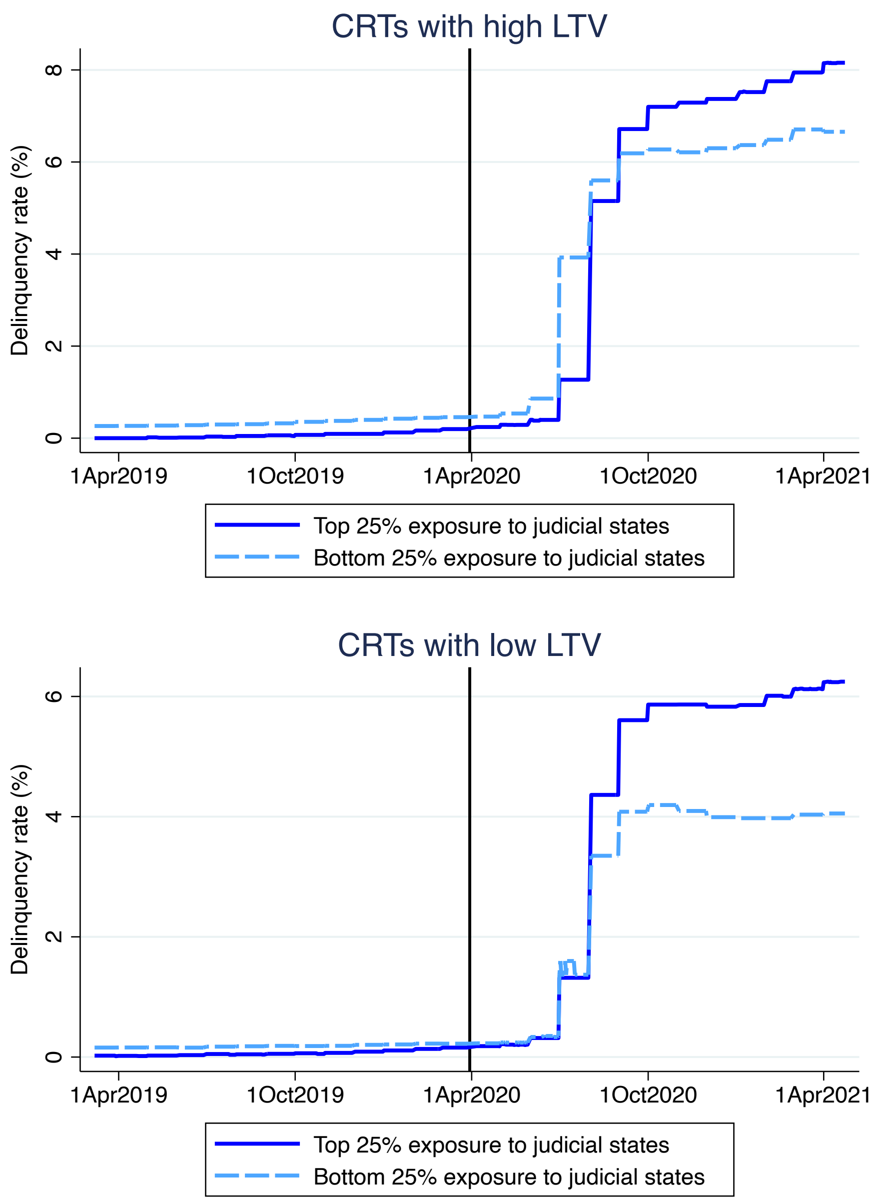


Figure 9. CRT Delinquencies by LTV Group and by Exposure to Judicial States. The figure plots the 90-day delinquency rate within the mortgage pools of CRT securities with the top 25% and the bottom 25% geographical exposure to judicial states. The top figure shows CRTs with reference mortgage pools of 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 (%)	2,138	9.501	9.000	2.055	62.18
Post CARES Indicator	2,138	0.486	0.500	0	1
Judicial Exposure (%)	2,138	35.04	3.621	25.82	41.19
Loan-to-Value Ratio	2,138	0.832	0.086	0.747	0.933
Debt-to-Income Ratio	2,138	0.367	0.014	0.336	0.389
FICO Credit Score	2,138	741.2	5.740	728.6	753.8
Risk Layer	2,138	0.477	0.258	0.085	0.944
Issuer (1 = Fannie)	2,138	0.419	0.494	0	1
10-Year Treasury Rate (%)	2,138	0.780	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 31, 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** (%)	15.36	9.843	3.149	62.18
Judicial Exposure (%)	35.04	3.621	25.82	41.19
Loan-to-Value Ratio	0.832	0.086	0.747	0.933
Debt-to-Income Ratio	0.367	0.014	0.336	0.389
FICO Credit Score	741.2	5.740	728.6	753.8
Risk Layer	0.477	0.258	0.085	0.944
CRTs with high LTV				
CRT Spread **Pre-CARES Act** (%)	3.856	1.688	2.055	8.603
CRT Spread **Post-CARES Act** (%)	15.92	9.932	8.427	59.46
Judicial Exposure (%)	37.61	2.065	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	4.657	731.0	747.5
Risk Layer	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** (%)	14.89	9.752	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	6.236	728.6	753.8
Risk Layer	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, the middle panel for CRT junior tranches that reference mortgage pools of high loan-to-value ratios (80.01% – 97%) and the bottom panel CRT junior tranches that reference mortgage pools of low loan-to-value ratios (60.01% – 80%).

