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Pretend or Amend? On Evergreening in CRE*

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Abstract

Loan modifications can either amplify or mitigate credit losses depending on the strategy lenders employ. Using detailed supervisory data and a model incorporating various frictions that could encourage modifications (liquidity constraints, foreclosure costs, and loss recognition costs), I assess why banks extend CRE loans. I find that extensions predominantly address temporary payment frictions, both in normal times and following the Spring 2023 bank stress episode. Contrary to concerns about banks "extending-and-pretending" following that episode, banks increased income and principal paydown requirements for extensions, contributing to strong ex-post performance for extended loans.

Keywords: commercial real estate, banks, evergreening

JEL Classification: E44, G21, R33

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1. INTRODUCTION

In many models of financial intermediation, the defining feature of bank credit is greater flexibility to renegotiate loan terms (see, for example, Rajan, 1992 and Hackbarth et al., 2007). Loan modifications can reduce banks' credit losses by replacing more costly resolution methods (Bolton and Scharfstein, 1996).[1] However, this flexibility can be a double-edged sword; bank actions to hide impairment can produce credit misallocation (Peek and Rosengren, 2005; Caballero et al., 2008), financial stability risks (Bruche and Llobet, 2014), and economic sclerosis (Acharya et al., 2021).

Deciphering why banks modify CRE loans has become particularly important in recent years, as CRE market strains have created a need for loss-mitigating modifications at the same time that banking sector strains potentially motivated loss-obscuring ones. While communications from regulators have emphasized the benefits of working proactively with stressed borrowers (Federal Reserve System et al., 2023), others have noted the risk of extend-and-pretend behavior that could harm banks down the road (Jiang et al., 2025; Crosignani and Prazad, 2024).

In this paper, I investigate whether extension practices are more consistent with banks restructuring loans to have favorable future repayment prospects or merely extending them to delay loss recognition. I begin by presenting a model of maturity extensions that incorporates various motivations banks might have for providing extensions. In the model, banks may extend loans to delay loss recognition (Crosignani and Prazad, 2024), avoid deadweight insolvency costs (Faria-e Castro et al., 2024), or give borrowers more time to find a suitable buyer (Sagi, 2021). In deciding the extension terms to offer, banks weigh these benefits against debt overhang costs from undercapitalized borrowers failing to maintain the property (Myers, 1977).

The model demonstrates that lenders' motivation for providing extensions can be inferred by the relationship between a loan's debt yield—net operating income (NOI) as a share of the loan

[1] This ability to mitigate losses by renegotiating loan terms can, in turn, account for the selection of smaller (Hackbarth et al., 2007), riskier (Black et al., 2020), or more liquidity constrained (Glancy et al., 2025) borrowers into banks.

balance—and the principal paydown required for an extension. Lenders looking to delay loss recognition need to provide subsidized terms to highly stressed borrowers to motivate those borrowers to extend rather than default. Borrowers with weak incomes therefore receive *forbearance* from required payments. In contrast, borrowers' participation constraints are not binding for extensions that remedy frictions in selling or refinancing a financially viable property. Those extension terms are determined by lenders' desired credit enhancements rather than borrowers' willingness to extend, meaning that weak income loans require *larger paydowns* to mitigate repayment risks. In short, risky extensions to avoid default costs entail subsidized terms and low debt yields, while safer extensions to remedy temporary strains entail either stringent terms or high debt yields.

I use detailed supervisory data on bank CRE loan holdings to test which motivation for extending loans can best explain observed extension patterns. I find that extension patterns in normal times (before the pandemic) are consistent with banks addressing temporary payment strains. Namely, the probability of principal repayment declines monotonically in debt yield, meaning the lowest income borrowers are most likely to repay principal. Moreover, banks provide maturity extensions throughout the debt yield distribution, not just income-strained loans. Both of these observations are consistent with liquidity-driven extensions in the model.

The primary empirical work analyzes how extension patterns changed after the 2023 bank stress episode relative to normal times. If banking sector strains caused banks to extend-and-pretend, we would expect to see (i) an increase in extensions, driven by highly strained borrowers, (ii) easier extension terms for those strained borrowers, and (iii) a lower share of extended loans eventually paying off.

I find that none of these three predictions hold in the data, suggesting that large banks continued to efficiently manage CRE risks following the stress episode. First, I examine outcomes of pending maturities to test whether extensions either became more common or shifted towards riskier loans following the 2023 bank stress episode. Between 2023 and 2025, banks extended a large share of loans (roughly half) as they matured. However, this behavior was not unusual; banks extended a similar share of loans before COVID, and even more at the onset of the pandemic. Thus loan extensions are not merely a response to the stress, but a persistent feature of bank loan servicing.

Regarding differences by risk, banks *reduced* extensions for low-debt-yield loans after 2022, the opposite of what the model predicts would have occurred if banking sector pressures encouraged banks to delay loss recognition. Banks similarly reduced extensions for nonrecourse loans, further supporting the idea that extension policies became more conservative in the face of CRE market strains.

Second, I test whether banks eased extension terms after 2022. As the model demonstrates, extensions that delay loss recognition entail lenient terms to the lowest quality borrowers because more dramatic accommodation is needed to prevent default. Instead, I find that riskier firms paid for extensions by providing credit enhancements that improve banks' future return prospects. Borrowers were more likely to pay down principal, provide additional guarantees, or accept higher loan spreads for extensions after 2022. Moreover, this tightening in terms was most pronounced for loans with other risk characteristics such as low debt yields, office collateral, or nonrecourse clauses.

Third, I examine whether performance deteriorated for extended loans. While the first set of results demonstrates that the quality of extensions rose on observed margins, it is still possible that banks extended loans with unobserved factors that make repayment unlikely.[2] Instead, I find that stress-era extensions performed slightly better than prepandemic ones, consistent with extensions going to higher-quality properties and having enhancements that bolster future repayment.[3]

While aggregate patterns are inconsistent with lenient extension policies driving pandemic-era extensions, this does not rule out such behavior for some lenders. For the final piece of analysis,

[2]For example, a loan against an empty office could have a high debt yield until leases expire and tenants can cease paying rent (Glancy and Wang, 2023). Borrowers might be willing to pay down the principal to extend the loan and keep collecting those cash flows even if pending vacancies leave little hope for the loan paying off.

[3]To be more precise, the performance of extended loans improved relative to the broader universe of maturing loans. CRE market stresses after 2022 caused performance to deteriorate for extended and non-extended loans alike.

I follow Crosignani and Prazad (2024) and examine differences in extension patterns by bank capitalization. I show that banks with low capital ratios behave similarly to the broader sample. If anything, worse-capitalized banks reduced extensions relative to better-capitalized banks after 2022 while tightening extension terms to a similar extent. However, estimates are noisy due to the limited number of banks in the sample.

1.1. Related literature

This paper contributes to three strands of literature. First, it contributes to work on risks posed to the banking sector by CRE market strains. Though it is well understood that changes in interest rates and remote work tendencies generated severe CRE valuation declines (Gupta et al., 2026), the extent of banks' exposure to CRE losses is up for debate. Jiang et al. (2025) find that potential CRE losses place many small banks at risk of solvency runs. However, realized bank delinquencies are lower than one might expect given the extent of valuation declines (Hinzen et al., 2025), raising the question of why bank CRE loan performance hasn't deteriorated more. Jiang et al. (2025); Crosignani and Prazad (2024) provide evidence that extend-and-pretend behavior contributes to banks' relatively modest delinquency rates in the face of these strains. However, Glancy and Kurtzman (2024) find that much of small and regional banks' strong performance can be attributed to portfolio composition—most notably, their minimal holdings of high-risk office loans—leaving less room for extend-and-pretend behavior to explain delinquency patterns.

This paper relates most closely to Crosignani and Prazad (2024), which also uses supervisory data on large banks' CRE loan holdings to analyze extend-and-pretend behavior following the pandemic. They show that worse-capitalized banks were more likely to extend loans that suffered income declines. There are two key differences in this study. First, I focus predominantly on the behavior of the sample as a whole rather than differences across banks. This approach allows me to avoid two difficulties with using cross-lender variation: limited statistical power due to the small number of Y-14 reporters, and complications identifying aggregate effects due to the missing intercept problem. Though Crosignani and Prazad (2024) provide evidence that capital considerations induced some banks to extend loans on the margin—in turn crowding out new lending—my results indicate that extend-and-pretend behavior was small in aggregate. Second, I incorporate information on the terms and ex-post performance of extended loans, which I theoretically demonstrate are informative as to banks' underlying motivation for extending loans.

Second, this paper relates to a broader literature on evergreening/zombie lending. This work demonstrates that weakly capitalized banks extend credit to underperforming firms to avoid writing off existing loans (Peek and Rosengren, 2005; Caballero et al., 2008) and the resulting distortion in credit allocation has negative macroeconomic consequences (Acharya et al., 2021, 2022). Zombie firms are typically defined by having some combination of income strains and subsidized credit (Adalet McGowan et al., 2018; Acharya et al., 2019). This notion aligns well with extend-and-pretend modifications in the model, which are characterized by low debt yields and lenient principal repayment requirements. My findings complement Favara et al. (2024), which uses similar data on commercial and industrial lending to show that large U.S. banks do not engage in zombie lending regardless of capitalization. A couple of factors might contribute to the apparent lack of zombie lending in this setting. First, the banks in the sample are generally well-capitalized, and thus lack the severe stresses and potential gambling for resurrection incentives that were in place in episodes typically associated with zombie lending (i.e., the Japanese financial crisis and European sovereign debt crisis). Second, the banks we study are subject to stress tests which should dampen extend-and-pretend incentives since projected losses from stressed extensions would add to banks' capital requirements.[4]

Finally, this paper contributes to work analyzing the servicing of distressed CRE loans. Brown et al. (2006) shows that sales of foreclosed CRE properties occur at substantial discounts relative to fundamental values, motivating lenders to renegotiate loans. Black et al. (2017, 2020) document that banks have an advantage in renegotiating CRE loans (relative to CMBS), and Glancy et al. (2025) provide evidence that such modifications supported loan performance at the onset of the

[4]Delaying loss recognition by rolling over risky loans could preserve capital by avoiding losses. However, the expected losses from these risky loans in a severe recession would result in a higher stress capital buffer, counteracting the ability of extensions to preserve capital buffers.

pandemic.[5] This work generally assumes that lenders set modification policies to maximize loan recoveries, but does not touch on distinguishing this motivation from extend-and-pretend considerations.

The rest of the paper proceeds as follows: Section 2 presents a model of loan extensions, and derives equilibrium extension terms and maturity outcomes. Section 3 describes the data and methodology. Section 4 presents the empirical findings. Section 5 concludes.

2. MODEL

2.1. Setup

To aid in the interpretation of observed loan extension patterns, I develop a dynamic model of CRE maturity outcomes where borrowers and lenders negotiate extensions to navigate various market frictions. All parties are risk neutral and have a discount factor of $\beta = (1+r)^{-1}$. The timing of the model is as follows: At the end of a period, a nonrecourse loan with an outstanding balance D against a property with NOI N is scheduled to mature. The lender makes an offer to extend the loan for another period, choosing a principal paydown of $p \cdot D$ as a condition of the extension. A value of $p = 1$ signifies that the lender rejects an extension, demanding full repayment, while $p < 0$ signifies interest payments getting partially capitalized into the loan balance.

Next, the borrower solicits bids on the property and receives an offer to purchase the property at a cap rate (NOI over property value) of κ.[6] Borrowers can therefore sell the property for N/κ, and use the proceeds to pay back the loan and accumulated interest $(1+r_m)D$, where r_m is the mortgage rate. Rent is paid after sales occur, and thus current rents are incorporated into property values, making $\underline{\kappa} \equiv (r-g)/(1+r)$ the cap rate that equates sale price to the present discounted value of cash flows, where g is per period expected income growth.

[5] Relatedly, Flynn et al. (2024); Dinc and Yönder (2022) analyze strategic renegotiation on the part of borrowers.

[6] Drawing a cap rate of κ is identical to pulling a value multiple of $1/\kappa$. I express values in terms of cap rates because it complements the focus on debt yields as the measure of loan risk; debt yield can be interpreted as the cap rate below which a borrower could sell a property to pay off a loan's principal. Namely, $\kappa \equiv N/V < N/D \implies V > D$, where V is the sale price and N/D the debt yield.

If the borrower rejects the sale offer, they can then either default, and forfeit the property, or accept the extension. If they extend the loan, they collect the income flow N, make the required principal and interest payments $(r_m + p)D$, and repeat the game next period with $D' = (1 - p)D$ and a new N' which depends on exogenous, stochastic growth (with mean g and standard deviation σ) and an endogenous maintenance decision. The possibility of lower drift due to debt-overhang-induced underinvestment is discussed in the next section.

2.2. Payoffs

I incorporate frictions into the model to account for the various motivations parties might have to extend loans at maturity.

1. **Search frictions**: κ is stochastic, creating the risk that borrowers receive a weak offer when their loan comes due. Extensions deal with this liquidity risk by giving borrowers time to shop for a better offer. I assume κ follows a Pareto distribution: $G(\kappa|\kappa \geq \underline{\kappa}) = 1 - (\underline{\kappa}/\kappa)^{\alpha}$, where α parameterizes market liquidity. The expected purchase offer is $\mathbb{E}(N/\kappa) = [\alpha/(1+\alpha)]N/\underline{\kappa}$, meaning an expected proportional discount of $1/(1+\alpha)$ if forced to sell in a particular period.[7]

2. **Liquidity Constraints**: Borrowers can only raise outside funds $f \cdot D$ to meet interest shortfalls and principal repayments, necessitating a property sale or extension to avoid maturity default. Extensions such that $p + r_m - N/D > f$ are infeasible, and cause default if borrowers cannot sell and pay off the loan.

3. **Foreclosure costs**: Expected recovery in foreclosure is $\Lambda N/\underline{\kappa}$, where $\Lambda \leq 1$. Foreclosure costs create a discontinuous drop in lender payouts at the default threshold. Consequently, extensions may reduce expected losses by giving the loan an opportunity to recover.[8]

[7] While I discuss this process in terms of search for a buyer, this mechanism could also capture search for a refinance, with κ reflecting whether a new loan offer is sufficient to refinance the outstanding loan.

[8] More formally, the discontinuous drop in loan values at the default threshold (absent an extension) causes loan values to be convex in N. Lenders are willing to extend loans since increases in N raise loan values more than declines reduce it.

4. **Delayed Loss Recognition**: Lenders may face a cost to realizing losses in a given period (e.g., due to equity issuance costs or lost opportunities from binding capital constraints). I incorporate this as an additional cost of $\chi(D - \Lambda N/\underline{\kappa})$ that lenders face if borrowers default.

The final element that I include in the model is debt overhang problems in the form of deferred maintenance. While the aforementioned elements generate benefits to extensions, endogenizing maintenance introduces a countervailing cost to them. Borrowers are able to receive an additional cash flow νN by neglecting maintenance, but this action reduces N' by a factor θ, permanently lowering cash flows. ν and θ are such that the return to proper maintenance is high. However, borrowers that expect to default in the near future will not prioritize future cash flows and try to extract as much as they can prior to default. This mechanism imposes a cost to lenders of providing extensions against stressed properties.

Since returns are homogeneous of degree one in D and N, I normalize payouts by D and express all payouts in terms of the debt yield $n \equiv N/D$.[9] The payouts are as follows:

Table 1: Payouts

<u>Outcome</u>	<u>Borrowers</u> $V_b(n; p, \kappa)$	<u>Lenders</u> $V_l(n; p)$
Sell	$n/\kappa - (1 + r_m)$	$1 + r_m$
Extend & Maintain	$n - (r_m + p) + \beta(1-p)\,\mathbb{E}[V_b(n')]$	$r_m + p + \beta(1-p)\,\mathbb{E}[V_l(n')]$
Extend & Neglect	$(1+\nu)n - (r_m + p) + \beta(1-p)\,\mathbb{E}[V_b(n')]$	$r_m + p + \beta(1-p)\,\mathbb{E}[V_l(n')]$
Default	0	$\Lambda n/\underline{\kappa}$

where $\mathbb{E}[V_i(n')] = \int_0^\infty V_i(Z\mu n)dF(Z) \equiv \mathscr{V}_i(\mu n)$ gives expected future values as a function of expected future debt yield for $i \in \{b, l\}$; $\mu n = n(1+g)(1 - \theta \mathbb{1}[\text{Neglect}])/(1-p)$ gives the expected future debt yield, which depends on income drift, principal paydowns and maintenance decisions; and F is a lognormal CDF representing proportional deviations from expected NOI.

Note that lenders' value functions omit the potential cost to loss recognition: $\chi(1 - \Lambda n/\underline{\kappa})$. I exclude that term so that the payouts are consistent with the functions determining the continuation

[9] Note that a value function normalized to D is $V(N/D) = \tilde{V}(D, N)/D$, where $\tilde{V}$ is the pre-normalization value function. This means that paydowns have the effect of creating a normalized continuation value $\tilde{V}(D', N')/D = (D'/D)V(N'/D') = (1-p)V(n')$.

values from extensions. The cost to loss recognition is incorporated as a one-time cost that does not affect continuation values (if loss recognition is costly in the future, there is little benefit to delaying it).

2.3. *Strategies and equilibrium*

I solve for a Markov perfect equilibrium where borrowers optimally select an action $a^*(n,p,\kappa) \in \{\text{Extend} \times \{\text{Neglect}, \text{Maintain}\}, \text{Default}, \text{Sale}\}$ subject to their liquidity constraint $p + r_m - n \leq f$, lenders optimally set paydown requirements $p^*(n)$, and value functions satisfy the Bellman equations:

$$
\begin{aligned}
V_b(n) = \mathbb{E}_\kappa \Bigg[\max \Bigg\{ & \underbrace{0}_{\text{Default}},\ \underbrace{\frac{n}{\kappa} - (1+r_m)}_{\text{Sell}},\ \underbrace{n - (r_m + p^*(n)) + \beta(1-p^*(n))\mathscr{V}_b\left(\frac{1+g}{1-p^*(n)} n\right)}_{\text{Extend-Maintain}} \\
& \underbrace{(1+\nu)n - (r_m + p^*(n)) + \beta(1-p^*(n))\mathscr{V}_b\left(\frac{(1+g)(1-\theta)}{1-p^*(n)} n\right)}_{\text{Extend-Neglect}} \Bigg\} \Bigg] \\
V_l(n) = \max_p \{ & \pi_{\text{sale}}(n,p)(1+r_m) + \pi_{\text{def}}(n,p)\Lambda n / \underline{\kappa} \\
& + \pi_{\text{ext}}(n,p)\Big(r_m + p + \beta(1-p)\mathscr{V}_l\big(\mu^*(n,p)n\big)\Big) \Big\}
\end{aligned}
\tag{1}
$$

where $\pi_{\text{sale}}(n,p)$, $\pi_{\text{def}}(n,p)$, and $\pi_{\text{ext}}(n,p)$ are payoff, default and extension probabilities, respectively, and $\mu^*(n,p)n$ is the expected future debt yield conditional on extending. These outcomes are determined by borrower's strategy $a^*(n,p,\kappa)$. The probabilities are stochastic from lenders' perspective because they do not observe κ (see Appendix B.1 for their derivation). $\mu^*(n,p)$ is not stochastic because maintenance decisions do not depend on κ.

