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11-14-2011

# Foreclosure of Securitized Commercial Mortgages - A Model of the Special Servicer

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## **Abstract**

The decision to foreclose on a CMBS mortgage is made by the special servicer. A mortgage loan is in special servicing when it is either delinquent or in a state of imminent default. A special servicer should represent the interests of the underlying CMBS bondholders by returning the highest possible value to the investors. In this paper, we show that a special servicer's compensation structure results in an incentive for her to extend a loan beyond the time desired by its bondholders. We develop a model and demonstrate how compensation incentives interact and influence a special servicer's foreclosure decisions. Our model takes into consideration the dynamic nature of such a decision by viewing it as a dynamic programming problem whereby foreclosure represents a discrete terminal state of an optimal stopping problem. This model thus captures the trade-off between continuation of a loan and termination and we use this model to determine how the stopping rule changes under various compensation structures.

## **Keywords**

CMBS, special servicer, foreclosure, optimal contract design, first-loss bond

## **Disciplines**

Finance and Financial Management | Real Estate

## **Comments**

### **Required Publisher Statement**

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# Foreclosure of Securitized Commercial Mortgages - A Model of the Special Servicer\*

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November 14, 2011

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\*The authors acknowledge valuable discussions with Yongheng Deng, Piet Eichholtz, David Geltner, Patric Hendershott, James Shilling, Alan Todd, Tricia Hall, and participants at the 2010 American Real Estate and Urban Economic Association annual meeting at Atlanta, the International Real Estate Economics and Finance Research Seminar at Skye, Scotland, and the 2010 MNM Symposium at MIT. Please address comments to Peng Liu, 465 Statler Hall, Ithaca, NY 14853; Tel: 607-2542960; Email: peng.liu@cornell.edu.

# Foreclosure of Securitized Commercial Mortgages - A Model of the Special Servicer

## Abstract

The decision to foreclose on a CMBS mortgage is made by the special servicer. A mortgage loan is in special servicing when it is either delinquent or in a state of imminent default. A special servicer should represent the interests of the underlying CMBS bondholders by returning the highest possible value to the investors. In this paper, we show that a special servicer's compensation structure results in an incentive for her to extend a loan beyond the time desired by its bondholders. We develop a model and demonstrate how compensation incentives interact and influence a special servicer's foreclosure decisions. Our model takes into consideration the dynamic nature of such a decision by viewing it as a dynamic programming problem whereby foreclosure represents a discrete terminal state of an optimal stopping problem. This model thus captures the trade-off between continuation of a loan and termination and we use this model to determine how the stopping rule changes under various compensation structures.

**Keywords:** CMBS, Special Servicer, Foreclosure, Optimal Contract Design, First-loss Bond.

## 1. Introduction

Following the recent collapse of the subprime mortgage market, there is widespread concern that the next wave of defaults will occur in the Commercial Mortgage-Backed Securities (CMBS) sector. With lax underwriting being the primary cause behind the high level of subprime mortgage defaults, a similar claim can be made about commercial mortgages that originated at the same time. During that period, loan underwritings were based on optimistic projections of future cash flow as opposed to typical cash flows, which had been common in the past. Many of these so-called “proforma loans” were structured as interest-only loans preventing the borrower from accumulating equity through amortization. These effects, taken together, may explain the steady increase in the rate of loan delinquencies we’re observing today.

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Figure 1 here

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With shortened balloon maturity dates of recent issuances and tighter credit markets, the inability of borrowers to refinance may also lead to defaults. Figure 1 plots the maturing balances of CMBS loans, broken down by year of origination. We see that, in 2011 and 2012, approximately \$39 billion and \$50 billion in loans will come due, respectively. If the present tight lending environment persists over the next three years, we may see a sizable number of such maturity defaults. Figure 2 shows that the number of CMBS loans that have been transferred to special servicers has been increasing since 2007. According to Trepp, as of January 31, 2011, distressed CMBS loans that are currently under special servicing have reached 13.40% of the CMBS market.<sup>1</sup>

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Figure 2 here

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While figure 2 indicates a potential looming problem, it is important to note that actual foreclosure decisions regarding CMBS loans are made by an entity called the special servicer. A special servicer has considerable discretion in deciding how she manages a distressed mortgage.

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<sup>1</sup>Commercial Mortgage Alert 2009, 2010.

Her actions may range from making advances for any debt service shortfalls to traditional loan workout strategies such as loan write-downs or loan modifications. Since a special servicer is compensated by a periodic fee along with other revenue sources for the period during which she is actively managing a loan, any actual foreclosure decision represents the termination of her compensation. This indicates that such a decision will likely involve a trade-off between retaining the compensation stream and realizing the benefits associated with mortgage termination.

The ability to postpone a foreclosure date, sometimes by as much as three years, suggests that whether a future wave of anticipated foreclosures will occur depends on the actions of the special servicers. Given the conflict between receiving income streams from postponing foreclosure and serving the needs of all bondholders, understanding this trade-off is an important step towards being able to assess the potential severity of a new CMBS loan default. Thus effective analysis of the potential CMBS default problem hinges on understanding how special servicers make foreclosure decisions and how such decisions are influenced by the various incentives that result from their sources of compensation.

These relationships are further complicated by the fact that most special servicers retain the first-loss bonds from the CMBS structures of loans that they are managing. Furthermore, special servicers usually have the right of first refusal to purchase defaulted loans at a price that is determined by the special very same servicers. Gan and Mayer 2007 report that, among CMBS deals that special servicers manage, 64% contain some portion of first-loss bonds held by special servicers. Holding such first-loss securities makes them essentially equity investors so foreclosure decisions apparently align more closely with the interests of the below-investment-grade CMBS bondholders rather than with those of the senior bondholders. Senior bondholders in general prefer that a property be sold quickly since they are the first to receive liquidation proceeds. In contrast, the below-investment-grade bond investors wish to postpone liquidation since any principal losses will immediately impact their bonds. With special servicers holding the riskiest of the below-investment-grade bonds, this may skew their decisions to postpone foreclosure at the expense of the senior bondholders.

In this paper, we provide a model of the special servicer and outline how these varying compensation structures influence foreclosure decisions. Our model captures the dynamic nature of such decisions whereby a special servicer must continuously evaluate the trade-off between keeping a loan alive with advances and foreclosing on the loan in an environment of changing and uncertain future market conditions. While numerous empirical studies have estimated the

factors leading to CMBS loan default, fewer have modeled the actual foreclosure decision.<sup>2</sup>

## 2. Loans in Special Servicing

As of the end of December, 2010, more than \$88.4 billion in loans, or 13.20% of all conduit loans by balance, had been submitted to special servicing. Sixteen companies serve as special servicers with the largest special servicer, LNR Partners, managing 1,275 loans valued at more than \$24 billion. Table 1 displays information on the numbers and sizes of loans managed by each of the special servicers.