Table 3. CARES Act Impact on CRT Spreads: 2-Week Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	12.893***	12.893***	11.265***	11.265***		
	(0.851)	(1.826)	(0.332)	(0.971)		
Exposure × Post-CARES	0.566***	0.566**	0.523***	0.523**	0.523***	0.523**
	(0.101)	(0.232)	(0.076)	(0.259)	(0.076)	(0.260)
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	1,200	1,200	1,200	1,200	1,200	1,200
Adj R Squared	0.608	0.608	0.710	0.710	0.708	0.708
Event Window	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks

This table reports the results from the estimation of Equation (1), 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 31, 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 4. CARES Act Impact On CRT Spreads: 30-Day Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	10.868***	10.868***	10.644***	10.644***		
	(0.568)	(1.596)	(0.226)	(0.910)		
Exposure × Post-CARES	0.451***	0.451**	0.478***	0.478*	0.478***	0.478*
	(0.067)	(0.187)	(0.048)	(0.252)	(0.048)	(0.253)
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	2,918	2,918	2,918	2,918	2,918	2,918
Adj R Squared	0.572	0.572	0.704	0.704	0.705	0.705
Event Window	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days

This table reports the results from the estimation of Equation (1), 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 31, 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; *p<0.10.

Table 5. CARES Act Impact On CRT Spreads: 60-Day Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	8.511***	8.511***	9.902***	9.902***		
	(0.360)	(1.376)	(0.167)	(0.816)		
Exposure × Post-CARES	0.397***	0.397***	0.502***	0.502**	0.501***	0.501**
	(0.042)	(0.149)	(0.033)	(0.207)	(0.033)	(0.208)
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	6,016	6,016	6,016	6,016	6,016	6,016
Adj R Squared	0.645	0.645	0.701	0.701	0.702	0.702
Event Window	60 Days	60 Days	60 Days	60 Days	60 Days	60 Days

This table reports the results from the estimation of Equation (1), 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 31, 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: 90-Day Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	6.724***	6.724***	8.988***	8.988***		
	(0.300)	(1.296)	(0.151)	(0.800)		
Exposure × Post-CARES	0.291***	0.291**	0.407***	0.407**	0.413***	0.413**
	(0.034)	(0.125)	(0.028)	(0.192)	(0.027)	(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	9,180	9,180	9,180	9,180	9,180	9,180
Adj R Squared	0.609	0.609	0.658	0.658	0.679	0.679
Event Window	90 Days	90 Days	90 Days	90 Days	90 Days	90 Days

This table reports the results from the estimation of Equation (1), 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 31, 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. 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	-0.224***	-0.101***	-0.231***	0.017	-0.030**	0.038***	-0.047*	**11.265*** **
	(0.037)	(0.018)	(0.048)	(0.015)	(0.015)	(0.004)	(0.025)	**(0.971)**
Exposure × Post-Event	-0.005	-0.001	-0.009	-0.000	-0.000	0.003	-0.019*	**0.523** **
	(0.009)	(0.005)	(0.013)	(0.004)	(0.003)	(0.002)	(0.011)	**(0.259)**
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	738	778	1,071	1,146	1,375	1,575	**1,200**
Adj R Squared	0.996	0.998	0.995	0.999	0.998	0.999	0.977	**0.710**
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 (1), 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 the last dates of the month. Exposure to judicial states is calculated as in Table 3. 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; *p<0.10.

Table 8. 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	14.532***	12.151***		11.833***	11.230***	
	(1.610)	(0.499)		(1.077)	(0.337)	
Exposure × Post-CARES	0.433	0.671***	0.671***	0.376*	0.784***	0.784***
	(0.322)	(0.198)	(0.200)	(0.214)	(0.125)	(0.125)
Observations	544	544	544	1,325	1,325	1,325
Adj R Squared	0.627	0.726	0.721	0.576	0.717	0.715
CRTs with low LTV						
Post-CARES	10.054***	10.530***		9.202***	10.156***	
	(3.158)	(0.443)		(2.052)	(0.302)	
Exposure × Post-CARES	0.530***	0.674***	0.674***	0.436***	0.629***	0.629***
	(0.191)	(0.116)	(0.117)	(0.124)	(0.074)	(0.074)
Observations	656	656	656	1,593	1,593	1,593
Adj R Squared	0.588	0.695	0.691	0.572	0.695	0.693
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 (1), 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 3. Robust standard errors are in parentheses. ***p<0.01; *p<0.10.