The algorithm to solve for the policy functions is outlined in Appendix B.2. Briefly put, the model is solved by guessing the value functions ($\mathscr{V}_b$ and $\mathscr{V}_l$), and then (i) solving for borrowers' optimal action as a function of n, p and κ based on the guess for $\mathscr{V}_b$, (ii) finding the lenders' optimal $p^*(n)$ given borrowers' policies, (iii) updating the value functions based on these best responses, and (iv) iterating until value functions converge.

2.4. Graphical analysis

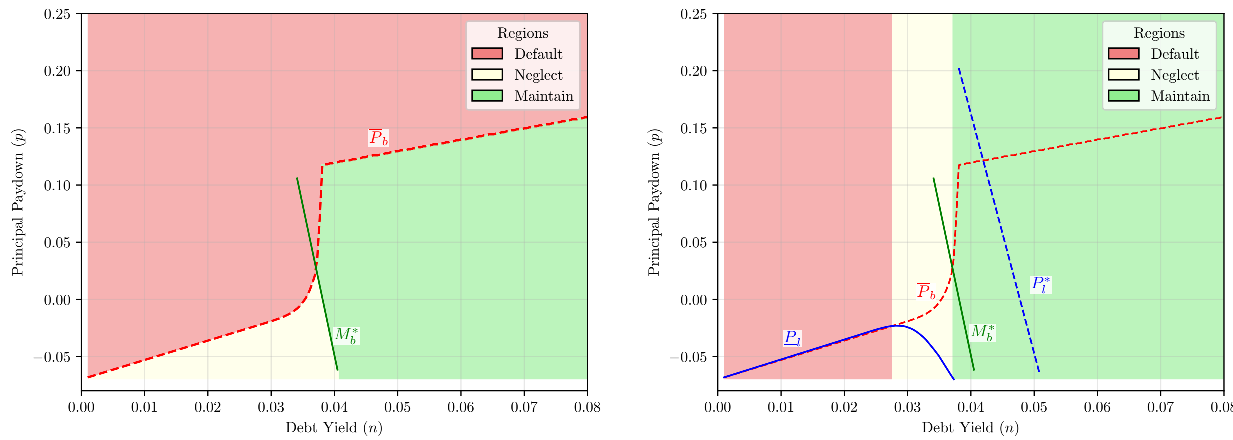
Here I will graphically characterize how equilibrium outcomes in the model are determined. The expressions underlying this analysis are discussed in Appendix B.3.

Starting with the borrower's decision, there are two key functions that determine whether a borrower is willing to accept an extension, and if so, whether they choose to maintain the property after. First, there is the maximum paydown they are willing to provide on an extension, denoted $\overline{P}_b(n)$. This curve is upward sloping since greater cash flows increase funds available to meet principal and interest payments and raise the likelihood borrowers can profitably sell the property in the future. Second, there is a downward sloping function, denoted $M_b^*(n)$, giving the paydown above which expected future distress is reduced sufficiently to motivate borrowers to maintain the property (if they extend).

Panel (a) of Figure 1 plots these curves, and shows the associated loan outcomes as a function of n and p. To start, we ignore the potential for property sales, so outcomes pertain to what happens to loans with a high enough κ draw for a sale to be undesirable. Parameter values are set to match estimates from other literature, as is discussed in Appendix B.4, and are presented in Table A.1. These parameters entail an expected 7.5% discount if forced to sell immediately ($\alpha = 12.3$) and 24% foreclosure costs ($\Lambda = 0.76$), but no cost to loss recognition ($\chi = 0$).

The curves define three regions. Borrowers default when $p > \overline{P}_b(n)$ (the red region), because the principal paydown is more than they are willing or able to provide. They maintain the property when $p \in [M_b^*(n), \overline{P}_b(n)]$, meaning paydowns are high enough that borrowers choose to maintain the property, but not so high that they choose to default (the green region). Finally, they neglect the property when $p < \min\{M_b^*(n), \overline{P}_b(n)\}$, meaning that lenient extension policies prevent default but do not leave borrowers sufficiently committed to the property to maintain it (the yellow region).

Figure 1: Equilibrium Maturity Outcomes



(a) Borrowers' Indifference Conditions

(b) Lenders' Optimality Conditions

Notes: Panel (a) plots the paydown above which borrowers default (red dashed line, $\overline{P}_b$), and the one above which borrowers maintain the property if they extend (green line, M_b^*). Red, yellow, and green regions show where borrowers with a debt yield of n would choose to default, neglect, and maintain, (respectively), given an extension offer of p and a κ draw such that paying off the loan is not optimal. Panel (b) adds the minimum paydown lenders will accept (solid blue line, $\underline{P}_l$), and lenders' optimal paydown when not constrained by borrowers' default or maintenance decisions (blue dashed line, P_l^*). The colored regions denote the outcomes at a given debt yield for lenders' optimal paydown rate.

Turning to lenders' problem, the regions in panel (a) determine the participation constraints lenders face in setting extension terms. The key functions defining lenders' actions are the minimum paydown lenders are willing to accept to extend a loan, denoted $\underline{P}_l(n)$, and the optimal paydown for lenders that are not constrained by borrowers' default decisions, denoted $P_l^*(n)$.

Panel (b) adds these curves to the figure. The shaded regions now pertain to outcomes that occur for the equilibrium $p = p^*(n)$ rather than the p on the y-axis. There are four regions defining loan outcomes.

1. $\overline{P}_b(n) < \underline{P}_l(n)$: At these low debt yields, borrowers are not willing to provide a paydown acceptable to lenders, resulting in default (the red region).

2. $\overline{P}_b(n) \in [\underline{P}_l(n), M_b^*(n)]$: borrowers will provide paydowns acceptable to lenders, but not high enough for them to maintain the property (the yellow region).

3. $\overline{P}_b(n) \in [M_b^*(n), P_l^*(n)]$: borrowers will provide paydowns that solve the debt overhang problem, but are still less than lenders would desire (the left-most part of the green region).

4. $\overline{P}_b(n) > P_l^*(n)$: Borrowers' participation constraint is not binding, so lenders can achieve their optimal principal repayment (the rest of the green region).

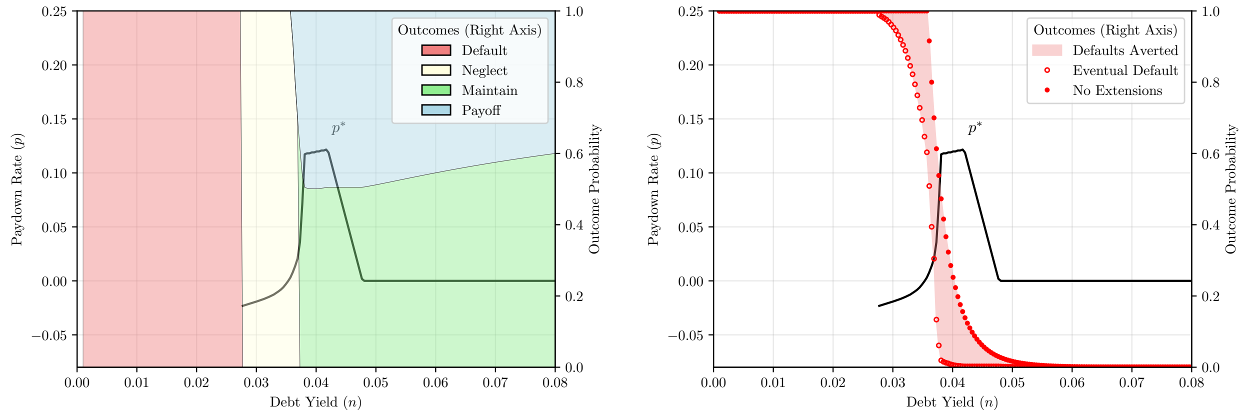
Figure 2 shows how these mechanics map into observed outcomes (what happens at maturity, what paydowns occur for extensions, and whether extended loans eventually pay off). Panel (a) presents maturity outcomes (the colored regions) and paydown rates (the black line). It clarifies that there are two distinct debt yield regions that determine extension terms. At low debt yields, lenders are constrained by borrowers' participation constraint, so extensions are determined by how large a paydown borrowers are willing and able to make. This causes p^* to be an increasing function of n, tracing out the part of the $\overline{P}_b(n)$ curve that sits above the $\underline{P}_l(n)$ curve. At higher debt yields, lenders are not constrained by borrowers' willingness to pay down a loan, so outcomes are determined by the size of a concession that lenders would like to mitigate risks of future property value declines. In this region, p^* declines in n because higher incomes reduce the need for paydowns to mitigate future default risk (p^* traces the $P_l^*(n)$ curve).[10]

Panel (b) shows that p^* and n are informative as to future repayment prospects. Hollow red dots show the probability that a loan eventually defaults (potentially after a string of extensions), and solid red dots show the probability that a loan with a given debt yield would default if lenders were unwilling to extend a loan. Extensions reduce the risk of default, but depending on the debt yield and principal paydown, sometimes future default remains highly likely.[11] There is a steep drop in future default risk beyond the point that borrowers become willing to maintain the property and the risk of future default becomes very low once borrowers are no longer limited in their willingness

[10] I assume that lenders cannot force borrowers to defer interest payments, so p^* is 0 for the high debt yields such that lenders would prefer borrowers to operate with higher loan balances.

[11] The derivation of eventual default probabilities is in Appendix B.1.

Figure 2: Observed Extension Outcomes



(a) Equilibrium Principal Paydowns

(b) Eventual Loan Performance

Notes: Panel (a) plots equilibrium principal paydowns (black line, left scale), and the probability that various maturity outcomes occur (colored regions, right scale). Red, yellow, green, and blue regions show the probability that borrowers would choose to default, neglect, maintain, and pay off a loan (respectively), given an extension offer of $p^*(n)$. Panel (b) adds information on ultimate performance; hollow red dots show the probability that a loan with a given n eventually defaults, and solid red dots show the probability that a loan would have defaulted if extensions were not available. The red area shows the decline in the probability of eventual default due to extensions.

to pay down loans.

In short, even though the future performance of extended loans is not observable in real time, the condition of the property and the terms of the extension are highly predictive of future repayment prospects. If a loan has either a high debt yield or a meaningful principal paydown, it means that the borrower is committed to the property and the loan is likely to pay off once they are able to get a competitive offer to sell or refinance. Extensions with minimal concessions at lower debt yields are the ones that are unlikely to successfully pay off without a loss in the future. In the baseline calibration with no capital preservation incentives, these extensions are still efficient since the potential to avoid foreclosure costs is enough to compensate for debt overhang costs. However, a byproduct of these actions is still that extensions could mask underlying CRE market strains since banks are extending some loans that would likely default in the future.

2.5. *What drives extensions?*

This section investigates how changes in model parameters affect equilibrium maturity and extension outcomes. I start by showing what happens when the benefit to delaying loss recognition (χ) rises from 0. I then discuss model outcomes isolating effects of specific frictions to clarify what types of extensions are caused by each friction.

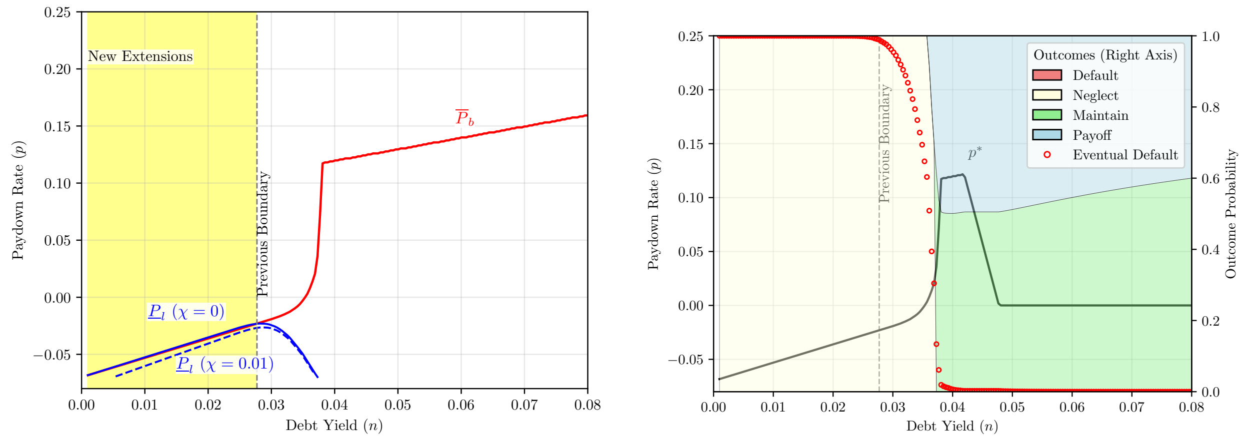
Extend-and-pretend incentives Figure 3 plots how increasing χ from 0 to 0.01 affects maturity outcomes. The left panel plots the shift in the $\underline{P}_l(n)$ curve brought about by the temporary cost to loss recognition. The paydown that lenders require to extend loans shifts down since lenders are more motivated to prevent default, even if only temporarily. The downward shift is most pronounced at very low debt yields since those loans would post the largest losses without an extension. For the parameter values in the baseline model, this temporary cost to loss recognition is enough for lenders to always be willing to offer lenient extension terms to prevent default.[12]

The right panel adds information on principal paydowns and the eventual probability of repayment. To the right of the dashed line, outcomes are all identical to the baseline calibration shown in Figure 2.[13] New extensions start to occur for the low debt yields documented in the left panel. These extensions are associated with negative paydowns (the black line showing $p^*(n)$ is below 0) and virtually no chance of loans ultimately repaying (the red dots showing the probability of eventual default are near 1). Unlike in the baseline calibration, lenders do not extend loans because the chance of avoiding foreclosure costs is enough to offset debt overhang effects; lenders benefit from delaying default and are willing to extend loans with no real prospect for future repayment.

[12] The baseline model has no role for bank examiners in restricting such extensions from being made, but could easily be amended by providing a floor to p reflecting examiners' ability to assess whether loans are "restructured with reasonable repayment terms" (Federal Reserve System et al., 2023). Such a change would prevent banks from extending the most severely stressed loans.

[13] This is because the terms of stressed extensions are determined by the maximum paydown borrowers will accept. This maximum paydown is unchanged because (i) it is lenders' payoffs that change and (ii) the shift in lenders' willingness to extend loans is temporary and thus doesn't affect borrowers' expectations for future extension policies.

Figure 3: Extend-and-Pretend Incentives (χ: 0→1%)



(a) Lenders' required paydowns shift down

(b) Observable outcomes

Notes: The solid blue and red lines in panel (a) show the minimum paydown acceptable to lenders and the maximum paydown borrowers will make, respectively. The dashed blue line shows how lenders' required paydowns shift if χ increases to 0.01. The highlighted area demonstrates the range of debt yields that newly receive extensions due to the change in lenders' objective function. Panel (b) provides outcomes at maturity when $\chi = .01$. Red, yellow, green and blue regions represent the probability of default, neglect, maintain, and pay off. The black line gives required pay downs by debt yield (left axis) and red hollow dots the probability that a loan ultimately defaults (right axis).

Roles of other frictions Figure A.1 presents model outcomes isolating the effects of the three drivers of extensions. Panel (a) shows outcomes with just search frictions, panel (b) outcomes with just foreclosure costs, and panel (c) outcomes with just costs to loss realization. Other parameters are the same as in the baseline calibration.

These figures show that the various motivations to extend loans affect different debt yield regions. Panel (a) demonstrates that search frictions only cause extensions at high debt yields. When foreclosure costs are removed, lenders have no reason to avoid foreclosure, and thus do not extend loans where borrowers would engage in inefficient maintenance practices after. Panel (b) shows that foreclosure costs cause extensions for debt yields just below the point at which borrowers would be able to pay the loan off. Above this point, loans always pay off (since there are no search frictions), and below it, debt overhang costs outweigh the benefit of giving time for incomes to recover. Finally, panel (c) shows that costs to loss recognition prompt lenders to extend only the most highly stressed loans, while allowing some closer-to-viable loans to default.[14]

Overall, these results point to a clear distinction between search-related frictions and those related to resolution costs. Search-related extensions go to borrowers that maintain the property, and have either high current debt yields or large paydowns (increasing future debt yields) so that the risk borne by lenders is minimal. In contrast, extensions related to costs of foreclosure or loss recognition tend to entail lower debt yields, low principal repayment, poor maintenance incentives, and poor future repayment prospects. The primary distinguishing factor is degree, as these issues are all more pronounced for extensions to delay loss recognition; since the motivation is to delay rather than minimize losses, poor future repayment prospects do less to deter extend-and-pretend behavior.

2.6. Recap and Testable Predictions

These figures provide the foundation for the empirical work in the next section. To summarize the results, motivations for extensions can be inferred by a combination of the debt yield of the loans getting extended and the terms of those extensions. Extensions due to default costs go to borrowers with low debt yields and entail minimal borrower concessions since borrowers would default if such concessions were required. In contrast, extensions to deal with property sale or refinancing frictions occur throughout the debt yield distribution, entail high principal paydowns for lower-debt-yield loans, and have a high probability of eventually paying off.

Regarding the response to stress, if strains related to monetary policy tightening and regional banking turmoil prompted banks to extend-and-pretend, we would expect to see the following based on Figure 3:

1. More extensions during the stress period

2. Extensions to occur at lower debt yields

[14] When all three frictions are removed, no extensions occur at all; borrowers repay loans if possible and default otherwise.

3. Extensions to have more lenient terms (less principal repayment)

4. Extended loans to have lower ex-post payoff rates

3. DATA AND METHODOLOGY

3.1. Data

I test the predictions from Section 2.6 using supervisory data that large banks report for their stress tests. FR Y-14Q Schedule H.2 filings provide a loan-quarter-level panel on non-owner-occupied CRE loan holdings with committed balances over $1 million from banks with more than $100 billion in assets. I start the sample in 2016q1 since a reporting change after that quarter allows me to identify what happens to loans that exit the balance sheet (e.g., distinguish payoffs from liquidations). The sample runs through 2025:Q4.

One of the key variables of interest is the maturity date, from which I derive whether loans are extended and whether a loan is scheduled to mature. Per the Y-14 reporting instructions "The maturity date is the last date upon which the funds must be repaid, inclusive of extension options that are solely at the borrower's discretion." Consequently, changes in this maturity date reflect extensions provided by lenders, rather than the exercise of existing options.

The main outcomes studied are whether a maturing loan is extended, what the terms of extensions are, and how loans perform following extension. I examine how these extension patterns compare during normal times (2016-2019) and after the bank stress episode (2023-2025) to assess both normal servicing patterns and changes during stress. The empirical methodology varies depending on the outcome of interest, so I discuss those in turn. The analysis is organized around the four predictions regarding extend-and-pretend behavior in Section 2.6, but each piece of analysis also speaks to extension drivers during normal times.

3.2. *Predictions 1 & 2: How many and which loans get extended*

The first two predictions say that greater extend-and-pretend incentives result in more extensions, driven by riskier loans. To test these predictions, I estimate regressions along the lines of:

$$100 \times \text{Extension}_{i,t+1} = (\beta' X_{i,t}) \times \text{2023-on}_t \times \text{Maturing}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t} \tag{2}$$

where $\text{Extension}_{i,t+1}$ is an indicator for whether a loan is extended in the next quarter, $\text{Maturing}_{i,t}$ is an indicator for whether it is scheduled to mature next quarter, and $\tau_{b(i),t}$ is a bank quarter-fixed effect (only included in some specifications). 2023-on_t takes a value of 1 for quarters starting 2023:Q1, and 0 for quarters before the pandemic. This period after 2022 was characterized by high interest rates, weak CRE transaction volumes, rising CRE nonperformance, and increased attention on bank CRE exposures following the Spring 2023 regional banking turmoil. I exclude the onset of COVID from the baseline analysis so the stress period is compared to a relatively normal environment, rather than one with elevated extensions due to the pandemic-era disruptions. See Glancy et al. (2025) for a description of CRE modification patterns early in the pandemic.