Table 1: CMBS Loans in Special Servicing by Servicers

<b>Special Servicer</b>	<b># of Loans</b>	<b>Balance of Loans (\$Mil.)</b>
LNR Partners, Inc.	1,275	24,340
CW Capital Asset Management	968	18,581
C-III Asset Management LLC	725	10,470
Midland	517	8,060
JE Roberts	311	4,958
Helios AMC, LLC	207	3,828
Torchlight Loan Services, LLC	173	2,840
Berkadia	295	1,795
Orix	102	850
NCB,FSB	12	171
Prudential	14	54
GMAC	13	41
Wells Fargo	10	42
GE Capital	2	11
Lend Lease	3	5
KeyBank	2	7

Source: JP Morgan CMBS Research, as of January 28, 2011

<sup>2</sup>For empirical default studies, see Ambrose and Sanders (2003), Ciochetti, Deng, Gao, and Yao (2002), Chen and Deng (2010), Vandell et al. (1993), and Leuret and Quan (2008). For models of special servicers, see Ambrose, Sanders, and Yavas (2010) and Gan and Mayer (2007).

To get a sense of the characteristics of loans that are in special servicing, Table 2 provides the number of loans and the percentage of the total loan balance by loan vintage. We see that 66.2% of loans held by special servicers originated in 2006 and 2007. This is consistent with the belief that the underwriting quality for these loans was poor during this period, the same period during which similarly lax standards were used to originate subprime mortgages.

Table 2: CMBS Loans in Special Servicing by Vintage

<b>Deal Vintage</b>	<b># of Loans</b>	<b>Balance</b>	<b>% by Balance</b>
1996	9	43,421,969	0.0%
1997	18	45,534,282	0.1%
1998	90	608,943,223	0.8%
1999	150	942,958,219	1.2%
2000	290	1,623,004,826	2.1%
2001	266	1,684,797,430	2.2%
2002	155	1,184,482,166	1.6%
2003	191	1,976,135,193	2.6%
2004	339	3,658,197,282	4.8%
2005	764	12,534,491,024	16.5%
2006	1,089	17,615,967,319	23.1%
2007	1,178	32,829,612,917	43.1%
2008	80	1,367,874,607	1.8%

Source: JP Morgan, CMBS Research, as of January 28, 2011.

Table 3 categorizes distressed mortgages under special servicing into groups according to collateral property type. The third column lists percentages of CMBS loan balances that have been transferred to special servicers by collateralized property type. It shows that the sectors that have been hardest hit by distressed loans are lodging (21.7%) and multi-family (19.2%) sectors. This is not surprising because the recent recession of 2008-2009 has hit the hotel industry (as well as apartment) revenue more quickly due to the lack of long-term leases. The fourth column lists the shares of specially serviced loan by property type. Given that retail dominates the CMBS sector, it takes the largest share of total specially-serviced loans (26.0%).

Table 3: CMBS Loans in Special Servicing by Property Types



<b>Property Type</b>	<b>Balance (\$Mil.)</b>	<b>Percentage of Balance in Special Servicing</b>	<b>Percentage of Special Servicing by Balance</b>
Office	23,035.6	11.4%	26.0%
Multi-family	18,631.5	19.2%	21.1%
Retail	17,939.2	9.1%	20.3%
Lodging	13,739.0	21.7%	15.5%
Industrial	2,752.6	8.4%	3.1%
Other	12,344.9	16.2%	14.0%
Total	88,443.1	13.2%	100.0%

Source: Commercial Mortgage Alert, as of January 28, 2011.

## 2.1. Special Servicers' Decisions

When loans are in delinquency or in a state of imminent default, master servicers transfer them to special servicers who are responsible for managing and possibly modifying the troubled loans.

Once a loan is in the hands of a special servicer, there are numerous actions she can take:

1. Maturity Date Extensions - Although loan extensions were quite rare prior to 2008, recent turmoil in credit markets have left many borrowers unable to refinance their mortgages to meet looming loan payments. Typical extensions range from 12 to 36 months, depending on the special servicer's assessment of a property's income-generating potential and the credit worthiness of the borrower.
2. Payment Modification - If there is insufficient property income to meet the scheduled debt service, the special servicer may reduce the payments for a defined period. This is a fairly popular type of restructuring.
3. Reduction in Interest Rates - Much like payment modification, the loan rate may be reduced if such a reduction can lead to payments that are manageable given the property's income.
4. Reduction in Principal Balance - This option is the most costly to the special servicer, who holds the first-loss bond from the CMBS structure. This is used only when other payment reduction strategies do not work. In some cases, the borrower will have to contribute additional funds to offset the principal reduction.

5. Discounted Payoffs - This option is used if the borrower has the ability to pay off the loan at the discounted value and it is not anticipated that property values will increase in the near future. This may have tax implications since such discounts may be viewed as discharging debt. A more tax efficient approach would be for the borrower to purchase the note at the discounted value.
6. Short Sales - This occurs when there is a potential buyer who is willing to purchase at a reduced price for the note. The loan is written down to a level that is acceptable to the new buyer, who assumes the loan upon sale.
7. Additional Capital Injection - The special servicer may require the borrower to contribute additional capital to avoid foreclosure.
8. A/B Split Note - The loan is split into two notes, with the A note equalling the amount of the loan that can be supported by the current property income. The B note is the difference between the loan amount and the size of the A note. This note is due at the time of maturity so there is a possibility that it may be paid.

## **2.2. Compensation Structure in Special Servicing**

The compensation structure that governs relationships among various participants in a CMBS deal is an important part of the Pooling and Servicing Agreement (PSA). Although a special servicer's role is to represent the interests of all CMBS bondholders, her sources of compensation may lead her to adopt foreclosure rules that conflict with the bondholders' interests. Special servicers are typically paid a fixed fee of 2 basis points of the balance each month. Furthermore, although this structure was originally proposed as a mechanism for ensuring the special servicers would minimize losses from managing these loans, they often hold the first-loss bonds from the CMBS structure that contains the loan under special servicing. The rationale for this is that any premature losses from poor loan management will result directly in losses incurred from holding the first-loss bonds. If a loan becomes current and is returned to the a master servicer, the associated special servicer will be rewarded 1% of the loan balance. The special servicer is also paid 1% of the proceeds from liquidation. In addition, the special servicer is paid a percentage of funds she is able to extract from the borrower. The special servicer should also have the ability to make advances to the bondholders if there is a shortfall in debt service payments. This advance is recovered from either the proceeds from a sale or from the borrower if the loan

is cured and becomes current. Such an advances have the first priority to be reimbursed before even the most senior bond holders get paid.

### 3. The Model

A special servicer’s optimal servicing decision is modeled as a dynamic programming problem (Rust,1987). The model captures the regenerative intertemporal trade-off decision faced by the servicer. At each point in time, she determines the value of continuing to service the loan and being compensated and weights this against the decision to foreclose on the property. The regenerative nature of her decision reflects the fact that postponing will allow her to make the same decision in the next period. What changes each period is the income-generating abilities of the property, which we take to be a stochastic process. The solution to this problem, which is captured by the Bellman equations, yields a cut-off point of property’s net operating income (NOI) which determines her default decision.

Every month, the special servicer makes a decision about whether to foreclose or continue into the next month. Foreclosing a loan terminates the option of working out the loan in the next period. If the special servicer chooses to continue, she can employ one or more workout strategies to modify the loan as previously outlined. The special servicer keeps the option of foreclosing on the loan in the next or future periods if the loan continues to underperform. Figure 3 illustrates the special servicer’s decision process.

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Figure 3 here

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A special servicer’s optimal decision can be summarized as being determined by the critical cut-off level of a property’s NOI whereby she forecloses if the property’s NOI is above this threshold level. We are interested in understanding how this critical value differs if she holds a first-loss bond. The decision rules discussed above differ for each loan and change over time according to market conditions and property characteristics.