Table 9. 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	9.552***	10.362***		7.418***	9.114***	
	(0.622)	(0.237)		(0.479)	(0.203)	
Exposure × Post-CARES	0.387***	0.993***	0.981***	0.179*	0.796***	0.794***
	(0.122)	(0.082)	(0.082)	(0.093)	(0.065)	(0.062)
Observations	2,731	2,731	2,731	4,179	4,179	4,179
Adj R Squared	0.669	0.713	0.712	0.649	0.674	0.703
CRTs with low LTV						
Post-CARES	7.915***	9.523***		7.076***	8.884***	
	(1.347)	(0.231)		(1.150)	(0.216)	
Exposure × Post-CARES	0.432***	0.719***	0.719***	0.387***	0.679***	0.687***
	(0.082)	(0.052)	(0.053)	(0.069)	(0.045)	(0.044)
Observations	3,285	3,285	3,285	5,001	5,001	5,001
Adj R Squared	0.638	0.702	0.699	0.598	0.658	0.670
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 (1), 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 3. Robust standard errors are in parentheses. ***p<0.01; *p<0.10.

Table 10. 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	23.3%	Deadweight loss in judicial states
δ_n	21.2%	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^w_j	1.242%	Lender's operating cost in judicial states
r^w_n	1.307%	Lender's operating cost in non-judicial states
Derived g-fees		
$r^g_{j,Pre}$	0.728%	G-fee pre-CARES Act in judicial states
$r^g_{n,Pre}$	0.663%	G-fee pre-CARES Act in non-judicial states
Targets		
$r^g_{j,Post}$	3.156%	G-fee post-CARES Act in judicial states
$r^g_{n,Post}$	1.334%	G-fee post-CARES Act in non-judicial states

This table lists the parameters used in Section 8.

Table 11. 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	0.728	3.021	
Non-judicial	3.470	0.663	3.021	
Post-CARES Act				
Judicial	6.139	3.397	13.736	$\times 4.5$
Non-judicial	5.415	2.608	11.700	$\times 3.9$

This table shows the results of the simulation using the model with the probability of defaults as inputs as described in Section 8 and the calibration from Table 10.

Table 12. Monthly Mortgage Outcomes

		Loans exactly 90-days delinquent as of:												
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Forbearance in 2020-2023	Loan count	257	304	362	590	2760	41130	26266	12349	8012	6671	5449	4627	108777
	Liquidation 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
	Liquidation + delinquent (%)	19.84	25.83	23.20	18.99	12.46	1.84	1.80	2.56	3.54	3.54	4.59	4.63	2.94
Not in Forbearance in 2020-2023	Loan count	248	305	270	224	186	241	196	183	191	215	190	224	2673
	Liquidation 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
	Liquidation + delinquent (%)	14.92	14.34	18.52	19.65	18.14	5.66	5.90	5.62	9.09	11.84	12.50	14.01	12.79

This table reports the outcomes of loans that were 90 days delinquent in each month of 2020, split into forbearance and "not in forbearance" groups. Each loan is followed until it leaves the data or until December 2023, whichever happens first. Recovery is defined as 6 months of current payments, measured at the start of the 6-month period, or loan prepayment, whichever happens first. Recovery represents the remainder of loans in the table to 100%. The last row in each group, "Liquidation + delinquent" is analogous to the Goodman and Zhu (2024) definition of liquidation, which includes loans that were 6 months delinquent at the end of their data sample. "Liquidation rate" uses the liquidation definition in the data. Loans that left the data because of repurchase or sale are reported on the third line, "Removal rate" and loans that were still delinquent as of December 2023 are reported in the fourth line.

APPENDIX

A1 Delinquency Experience

In addition to the spread response at the time of CARES introduction, we also analyze the 90-day delinquency change. The event date in this case is June 30, 2020, 90 days after the CARES Act was introduced.

Since the delinquency data is updated monthly and at the deal level, rather than the tranche level, this estimation is based on far fewer observations. As a result, we limit the number of variables and estimate a basic model, as follows:

$$\begin{aligned} DelinquencyRate_{i,t} = \beta_1 + \beta_2 postEvent_t + \beta_3 Exposure_i \times PostEvent_t + \\ \beta_4 Issuer_i + \beta_5 riskLayers_{i,t} + \beta_6 Exposure_i \end{aligned} \tag{5}$$

Table A5 reports the post event and the interaction coefficients as estimated on July 30, August 30, or September 30, relative to June 30, 2020. We report the results using continuous definition of judicial exposure as well as using an indicator variable that takes the value of one if exposure is above median and zero otherwise.

Delinquencies jump immediately after the event date, meaning many borrowers stopped making payments just a few days after the CARES Act. The July 30th interaction coefficient is not significant, but still positive and sizeable. After that, both the level and the interaction coefficients are highly significant.

Table A6 reports the estimation results from the same regression model, except with different, false, event dates. For instance, the first implementation, labeled "Mar 2020", captures the 90-day delinquencies reported during March, 2020, meaning between end of February and end of March.

The delinquency rates increased substantially relative to the previous month in July, August, and September, especially in judicial states. June also shows a statistically significant increase, but the coefficient is small, one-tenth of the coefficient for July.

The R-squared statistic also presents an interesting pattern - the deal characteristics and judicial exposure explain only about 30% of the delinquency variation prior to July, 2020. After that, it explains 95% of the variation. This indicates delinquencies prior to July were mostly random, while delinquencies after that were closely tied to the deal characteristics and judicial exposure.