When $X_{i,t}$ only includes an intercept, β estimates how the probability that a maturing loan is extended changes during the stress period, thus testing the prediction that extensions rose at that time. $\text{Lower Level Controls}_{i,t}$ includes the non-interacted variables, and thus γ can also provide an estimate for the change in extension frequencies for loans without pending maturities (from the coefficient on 2023-on_t in specifications that omit time-fixed effects).

When $X_{i,t}$ is expanded to include risk characteristics, the regression tests the second hypothesis; namely, that riskier loans got extended during the stress period. In this analysis, $X_{i,t}$ includes indicators for whether the loan has a debt yield under 8%, is nonrecourse, or is secured by a small- or large-sized office (defined by square footage under or over 250,000).[15] β estimates the extent to

[15] Debt yield may be uninformative if NOI is missing or hasn't been updated in the last year, or if repayment relies on the successful execution of a construction or renovation plan rather than in place cash flows (i.e., for nonstabilized loans). In these circumstances, I mark $\text{Low Debt Yield}_{i,t}$ to 0 and include an indicator to denote a missing debt yield.

which loans with these risk factors were disproportionately extended at maturity during the stress period. The prediction that extend-and-pretend incentives cause extensions to increase for low debt yield loans comes directly from the model. The remaining variables in $X_{i,t}$ reflect other risk factors that would have similar effects to low debt yields; nonrecourse clauses remove lenders' claim on borrowers' other assets and may thus reduce foreclosure recoveries (Glancy et al., 2023), and office loans have poor NOI growth prospects due to the shift to work from home (Gupta et al., 2026; Glancy and Wang, 2023). These latter effects are particularly pronounced for larger offices, motivating the decision to segment offices by size (Glancy and Kurtzman, 2024).

I also conduct several variants of this type of analysis. This work includes (i) examining other loan outcomes (default or payoff) besides extensions, (ii) examining differences in extension rates quarter-by-quarter rather than pooling stress and non-stress periods, (iii) analyzing pending maturities over a one-year horizon to account for loans that pay off or get extended before their quarter of maturity, and (iv) estimating the probability that loans are extended as a flexible function of debt yield rather than using the low debt yield indicator.

3.3. *Prediction 3: Terms of extensions*

To test the prediction that extend-and-pretend incentives cause banks to ease terms (accept lower principal repayment) on extended loans, I estimate:

$$100 \times \Delta \text{Term}_{i,t} = (\beta' X_{i,t-1}) \times \text{2023-on}_t \times \text{Extension}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t-1} + \tau_{b(i),t} + \varepsilon_{i,t} \tag{3}$$

where $\Delta\text{Term}_{i,t}$ reflects the change in principal balance, loan rate spreads or recourse status of a loan. Lower Level $\text{Controls}_{i,t-1}$ includes lower level interactions of the variables of interest, as well as a vector of variables related to changes in loan terms that might occur without extensions. These include controls for the loans' age, size, scheduled amortization, and previous spread.[16]

[16] Size is the logarithm of the previous loan balance. Controls for scheduled amortization include both the scheduled

In the baseline analysis, $X_{i,t-1}$ only includes a constant, so β measures how much more often a given term was incorporated into extensions relative to before the pandemic. The coefficient on $\text{Extension}_{i,t}$ (included in γ) measures the baseline increase in frequency with which a term is changed for extended loans relative to similar non-extended loans, thus distinguishing the effect of extensions from changes in terms that occur for other reasons. When $X_{i,t-1}$ is expanded to include the risk factors discussed in Section 3.2, β measures whether banks tightened or eased terms on extensions during the stress period for riskier loans in particular. Risk factors are measured as of the quarter before the extension so that $X_{i,t-1}$ does not reflect changes that were a part of the extension (e.g., a debt yield that is high due to a principal paydown).

3.4. *Prediction 4: Ex-post performance of extended loans*

To test whether stress-era extensions performed worse than other loans, I estimate

$$100 \times \text{Paid Off}_{i,t+1} = \beta_1 \text{Extended}_{i,t} + \beta_2 \text{Extended 2023-on}_{i,t} + \tau_{b(i),t} + \alpha_{m(i,t)} + \varepsilon_{i,t} \tag{4}$$

where the dependent variable is an indicator for whether the loan pays off next quarter, $\text{Extended}_{i,t}$ is an indicator for whether the loan was previously extended, and $\text{Extended 2023-on}_{i,t}$ is an indicator for whether the loan was extended during the stress period. $\alpha_{m(i,t)}$ is a fixed effect for the number of quarters to maturity, which accounts for the fact that extension terms are typically shorter than those of new loans. $\tau_{b(i),t}$ is a bank-quarter fixed effect, which accounts for broad changes in the probability of repayment over time.

β_1 captures differences in payoffs between prepandemic extensions and other loans at the same bank and quarter, controlling for time to maturity. β_2 captures how payoff rates differ for stress-era extensions relative to prepandemic ones. If banks extend loans during the stress period because

payment as a share of the previous loan balance based on the reported amortization schedule and the realized amortization in the previous quarter. I include the latter due to some apparent reporting errors with scheduled amortization causing lagged principal repayment to be more predictive of future repayment. To reduce the influence of reporting errors or outliers, missing or extreme values for spread or amortization variables are set to 0, and dummies for whether values are missing, high outliers or low outliers are included. Most CRE loans have minimal amortization, so results are not sensitive to the controls.

they want to delay loss recognition rather than because they expect modifications to enhance future repayment prospects, β_2 would be negative.

3.5. Differences by bank capitalization

The last piece of analysis investigates differences in extension frequencies and terms across lenders by capitalization level. This analysis tests whether banks that are closer to a capital requirement extend more loans, extend riskier loans, or provide more lenient terms on extensions. Such behavior would suggest that capital constraints induce some banks to delay loss recognition in order to preserve capital.

For this analysis, I supplement the CRE loan data with information on bank capital ratios from Y-9C, and stress test outcomes from public disclosures by the Federal Reserve Board. How stress tests were incorporated into capital requirements changed between the prepandemic and stress periods. Before the pandemic, stress tests were pass/fail based on banks' estimated capital in a "severely adverse scenario." For these years, I measure distance to capital constraints by the minimum common equity tier 1 capital (CET1) ratio in the stress tests. This variable reflects how much headroom a bank had in passing their stress tests.

During the stress period, stress test results translated into capital requirements through a stress capital buffer. For this period, I measure distance to a capital constraint as the difference between a bank's CET1 capital ratio reported in their Y-9C, and their capital requirement inclusive of the bank-specific G-SIB surcharge and stress capital buffer.

I then repeat analysis along the lines of that in Equations (2), (3) and (4), but adding an additional interaction with whether a bank's capital buffer is below the median for the quarter (Low $\text{Capital}_{b(i),t} = 1$).

3.6. *Summary statistics*

Summary statistics of the main variables of interest are shown in Table A.2, and summary statistics for selected subsamples (prepandemic observations, 2023-on observations, maturing loans, and extended loans) are shown in Table A.3. The tables show that extension rates are modest overall (3% per quarter), but high for maturing loans (52%). Loan terms are fairly stable over the life of CRE loans, but change much more frequently in quarters of extension. For example, the probability of the principal balance declining by at least 5% is 8% for loans receiving extensions, but around 1% for the sample as a whole. Likewise, loans receiving extensions are three to five times more likely to have their committed balance rise, their spread change, or their recourse status change.

4. WHY DO BANKS EXTEND LOANS?

This section examines which potential motivations for extensions match observed empirical patterns. Section 4.1 shows that banks did not materially increase the frequency of extensions after 2022. Section 4.2 shows that stress-era extensions shifted towards *safer* borrowers. Section 4.3 shows that terms of stress-era extensions became stricter. Section 4.4 shows that stress-era extensions paid off at similar rates to prepandemic extensions. Finally, Section 4.5 shows that these patterns do not differ materially by bank capitalization.

4.1. *Did banks increase extensions?*

The first testable prediction is that extend-and-pretend incentives prompt banks to extend loans they wouldn't otherwise extend, causing more extensions to occur. If fair value declines of banks' fixed-rate assets or increased scrutiny of CRE exposures following the 2023 regional banking turmoil caused banks to extend loans to obscure pending loan losses, we would expect to see more maturity extensions starting in 2023.

To examine how extension frequencies have changed over time, I study outcomes of loans that are slated to mature in four quarters, and assess loan outcomes as of the original quarter of maturity.

The outcomes considered are:

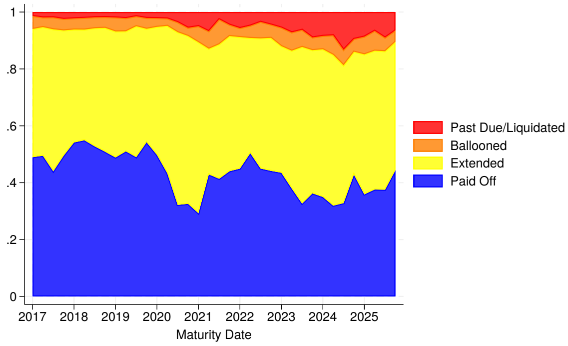
1. Paid off: If the loan is disposed of in the following year, and the disposition code indicates a voluntary payoff. I also include a small number of loans that were sold without a charge-off.
2. Extension: If the loan is current and on the balance sheet at the end of the quarter of maturity, but the maturity date was extended into the future.
3. Ballooned: If the loan is not past due on interest payments, but the reporting date is after the current maturity date.
4. Delinquent: If the loan is past due in the quarter of maturity, or marked as liquidated, involuntarily paid off or sold at a loss by that point.

Figure A.2 shows that the occurrence of these outcomes rises slightly in the year before maturity, and then jumps in the actual quarter of maturity. Consequently, the one-year window I consider should capture most extensions, payoffs, and delinquency associated with a pending loan maturity.

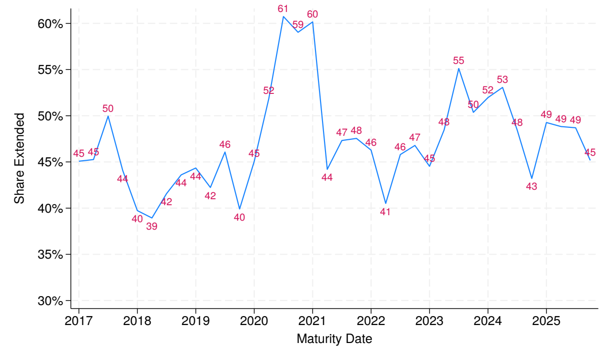
Figure 4 plots the composition of outcomes for loans with a pending maturity (left) and the share of pending maturities that get extended (right) by quarter of maturity. The figure shows that extension volumes rose after 2022, but not dramatically so. The volume of maturing loans receiving extensions was a bit under 50% for most quarters since the start of 2023. This exceeds pre-pandemic extension rates (typical in the mid-40s) but was well below the 60 percent extension rate observed for loans maturing early in the pandemic. The share of loans paying off at maturity (the blue area in the left panel) fell from near one half before the pandemic, to around one third in 2023, but this was mostly attributable to more loans missing payments rather than more loans receiving extensions. Delinquency rates started to recede and payoff rates to recover for loans maturing in late-2024 or 2025, but maturity distress remained elevated relative to prepandemic norms as of the 2025:Q4 sample end.

The appendix presents similar analysis at a more disaggregated level. Figures A.3 and A.4 dis-

Figure 4: Outcomes of Pending CRE Loan Maturities



(a) Maturity Outcomes



(b) Extension Rate over Time

Notes: The left figure shows the share of outstanding loan balances that are paid off (blue), extended (yellow), performing past their maturity date (orange) and past due or liquidated (red) by the quarter of scheduled maturity. Sample is composed of loans that are four quarters from the scheduled maturity. The right panel shows the share of balances that are extended, corresponding to the yellow region in the left chart.

tinguish stabilized vs. non-stabilized (construction and renovation) loans and offices vs. other property types, respectively. The results show that outcomes of loan maturities were broadly similar for stabilized and non-stabilized CRE loans. Across property types, office loans became much less likely to pay off at maturity: Only about 20% of office loan balances paid off during the period of stress, compared to over 40% before the pandemic. However, this change mostly reflected a higher rate of default rather than an increase in extensions.

There is also little evidence of extensions increasing after 2022 when the analysis is expanded to include loans without pending maturities. The first column of Table A.4 presents estimates from equation (2), excluding the interactions with risk characteristics and the bank-quarter fixed effect (so that 2023-on$_t$ is identified). It shows that on an unweighted basis, maturing loans were about 6 percentage points less likely to be extended during the stress period and non-maturing loans were about half a percentage point less likely to get extended.[17] The fourth column demonstrates that delinquency rates for maturing and non-maturing loans rose by about as much as extensions fell (4.4 and 0.8 percentage points, respectively).

[17]The decomposition in Figure 4 codes loans as delinquent when they were both extended and delinquent in order for outcomes to sum to one. In regressions, I count these loans as being extended since I am not trying to decompose loan outcomes.

Overall, these time series patterns demonstrate that CRE market stress prompted more loans to default upon maturity. However, there is no clear sign of banks increasing extensions to hide the stress. Extension rates were roughly in line with historical norms, increasing somewhat relative to before the pandemic on a weighted basis and decreasing somewhat on an unweighted basis.[18] These patterns are more consistent with property value declines causing borrowers to default than banking stresses causing banks to increase extensions to delay default.

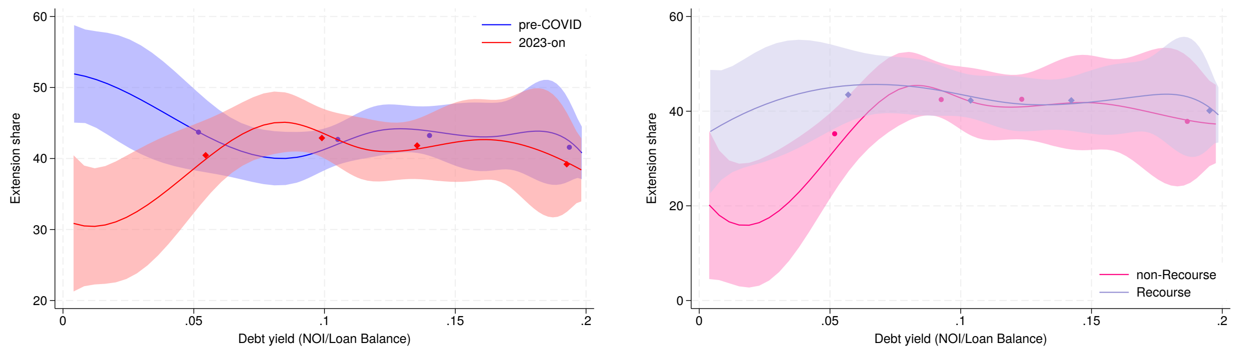
Another implication of the fact that recent extension rates are in line with historical norms is that the pending "wall of maturities" is also not historically atypical. One frequently cited concern about recent CRE loan extensions is that they create a build-up of near-term maturities that could strain loan performance going forward (Crosignani and Prazad, 2024). While it is true that recent extensions add to pending maturities, this situation is not unique to the stress period. Figure A.6 plots the share of outstanding CRE loans scheduled to mature in the next two years, and the portion of those loans accounted for by recently extended loans. As of 2025:Q4, about 40 percent of loan balances are within two years of their maturity, a bit under 30 percent of which (i.e., about 11 percent of total balances) come from loans extended in the last two years. The share of loans with imminent maturities has risen since the onset of the pandemic, but is only slightly above prepandemic norms.

4.2. Did extensions rise for riskier loans?

The second testable prediction is that extend-and-pretend incentives cause banks to extend lower-quality loans. In the context of the model, the marginal extensions driven by capital preservation incentives occur at very low debt yields since those loans would produce larger losses in default. Other factors that reduce property valuations (e.g., office strains) or recovery prospects (e.g., nonrecourse clauses) would also increase potential losses and thus similarly affect extension incentives. In contrast, extensions due to temporary repayment difficulties go to higher-debt-yield loans where

[18] Figure A.5 shows that the probability of extension generally rose for maturing loans over $20 million in size, and fell for smaller loans, explaining the discrepancy in weighted and unweighted results.

Figure 5: Maturity Extensions by Risk Characteristics



(a) Extensions by Debt Yield and Time Period

(b) Stress period Extensions by Debt Yield and Recourse

Notes: Figure presents semi-linear regression estimates of the probability of extension as a function of a loan's debt yield and bank-quarter fixed effects. Estimates come from a cubic B-spline, restricted to have a continuous second derivative, using the binsreg package of Cattaneo et al. (2024). Dots provide binscatter estimates by quartile. Sample includes stabilized loans with recent NOI updates that are scheduled to mature in four quarters. The left panel compares loans slated to mature before the pandemic (blue) and during the stress period (red). The right panel analyzes extension rates during the period of stress for recourse (lavender) and non-recourse (pink) loans.

borrowers are not at the margin of default.

Figure 5 demonstrates that extension rates declined for low debt yield loans after 2022, contrary to banking strains causing extend-and-pretend behavior. Each chart presents cubic spline regression estimates predicting whether loans maturing in the next year receive an extension as a function of their debt yield, controlling for bank-quarter fixed effects. The left panel compares extension rates across time periods. Extension rates were roughly flat across debt yields before the pandemic (the blue line), but drop notably for income-strained properties after 2022. The probability of extension falls from around 40–45 percent at a debt yield of 8 percent, to around 30 percent for loans with non-positive net income.

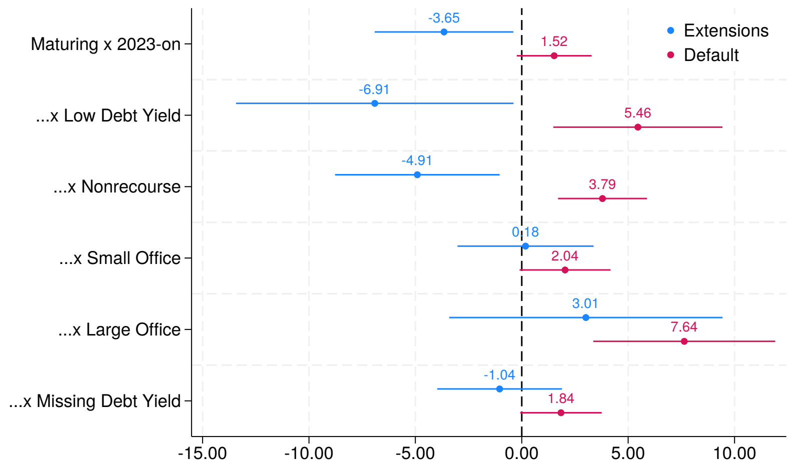
The right panel provides more detail on the decline in extensions of income-strained loans by separately estimating extension rates for recourse and non-recourse loans. The decline in low-debt-yield loan extensions after 2022 is almost entirely accounted for by non-recourse loans. About 40 percent of recourse loans with very low debt yields get extended, compared to only about 20 percent of non-recourse loans. Namely, when banks do extend loans against income-strained properties, those loans disproportionately have guarantees so that the strained property is not their only source of recovery. Taken together, these figures show that loans typically required either strong collateral or sponsor guarantees to get extended after 2022, indicating that banks are not extending loans with unfavorable recovery prospects to delay loss recognition.