Assume that a borrower’s NOI follows a first-order autoregressive  $AR(1)$  process:

$$NOI_{t+1} = \mu + \phi NOI_t + e_t \tag{3.1}$$

where  $\mu$  is a constant mean;  $\phi \in (0, 1)$  is an autoregressive parameter, and  $e_t$  is the error term, which follows a standard normal distribution with constant variance  $\sigma^2$ . Let the initial stabilized NOI at loan origination be  $NOI_0$ , and the going-in capitalization rate be  $Cap_0$ . The lender's underwriting criteria can be summarized by two variables: the maximum loan-to-value ratio ( $LTV_0$ ) and the minimum debt service coverage ratio ( $DSCR_0$ ). The CMBS deal contains two infinitely-lived tranches<sup>3</sup>: a senior tranche and a subordination tranche (first-loss bond) with the same coupon rate  $R_0$ <sup>4</sup>. Assuming that the CMBS loan was issued at the binding constraints, the maximum loan amount at origination is determined by the periodic stabilized  $NOI$  that the underlying property generates. The advantage of this assumption is that it makes the mortgage scalable, so the loan amount is a constant multiple of stabilized NOI at origination.

$$L = \gamma NOI_0 \text{ where } \gamma = \min \left\{ \frac{LTV_0}{Cap_0}, \frac{1}{DSCR_0 \times R_0} \right\} \quad (3.2)$$

The optimal stopping rule is the solution to a stochastic dynamic programming problem that formalizes the trade-off between the conflicting objectives of maximizing a special servicer's income for continuation of a workout and maximizing the liquidation value of the property. The idea is to explain the joint stochastic processes  $\{i, X_t\}$ , where  $\{i_t\}$  is a set of binary-valued processes:  $i_t = 1$  if the special servicer forecloses the property, and 0 otherwise.  $\{X_t\}$  is a vector of state variables observed by both the special servicer and us, the model builders. We choose the cumulative advances as the state variable  $X_t$  in our model. The cumulative advances, which is defined as the total advances the servicer has made since the servicing transfer event, are determined by many factors such as macroeconomic conditions, loan performance history, loan terms, and collateral information. The vector  $\{\varepsilon_t\}$  represents the latent variables observed only by the servicer but not by us.<sup>5</sup> The hypothesis we maintain is that the special servicing follows an intertemporal optimal strategy.

It can be shown that the stochastic process governing  $\{X_t, \varepsilon_t\}$  is the solution to the following

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<sup>3</sup>We later relax this assumption by assuming the holdings of the first-loss pieces decrease over time.

<sup>4</sup>Normally the coupon rate of a subordination bond is higher than that of the senior tranche. However, making the interest rates of the two tranches the same does not affect the main result.

<sup>5</sup>The error term can be interpreted as special servicer's heterogeneity. For example, if a special servicer chooses to hedge her first-loss holdings by entering into swap contracts, her workout strategy will be different from that of those who have market exposure to first-bond price risks. For discussion of different interpretation and model techniques of the error terms, please see Rust 1992.

value function:

$$V_\theta (X_t, \varepsilon_t) = \sup_\pi E \left\{ \sum_{j=1}^{\infty} \beta^{(j-t)} [u(x_j, f_j, \theta_1) + \varepsilon_j(f_j)] | x_t, \varepsilon_t, \theta_2, \theta_3 \right\} \quad (3.3)$$

where the servicer chooses a sequence of decision rules  $f_t(x_t, \varepsilon_t, \theta)$  to maximize her expected discounted utility function over an infinite horizon,  $\pi = \{f_t, f_{t+1}, f_{t+2}, \dots\}$ , with  $\beta$  being her intertemporal rate of time preference.

The optimal value function  $v_\theta$  is the unique solution to the following Bellman's equation:

$$v_\theta(x_t, \varepsilon_t) = \max_{i \in C(x_t)} [u(x_t, i, \theta_1) + \varepsilon_t(i) + \beta E v_\theta(x_t, \varepsilon_t, i)] \quad (3.4)$$

The realized single-period utility of decision  $i$  when state variable is  $(x_t, \varepsilon_t)$  can be written as:

$$= \begin{cases} u(x_t, i, \theta_1) + \varepsilon_i(i) & i_t = 0 \text{ continue} \\ s_1 L + bLR_0 - Z_t + \varepsilon_t(0), & \\ s_2 V_t + \sum_{j=1}^t Z_j (1 + R_1)^{t-j} + \max(0, V_t - (1 - b)L) - Y(X_t) + \varepsilon_t(1), & i_t = 1 \text{ foreclose} \end{cases} \quad (3.5)$$

Each month, the servicer faces a discrete decision about whether to continue monitoring the loan or to foreclose on the property. If she chooses to continue, she receives a constant monthly servicing fee of  $s_1$ . She makes an advance if the realized NOI is smaller than the scheduled monthly payment. The periodic advance, including principal and interest payable to bond holder in addition to servicing advances, is defined in terms of the incremental changes in the observed state variable  $\{X\}$ ,  $Z_t = X_t - X_{t-1}$ .

In addition to servicing income and expenses, the servicer receives payment from holding the subordination or first-loss bond. The servicer receives interest income  $bLR_0$  where  $b$  is the proportion of all subordination bonds that she holds. When the loan becomes performing again (NOIs are higher than debt service for a certain period), the loan is sent back to the master servicer. If the special servicer chooses to foreclose on the loan, all advances the special servicer has made since the transfer event will be reimbursed with interests,  $\sum_{j=1}^t Z_j (1 + R_1)^{t-j}$ , before the proceeds are distributed to bond holders. In addition, the special servicer receives a liquidation fee,  $s_2 V_t$ , expressed as a percentage of the property liquidation value  $V_t$  after it pays out to other senior bond holders if its principal is not wiped out,  $\max(0, V_t - (1 - b)L)$ . The property liquidation value can be derived as the last period NOI capitalized at the terminal cap rate,  $R_T$ , i.e.  $V_t = \frac{NOI_t}{R_T}$ . Brown, Ciocheti, and Riddiough (2006) suggest that depressed industry

conditions will drive a wedge between the fundamental asset value and the asset sale price. Therefore the terminal cap rate is assumed to be higher than the going-in cap rate. In addition,  $Y(X_t)$  captures the disutility (or penalty) a special servicer suffers if she has been working with the distressed loan for a significantly long period.  $Y(X_t)$  is modeled as negatively related to the cumulative advancement  $X_t$ . As for the same-revenue incentive, the longer a distressed loan has been in the special servicer's house, the bigger the reputational penalty it will incur if she does not achieve a successful workout.

The special servicer's utility for a successful workout or loan modification is

$$u(x_t, \theta_1) = s_3L + bLR_0 + \sum_{j=1}^t Z_j (1 + R_1)^{t-j}, \quad (3.6)$$

which is the utility of one possible terminal state exogenously specified.