The above results show that the CARES Act had a significant impact not only on the immediate CRT spreads, but also on the subsequent delinquencies. Therefore, the CRT investors did not simply over-react to the CARES Act. Instead, they correctly predicted the increase in delinquencies, and that this increase would be bigger in judicial states. If any over-reaction occurred, it may have been in the magnitude of the delinquency increase. However, even this conclusion is debatable because the eventual delinquencies were influenced by the strong increase in home prices and the reversal of the economic slowdown. CRT investors would have had no way to predict these positive influences on March 27 when the CARES Act was introduced. Therefore, we see no evidence of investor over-reaction.

Figures for the Appendix

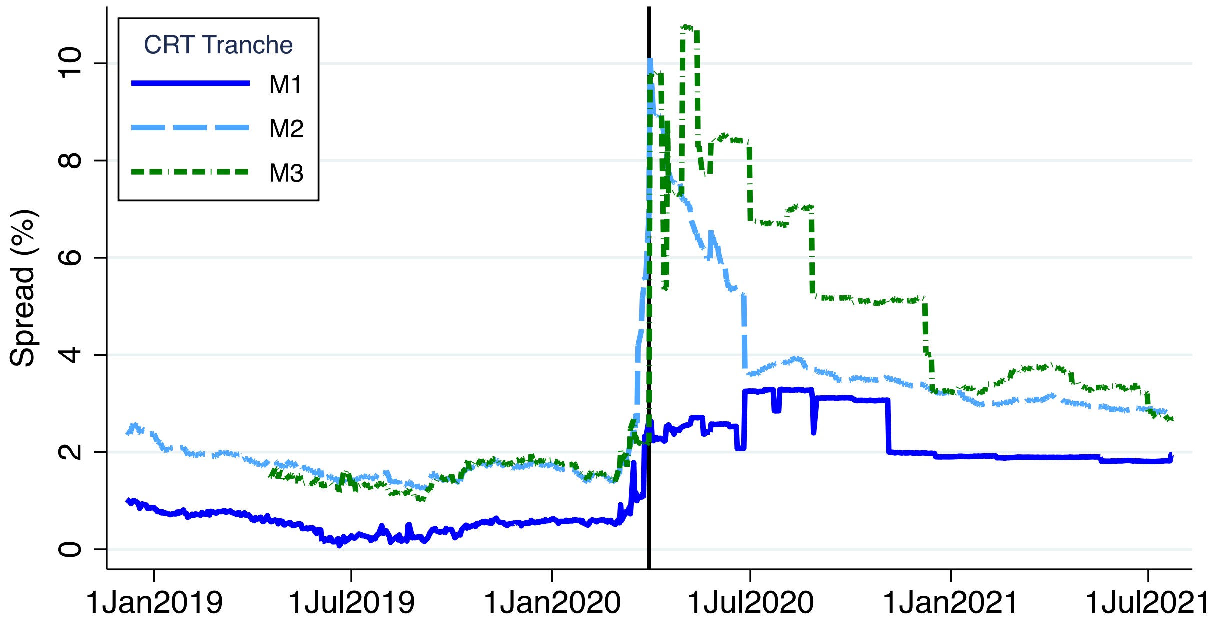


Figure A1. CRT Spreads and the CARES Act: Mezzanine Tranches. The figure plots the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of mezzanine tranches of CRT securities. M1 is the upper mezzanine, M2 the middle mezzanine and M3 the lower mezzanine tranche. 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.