Though these results indicate that banks had fairly stringent income requirements after 2022, Figure A.7 provides some evidence of increased risk taking with respect to the property types receiving extensions. Each figure plots the share of pending CRE loan maturities that receive extensions by property type before COVID, from 2020 to 2022, and after 2022. The largest increase in extensions is for industrial properties—the property type with the lowest delinquency rate after the pandemic. However, extension rates rose for office loans following the pandemic, especially on a weighted basis (the left panel). Given that the deterioration in loan performance during this period was concentrated in large-sized office loans (Glancy and Kurtzman, 2024), this result could reflect banks extending loans with worse future income prospects.

Figure 6 presents regression estimates that jointly account for how these different risk factors (low debt yields, nonrecourse clauses, office collateral) relate to loan extension frequencies. Blue dots (lines) plot point estimates (95% confidence intervals) from equation (2), while red dots show equivalent estimates predicting whether loans are delinquent in the following quarter. The figure plots estimates of the β vector, reflecting how much banks changed their tendency to extend risky loans upon maturity. Other coefficient estimates, for example those pertaining to extensions of maturing loans before the period of stress or changes in extensions for non-maturing loans, are shown in Table A.4.

Overall, the figure validates the idea that banks reduced maturity extensions for riskier loans. Low debt yield loans were about 7 percentage points less likely to receive extensions after 2022, and nonrecourse loans were 5 percentage points less likely to get extended. The one dimension where maturity extensions appear to have become riskier is that the extension rate for large office loans rose 3 percentage points (though the difference is statistically insignificant due to the limited num-

Figure 6: Maturity Extensions by Risk Characteristics, Regression Estimates



Notes: Figure presents estimates of β from the specification

$$100 \times \text{Extension}_{i,t+1} = (\beta' X_{i,t}) \times \text{2023-on}_t \times \text{Maturing}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where $\tau_{b(i),t}$ is a bank quarter fixed effect. Blue dots (lines) present point estimates (95% confidence intervals) for how much particular risk factors increased the probability that maturing loans received extensions during the period of stress relative to before the pandemic. Red dots (lines) present equivalent estimates of the probability that loans are delinquent as of maturity. Estimates correspond to columns (3) and (6) from Table A.4.

ber of large office loans). The red dots show that these risk factors are all associated with higher maturity default risk.[19]

To summarize the aggregate evidence, banks frequently extend CRE loans at maturity. This behavior is not concentrated in weaker loans and not concentrated in the period of stress, consistent with extensions predominantly addressing temporary payment difficulties. In fact, maturity extension rates declined for loans with weak incomes during the stress period, especially for nonrecourse loans, contrary to banks offering lenient extension policies to prevent highly stressed borrowers from defaulting.

The one result potentially consistent with extend-and-pretend behavior is that banks increased office loan extensions. Whether these office extensions contain provisions that bolster future per-

[19] Though banks generally reduced extensions of risky loans with pending maturities, there is some evidence of extensions for riskier non-maturing loans increasing. Column (3) of Table A.4 shows that extension rates for small and large office loans without pending maturities rose 0.3 and 1.4 percentage points, respectively, starting in 2023. There was no significant difference in non-maturity extension rates by recourse status or debt yield.

formance prospects is therefore of particular interest. In the next section I will pay additional attention to office loans when assessing the terms of extensions.

4.3. Did banks ease terms on extensions?

Next, I shift attention to characterizing the terms of extensions. One of the defining characteristics of evergreening/zombie lending is that lenders provide subsidized credit to induce firms to continue operating when they wouldn't otherwise be financially viable. In the model, this materializes as a reduction in required payments that, in essence, provides borrowers with a cheap option on the property. First, I examine how extension terms changed on average during the stress period, then I examine differences by borrower risk.

Extension terms, on average Table 2 presents estimates from Equation (3). The first column predicts the percentage quarterly decline in loan balances by whether or not the loan receives an extension. After 2022, borrowers paid down 2.5 percentage points more of their loan balance to extend loans. Columns 2 and 3 show that the higher paydown rate reflects both more extensions requiring paydowns and fewer loans with balances rising. CRE loan extensions in the stress period were about 5.1 percentage points more likely to entail paydowns exceeding 5% of the loan balance relative to before the pandemic, and were about 6.4 percentage points less likely to have balances increase (potentially reflecting interest deferrals).

Additionally, column 4 shows that extensions after 2022 were 1.6 percentage points more likely to switch to having recourse. As recourse provides banks an additional means of recovery beyond the subject property, this change has a similar effect on a loan's future repayment prospects as decreasing the loan balance (Glancy et al., 2023).

The last three columns investigate changes in loan pricing. On average, banks increase spreads on extended loans by about 8 basis points more after 2022 compared to before the pandemic. This effect is driven by banks becoming both more likely to increase spreads (column 6) and less likely to reduce them (column 7).

Table 2: Terms of Extensions

	Pay down	$\mathbb{1}$(Pay down $> 5\%$)	ΔBalance> 0	Gained Recourse	ΔSpread	$\mathbb{1}(\Delta\text{Spread} > 0)$	$\mathbb{1}(\Delta\text{Spread} < 0)$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\text{Extension}_{i,t}$	-2.06**	3.17**	10.93**	2.22**	-0.03**	5.25**	12.14**
	(0.24)	(0.33)	(0.87)	(0.56)	(0.00)	(0.38)	(0.65)
$\ldots\times\text{2023-on}_t$	2.54**	5.13**	-6.37**	1.62*	0.08**	9.52**	-6.88**
	(0.28)	(0.51)	(1.02)	(0.76)	(0.01)	(0.93)	(0.85)
R^2_a	0.054	0.068	0.138	0.167	0.103	0.284	0.190
Observations	1,356,810	1,356,810	1,356,810	525,523	700,524	700,524	700,524
Controls	✓	✓	✓	✓	✓	✓	✓
Bank-quarter FE?	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100\times\Delta\text{Term}_{i,t} = (\beta_1+\beta_2\text{2023-on}_t)\text{Extension}_{i,t}+\gamma'\text{Controls}_{i,t-1}+\tau_{b(i),t}+\varepsilon_{i,t}$$

where the dependent variable is the change in some loan term, scaled by 100 so estimates are in percentage points. This variable is the principal paid down as a share of the loan balance in column (1), an indicator for whether this pay down is at least 5% in (2), an indicator for whether the committed balance rose in column (3), an indicator for whether a previously nonrecourse loan became recourse in (4), the change in loan spread in (5) and indicators for whether the spread rose or fell in columns (6) and (7), respectively. The sample changes throughout the analysis: (1)–(3) exclude loans with changes in utilization or charge-offs, (4) requires the loan to previously be nonrecourse, and (5)–(7) require loans to have floating rates. The main independent variables are indicators for whether the loan is extended in quarter t and its interaction with an indicator for whether t occurs during the period of CRE stress (2023-on). All specifications include controls for a loan's age, size, amortization, and previous spread; and bank-quarter fixed effects. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Overall, these findings all point in the same direction; namely, that the terms on extensions became more stringent. During the period of CRE market turmoil, borrowers had to pay down more debt and pay higher interest rates to continue receiving credit. While this doesn't necessarily rule out credit being subsidized seeing as fundamental risks to the CRE market rose, it indicates that the motivation for extensions is not merely to delay losses. The model demonstrates that property strains only cause terms to become more stringent in the region where extensions remedy search frictions, not where subsidized credit is needed to keep borrowers from defaulting. That banks amended loan terms in ways that improved the prospect for future recoveries and compensated them for the risks they were taking—and the fact that borrowers were willing to accept these terms without defaulting—are positive signals as to the viability of these extended loans eventually paying off.

Paydowns by loan risk How do these extension terms vary by loan risk? The model demonstrates that the relationship between principal repayment and debt yield can inform why extensions occur and how much risk there is to future performance. If banks provide easier terms for weaker loans, it indicates that borrowers' participation constraint is binding and lenders are providing lenient terms to avoid the costs associated with default.

The question is whether banks are willing to provide the extensions that require subsidized credit. If banks limit extensions to loans that are likely to ultimately pay off—lending to customers that are committed to the property but facing temporary difficulties raising funds for loan repayment—then CRE market strains would cause extension terms to tighten, particularly for stressed loans. If instead banks are willing to extend-and-pretend, we'd see easier terms for more-stressed properties to prevent default. For this analysis, I focus predominantly on whether or not extensions entail the repayment of at least 5% of the principal since that change most clearly improves banks' prospects for future repayment.[20]

[20] Higher spreads don't increase the likelihood that loans pay off, they just increase the compensation that banks receive for taking on that default risk. Increases in balances are also somewhat harder to interpret than paydowns since they could reflect interest deferrals (which increase leverage) or the funding of property improvements to enhance collateral values (potentially reducing leverage).

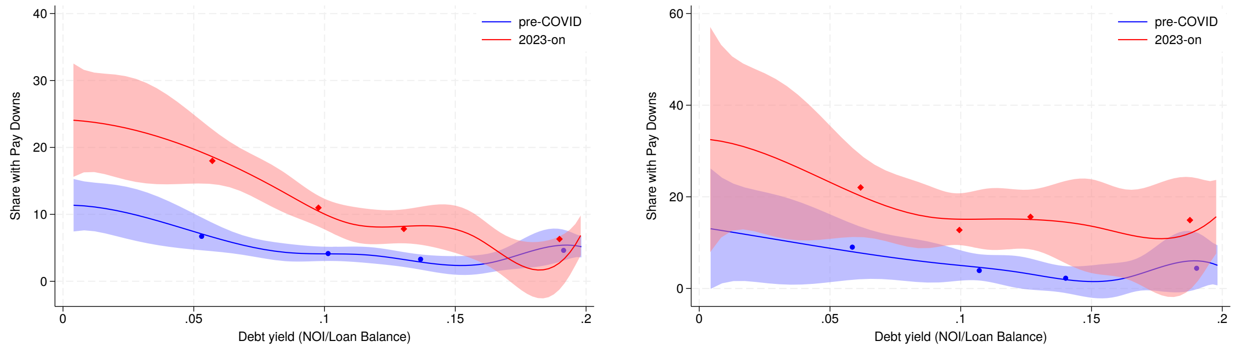
Figure 7 presents spline estimates of the share of CRE loan extensions that entailed a principal paydown of at least 5% after 2022 (red) and before the pandemic (blue). The left panel presents findings for all property types, and the right restricts the sample to office loans.

The figure demonstrates that principal paydowns became more likely for low-debt-yield loans during the stress period. For the full sample, about 20% of loan extensions in the bottom quartile of the debt yield distribution had material principal paydowns during the stress period, compared to under 10% of extensions before the pandemic. The frequency of paydowns at the top of the debt yield distribution is lower (around 5%), and differs little across the two time periods. The pick-up in principal paydowns is even more stark in the office sample, with paydown rates shifting up throughout the debt yield distribution and reaching over 30% for very low-debt-yield loans.

To recap, extend-and-pretend incentives would prompt lenders to provide lenient extension terms to low-debt-yield borrowers to induce them to extend rather than default (Figure 3). In contrast, we see a negative relationship between principal paydowns and debt yield both in normal times and after the bank stress episode, even at low debt yields. These results indicate that banks predominantly extend loans for which borrowers are committed to the property and willing to provide credit enhancements to retain it.[21] Moreover, that banks reduced extensions and increased paydown requirements for low-debt-yield loans after 2022 indicates that banking sector strains did not cause banks to delay loss recognition. When low-debt-yield borrowers were not willing to provide enhancements, banks appear to have been comfortable allowing them to default, as evidenced by the decline in extensions and rise in maturity defaults for low-debt-yield loans in Figure 6.

[21] Note that not all potential credit enhancements are observed in the data. Extensions might also include contributions to reserves for capital expenditure, leasing costs, or other future expenses, which would have similar effects to principal curtailment. Likewise, additional guarantees, covenants, or cash sweep or lockbox provisions can enhance lenders' repayment prospects or control rights. Namely, loans that do not receive principal paydowns may receive other unobserved enhancements.

Figure 7: Paydowns by Debt Yield



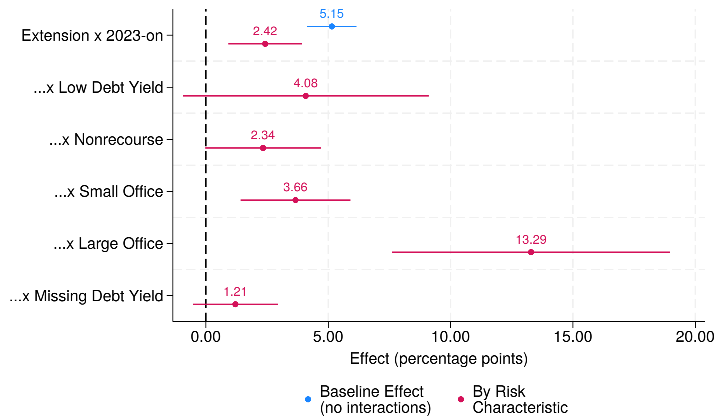
(a) All Extensions (b) Office Loan Extensions

Notes: The left panel presents semi-linear regression estimates of the probability an extension entails a principal paydown of at least 5% as a function of a loan's debt yield, controlling for amortization and bank-quarter fixed effects. Estimates come from a cubic B-spline, restricted to have a continuous second derivative, using the binsreg package of Cattaneo et al. (2024). Dots provide binscatter estimates by quartile. Sample includes loan extensions with recent NOI updates. Estimates for pandemic-era extensions are in blue and stress-era extensions in red. The right panel presents the same estimates, but with the sample restricted to extensions of office loans.

Robustness to other risk factors and loan terms Patterns are broadly similar for other risk factors (besides low debt yields) and other extension terms (besides principal paydowns). Figure 8 extends the analysis to consider other risk factors. Each dot presents coefficient estimates for β from the specification in Equation (3), corresponding to how much a particular risk characteristic shifted the probability that an extended loan received a paydown during the period of stress relative to normal times.

The results demonstrate that paydowns for riskier loans increased after 2022, both overall and relative to extensions for safer loans. The blue dot repeats the second column of Table 2 with the additional (uninteracted) risk factor controls, showing that extensions after 2022 were 5.15 percentage points more likely to have a 5% paydown compared to prepandemic extensions. The red dots present the triple-interaction coefficients from Equation (3) when $X_{i,t-1}$ is expanded to include risk characteristics. These results show that the increase in principal paydowns for extensions is most pronounced for riskier loans. A low debt yield increases the probability of a principal paydown by 4.1 percentage points more during the period of stress, though the difference is statistically

Figure 8: Paydowns by Risk Characteristic



Notes: The figure presents β estimates from equation (3), pertaining to changes in the frequency with which extensions have paydowns of at least 5% during the stress period. The blue dot presents the estimated coefficient on Extension$_{i,t}$ $\times$2023-on$_t$ in the specification without the risk interactions, while the red dots present estimates of the β vector from the fully-interacted specification. Lines present 95% confidence intervals based on standard errors that are clustered at the bank-quarter level.

insignificant. Likewise, nonrecourse loans, small office loans, and large office loans were 2.3, 3.7 and 13.3 percentage points more likely to have paydowns during the period of stress, respectively, compared to before the pandemic.

Table A.5 presents results for other loan terms, as well as providing estimates for other coefficients that are not displayed in Figure 8 (e.g., the prevalence with which terms change for extensions during normal times). These results show that low debt yields also increased paydowns for extensions by about 4 percentage points during the prepandemic period, meaning that low debt yields increased the probability that stress-era extensions have paydowns by nearly 8 percentage points overall (summing the effect of extensions during normal times and the change during the period of stress). The other risk factors appear to have mattered little before the pandemic.

Regarding other extension terms, office loan extensions were roughly 2 percentage points more likely to have recourse added as a condition of extensions and saw spreads rise by 8–10 basis points more than other loan extensions (though the increase in recourse is statistically insignificant). Low-debt-yield loans were less likely to have spreads rise relative to other stress-period extensions, perhaps reflecting banks' concern about those borrowers being able to service their debt at higher spreads when reference rates were typically much higher than at origination.

In short, the analysis of loan terms shows that banks required greater concessions from borrowers to provide extensions during the stress period. Moreover, the increase in concessions was most pronounced for riskier loans. This tightening in terms indicates that banks did not provide lenient extension policies to prevent borrowers from defaulting as would be emblematic of extend-and-pretend modifications. The tightening in terms was most pronounced for office loans, indicating that the increase in extensions for office loans discussed in Section 4.2 is not the result of subsidized credit from banks that are unwilling to recognize losses.

4.4. Were extended loans less likely to ultimately pay off?

Unlike extensions to address foreclosure costs or search frictions, extensions to delay loss recognition can be desirable from a bank's perspective even if the probability of future repayment is negligible. Indeed, Figure 3 shows that the extensions induced by costs to loss recognition have almost no hope of paying off. This section tests whether future payoff rates for stress-era extensions deteriorated.

Figure 9 compares the performance of extended loans to that of other loans with pending maturities that had not been previously extended. The left panel plots the share of extended loan balances that have paid off over time since the extension. Dashed, dotted, and solid blues show payoff rates for loans extended before, during, and after COVID, respectively. Red lines plot the share of loans that are in default at that time (including loans that are delinquent, nonaccrual, or past their maturity date). I restrict the sample for this analysis to extensions where the time to extended maturity is within 6 quarters, and exclude time horizons pertaining to periods occurring after the 2025:Q4 sample end.[22] These criteria ensure that whether a payoff occurs is always observable at the specified time horizon and that maturity outcomes are realized by the final time horizon. Namely, loans not paying off by the 6-quarter ahead time period would have either defaulted or

[22]For example, extensions occurring in 2025:Q1 only contribute to estimated payoff rates up to a three-quarter horizon. The 6-quarter ahead payoff rate pertains to extensions occurring between 2023:Q1 and 2024:Q2 that mature within 6 quarters.

been extended.

The figure demonstrates that stress-era extensions were less likely to pay off following the extension. 66% of pre-COVID extensions paid off within 6 quarters of the extension, compared to only 58% of loans that were extended during the period of stress. Payoff rates for COVID-era extensions were similar to stress-era extensions at 60%.

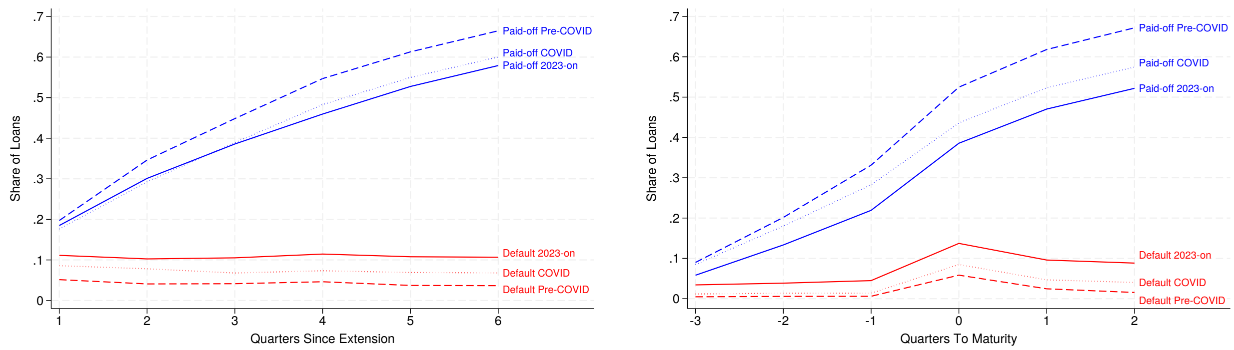
Regarding default, loans extended during the period of stress are more likely to default following the extension, but extensions appear to not do much to delay the reporting of default; about 11% of loans are in default the quarter after extension, and this defaulted share remains about flat in the year and a half following extension. Six quarters after the extension, the default rate is 7 percentage points higher than before the pandemic, thus accounting for almost all of the 8 percentage point decline in the payoff rate. This result means that the share of loans still outstanding and performing after 6 quarters due to the receipt of another extension is about unchanged relative to before the pandemic at 31%. Namely, banks are not rolling over short-term extensions at a higher rate.