A loan is sent back to the master servicer when its current  $NOI_t$  exceeds the stabilized NOI determined at loan origination plus an extra amount, which is modeled as an increasing function of the cumulative advances; that is,  $NOI_t \geq NOI_0 + kX_t$ . The proceeds a special servicer receives include a workout fee  $s_3L^6$ , interest payment  $bLR_0$  from the first-loss bonds she holds, and the reimbursement of total advances made with compounded interest.<sup>7</sup>

## 4. Results

We calibrate our model parameters and estimate any behavior biases as a consequence of special servicer compensation. We particularly focus on investigating the influence of the servicer holding first-loss bonds. The data-generating process can be regarded as realization of a controlled Markov process generated from the solution to the infinite horizon stochastic control problem. The estimation in this paper is based on simulations. The parameter values of the base scenario are shown in table 4, and the value function is approximated using nested fixed point algorithm.

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<sup>6</sup>Under current special servicing industry practice, the workout fee is the same as the amount of fees received if a special servicer forecloses on a loan.

<sup>7</sup>Note equation 3.6 does not have an error term, because it is one of the possible results from a decision to continue. Modeling all possible loan modifications is not tractable.

Table 4 Parameter Values of the Base Scenario

<b>Baseline Scenario</b>	<b>Parameter Value</b>
Loan-to-Value Ratio ( $LTV_0$ )	0.7
Debt Service Coverage Ratio ( $DSCR_0$ )	1.4
Capitalization Rate (Annual) ( $Cap_0$ )	9%
Subordination Tranche Coupon Rate ( $R_0$ )	10%
Reimbursement Interest Rate (Annual) ( $R_1$ )	7%
Intertemporal Rate of Substitution ( $\beta$ )	0.992
Stabilized NOI (Monthly) ( $NOI_0$ )	10
Volatility (Standard Deviation) of NOI	3
Autoregressive Parameter ( $\phi$ )	0.7
Portion of First-loss Bond Holding ( $b$ )	0.2% – 2%
<b>Compensations of the Special Servicer</b>	
Fixed (Monthly) Special Servicing Fee ( $s_1$ )	2 <i>bps</i>
Foreclosure Fee ( $s_2$ )	1%
Workout Fee ( $s_3$ )	1%

The objective of this study is to quantify the magnitude of foreclosure bias in terms of NOI threshold. The foreclosure NOI cut-off point is the result of the optimal decision of a special servicer based on current realization of cash flow ( $NOI_t$ ) and cumulative advances ( $X_t$ ) made since the servicing transfer event. The special servicer is essentially making an optimal stopping (foreclosure) decision to exercise the workout option. The option value of continued workout is the central feature of the model. By extending the specially serviced loan into the next period, the servicer preserves the option of workout or later liquidation. Holding a portion of the subordination bonds typically provides her with a stronger incentive to postpone foreclosure.

We define *foreclosure bias* as the percentage difference in the foreclosure thresholds of a special servicer who holds a first-loss piece and one who does not hold a first-loss piece. Let  $NOI^{**}$  ( $NOI^*$ ) be the foreclosure thresholds for the special servicer who holds (does not hold) first-loss bonds. We thus measure foreclosure bias as the percentage difference between  $NOI^{**}$

and  $NOI^*$ , normalized by initial cash flow  $NOI_0$ <sup>8</sup>.

$$\text{Foreclosure Bias} = \frac{NOI^{**} - NOI^*}{NOI_0} \quad (4.1)$$

#### 4.1. Foreclosure Bias When the Special Servicer Holds First-loss Bonds

Figure 4 provides simulated regions for continuation, foreclosure, and workout decisions on the part of a special servicer. Two axes represent two observable state variables (realized NOI and cumulative advances) in our model. The vertical axis represents the NOI realization state and the horizontal axis is cumulative advances  $X_t$ , measured by the number of months<sup>9</sup> after the special servicing transfer event. These area plots can be interpreted as a map of optimal workout strategies resulting from the special servicer's dynamic programming problem. Any point on the map, which gives a special servicer an optimal workout decision, results from two state variables: 1) the current NOI level, and 2) the special servicing severity (cumulative advances made by the special servicer measured in number of months in special servicing).

The four panels in figure 4 demonstrate four scenarios corresponding to a range of optimal workout strategies according to various first-loss bond holding percentages when a delinquent loan was transferred to a special servicer (b ranges from 0 to 2 percent). The white area represents the workout region, where sufficient NOIs made the loan performing and current and the specially serviced loan has been returned to the master servicer. The criteria for a successful workout is exogenously specified as NOI returns to the stabilized NOI level, which is modeled as an increasing function of special servicing severity to capture the fact that a deeply distressed loan should achieved a higher NOI before being returned to a master servicer. The dark area represents the foreclosure region where a special servicer's optimal decision is to foreclose on the property. The gray area at the bottom of the graph is the continuation region. The border line between the foreclosure region and the continuation region is the foreclosure NOI threshold. If the NOI is lower than the border line, the special servicer will choose to postpone the foreclosure. Because low net operating income means poor liquidation value, the option of foreclosure is deeply out of the money.

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<sup>8</sup>We choose the initial  $NOI_0$  level to normalize foreclosure bias rather than  $NOI^*$ , because NOI itself is a random variable and it can vary dramatically according to state realizations, which makes the normalized bias unstable.

<sup>9</sup>The severity of special servicing can be measured in terms of the number of months under special servicing by assuming that the incremental advance equals the total monthly debt payment.



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Figure 4 here

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We are particularly interested in understanding how a special servicer’s first-loss holdings bias her foreclosure decisions. It is apparent from figure 4 that the continuation region (or the number of states that are involved in extending the foreclosures) increases when the first-loss bond holding rises from no-holding to a 2% holding. The marginal changes in foreclosing NOI levels reflect the discrepancy in foreclosure decisions for a special servicer who holds first-loss bonds. In order to identify the foreclosure bias, figure 5 summarizes the information from figure 4 and shows this foreclosure bias at various special servicing periods. The optimal foreclosure threshold can be 50% higher for servicers who hold first-loss bonds than for those who do not hold such bonds. The dotted line represents the case in which the servicer holds only 0.2% of the first-loss bonds. The dashed line represents a first-loss bond holding of 0.5% while the solid line represents a holding of 2%. Figure 5 shows significant bias ranging from zero to 50%. The gap is higher when the cumulative advances are larger. (A larger first-loss bond holding yields higher foreclosure bias.) A continually underperforming property causes continuously rising advances. As a result, the likelihood that it will generate sufficient income to cover debt service payments declines. As this process continues, the foreclosure bias decreases until the bias is eliminated. That is, as more and more advances are made, the likelihood of recovering these advances diminishes to the point where the special servicer’s foreclosure decision would be identical to that of a servicer who does not hold first-loss bonds.

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Figure 5 here

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## 4.2. Robustness Checks

Our results are robust under various parameter specifications. The foreclosure biases are both statistically and economically significant under various NOI processes and various CMBS underwriting standards (LTV, DSCR,  $R_0$ ,  $R_1$  etc.). In this section, we exam whether the current practices of “delay and pray” or “pretend and extend” are due to a dramatic change in mar-

ket fundamentals. The second hypothesis addresses the argument that first-loss bonds held by special servicers have been under water or deteriorating.

#### 4.2.1. Foreclosure Bias When Market Fundamentals Change

The record-high numbers of CMBS loans in distress are coupled with dramatic changes in financial market fundamentals. Can changes in market fundamentals alone explain the systematic biases of the special servicer's foreclosure decision? How much foreclosure bias is due to changes in market fundamentals and how much is attributable to the special servicer's holding of first-loss bonds? This section investigates this question by assuming a structural shift in the market capitalization rate. The cap rate is the market average rate used to capitalize the stabilized NOI to determine the asset value. Now let's assume the occurrence a permanent shock to the economy and examine how market value cash flows<sup>10</sup>. In particular, we assume that the expected average cap rate permanently increases from 9% to 12% after loan underwriting.