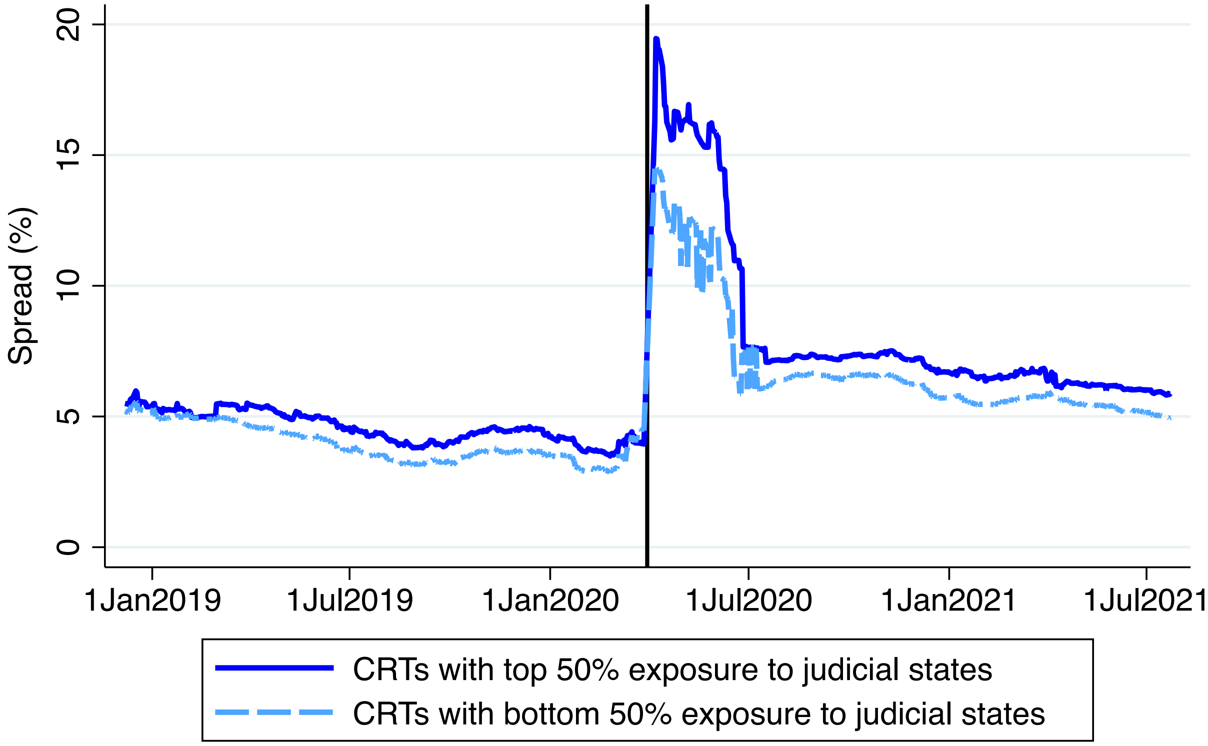


Figure A2. CRT Spreads by Exposure to Judicial States. The figure plots the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities, with mortgage pools that have the top 50% and the bottom 50% geographical exposure to judicial 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.

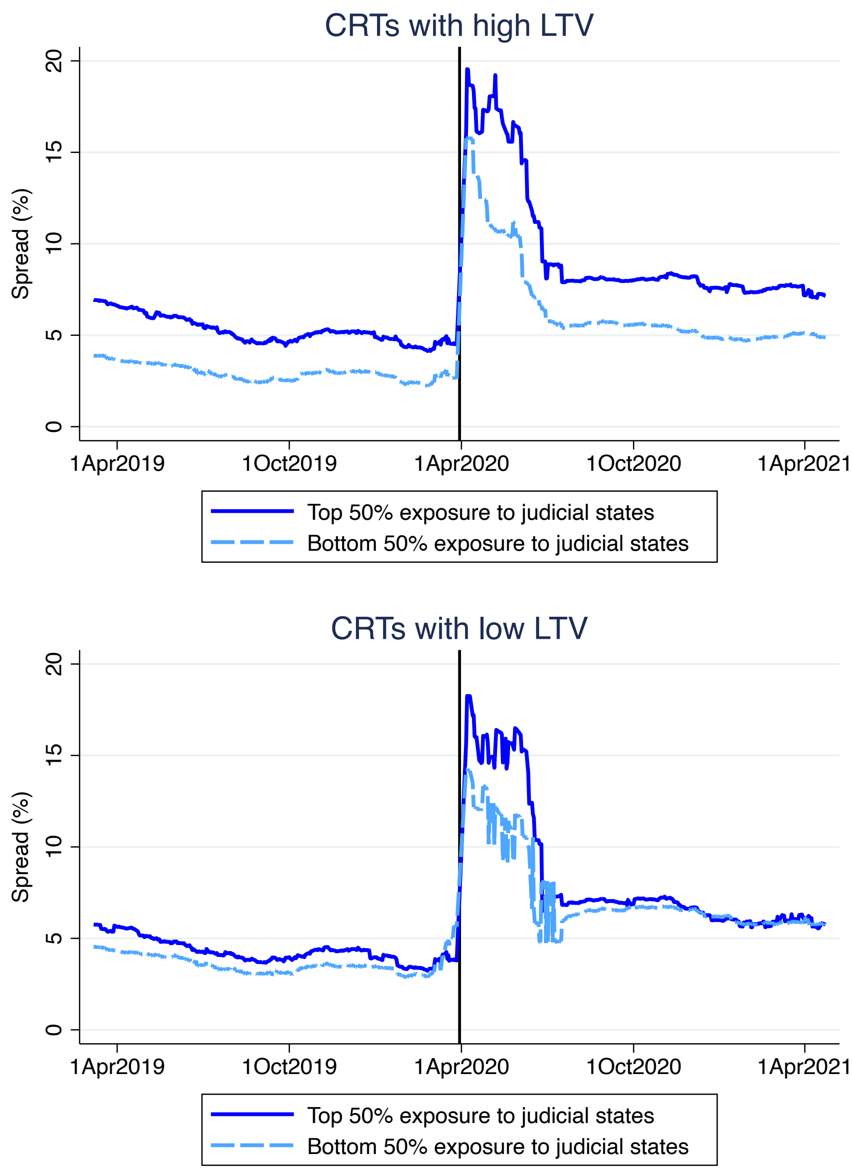
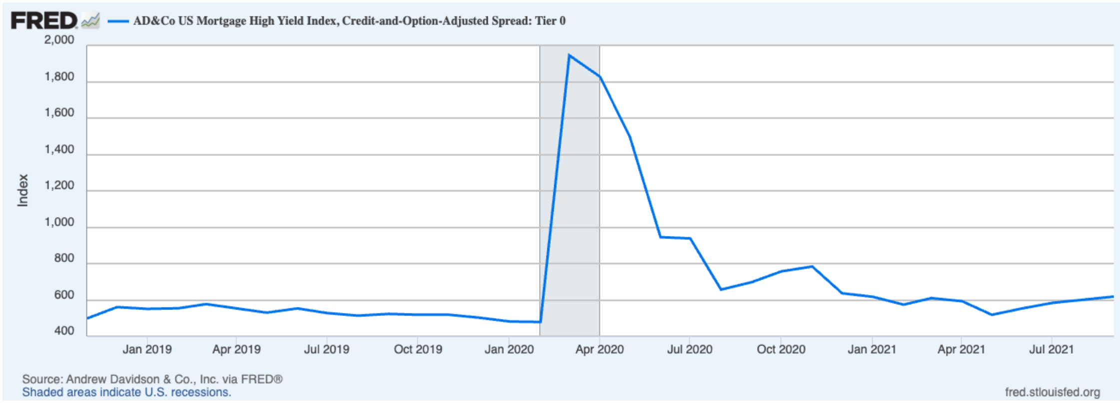