The key question is whether loan performance deteriorated because lenders started extending lower quality loans, or because stresses in the market caused performance to deteriorate more broadly (e.g., worse property market liquidity reducing payoffs for extended and non-extended loans alike). To get at this effect, the right panel plots the payoff rates for loans with pending (four quarter ahead) maturities that had not been previously extended. These loans would not be subject to the selection effects induced by extension decisions and give a comparison group for how performance would differ over time absent such selection effects.

The deterioration in loan payoffs during the stress period is slightly more pronounced for non-extended loans. The share of non-extended loans paying off after 6 quarters declined by 15 percentage points relative to before the pandemic (67% to 52%), compared to 8 percentage points for extended loans (66% to 58%). In fact, the 6-quarter-ahead payoff rate for stress-era extensions is above that of non-extended loans (58% vs. 52%).

In short, Figure 9 shows that extended loans usually perform similarly to other loans, paying off

Figure 9: Payoff Rates Over Time



(a) Extended Loans (b) Other Maturing Loans

Notes: Blue lines plot the share of loan balances that pay off over time before (dashed), during (dotted) and after (solid) the pandemic. Red lines plot the share of loan balances that are delinquent or liquidated at that time. The left panel plots performance for loans that were extended by the number of quarters since extension, while the right plots performance for non-extended loans by the number of quarters to maturity.

within six quarters about two-thirds of the time, and mostly receiving another extension the other third of the time. This high rate of payoff and low rate of future default is consistent with extensions relieving temporary stress rather than persistent payment difficulties. Extended loans actually outperformed other loans after 2022, consistent with the other findings about banks becoming more selective with extensions and requiring greater principal paydowns to support future repayment prospects at that time. Namely, more stringent extension policies appear to have bolstered the performance of extended loans during a period of broad repayment difficulties.

Table A.6 presents regression estimates along the same lines as those in Figure 9. Each regression predicts whether a loan pays off in the following quarter based on whether the loan was previously extended, and if so, whether the last extension occurred in 2023 or later. Each specification includes quarter-to-maturity fixed effects to account for differences in loan terms for extensions vs. new originations. The table shows that stress-era extensions are about 2.3 percentage points less likely to pay off than other extended loans in the specification without quarter fixed effects (column 1). However, the effect switches sign when quarter or bank-quarter fixed effects are added in columns (2) and (3). Namely, once the broad deterioration in loan payoffs during the stress period is accounted for, stress-era extensions are at least 1.4 percentage points more likely to pay off in a quarter compared to prepandemic extensions.

4.5. Did worse capitalized banks have easier extension policies?

Overall, the aggregate evidence is inconsistent with incentives to delay loss recognition driving banks to extend loans with weak repayment prospects. Extension rates changed little after 2022 and actually declined for riskier loans. Furthermore, the extensions that occurred during the stress period tended to have more stringent paydown requirements and performed favorably relative to prepandemic extensions. While these findings all suggest that extend-and-pretend was small in aggregate, it does not rule out those incentives affecting behavior at some banks. In this last section, I examine whether extension patterns at banks near their capital constraints are more consistent with extend-and-pretend behavior.

Extension policies by bank capitalization To investigate how extension policies differ by bank capitalization, I re-estimate equations (2), (3), and (4), but add an additional interaction with Low Capital$_{b(i),t}$, which takes a value of 1 if a bank is closer to its capital requirement than the median for a given quarter.

Table A.7 demonstrates that low capital banks, if anything, reduced extensions even more than banks that were comfortably above their capital requirements, but differences are small and statistically insignificant. Well-capitalized banks reduced extension rates by 0.4 percentage points for non-maturing loans and an additional 4.3 percentage points for maturing loans during the stress period (the coefficients on 2023-on$_t$ and Maturing$_{i,t}$×2023-on$_t$, respectively). These contractions in extensions were about 0.4 percentage points larger for banks closer to their capital constraint (the coefficients on the aforementioned variables interacted with Low Capital$_{b(i),t}$).

Table A.8 shows that changes in the stringency of extension terms were generally similar at low and high capital banks. The increases in the shares of extensions receiving material paydowns and higher spreads during the period of stress were 2.7 percentage points and 4.3 percentage points greater, respectively, for low capital banks. However, loans at low capital banks were also more likely to have balances rise or spreads fall when extended, indicating that the differences reflect a greater general tendency to adjust terms when extending loans rather than a difference in overall stringency. On net, the changes in paydowns and spreads were about the same for high and low capital banks. The differences by bank capitalization are small relative to the broader changes during the period of stress: Low and high capital banks alike increased paydowns, spreads, and recourse requirements when extending loans after 2022 (though recourse results are insignificant).

Differences by loan risk The findings so far regarding the effects of proximity to capital requirements indicate that (i) more capital constrained banks, if anything, provided fewer extensions during the period of stress and (ii) high and low capital banks increased paydown requirements and loan rate spreads by similar amounts during the stress period. In other words, capitalization relates only weakly to extension patterns.

One pessimistic interpretation of these findings is that low capital banks tried to discourage extensions from high-quality borrowers (so loans would pay off and free up capital) while encouraging them from those who might default without generous extension policies. Namely, aggregate patterns might mask a shift in the composition of extensions for more constrained banks.

To assess this possibility, I repeat the analysis from Tables A.7 and A.8, but add additional interaction terms to capture how capitalization relates to extension frequencies and terms for borrowers with different risk characteristics. Every specification includes lower-level interaction terms and bank-quarter fixed effects. As the bank-quarter fixed effect controls for any broad tendency to provide extensions or change loan terms, the estimates reflect differences in how banks manage extensions across loans of different risk.

Figure 10 summarizes the main findings from this analysis, while the disaggregated regression estimates are reported in Tables A.9 and A.10. The left figure shows how extension policies at low capital banks changed after 2022. Red dots plot the change (relative to before the pandemic) in extension rates for loans at low capital banks that are scheduled to mature next quarter, the blue dots the change in extension rates for nonmaturing loans, and the green dots the change in how often extended loans have a principal paydown of at least 5%. The right figure plots the change in extension outcomes for low capital banks relative to high capital banks. The top row presents overall estimates (from regressions without the risk factor interactions), and the other rows plot results from the fully-interacted specification; No Risk Factor reports the predicted extension outcomes for a recourse, non-office loan, with a debt yield over 8%, and the other rows report estimates for a loan with a single risk factor.

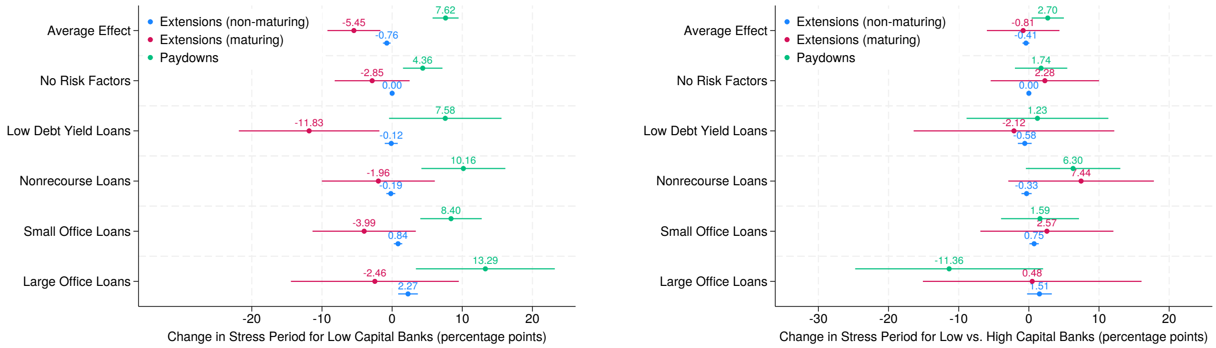
If proximity to a capital buffer induces low capital banks to extend-and-pretend, we would expect those banks to disproportionately extend riskier loans (red and blue dots would be to the right of the zero line for loans with the listed risk factors) and provide lenient extension policies to induce borrowers to extend (green dots would fall to the left of the zero line, indicating fewer extensions with principal paydowns).

There is no area where this combination of easing terms and rising quantities occurred. The only evidence of low capital banks providing more extensions of risky loans is with nonmaturing office loans; non-maturity extension rates rose by 0.8 and 2.3 percentage points for small and large office loans, respectively. However, the frequency of principal paydowns rose about 8.4 and 13.3 percentage points for these loans, indicating that the change was not prompted by easier extension policies. In fact, low capital banks increased paydown requirements for loans with every assessed risk factor; namely, the frequency of paydowns at low capital banks rose by 7.6 and 10 percentage points for low debt yield loans and nonrecourse loans, respectively, after 2022.

The right panel plots estimates for the change in extension outcomes at low capital banks net of the change at high capital banks. This analysis examines whether low capital banks eased extension policies relative to other banks even if they did not ease policies in general. If paydowns rose broadly due to greater risks, or extensions fell because more borrowers defaulted, we might still see relatively smaller shifts for low capital banks if these developments were partially counteracted by some capital-preservation-motivated extensions.

There is little consistent evidence of extension policies becoming more stringent at one type of

Figure 10: Extension Policies by Bank Capitalization



(a) Change for Low Capital Banks (b) Change Relative to High Capital Banks

Notes: The left figure plots the predicted changes in extension outcomes during the stress period for low capital banks. Outcomes considered are the predicted change in the probability that a nonmaturing loan is extended (blue), that a maturing loan is extended (red) and that an extended loan receives a principal paydown of at least 5%. These estimates come from fully-interacting the specifications in equations (2) and (3) with a low capital indicator. The average effect comes from the specification excluding interactions with loan risk factors, and the other estimates provide predictions for a loan with a single risk factor (besides the "No Risk Factor" line which pertains to loans where all of the indicators in $X_{i,t}$ are 0). The right panel presents estimates of the change in policies at low capital banks net of the change at high capital banks (e.g., for paydowns, the No Risk Factor dot plots the coefficient on Low Capital$_{b(i),t}$ $\times$2023-on$_t$ $\times$Extension$_{i,t}$, while the others add the coefficient on the relevant quadruple interaction).

bank relative to the other. Low capital banks increased paydown requirements more than high capital banks for three of the four risk factors (large office being the exception), but reduced maturity extension rates by less for three of the four risk factors (low debt yield being the exception). Changes in non-maturity extension rates were mixed: low capital banks reduced non-maturity extensions of low debt yield and nonrecourse loans relative to high capital banks, but increased office extensions relative to those banks. Across combinations of the four risk factors and three metrics for extension stringency, low and high capital banks are thus evenly split in whether they tightened policies for risky loans relative to the other. Furthermore, these differences are almost always statistically insignificant.

Differences in the performance of extended loans Table A.11 repeats the analysis from Table A.6 analyzing the ex-post payoff rate for extended loans, but adding an extra interaction with Low $\text{Capital}_{b(i),t}$. The specification with quarter fixed effects—which compares the performance of extended loans relative to other loans in the same quarter—shows that the payoff rate of extended loans improved slightly during the stress period (by 0.6 percentage points) for well-capitalized banks, and an additional 2.4 percentage points for low capital banks. However, the difference between high and low capital banks is statistically insignificant and mostly goes away when bank-quarter fixed effects are added in column (3). Overall, there is no evidence that the probability of future repayment deteriorated for extensions made by low capital banks during the period of stress.

To summarize the bank capital results, low and high capital banks alike reduced extensions and tightened extension terms, particularly for riskier loans. These results suggest that proximity to capital buffers did not induce banks to provide lenient policies to extend loans with little hope of repayment. Indeed, loans extended by low capital banks during the stress period performed comparably to loans extended by higher capital banks.

5. CONCLUSION

This paper uses detailed supervisory data on bank CRE loans and a model with competing extension motivations (search frictions, foreclosure costs, temporary loss recognition costs) to assess why banks extend CRE loans. Before the pandemic, banks frequently extended loans secured by properties with strong cash flows and disproportionately required principal paydowns to extend weaker-income loans. These patterns are consistent with extensions helping borrowers navigate temporary frictions in selling or refinancing properties to meet maturity payments.

Furthermore, I present four pieces of evidence against 2023 banking strains prompting banks to ease extension policies to delay loss recognition. First, extension frequencies were not materially different after 2022 relative to before the pandemic. Second, banks reduced extensions for the income-strained properties where extend-and-pretend incentives would be the strongest. Third, extension terms became more stringent during the stress period. Rather than provide highly subsidized credit, banks increasingly required equity contributions and higher spreads from borrowers to extend loans. Fourth, the payoff probability for stress-era loan extensions did not deteriorate relative to other maturing loans, demonstrating that most extensions were for financially viable loans. Moreover, these four patterns hold even for banks closer to their capital requirements, inconsistent with capital preservation incentives motivating banks to adopt lenient extension policies.

In short, observed extension patterns generally indicate that banks efficiently manage the risks associated with loan extensions. However, one significant limitation of this work is that it only covers larger banks, which tend to be less exposed to CRE loans and thus perhaps have weaker extend-and-pretend incentives. In complementary work, Glancy and Kurtzman (2024) demonstrate that while small banks have superior CRE loan performance, this difference is mostly attributable to loan portfolio composition, leaving little room for extend-and-pretend behavior to contribute to performance disparities. Taken together, these papers thus indicate that (i) large banks do not extend-and-pretend and (ii) small banks do not obscure delinquency *relative to large banks*. This line of work therefore provides suggestive evidence against pervasive extend-and-pretend behavior; however, more direct analysis of servicing decisions at small banks would be valuable.

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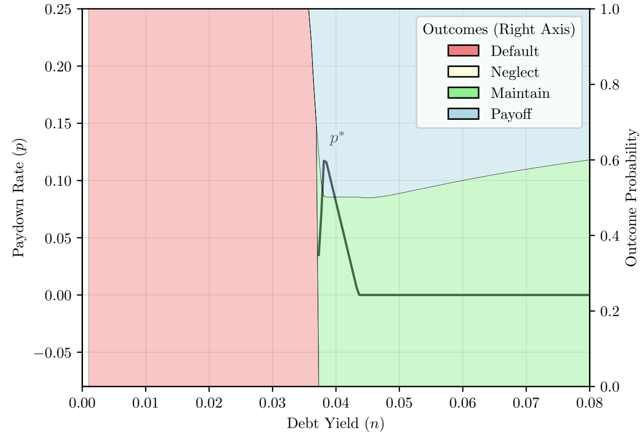
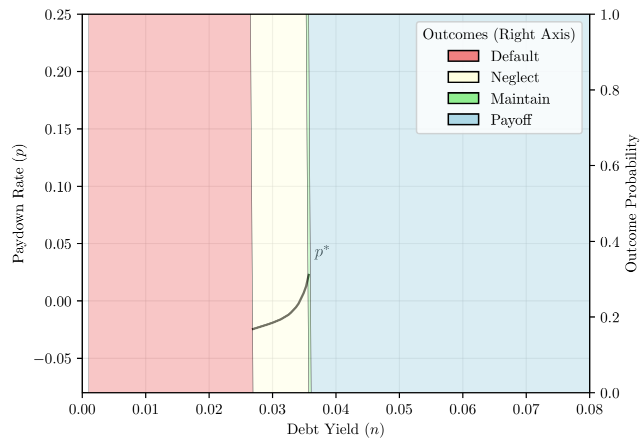
APPENDIX

A. ADDITIONAL TABLES AND FIGURES

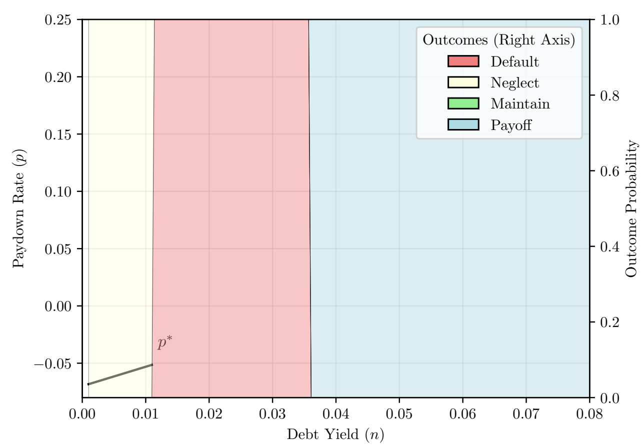
Figure A.1: What Drives Extensions



(a) Just Search Costs ($\Lambda = 1$)



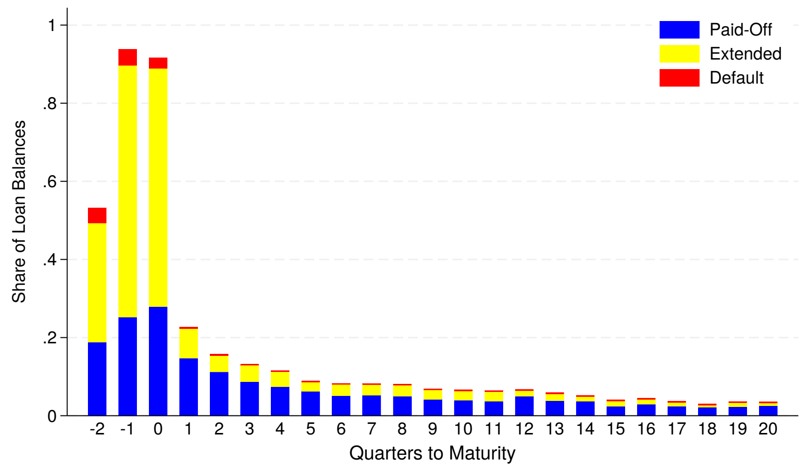
(b) Just Foreclosure Cost ($\alpha = \infty$)



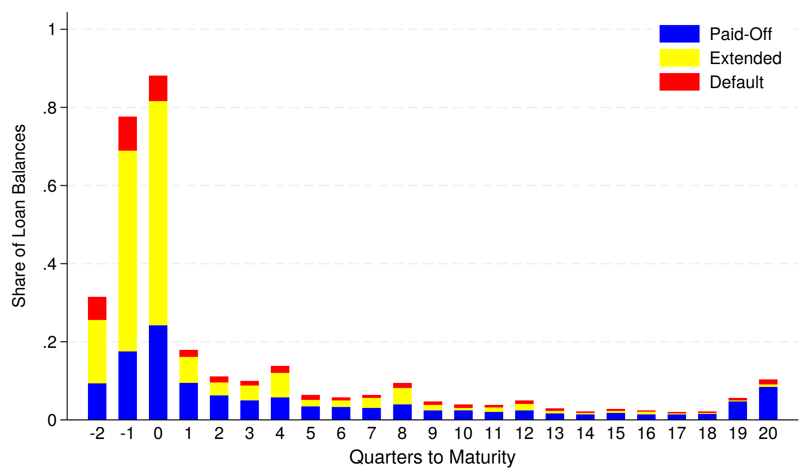
(c) Just Capital Costs ($\chi = .01, \alpha = \infty, \Lambda = 1$)

Notes: Each chart presents a stacked area chart showing the probability that a loan with a given debt yield defaults (red), extends and neglects (yellow), extends and maintains (green), or pays off at maturity (blue). Black line plots $p^*(n)$. Parameters are as in Table A.1, except only including one friction at a time. Panel (a) just has search costs ($\Lambda = 1$). Panel (b) just has foreclosure costs ($\alpha = \infty$). Panel (c) just has capital costs (setting $\chi = .01$ and turning off search and foreclosure costs).