Figure 6 compares the excess delays in foreclosures following cap rate increases under various first-loss bond holdings, ranging from zero to one percent. The percentage changes in the foreclosure threshold are calculated as percentage differences in NOI cutoff points. The dotted line of zero first-loss holding in figure 6 shows that the extended delays are expected for distressed loans that are newly transferred and for loans that have stayed in special servicing for longer periods. For loans that are in special servicing for 15 to 28 months, special servicers tend to foreclose sooner, because they no longer expect market conditions to improve significantly in the near future and foreclose quickly to recover as much value as possible. The U-shaped pattern becomes pronounced as the percentage of first-loss holdings increases. To estimate the overall or cumulative effect of such a cap rate change, we measure the likelihood of the continuation region weighted by state probability, because the distribution of NOI realization is not uniform (the realization probability of  $NOI = 9$ , is much higher than that of  $NOI = 3$ , for example). However correctly assigning the NOI probability distribution is non-trivial, as a loan that has been in special servicing for 10 months of is conditional on the fact that it has been with the special servicer for 9 months. To facilitate faster calibration, we use stationary distribution of  $AR(1)$  for the NOI process. Therefore, the resulting measure of excess delays in foreclosures under-estimates true extension bias.

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<sup>10</sup>This may be due to changes in people's perception of risk or valuation of risks.

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Figure 6 here

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Three curves in figure 7 confirm the intuition that a permanent negative shock in market fundamentals causes special servicers to postpone foreclosure. However, this effect produces only a limited bias of under 0.5% for loans that are in special servicing for more than 8 months if the special servicer holds no first-loss piece. The market fundamental effect plays a much more important role when a special servicer holds first-loss pieces. If a special servicer holds 0.5% and 1% of first-loss bonds, the excess delay could be as high as 75% and 30%, respectively. We conclude that such a first-loss holding causes a special servicer to delay foreclosure substantially in response to a permanent change in market fundamentals.

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Figure 7 here

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#### **4.2.2. Foreclosure Bias When a Special Servicer's First-loss Bond Holdings Decrease**

The results for the base model build on the assumption that the shares in first-loss pieces that a special servicer holds remain constant during the special servicing periods. As loan performance deteriorates, a special servicer's first-loss holding may decrease or even be wiped out entirely. To estimate the impact of such deteriorating effects, we compare the constant holding with diminishing holding for foreclosure biases of 0.5% initial first-loss bond holdings. Figure 8 shows that the foreclosure bias remains significant. For loans that are in special servicing under 15 months, the biases are the same. It is only when the first-loss holdings are reduced to almost zero that the foreclose bias starts to narrow.

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Figure 8 here

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## 5. Conclusion and Implications for CMBS Contract Design

Conflicts of interest between senior bond holders and junior bond holders as well as the “self-dealing” problem regarding special servicers raise a bigger question about optimal contract design of CMBS deals. The record high level of defaults and the temporary suspension of CMBS issuance during 2008-2009 provide challenges as well as opportunities for CMBS design. We proxy the self-dealing problem for using the first-loss bond ownership and the conflict between compensation structures. We demonstrate how a special servicer, when she holds first-loss bonds from the structure that contains the nonperforming loans she is managing, might postpone the foreclosure decision. Thus our model illustrates the current industry practice of “*Delay and Pray*” or “*Extend and Pretend*”. We show that the more subordination bonds a special servicer holds, the more inclined she is to postpone the foreclosure decision. However, this workout behavior skews the decision only up to a point, after which the servicer reverts back to an unbiased foreclosure rule.

Governed by the pooling and servicing agreement, a special servicer should maximize the total recovery of all CMBS bonds on a present value basis. We show that since most special servicers are also investors in or appointed by the controlling class (first-loss bond investors), their foreclosure decisions regarding specially serviced loans might be biased. Our dynamic programming model attempts to quantify this bias, which can be as high as 50 percent, in terms of optimal NOI foreclosing threshold.

Based on our model, we offer the following recommendations<sup>11</sup> for optimal design of CMBS service contracts: (1) Special servicers should not be granted the first-refusal option to purchase defaulted loans; they should buy the defaulted loans in a competitive market; (2) the re-appointment of a special servicer should be made by an independent entity that would represent the whole trust; (3) fees paid to special servicers should be capped or shared by the trust; (4) total advances should be restricted to a certain percentage of asset market value.

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<sup>11</sup>Some of the recommendations are consistent with the recent CMBS deal - the \$788.5 million GS Mortgage Securities Trust 2010-C1, backed by commercial mortgages contributed by Goldman Sachs, Citi and Starwood Property Trust. In this deal, where Wells Fargo was appointed master and special servicer, a cap was put on special servicer fees for loan workout. The replacement of the special servicer will be determined by the a majority vote; no single bond class will have the right to replace the special servicer. In addition, the deal eliminated the traditional option for the special servicer to buy defaulted loans. Instead, loans have to be marketed and sold to the highest bidders.

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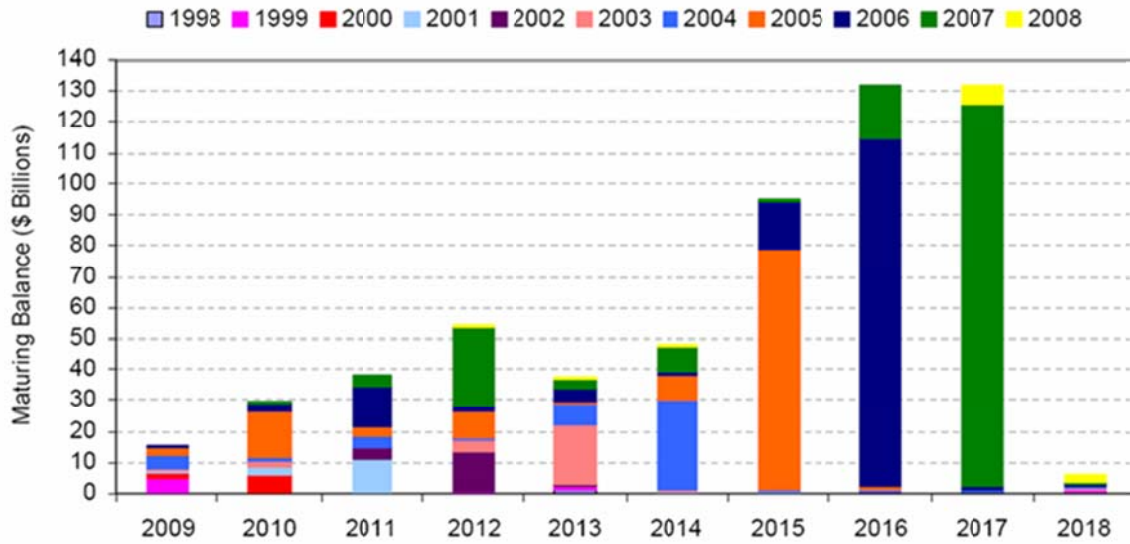


Figure 1: Maturing CMBS Loan Balance by Issuing Vintage (Source: Trepp)