Figure A3. CRT Daily Spreads by LTV Group and by Exposure to Judicial States. The figures plot the average daily spread (yield to maturity minus one-month US Dollar Libor) in the secondary market of junior tranches of CRT securities, with mortgage pools that have the top 50% and the bottom 50% geographical 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.



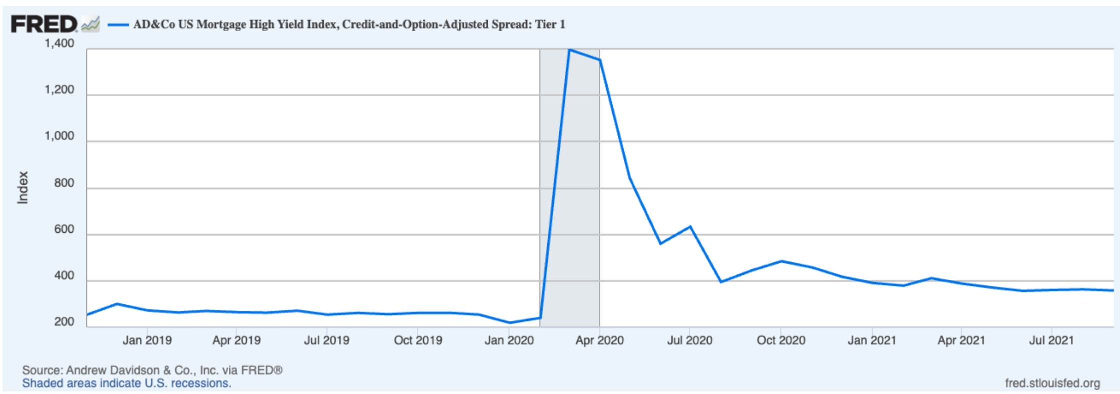


Figure A4. CRT Spreads. These figures plot the AD&Co US Mortgage High Yield Index crOAS, credit-and-option-adjusted spread. The indices include the cash CRT bonds CAS from Fannie Mae and STACR from Freddie Mac offered to the public, whether they are exchangeable or not, that have or have had IDC prices. 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.