Figure A.2: Loan Outcomes by Time to Maturity



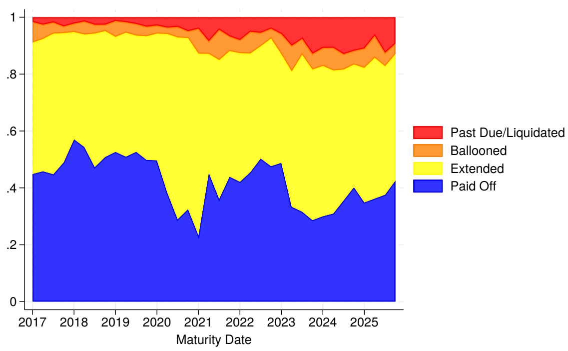
(a) Pre-COVID



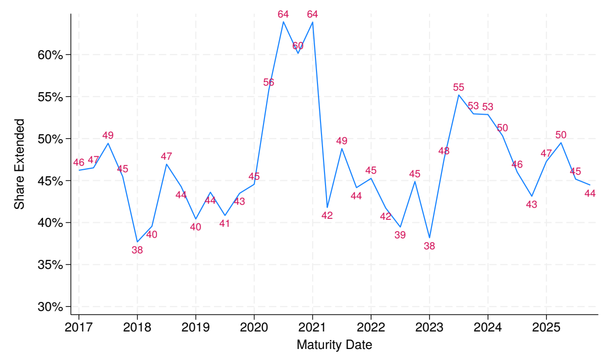
(b) 2023-on

Notes: These figures report loan outcomes by the number of quarters to maturity. Each bar shows the share of outstanding loan balances that are paid off (blue), extended (yellow) and delinquent or liquidated (red). The top panel shows results for the years 2016-2019, and the bottom years from 2023-2025. Quarters to maturity is based on the previous quarter's maturity date. For example, the 0 bar shows the outcomes for loans that were scheduled to mature that quarter as of the previous quarter. I do not show a bar for ballooned loans since that outcome can only occur following maturity.

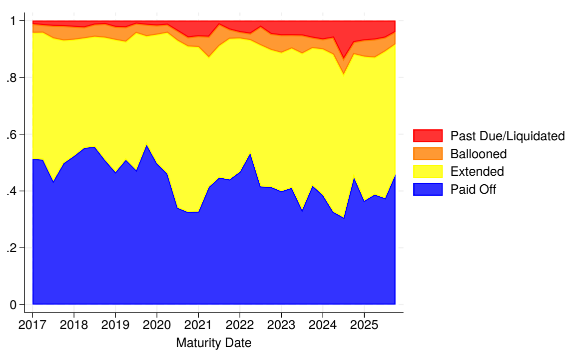
Figure A.3: Outcomes of Pending CRE Loan Maturities, By Stabilization



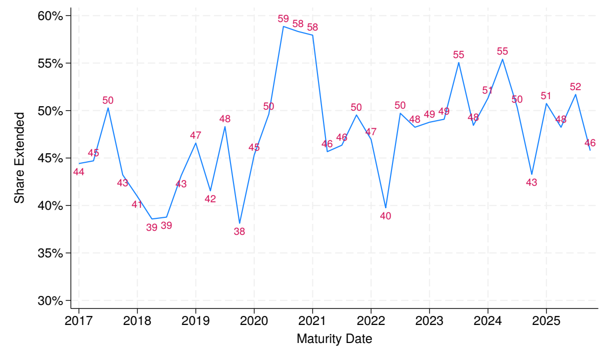
(a) Maturity Outcomes, Stabilized Properties



(b) Extension Rates, Stabilized Properties



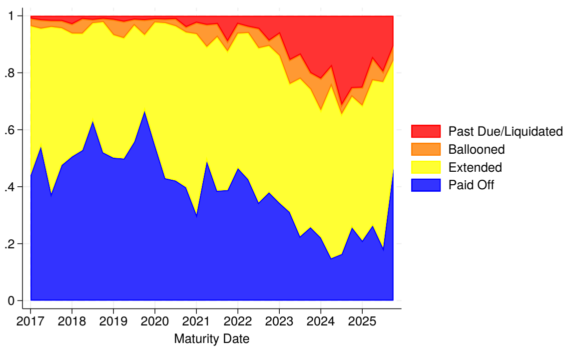
(c) Maturity Outcomes, Non-stabilized Properties



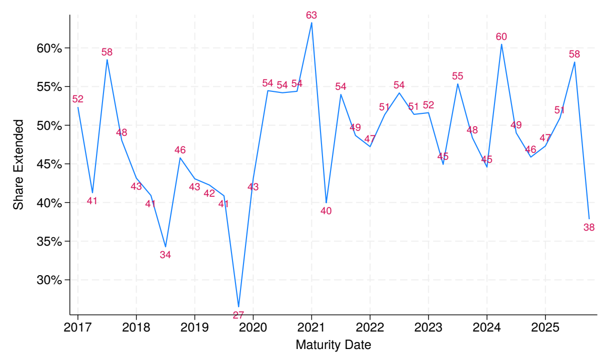
(d) Extension Rates, Non-stabilized Properties

Notes: The left figures show the share of outstanding loan balances that are paid off (blue), extended (yellow), performing past their maturity date (orange) and past due or liquidated (red) by the quarter of scheduled maturity. The right panels show the share of balances that are extended, corresponding to the yellow region in the left charts. The top panels pertain to stabilized properties, and the bottom panels non-stabilized properties. Loan balances and scheduled maturity dates are measured as of four quarters before the scheduled maturity.

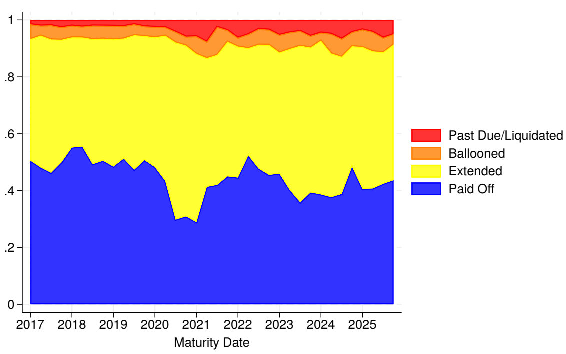
Figure A.4: Outcomes of Pending CRE Loan Maturities, By Property Type



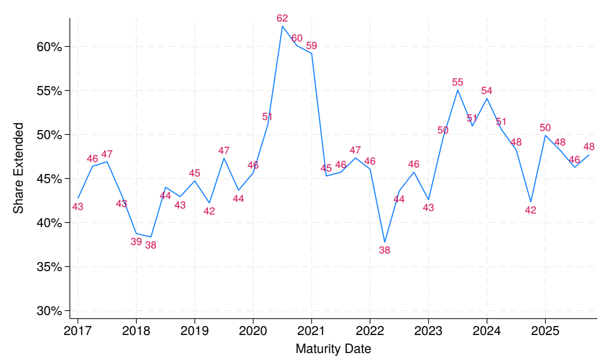
(a) Maturity Outcomes, Office Properties



(b) Extension Rates, Office Properties



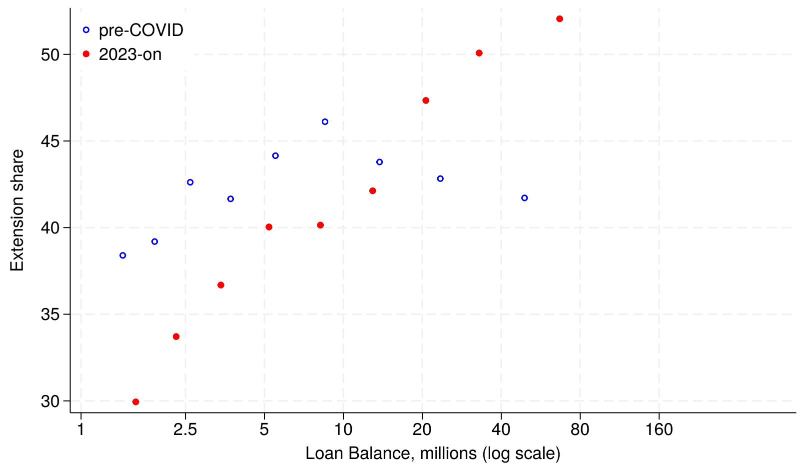
(c) Maturity Outcomes, Non-office Properties



(d) Extension Rates, Non-office Properties

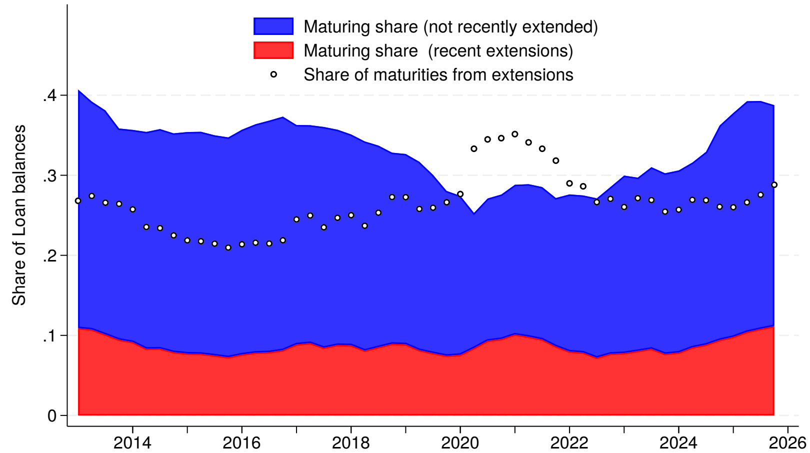
Notes: The left figures show the share of outstanding loan balances that are paid off (blue), extended (yellow), performing past their maturity date (orange) and past due or liquidated (red) by the quarter of scheduled maturity. The right panels show the share of balances that are extended, corresponding to the yellow region in the left charts. The top panels pertain to office properties, and the bottom panels non-office properties. Loan balances and scheduled maturity dates are measured as of four quarters before the scheduled maturity.

Figure A.5: Maturity Extension Rates by Loan Size



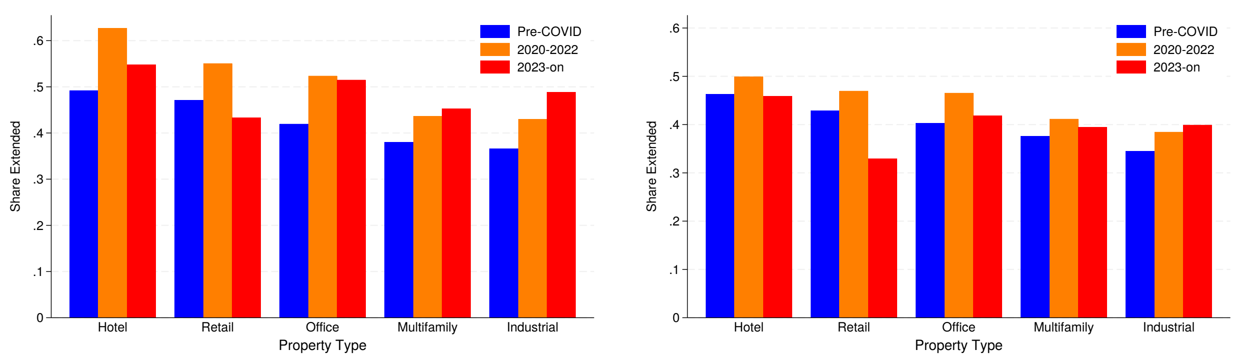
Notes: This figure plots the estimated probability of extension as a function of a loan's size and bank-quarter fixed effects. Each dot estimates the share of loans with pending maturities that get extended by decile of the outstanding loan balance (on a logarithmic scale). Estimates for loans slated to mature before the pandemic are in blue and during the stress period in red.

Figure A.6: Maturities in Next Two Years



Notes: This figure plots the share of outstanding CRE loans that are scheduled to mature in the next two years over time (the top of the blue area), and the portion of those loans accounted for by loans that have received extensions in the past two years (the red area), and the share of pending maturities coming from recent extensions (white dots).

Figure A.7: Extensions by Property Type and Period



(a) Weighted (b) Unweighted

Notes: Each panel plots the share of loans with pending (four quarters ahead) maturities that get extended by property type. Blue, orange, and red bars give extension rates before, during and after the pandemic, respectively. The left panel weights by loan balance and the right is unweighted.

Table A.1: Parameters used in baseline model

Parameter	Description	Value
r	Discount rate	0.045
r_m	Mortgage rate	0.07
f	External funds available	0.15
g	Expected NOI Growth	0.01
σ	Standard Deviation of NOI Growth	0.1
α	Pareto Shape Parameter	12.3
Λ	Recovery Factor	0.76
θ	Decline in NOI from Neglect	0.045
ν	Temporary NOI Boost From Neglect	0.69
χ	Cost to Loss Recognition	0

Notes: $r = 4.5\%$ is set to match 30-year Treasury yields in the period of stress, and $r_m = 7\%$ to match spreads in Glancy et al. (2022). α is based on search frictions estimated in Sagi (2021). g and σ are set to match the statistics on annual rent growth in An et al. (2016). Λ and θ are based on foreclosure costs in Brown et al. (2006). ν is set so that deferred maintenance is an equal-sized transfer and deadweight loss. f is set to match the 95th percentile difference between loan payments and net income in the 2023-on extension data. In the baseline calibration, I set $\chi = 0$ based on Favara et al. (2024). See Appendix B.4 for details.

Table A.2: Select Summary Statistics

	Mean	Std	p10	p50	p90	N
2023-on$_t$	0.48	0.50	0.00	0.00	1.00	1,785,400
Maturing$_{i,t}$	0.03	0.17	0.00	0.00	0.00	1,785,400
Extension$_{i,t+1}$	0.03	0.16	0.00	0.00	0.00	1,683,672
Default$_{i,t+1}$	0.01	0.12	0.00	0.00	0.00	1,683,672
Paid off$_{i,t+1}$	0.19	0.39	0.00	0.00	1.00	1,683,672
Debt Yield$_{i,t}$	0.12	0.05	0.07	0.11	0.20	615,271
Low Debt Yield$_{i,t}$	0.07	0.26	0.00	0.00	0.00	1,785,400
Nonrecourse$_{i,t}$	0.34	0.47	0.00	0.00	1.00	1,785,400
Small Office$_{i,t}$	0.11	0.31	0.00	0.00	1.00	1,785,400
Large Office$_{i,t}$	0.01	0.11	0.00	0.00	0.00	1,785,400
Missing Debt Yield$_{i,t}$	0.66	0.48	0.00	1.00	1.00	1,785,400
Stabilized$_{i,t}$	0.70	0.46	0.00	1.00	1.00	1,785,400
Paydown$_{i,t}$	0.01	0.03	0.00	0.01	0.01	1,505,890
$\mathbb{1}(\text{Paydown} > 5\%)_{i,t}$	0.01	0.11	0.00	0.00	0.00	1,505,890
$\mathbb{1}(\Delta\text{Balance} > 0)_{i,t}$	0.04	0.19	0.00	0.00	0.00	1,505,890
Gained Recourse$_{i,t}$	0.01	0.09	0.00	0.00	0.00	526,040
ΔSpread$_{i,t}$	0.00	0.00	0.00	0.00	0.00	800,672
$\Delta\mathbb{1}(\text{Spread} > 0)_{i,t}$	0.04	0.19	0.00	0.00	0.00	800,672
$\Delta\mathbb{1}(\text{Spread} < 0)_{i,t}$	0.03	0.17	0.00	0.00	0.00	800,672
Low Capital$_{b(i),t}$	0.38	0.48	0.00	0.00	1.00	1,436,889

Notes: Excludes years 2020-2022 to remain consistent with regression samples. Paid off$_{i,t+1}$ is missing for 2025:Q4 observations and for loans that exited the sample for non-standard reasons (e.g., balances falling below the reporting threshold). Stabilized$_{i,t}$ is an indicator for whether the property is not a construction loan, and the value is reported as is (rather than as completed or as stabilized). Debt Yield$_{i,t}$ (net operating income over the loan balance) is bottom- and top-coded at 0 and 0.2, respectively. Missing Debt Yield$=1$ for nonstabilized loans or loans where NOI has not been updated in the last year. Paydown variables exclude quarters with charge-offs or changes in utilization. Paydown$_{i,t}$ is bottom- and top-coded at -.5 and .5, respectively. Gained Recourse$_{i,t}$ is missing for loans that already had recourse. Variables measuring changes in spreads are missing for loans that do not have floating rates. Bank capital is missing when banks first enter the sample as reporting begins before the first stress test results come out.

Table A.3: Select Summary Statistics

	$2023\text{-on}_t = 0$	$2023\text{-on}_t = 1$	$\text{Maturing}_{i,t} = 1$	$\text{Extension}_{i,t} = 1$
	(1)	(2)	(3)	(4)
2023-on_t	0.00	1.00	0.43	0.37
$\text{Maturing}_{i,t}$	0.03	0.03	1.00	0.26
$\text{Extension}_{i,t+1}$	0.03	0.02	0.52	0.16
$\text{Default}_{i,t+1}$	0.01	0.02	0.08	0.04
$\text{Paid off}_{i,t+1}$	0.21	0.16	0.56	0.35
$\text{Debt Yield}_{i,t}$	0.12	0.11	0.12	0.12
$\text{Low Debt Yield}_{i,t}$	0.08	0.07	0.05	0.06
$\text{Nonrecourse}_{i,t}$	0.29	0.39	0.26	0.28
$\text{Small Office}_{i,t}$	0.12	0.09	0.15	0.13
$\text{Large Office}_{i,t}$	0.01	0.01	0.03	0.03
$\text{Missing Debt Yield}_{i,t}$	0.63	0.68	0.75	0.70
$\text{Stabilized}_{i,t}$	0.68	0.72	0.42	0.41
$\text{Paydown}_{i,t}$	0.01	0.01	0.01	-0.00
$\mathbb{1}(\text{Paydown} > 5\%)_{i,t}$	0.01	0.01	0.03	0.08
$\mathbb{1}(\Delta\text{Balance} > 0)_{i,t}$	0.02	0.07	0.06	0.13
$\text{Gained Recourse}_{i,t}$	0.01	0.00	0.02	0.05
$\Delta\text{Spread}_{i,t}$	0.00	0.00	0.00	0.00
$\Delta\mathbb{1}(\text{Spread} > 0)_{i,t}$	0.03	0.05	0.05	0.12
$\Delta\mathbb{1}(\text{Spread} < 0)_{i,t}$	0.03	0.03	0.03	0.12
$\text{Low Capital}_{b(i),t}$	0.35	0.42	0.46	0.48
Observations	933,209	852,191	52,343	47,442

Notes: Each column presents the mean of the variables of interest for a subset of the data. Column (1) summarizes variables in the prepandemic period, column (2) for the stress period, (3) for loans that are scheduled to mature next period, and (4) for loans that were extended in a given quarter.