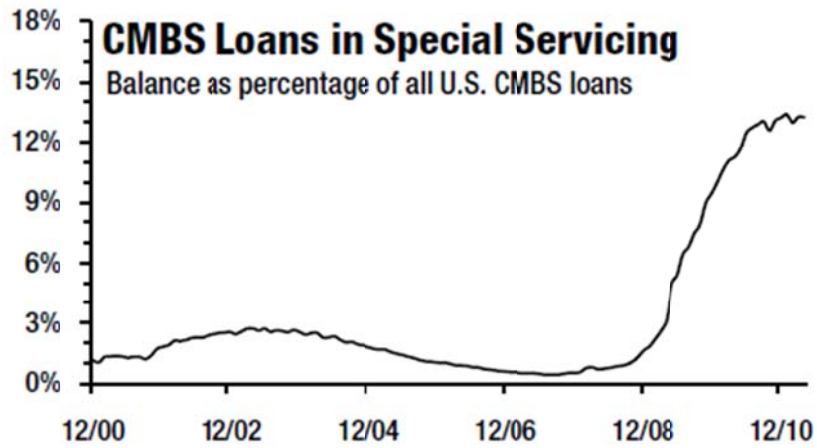


Figure 2: CMBS Loans in Special Servicing (Source: Trepp)

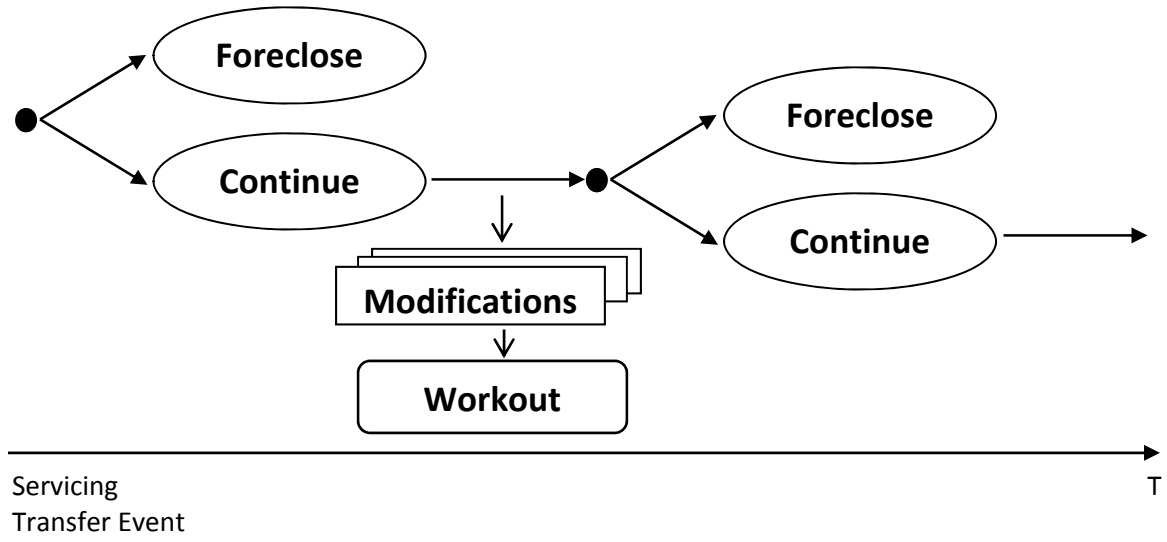


Figure 3: Decision Tree of a Typical Special Servicer

Figure 4: Simulation Results of the Special Servicer's Decision

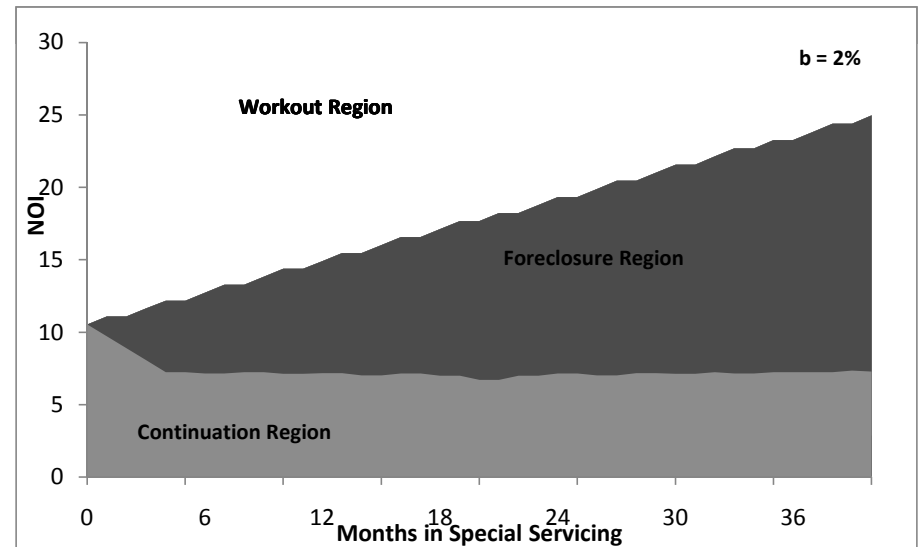
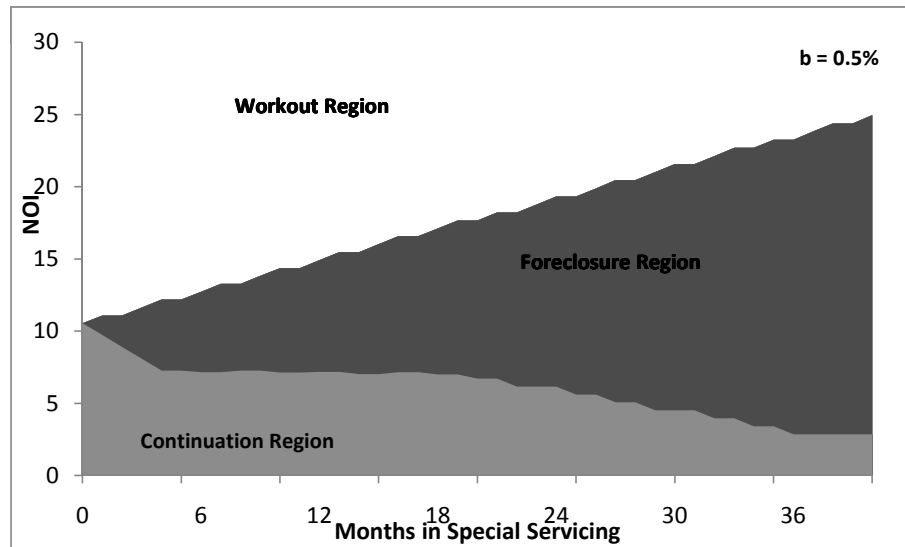
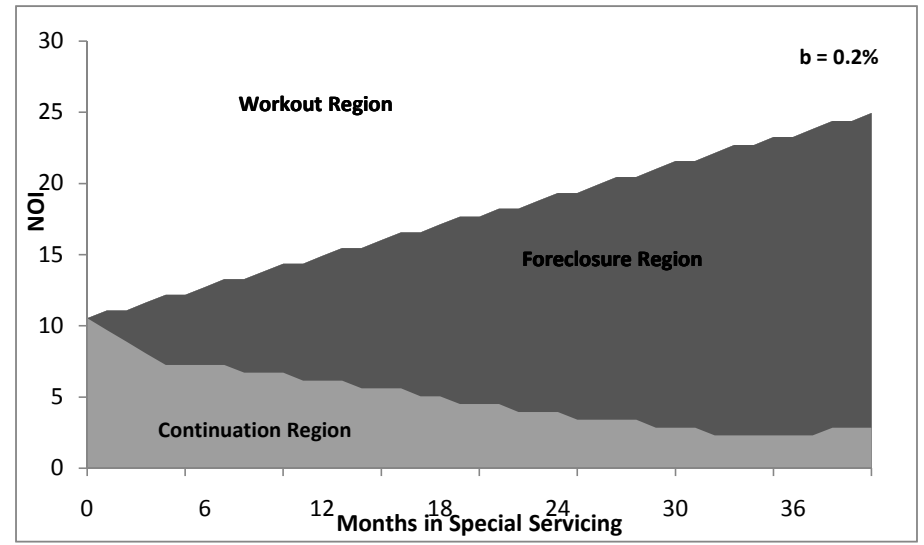
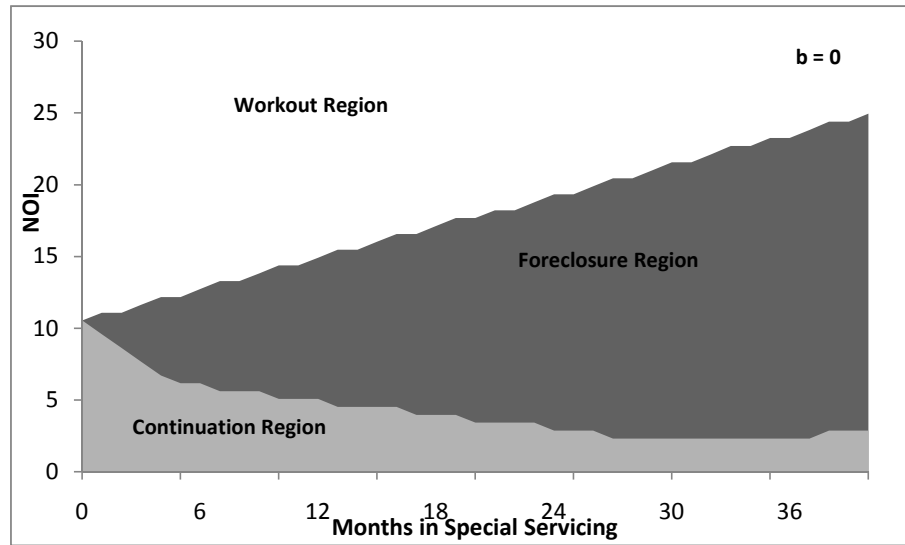