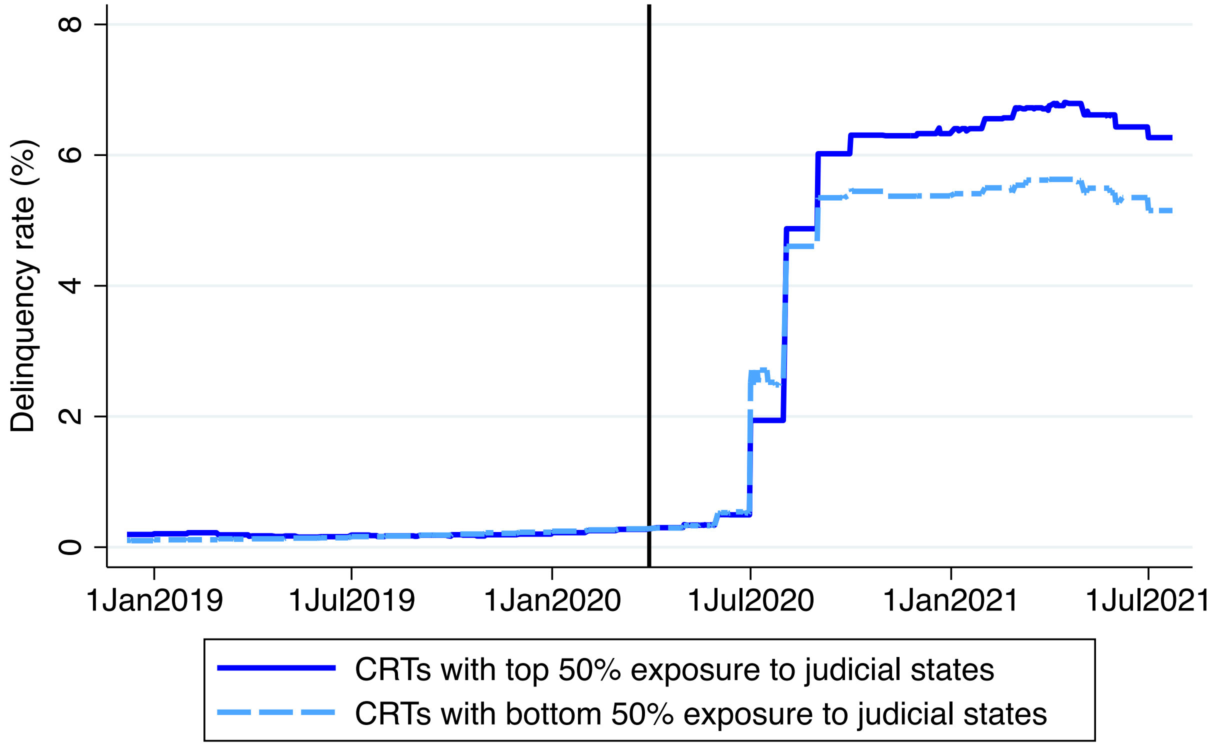
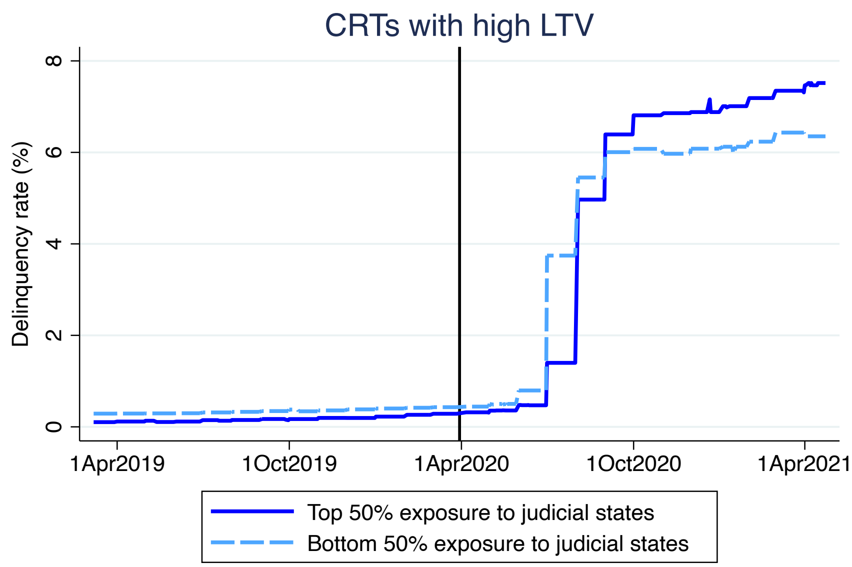


Figure A5. CRT Delinquencies by Exposure to Judicial States. The figure plots the 90-day delinquency rate within the mortgage pools of CRT securities with the top 50% and the bottom 50% geographical exposure to judicial states. These CRTs were issued between January 2017 and December 2019 by Fannie Mae 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.