Table A.4: Extensions During the Stress Period

	$100\times$Extension$_{i,t+1}$			$100\times$Default$_{i,t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Maturing$_{i,t}\times$2023-on$_t$	-5.73**	-3.61*	-3.65*	4.39**	2.04*	1.52$^+$
	(1.13)	(1.65)	(1.66)	(0.63)	(0.90)	(0.90)
...$\times$Low Debt Yield$_{i,t}$		-7.84*	-6.91*		5.72**	5.46**
		(3.36)	(3.32)		(2.07)	(2.03)
...$\times$Nonrecourse$_{i,t}$		-4.58*	-4.91*		3.29**	3.79**
		(2.15)	(1.97)		(1.12)	(1.07)
...$\times$Small Office$_{i,t}$		0.22	0.18		2.43*	2.04$^+$
		(1.66)	(1.63)		(1.08)	(1.09)
...$\times$Large Office$_{i,t}$		3.21	3.01		8.15**	7.64**
		(3.29)	(3.27)		(2.19)	(2.18)
Maturing$_{i,t}$	53.18**	54.74**	53.87**	5.32**	4.75**	4.57**
	(0.60)	(0.99)	(1.04)	(0.31)	(0.45)	(0.46)
...$\times$Low Debt Yield$_{i,t}$		5.34*	4.29$^+$		3.16**	3.35**
		(2.60)	(2.57)		(1.02)	(0.99)
...$\times$Nonrecourse$_{i,t}$		1.29	1.07		-0.96	-1.54**
		(1.08)	(1.08)		(0.59)	(0.57)
...$\times$Small Office$_{i,t}$		-2.61**	-2.00*		1.62**	2.44**
		(0.97)	(0.95)		(0.48)	(0.52)
...$\times$Large Office$_{i,t}$		1.09	2.14		-3.24**	-2.31**
		(2.21)	(2.21)		(0.67)	(0.70)
2023-on$_{i,t}$	-0.58**	-0.23		0.84**	-0.27$^+$	
	(0.21)	(0.22)		(0.18)	(0.15)	
...$\times$Low Debt Yield$_{i,t}$		0.44*	0.19		1.72**	1.68**
		(0.21)	(0.17)		(0.39)	(0.35)
...$\times$Nonrecourse$_{i,t}$		-0.56*	-0.02		1.20**	0.77**
		(0.28)	(0.15)		(0.39)	(0.16)
...$\times$Small Office$_{i,t}$		0.25$^+$	0.33*		1.76**	1.60**
		(0.15)	(0.13)		(0.15)	(0.14)
...$\times$Large Office$_{i,t}$		1.40**	1.39**		13.66**	13.61**
		(0.52)	(0.42)		(0.69)	(0.71)
R^2_a	0.286	0.286	0.309	0.018	0.025	0.075
Observations	1,683,672	1,683,672	1,683,671	1,683,672	1,683,672	1,683,671
Bank FE?	✓	✓		✓	✓	
Bank Quarter FE?			✓			✓
Controls	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100\times\text{Extension}_{i,t+1} = (\beta' X_{i,t})\times\text{2023-on}_t\times\text{Maturing}_{i,t} + \gamma'\text{Lower Level Controls}_{i,t} + \tau_{b(i)} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether the loan gets extended in the following quarter in (1)–(3) and an indicator for whether it is delinquent in (4)–(6). These outcomes are not mutually exclusive. 2023-on$_t$ is 1 for quarters starting in 2023:Q1 and 0 before the pandemic. Maturing$_{i,t}$ is an indicator for whether a loan is scheduled to mature next quarter. $X_{i,t}$ includes indicators for whether the loan has a debt yield under 8%, is nonrecourse, is secured by a small-sized office (under 250,000 square feet in size), is secured by a large office, and an indicator for whether debt yield is missing (for non-stabilized loans or loans with stale income reporting). Coefficients for uninteracted $X_{i,t}$ controls, and all interactions with the missing debt yield indicator are not displayed. Relative to the listed specification, columns (1) and (4) omit the interaction with $X_{i,t}$, and columns (3) and (6) add bank-quarter fixed effects. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.5: Extension Terms by Risk Factors

	Pay down	$\mathbb{1}$(Pay down > 5%)	ΔBalance> 0	Gained Recourse	ΔSpread	$\mathbb{1}$(ΔSpread > 0)	$\mathbb{1}$(ΔSpread < 0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Extension$_{i,t}$ × 2023-on$_{i,t}$	2.95**	2.42**	-5.63**	1.42	0.12**	13.65**	-9.59**
	(0.54)	(0.77)	(1.97)	(0.94)	(0.02)	(1.38)	(1.61)
...×Low Debt Yield$_{i,t}$	-1.28	4.08	-4.26	-0.95	-0.02	-8.14**	-0.88
	(0.86)	(2.56)	(3.67)	(1.32)	(0.04)	(2.99)	(2.82)
...×Nonrecourse$_{i,t}$	0.61	2.34^{+}	-3.19		0.02	1.95	-1.62
	(0.59)	(1.20)	(2.34)		(0.02)	(1.45)	(1.32)
...×Small Office$_{i,t}$	0.56	3.66**	-0.67	1.87	0.08**	8.12**	-0.83
	(0.41)	(1.14)	(1.44)	(1.50)	(0.02)	(1.47)	(1.14)
...×Large Office$_{i,t}$	1.28	13.29**	-12.08**	2.45	0.10**	11.52**	-3.12
	(0.92)	(2.89)	(3.76)	(1.63)	(0.04)	(2.36)	(2.68)
Extension$_{i,t}$	-4.04**	2.27**	15.69**	1.69**	-0.04**	6.72**	16.92**
	(0.48)	(0.35)	(1.52)	(0.55)	(0.01)	(0.71)	(1.43)
...×Low Debt Yield$_{i,t}$	3.81**	4.05*	-2.07	-0.63	0.03	6.50**	-0.98
	(0.70)	(1.58)	(3.30)	(0.67)	(0.03)	(2.24)	(2.51)
...×Nonrecourse$_{i,t}$	-0.47	-0.17	4.00*		0.00	0.17	0.66
	(0.51)	(0.61)	(1.82)		(0.01)	(0.62)	(0.97)
...×Small Office$_{i,t}$	0.35	-0.92^{+}	-0.54	0.92	-0.00	-0.33	-0.72
	(0.31)	(0.49)	(1.02)	(0.88)	(0.01)	(0.71)	(0.85)
...×Large Office$_{i,t}$	1.73*	-0.03	-1.80	-2.34*	-0.03*	-1.60	1.94
	(0.75)	(1.40)	(2.61)	(0.97)	(0.01)	(1.03)	(2.19)
2023-on$_{i,t}$							
...×Low Debt Yield$_{i,t}$	0.02	0.11	0.44	-0.14	-0.00	-3.02**	-2.21**
	(0.03)	(0.16)	(0.75)	(0.13)	(0.01)	(0.94)	(0.80)
...×Nonrecourse$_{i,t}$	0.00	-0.05	-0.64		0.00^{+}	-0.19	-0.42
	(0.03)	(0.16)	(1.26)		(0.00)	(0.48)	(0.43)
...×Small Office$_{i,t}$	0.12**	0.26**	-0.68*	0.13	0.00*	1.11**	0.69**
	(0.02)	(0.10)	(0.32)	(0.24)	(0.00)	(0.26)	(0.25)
...×Large Office$_{i,t}$	0.05	0.54	14.27**	0.82	0.02**	1.15*	0.17
	(0.10)	(0.33)	(1.77)	(0.55)	(0.00)	(0.51)	(0.39)
R^2_a	0.057	0.069	0.142	0.168	0.105	0.287	0.192
Observations	1,356,810	1,356,810	1,356,810	525,523	700,524	700,524	700,524
Bank-Quarter FE?	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100 \times \Delta\text{Term}_{i,t} = (\beta' X_{i,t-1}) \times \text{2023-on}_t \times \text{Extension}_{i,t} + \gamma' \text{Lower Level Controls}_{i,t-1} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where the dependent variable is the change in some loan term, scaled by 100 so estimates are in percentage points. These dependent variables are as described in Table 2. The main independent variables are an indicator for whether the loan receives an extension and an indicator for whether the quarter is 2023 or later. $X_{i,t-1}$ includes indicators for whether the loan has a debt yield under 8%, is nonrecourse, is secured by a small-sized office (under 250,000 square feet in size), is secured by a large office, and an indicator for whether debt yield is missing (for non-stabilized loans or loans with stale income reporting). Coefficients for uninteracted $X_{i,t-1}$ controls; controls for age, size, amortization, and previous spread; and all interactions with the missing debt yield indicator are not displayed. $\tau_{b(i),t}$ is a bank-quarter fixed effect. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.6: Payoffs By Previous Extension

	100×Paid Off$_{i,t+1}$		
	(1)	(2)	(3)
Extended$_{i,t}$	-2.09**	-2.72**	-2.45**
	(0.46)	(0.42)	(0.36)
Extended 2023-on$_{i,t}$	-2.25**	2.24**	1.44**
	(0.78)	(0.66)	(0.51)
R^2_a	0.112	0.127	0.142
Observations	1,681,663	1,681,663	1,681,662
Quarter-to-Maturity FE?	✓	✓	✓
Bank FE?	✓	✓	
Quarter FE?		✓	
Bank Quarter FE?			✓

Notes: This table presents estimates from the equation

$$100 \times \text{Paid Off}_{i,t+1} = \beta_1 \text{Extended}_{i,t} + \beta_2 \text{Extended 2023-on}_{i,t} + \tau_{b(i),t} + \alpha_{m(i,t)} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether an outstanding loan paid off the following quarter. Extended$_{i,t}$ is an indicator for whether the loan was previously extended, and Extended 2023-on$_{i,t}$ is an indicator for whether the loan was extended during the period of stress. $\tau_{b(i),t}$ and $\alpha_{m(i,t)}$ are bank-quarter and quarters-to-maturity fixed effects. Relative to the specification above, columns (1) and (2) replace the bank-quarter fixed effects with bank fixed effects and bank and quarter fixed effects, respectively. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.7: Maturity Extensions By Capitalization

	$100\times\text{Extension}_{i,t+1}$	$100\times\text{Default}_{i,t+1}$
	(1)	(2)
Low $\text{Capital}_{b(i),t}$	0.02	0.13
	(0.25)	(0.12)
$...\times\text{Maturing}_{i,t}\times\text{2023-on}_t$	-0.40	0.83
	(2.68)	(1.52)
$...\times\text{Maturing}_{i,t}$	1.45	-2.75**
	(1.24)	(0.82)
$...\times\text{2023-on}_t$	-0.41	-0.15
	(0.26)	(0.20)
$\text{Maturing}_{i,t}\times\text{2023-on}_t$	-4.29*	4.65**
	(1.80)	(1.00)
$\text{Maturing}_{i,t}$	51.85**	5.77**
	(0.87)	(0.35)
$\text{2023-on}_{i,t}$	-0.35**	0.71**
	(0.10)	(0.10)
R_a^2	0.294	0.062
Observations	1,412,843	1,412,843
Bank FE?	✓	✓

Notes: This table presents estimates from the equation

$$100\times\text{Extension}_{i,t+1} = \beta\text{Low Capital}_{b(i),t}\times\text{2023-on}_t\times\text{Maturing}_{i,t} + \gamma'\text{Lower Level Controls}_{i,t} + \tau_{b(i)} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether the loan gets extended in the following quarter in (1) and an indicator for whether it is delinquent in (2). Low $\text{Capital}_{b(i),t}$ is 1 for banks closer than the median to their capital buffer (determined by the banks' minimum CET1 ratio in the severely adverse scenario in the pre-SCB era and the distance to the bank-specific CET1 capital buffer, inclusive of the SCB and G-SIB surcharge, in the SCB-era). 2023-on_t is 1 for quarters starting in 2023:Q1 and 0 before the pandemic. $\text{Maturing}_{i,t}$ is an indicator for whether a loan is scheduled to mature next quarter. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.8: Extension Terms By Capitalization

	Pay down	$\mathbb{1}$(Pay down > 5%)	ΔBalance> 0	Gained Recourse	ΔSpread	$\mathbb{1}(\Delta$Spread > 0)	$\mathbb{1}(\Delta$Spread < 0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Low Capital$_{b(i),t}$ $\times$Extension$_{i,t}$	0.33	-0.51	-2.86^{+}	-1.13	0.01	-0.67	-3.18*
	(0.52)	(0.69)	(1.71)	(1.10)	(0.01)	(0.81)	(1.28)
...$\times$2023-on$_t$	0.06	2.70*	3.80^{+}	-0.23	0.00	4.32^{+}	4.46**
	(0.61)	(1.17)	(2.25)	(1.78)	(0.02)	(2.47)	(1.68)
Extension$_{i,t}$	-2.22**	3.32**	12.18**	2.69**	-0.03**	5.53**	13.50**
	(0.29)	(0.42)	(1.11)	(0.91)	(0.01)	(0.43)	(0.96)
...$\times$2023-on$_t$	2.87**	4.92**	-8.80**	1.98	0.10**	9.60**	-9.88**
	(0.34)	(0.69)	(1.48)	(1.35)	(0.01)	(1.84)	(1.27)
R^2_a	0.053	0.072	0.133	0.177	0.120	0.298	0.137
Observations	1,086,286	1,086,286	1,086,286	394,537	575,108	575,108	575,108
Bank-quarter FE?	✓	✓	✓	✓	✓	✓	✓
Controls?	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100 \times \Delta \text{Term}_{i,t} = \beta \text{Extension}_{i,t} \times \text{2023-on}_t \times \text{Low Capital}_{b(i),t} + \gamma' \text{Lower Level Controls}_{i,t-1} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where the dependent variable is the change in some loan term, scaled by 100 so estimates are in percentage points. These dependent variables are as described in Table 2. The main independent variables are indicators for whether the loan receives an extension, the time period is 2023 or later, and the loan is held by a bank holding company that is closer than the median to its regulatory capital constraint. Unreported controls include interactions of the main variables of interest that do not include Extension$_{i,t}$, and controls for a loan's age, size, amortization, and previous spread. $\tau_{b(i),t}$ is a bank-quarter fixed effect. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.9: Maturity Extensions By Capitalization and Risk Characteristics

	$100\times\text{Extension}_{i,t+1}$		$100\times\text{Default}_{i,t+1}$	
	(1)		(2)	
Low $\text{Capital}_{b(i),t}\times\text{Maturing}_{i,t}\times\text{2023-on}_t$	2.28	(3.94)	6.40**	(1.87)
...$\times$Low Debt $\text{Yield}_{i,t}$	-3.82	(7.21)	-0.77	(4.16)
...$\times\text{Nonrecourse}_{i,t}$	5.49	(4.51)	-4.93*	(2.31)
...$\times$Small $\text{Office}_{i,t}$	-0.46	(3.52)	-3.24	(2.49)
...$\times$Large $\text{Office}_{i,t}$	-3.31	(7.20)	-4.89	(4.70)
Low $\text{Capital}_{b(i),t}\times\text{2023-on}_t$				
...$\times$Low Debt $\text{Yield}_{i,t}$	-0.58	(0.50)	0.54	(0.72)
...$\times\text{Nonrecourse}_{i,t}$	-0.33	(0.37)	0.99*	(0.39)
...$\times$Small $\text{Office}_{i,t}$	0.75*	(0.34)	-0.64^{+}	(0.34)
...$\times$Large $\text{Office}_{i,t}$	1.51^{+}	(0.90)	5.13**	(1.58)
Low $\text{Capital}_{b(i),t}\times\text{Maturing}_{i,t}$	-0.01	(2.19)	-4.40**	(0.82)
...$\times$Low Debt $\text{Yield}_{i,t}$	0.66	(5.25)	-0.32	(1.95)
...$\times\text{Nonrecourse}_{i,t}$	-0.02	(2.23)	2.33^{+}	(1.22)
...$\times$Small $\text{Office}_{i,t}$	1.11	(2.00)	2.95**	(1.06)
...$\times$Large $\text{Office}_{i,t}$	-2.32	(4.53)	2.85*	(1.43)
Low $\text{Capital}_{b(i),t}$				
...$\times$Low Debt $\text{Yield}_{i,t}$	0.37	(0.45)	0.01	(0.18)
...$\times\text{Nonrecourse}_{i,t}$	0.37	(0.26)	-0.30^{+}	(0.16)
...$\times$Small $\text{Office}_{i,t}$	-0.65*	(0.29)	0.47**	(0.12)
...$\times$Large $\text{Office}_{i,t}$	-1.12^{+}	(0.68)	-0.89**	(0.20)
R^2_a	0.314		0.084	
Observations	1,412,843		1,412,843	
Bank-Quarter FE?	✓		✓	
Lower Level Interactions	✓		✓	

Notes: This table presents estimates from the equation

$$100\times\text{Extension}_{i,t+1} = (\beta' X_{i,t})\text{Low Capital}_{b(i),t}\times\text{2023-on}_t\times\text{Maturing}_{i,t} + \gamma'\text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether the loan gets extended in the following quarter in (1) and an indicator for whether it is delinquent in (2). Low $\text{Capital}_{b(i),t}$ is 1 for banks closer than the median to their capital buffer (determined by the banks' minimum CET1 ratio in the severely adverse scenario in the pre-SCB era and the distance to the bank-specific CET1 capital buffer, inclusive of the SCB and G-SIB surcharge, in the SCB-era). 2023-on_t is 1 for quarters starting in 2023:Q1 and 0 before the pandemic. $\text{Maturing}_{i,t}$ is an indicator for whether a loan is scheduled to mature next quarter. $X_{i,t}$ includes indicators for whether the loan has a debt yield under 8%, is nonrecourse, is secured by a small-sized office (under 250,000 square feet in size), is secured by a large office, and an indicator for whether debt yield is missing (for non-stabilized loans or loans with stale income reporting). Coefficients for variables not interacted with Low $\text{Capital}_{b(i),t}$ as well as all interactions with the missing debt yield indicator are not displayed. Standard errors, in parentheses in the right columns for each model, are clustered by bank-quarter. $^{+,*,**}$ indicate significance at 10%, 5%, and 1%, respectively.