Figure 5: Foreclosure Bias when the Special Servicer Holds a Certain Percentage of the First-loss Bonds

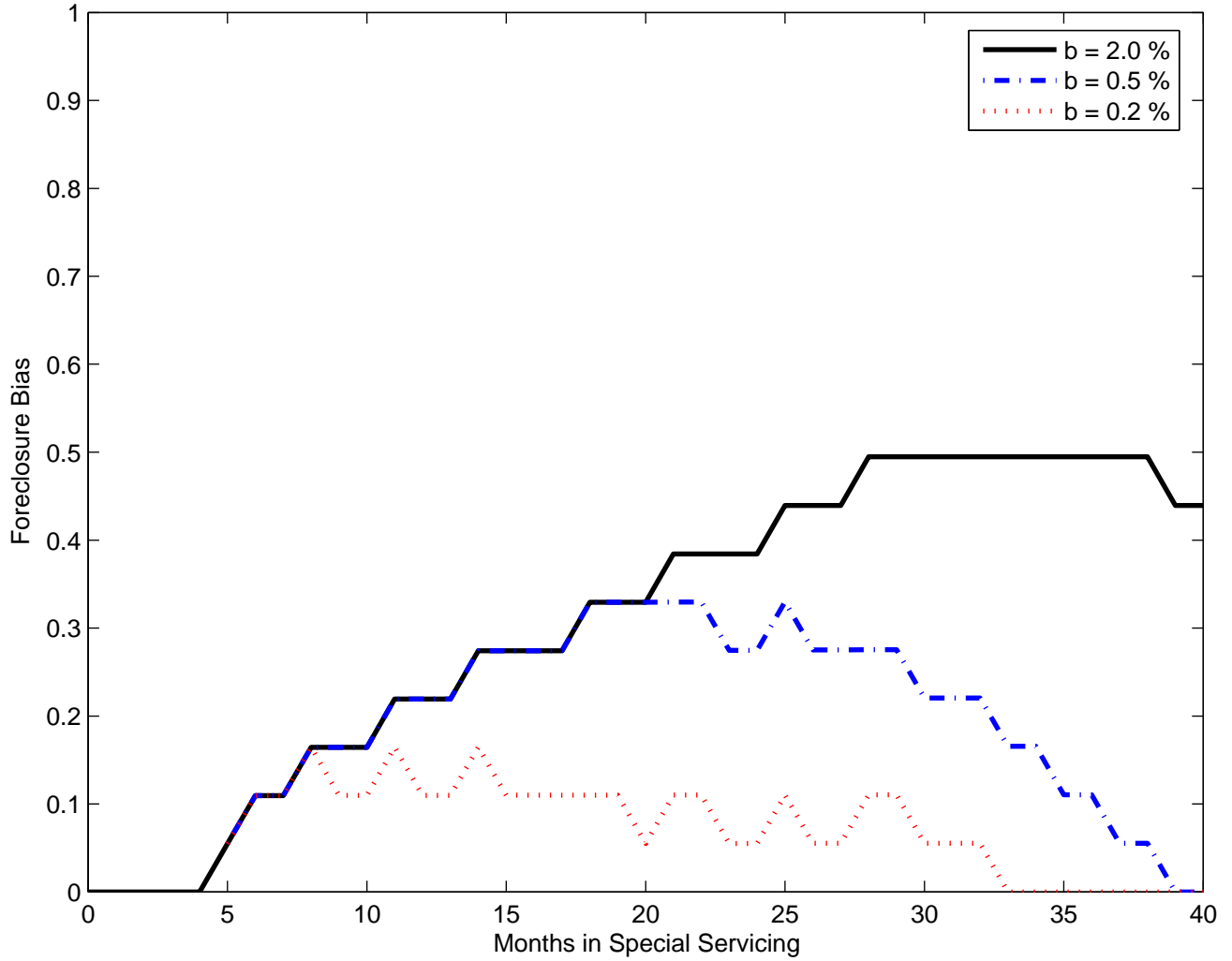


Figure 6: Percentage Change in Special Servicer's Foreclosure Threshold when Market Cap Rate Increase from 9% to 12%