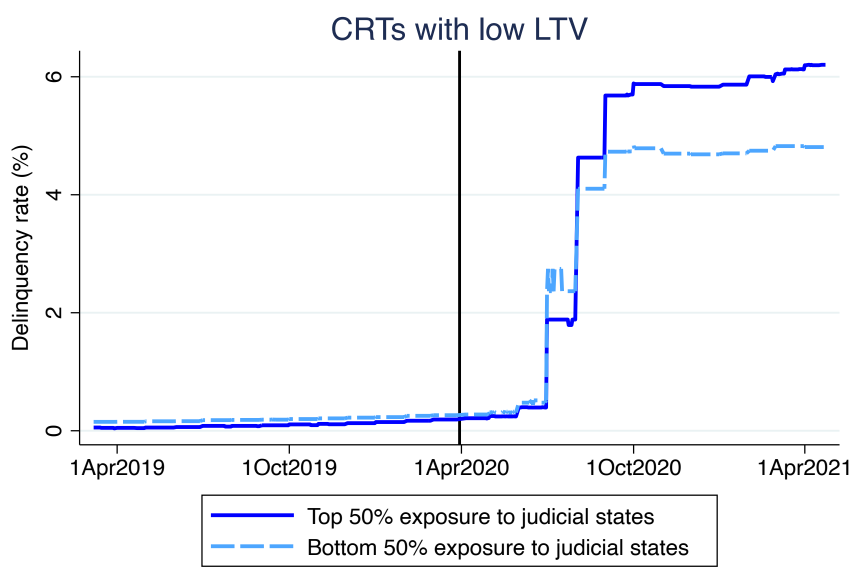


Figure A6. CRT Delinquencies by LTV Group and by Exposure to Judicial States. The figure plots the 90-day delinquency rate within the mortgage pools of CRT securities with the top 50% and the bottom 50% geographical exposure to judicial states. The top figure shows CRTs with reference mortgage pools 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 Layer
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	-0.286***	-0.120***	-0.297***	0.118***	-0.067***	-0.021**	-0.150***	**10.644*** **
	(0.039)	(0.027)	(0.051)	(0.026)	(0.021)	(0.010)	(0.030)	**(0.910)**
Exposure × Post-Event	-0.002	0.001	-0.003	-0.008	-0.007	0.002	-0.019	**0.478* **
	(0.010)	(0.008)	(0.013)	(0.005)	(0.006)	(0.004)	(0.013)	**(0.252)**
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	1,514	1,659	2,169	2,383	2,953	3,204	**2,918**
Adj R Squared	0.997	0.994	0.994	0.996	0.995	0.994	0.970	**0.704**
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 (1), 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 the last dates of the month. Exposure to judicial states is calculated as in Table 4. The last column, Model (9), 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	10.027***	10.027***	9.210***	9.210***		
	(0.982)	(2.346)	(0.427)	(0.719)		
High Exposure × Post-CARES	4.727***	4.727***	3.951***	3.951**	3.951***	3.951**
	(0.678)	(1.730)	(0.519)	(1.793)	(0.521)	(1.803)
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	1,200	1,200	1,200	1,200	1,200	1,200
Adj R Squared	0.620	0.620	0.712	0.712	0.711	0.711
Event Window	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks	2 Weeks

This table replicates Tables 3 through 6 except that the judicial exposure is measured as an indicator variable that takes the value of one if exposure is above the median and zero otherwise.

Table A4. Alternative Exposure Definition: 30-Day Window

	Dependent Variable: CRT Spread					
	(1)	(2)	(3)	(4)	(5)	(6)
Post-CARES	8.764***	8.764***	8.953***	8.953***		
	(0.658)	(2.316)	(0.284)	(0.502)		
High Exposure × Post-CARES	3.535***	3.535**	3.249***	3.249*	3.250***	3.250*
	(0.450)	(1.623)	(0.332)	(1.728)	(0.331)	(1.739)
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	2,918	2,918	2,918	2,918	2,918	2,918
Adj R Squared	0.578	0.578	0.704	0.704	0.705	0.705
Event Window	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days

This table replicates Table 4 except that the judicial exposure is measured as an indicator variable that takes the value of one if exposure is above the median and zero otherwise.

Table A5. Probability of 90 Days Delinquency at Different Points in Time

	Dependent Variable: 90-day Delinquency Rate		
Days After June 30	30	60	90
Post-Event	0.0391***	0.0536***	0.0586***
	(0.0023)	(0.0025)	(0.0026)
Exposure $\times$ Post-Event	0.0717	0.1888***	0.2566***
	(0.0567)	(0.0608)	(0.0663)
Observations	38	38	38
Adj R Squared	0.957	0.970	0.974
CRT Characteristics	Yes	Yes	Yes
CRT Fixed Effects	No	No	No
Clustered Errors	No	No	No

Equation (5) estimation results. We compare the 90-day delinquency rate measured 30, 60, or 90 days past June 30 to the delinquency rate as of June 30, 2020. For instance, the first regression compares the 90-day delinquency rate on July 31st to that on June 30th. June 30th is 90 days past the introduction of the CARES Act and the first 90-day delinquencies in response to the CARES Act would be reported between June 30 and July 31. We report the results from using continuous judicial exposure.

Table A6. Delinquency Time Pattern

	Dependent Variable: 90-day Delinquency Rate										
	Pre-CARES Delinquencies			Post-CARES Delinquencies							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Event Month	Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021
Post-CARES	0.0002	0.0003	0.0008	0.0036***	0.0391***	0.0145***	0.0050***	0.0001	-0.0006	0.0025	0.0011
	(0.0006)	(0.0005)	(0.0005)	(0.0006)	(0.0023)	(0.0018)	(0.0016)	(0.0016)	(0.0016)	(0.0018)	(0.0019)
Exposure × Post-CARES	0.0024	0.0077	0.0036	0.0013	0.0717	0.1172**	0.0678**	0.0172	0.0284	0.0397	0.0292
	(0.0138)	(0.0132)	(0.0134)	(0.0138)	(0.0567)	(0.0469)	(0.0318)	(0.0299)	(0.0299)	(0.0342)	(0.0378)
Observations	38	38	38	38	38	38	38	38	38	38	38
Adj R Squared	0.315	0.276	0.312	0.698	0.957	0.974	0.940	0.912	0.904	0.896	0.894
CRT Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CRT Fixed Effects	No	No	No	No	No	No	No	No	No	No	No
Clustered Errors	No	No	No	No	No	No	No	No	No	No	No
Event Window	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days	30 Days

This table repeats the estimation presented in Table A5 with a continuous definition of exposure for alternative (false) event dates. For instance, the first implementation, labeled "Mar 2020", compares the delinquency rates at the end of March to those at the end of February. In other words, the first model captures the delinquencies that occurred during March, 2020.