Table A.10: Extension Terms By Capitalization and Risk Characteristics

	Pay down	$\mathbb{1}$(Pay down > 5%)	ΔBalance> 0	Gained Recourse	ΔSpread	$\mathbb{1}$(ΔSpread > 0)	$\mathbb{1}$(ΔSpread < 0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Low $\text{Capital}_{b(i),t} \times \text{Extension}_{i,t} \times \text{2023-on}_t$	-0.48	1.74	8.49$^+$	0.80	-0.08$^+$	-2.09	8.23*
	(1.26)	(1.90)	(4.73)	(2.13)	(0.04)	(3.42)	(3.41)
...×Low Debt $\text{Yield}_{i,t}$	-1.91	-0.52	6.83	-3.89	-0.05	3.84	5.64
	(1.87)	(5.58)	(6.95)	(2.72)	(0.09)	(6.55)	(5.28)
...×$\text{Nonrecourse}_{i,t}$	3.14*	4.56	-13.55*		0.06	1.87	0.64
	(1.28)	(3.06)	(5.62)		(0.04)	(4.01)	(2.85)
...×Small $\text{Office}_{i,t}$	-0.31	-0.15	1.63	-4.32	0.03	6.53$^+$	0.36
	(0.92)	(3.04)	(3.22)	(3.69)	(0.04)	(3.40)	(2.44)
...×Large $\text{Office}_{i,t}$	-3.50	-13.10$^+$	10.39	-4.55	-0.13	-9.14$^+$	9.53$^+$
	(2.18)	(7.11)	(8.12)	(4.06)	(0.08)	(5.51)	(5.28)
$\text{Extension}_{i,t} \times \text{2023-on}_t$	3.59**	2.62*	-8.54**	0.63	0.17**	16.51**	-15.26**
	(0.61)	(1.25)	(2.63)	(1.72)	(0.02)	(2.29)	(2.05)
...×Low Debt $\text{Yield}_{i,t}$	-0.21	3.73	-7.37	0.49	-0.02	-10.09*	-2.63
	(1.03)	(3.27)	(5.64)	(2.23)	(0.05)	(4.15)	(3.90)
...×$\text{Nonrecourse}_{i,t}$	-0.23	1.23	0.46		0.02	1.67	-2.42
	(0.66)	(1.59)	(3.05)		(0.02)	(2.36)	(2.15)
...×Small $\text{Office}_{i,t}$	0.63	4.19*	-1.17	4.79$^+$	0.05*	4.96*	-0.37
	(0.56)	(1.73)	(2.08)	(2.79)	(0.02)	(2.26)	(1.51)
...×Large $\text{Office}_{i,t}$	2.68*	22.03**	-17.16**	5.27$^+$	0.16**	16.02**	-5.34
	(1.35)	(4.66)	(5.87)	(2.86)	(0.05)	(4.20)	(3.43)
R^2_a	0.058	0.074	0.143	0.178	0.121	0.301	0.139
Observations	1,086,286	1,086,286	1,086,286	394,537	575,108	575,108	575,108
Bank-Quarter FE?	✓	✓	✓	✓	✓	✓	✓
Controls?	✓	✓	✓	✓	✓	✓	✓

Notes: This table presents estimates from the equation

$$100 \times \Delta\text{Term}_{i,t} = (\beta' X_{i,t-1})\text{Extension}_{i,t} \times \text{2023-on}_t \times \text{Low Capital}_{b(i),t} + \gamma' \text{Lower Level Controls}_{i,t-1} + \tau_{b(i),t} + \varepsilon_{i,t}$$

where the dependent variable is the change in some loan term, scaled by 100 so estimates are in percentage points. These dependent variables are as described in Table 2. The main independent variables are interactions between indicators for whether (i) the bank holding the loan is closer than the median to its regulatory capital constraint, (ii) the loan was extended in quarter t, (iii) the observation is from the stress period and (iv) a risk factor: low debt yield, missing debt yield, nonrecourse, and small and large office indicators. All specifications include lower level interactions of all variables; controls for a loan's age, size, amortization and previous spread; and bank-quarter fixed effects. Standard errors, in parentheses, are clustered by bank-quarter. $^+$,*,** indicate significance at 10%, 5%, and 1%, respectively.

Table A.11: Payoffs By Previous Extension and Capitalization

	$100\times$Paid Off$_{i,t+1}$		
	(1)	(2)	(3)
Low Capital$_{b(i),t}$	0.00	0.34	
	(0.70)	(0.74)	
...x Extended$_{i,t}$	-2.42^{+}	-2.03*	-2.00*
	(1.40)	(1.02)	(0.83)
...x Extended 2023-on$_{i,t}$	2.84	2.36	0.52
	(1.92)	(1.53)	(1.54)
Extended$_{i,t}$	-1.85	-1.99**	-1.79**
	(1.43)	(0.63)	(0.54)
Extended 2023-on$_{i,t}$	-0.45	0.60	1.55
	(2.15)	(1.28)	(0.98)
R^2_a	0.119	0.123	0.137
Observations	1,410,995	1,410,995	1,410,995
Quarter-to-Maturity FE?	✓	✓	✓
Bank FE?	✓	✓	
Quarter FE?		✓	
Bank Quarter FE?			✓

Notes: This table presents estimates from the equation

$$100\times\text{Paid Off}_{i,t+1} = \beta\text{Extended 2023-on}_{i,t}\times\text{Low Capital}_{b(i),t} + \gamma'\text{Lower Level Controls}_{i,t} + \tau_{b(i),t} + \alpha_{m(i,t)} + \varepsilon_{i,t}$$

The dependent variable is an indicator for whether the loan is paid off next quarter. Extended 2023-on$_{i,t}$ is an indicator for whether the loan was extended during the stress period, Low Capital$_{b(i),t}$ is an indicator for whether the bank is closer than the median to its capital buffer. $\tau_{b(i),t}$ and $\alpha_{m(i,t)}$ are bank-quarter and quarters-to-maturity fixed effects. Lower Level Controls$_{i,t}$ includes Extended 2023-on$_{i,t}$, Extended$_{i,t}$, Low Capital$_{b(i),t}$, and Extended$_{i,t}\times$ Low Capital$_{b(i),t}$. Relative to the specification above, columns (1) and (2) replace the bank-quarter fixed effects with bank fixed effects and bank and quarter fixed effects, respectively. Standard errors, in parentheses, are clustered by bank-quarter. $^{+}$,*,** indicate significance at 10%, 5%, and 1%, respectively.

B. MODEL APPENDIX

B.1. Expectation Derivations

Expectations over Sale Offers Whether borrowers choose to extend or sell depends on the sale offer borrowers receive. If n is high enough that it is possible for borrowers to want to sell, maturity outcomes are stochastic and expected payouts come from integrating over κ.

First, I solve for the critical $\kappa^*(n)$ below which borrowers with a debt yield of n choose to sell. If borrowers reject a sale offer, they will either default or extend, making their outside option to selling $V^+_{b,ext}(n) \equiv \max\{V_{b,\text{maintain}}(n), V_{b,\text{neglect}}(n), 0\}$. The optimal κ^* is such that borrowers are indifferent between selling and that outside option. This occurs when $n/\kappa^*(n) - (1+r_m) = V^+_{b,ext}$, meaning that

$$\kappa^*(n) = \frac{n}{1 + r_m + V^+_{b,ext}(n)}$$

If $\kappa^*(n) < \underline{\kappa}$, there is no chance of a sale, and the borrower either defaults or extends. That is, either $\pi_{\text{ext}}(n) = 1$ or $\pi_{\text{def}}(n) = 1$ depending on whether a mutually beneficial extension is feasible. If $\kappa^*(n) \geq \underline{\kappa}$, the probability of a sale is $\pi_{\text{sale}}(n) = G(\kappa^*(n)) = 1 - \left(\frac{\underline{\kappa}}{\kappa^*(n)}\right)^{\alpha}$.

The borrower's value function in the region where sales are possible comes from integrating over potential offers:

$$\begin{aligned} V_b(n) &= \int_{\underline{\kappa}}^{\kappa^*(n)} \left(\frac{n}{\kappa} - (1+r_m)\right) g(\kappa) d\kappa + V^+_{b,ext}(n) \int_{\kappa^*}^{\infty} g(\kappa) d\kappa \\ &= \underbrace{\frac{\alpha}{1+\alpha}\frac{n}{\underline{\kappa}} - (1+r_m)}_{\text{Expected Return from Forced Sale}} + \underbrace{\frac{1}{1+\alpha}\frac{n}{\kappa^*(n)}\left(\frac{\underline{\kappa}}{\kappa^*(n)}\right)^{\alpha}}_{\text{Option Value of Default/Extension}} \end{aligned}$$

The lender's value function comes from applying the sale, extension and default probabilities to equation (1).

Probability of Eventual Default Let π_m, π_n, and π_{def} be the vectors of probabilities that borrowers choose extend-maintain, extend-neglect, and default on a grid of debt yield values. Let P_m and P_n denote the transition matrices that give the probability that a borrower who chooses extend-maintain and extend-neglect, respectively, transitions from debt yield i to debt yield j next period.

Then the probability that a borrower with a given debt yield i extends in a given period and winds up at debt yield j is given by:

$$P \equiv \text{diag}(\pi_m)P_m + \text{diag}(\pi_n)P_n$$

and the probability that the borrower ultimately winds up defaulting is given by:

$$\Pr(\text{Eventual Default}) = \lim_{T\to\infty}\sum_{t=0}^{t=T} P^t \pi_{def} = (I-P)^{-1}\pi_{def}$$

These equations take the dynamics for debt yield implied by the model (P_n and P_m) and the solution for equilibrium default and extension probabilities for a given debt yield (π_{def}, π_m and π_n) and give the probability of eventual default after a potential string of extensions.

B.2. Numerical Solution

1. Make an initial guess for borrowers' and lenders' values, $\mathbf{V_b}$ and $\mathbf{V_l}$, on a grid of debt yields $\mathbf{n}$.

2. Take expectations over a lognormal distribution to calculate continuation values implied by those value functions (solving for $\mathscr{V}_b(n')$ and $\mathscr{V}_l(n')$).

   (a) Note that $n' = \mu Z n$, where $\mu = (1-\theta\mathbb{1}[\text{neglect}])(1+g)/(1-p)$, and Z is a log-normally distributed variable such that $\mathbb{E}(Z) = 1$. Since the effects of paydowns, neglect, and value appreciation in terms of normalized continuation values are isomorphic to a change in initial NOI, one can take a single expectation (for $\mu = 1$) and use that function to find continuation values associated with other outcomes.

(b) Expectations are estimated by Gauss-Hermite quadrature, interpolating between grid points. For quadrature points falling off the grid, I linearly extrapolate from the last two grid points to calculate lenders' value functions below the grid and borrowers' value functions above the grid. Other off-grid values are assumed to stay at the value for the last grid point.

3. Use $\mathscr{V}_b(n')$ and $\mathscr{V}_l(n')$ to find borrowers' and lenders' value functions for a given action $a(n,\kappa) \in \{\text{Extend} \times \{\text{Neglect}, \text{Maintain}\}, \text{Default}, \text{Pay off}\} \times p$.
4. Solve for borrowers' optimal actions $a_b^*(n,p,\kappa)$.
5. Solve for lenders' optimal $p^*(n)$, given $a_b^*(n,p,\kappa)$.
6. Update value functions based on $a_b^*(n,p,\kappa)$ and $p^*(n)$. Integrating over the Pareto distribution for κ gives the ex-ante values for borrowers and lenders, $\mathbf{V_b}$ and $\mathbf{V_l}$ (see Section B.1).
7. Check for convergence, otherwise return to step 1 with the updated $\mathbf{V_b}$ and $\mathbf{V_l}$.

B.3. Characterization of Equilibrium

B.3.1. Borrowers' problem

I will start by discussing borrowers' optimal decision to default, neglect, or maintain given a particular debt yield and paydown requirement. I abstract from sale decisions here and just characterize which outcomes borrowers select as a function of n and p when a sale offer is not worth taking. Borrowers' optimal selection from these three options determines the outside option to selling—$V^+_{b,ext}(n)$—which in turn determines the likelihood a loan pays off (see Section B.1).

The key boundaries determining where borrowers choose to default are found by setting the values of Extend-Maintain and Extend-Neglect in Table 1 to 0 (the value from defaulting). Call these expressions Equations (DN_b) and (DM_b) because they implicitly define the locus of points such that borrowers are indifferent between default and neglect and default and maintain, respectively:

$$(1+\nu)n-(r_m+p)+\beta(1-p)\mathscr{V}_b\left(\frac{(1-\theta)(1+g)n}{1-p}\right)=0 \tag{DN_b}$$

$$n-(r_m+p)+\beta(1-p)\mathscr{V}_b\left(\frac{(1+g)n}{1-p}\right)=0 \tag{DM_b}$$

The left-hand side of these expressions is clearly increasing in n. Additionally $\mathscr{V}_b'(\cdot)$ is low when n is, so higher paydowns reduce cash flows (net of loan payments) more than they increase continuation values. This means that each expression is decreasing in p for a range of low n. Consequently, from the implicit function theorem, these expressions define upward-sloping functions giving the principal paydown such that borrowers are indifferent between default and each extension type for a given n.[23] Denote these equations defining the indifference boundaries as $DM_b(n)$ and $DN_b(n)$. The upper envelope of these two expressions gives the p that makes a borrower indifferent to default, and the minimum of this and the maximum feasible paydown given borrowers' liquidity constraints determines the maximum achievable paydown that is shown in Figure 1:

$$\overline{P}_b(n)=\min\{\underbrace{\max\{DM_b(n),DN_b(n)\}}_{\text{What borrowers are willing to pay down}},\ \underbrace{f+n-r_m}_{\text{What borrowers can pay down}}\} \tag{5}$$

To characterize $\overline{P}_b(n)$, lenders are constrained by borrowers' default condition when n is low and optimally require the largest paydown that borrowers are willing to make. That is, borrowers are indifferent to default for low-n extensions. If $\mathscr{V}_b(n)\approx 0$—namely there's almost no hope of a borrower leaving the region in which they are indifferent to default—neglect is preferred

[23] The slopes of the curves are:

$$\left.\frac{\partial p}{\partial n}\right|_{DN_b}=\frac{1+\nu+\beta(1-p)\mu_n\mathscr{V}_b'(\mu_n n)}{1+\beta(\mathscr{V}_b(\mu_n n)-\mu_n n\mathscr{V}_b'(\mu_n n))}\quad\text{and}\quad\left.\frac{\partial p}{\partial n}\right|_{DM_b}=\frac{1+\beta(1-p)\mu_m\mathscr{V}_b'(\mu_m n)}{1+\beta(\mathscr{V}_b(\mu_m n)-\mu_m n\mathscr{V}_b'(\mu_m n))}$$

for $\mu_n=\frac{(1-\theta)(1+g)}{1-p}$ and $\mu_m=\frac{(1+g)}{1-p}$.

to maintain, and $\overline{P}_b(n) \approx (1+\nu)n - r_m$. In other words, lenders require all cash flows from the property to go towards loan payments. Since those cash flows are low, this entails interest payments that exceed property cash flows getting capitalized into the loan balance.

More generally, borrowers' willingness to pay a loan down is increasing and convex in n. A higher n means that there are both higher cash flows available to the lender (reducing the need for forbearance) and more potential for price appreciation to pull the property into the region where a sale can be profitable for the borrower (making borrowers more willing to make principal and interest payments that exceed property cash flows). The first effect is linear in n and the second convex. Since the liquidity constraint is linear, the liquidity constraint becomes binding at a higher n, and borrowers' maximum paydown rises dollar for dollar with debt yield since greater property cash flows relieve that constraint.

The second relevant margin is whether borrowers choose to maintain the property. Setting the payouts to extend-maintain and extend-neglect equal to each other, we get:

$$-\nu n + \beta(1-p)\left(\mathscr{V}_b\left(\frac{(1+g)n}{1-p}\right) - \mathscr{V}_b\left(\frac{(1-\theta)(1+g)n}{1-p}\right)\right) = 0 \qquad (M_b^*)$$

When the left-hand side of the equation is positive, the borrower chooses to maintain the property because the increase in continuation values is enough to compensate for the savings from underinvestment. This expression implicitly defines the modification boundary $M_b^*(n)$.

B.3.2. Contracts and Outcomes Chosen by Lenders

When n is low, lenders are constrained by borrowers' willingness to accept a principal paydown and require the highest paydown borrowers will offer (the $\overline{P}_b(n)$ boundary defined in Section B.3.1). The pivotal boundary for lenders' management of stressed loans is whether they are willing to provide an extension to a borrower that will not accept a significant principal paydown and lacks the incentives to maintain the property.

Lenders' decisions here amount to whether Extend-Neglect gives a higher recovery than foreclosure. Lenders are indifferent between the two outcomes when:

$$r_m + p + \beta(1-p)\mathscr{V}_l\left(\frac{(1-\theta)(1+g)}{1-p}n\right) - \left(\Lambda n/\underline{\kappa} - \chi(1-\Lambda n/\underline{\kappa})\right) = 0 \qquad (\underline{P}_l)$$

and will prefer to extend loans if that quantity is positive. This function implicitly defines the minimum paydown lenders accept.

For high n, borrowers' participation constraint is not binding. In this area, lenders require the paydown that satisfies the first order condition maximizing their value function. Taking the expression for lenders' value function in equation (1), and noting that for this region of n $\pi_{\text{def}}(n,p) = 0$, $\pi_{\text{ext}}(n,p) = 1 - \pi_{\text{sale}}(n,p)$ and $\mu^*(n,p) = \frac{(1+g)}{1-p}$, we can express the first order condition as

$$\frac{\partial}{\partial p}\left[\pi_{\text{ext}}(n,p)\Big(p - 1 + \beta(1-p)\mathscr{V}_l\big((1+g)n/(1-p)\big)\Big)\right] = 0 \qquad (P_l^*)$$

where

$$\pi_{\text{ext}}(n,p) = (\underline{\kappa}/\kappa^*(n))^{\alpha}$$

$$\kappa^*(n) = n/(1+n-p+\beta(1-p)\mathscr{V}_b((1+g)n/(1-p)))$$

are the probability of extension and critical cap rate offer below which borrowers pay back the loan, as derived in Appendix B.1. The expression for $\kappa^*(n)$ substitutes in the value to extend-maintain for $V^+_{b,ext}(n)$ since this expression pertains to the optimization problem when lenders are not confined by maintenance decisions. This expression shows that lenders optimally trade off the loss of immediate principal repayment from an extension, (1-p), and the value of future loan payments from the extension: $\beta(1-p)\mathscr{V}_l\big((1+g)n/(1-p)\big)$.

B.4. Calibration

I set $r = 4.5\%$ to match 30-year Treasury yields in the period of stress, and $r_m = 7\%$ to match the 2.5% loan rate spread for CRE loans in Table 1 of Glancy et al. (2022). I set $\alpha = 12.3$ to match the 5% discount required for immediate sales during expansions from Figure 8 in Sagi (2021).[24] I set f to 0.15 to match the 95th percentile of $p + r_m - n$ for post-2022 extensions in the data. I set $g = 0.01$ and $\sigma = 0.1$ to match the statistics on annual rent growth in Table 2 of An et al. (2016), and $\Lambda = .76$ to match the 24% deadweight foreclosure costs in Brown et al. (2006).[25] I set the decline in property values from deferred maintenance to $\theta = 0.045$ based on the additional annualized capital expenditures required of lenders following foreclosure to compensate for previous underinvestment by financially distressed owners from Table 7 of Brown et al. (2006).[26] It is unclear how much of this value decline is lost from inefficiency vs. transferred to borrowers. I assume a 50/50 split, meaning that $.5\theta n/\underline{\kappa} = \nu n$, making $\nu = 0.69$. In the baseline calibration, I set $\chi = 0$ based on the finding from Favara et al. (2024) that large U.S. banks do not engage in zombie lending for C&I loans regardless of capitalization.

[24]There is a 5% discount relative to a seller with a two-year horizon. I approximate this as the expected discount from a forced sale relative to an investor with three times as many sale opportunities (i.e., in years 0, 1, and 2). The minimum from 3 draws of a Pareto distribution is Pareto distributed with a shape parameter 3α. Since the expected sale is proportional to $\alpha/(1+\alpha)$, I set α to satisfy $\alpha/(1+\alpha) = 0.95 \times 3\alpha/(1+3\alpha)$.

[25]I use the measure of foreclosure costs that doesn't account for lenders' required capital expenditures due to deferred maintenance since such costs are captured in the model.

[26]Lenders of foreclosed properties had capital expenditure rates of 6.4%, compared to 1.5-2% for nondistressed owners.