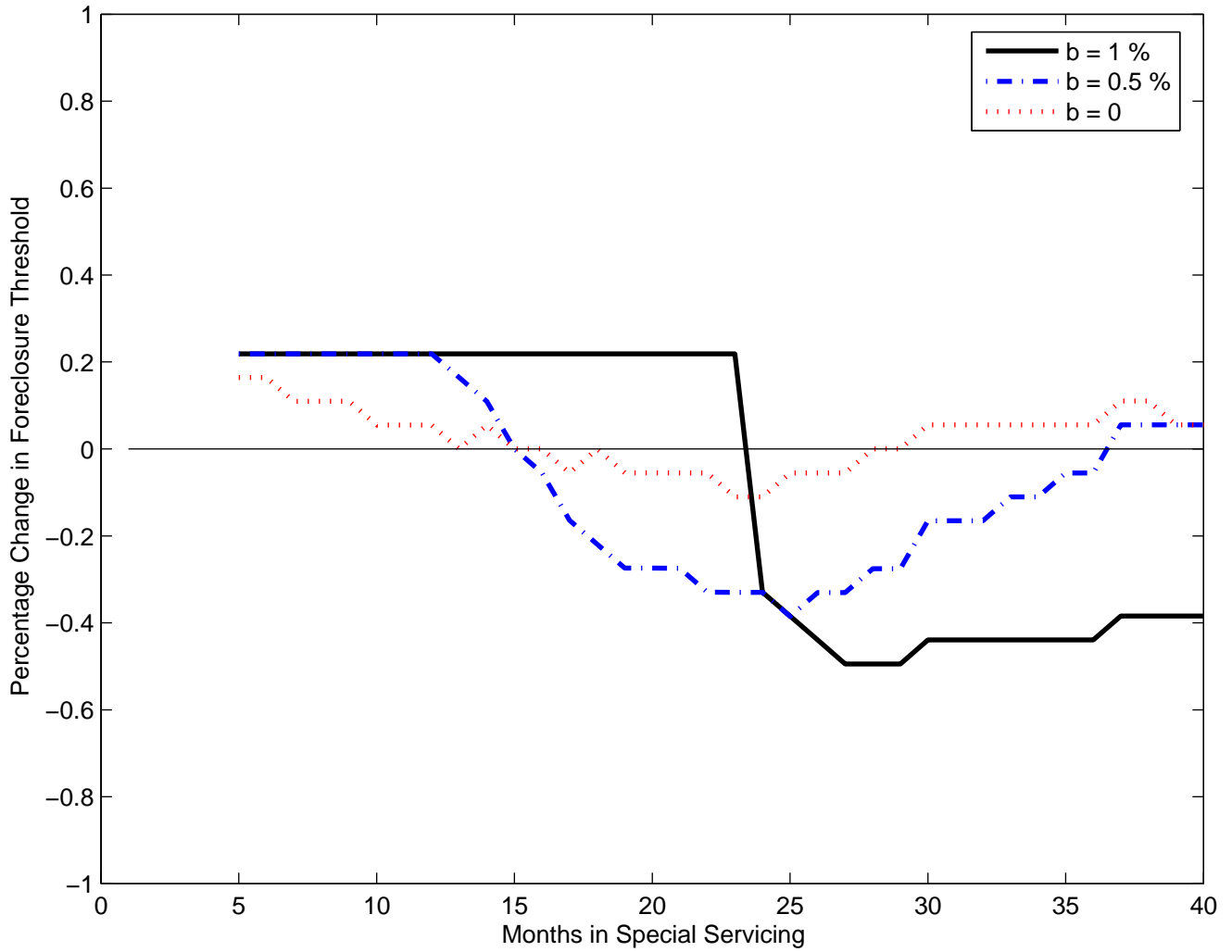


Figure 7: Excess Delay in Special Servicer's Foreclosure Decision when Market Cap Rate Increase from 9% to 12%

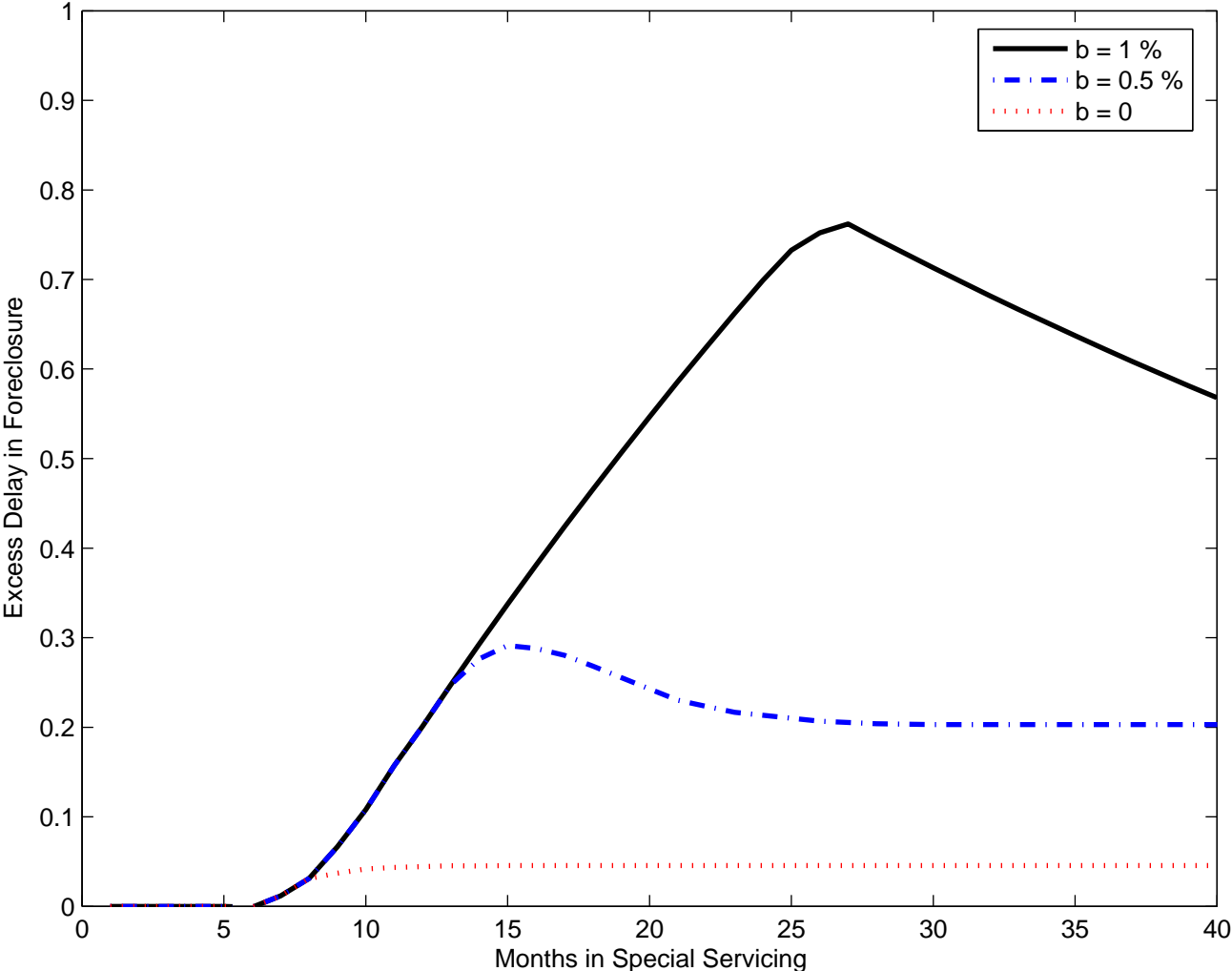


Figure 8: Excess Delay in Foreclosure when a Special Servicer's First-loss Bond Holdings Decrease

