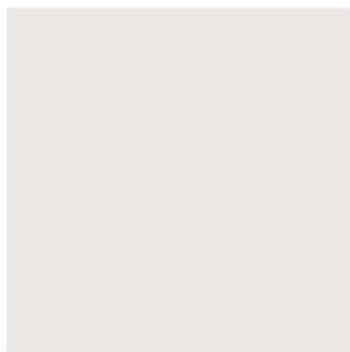
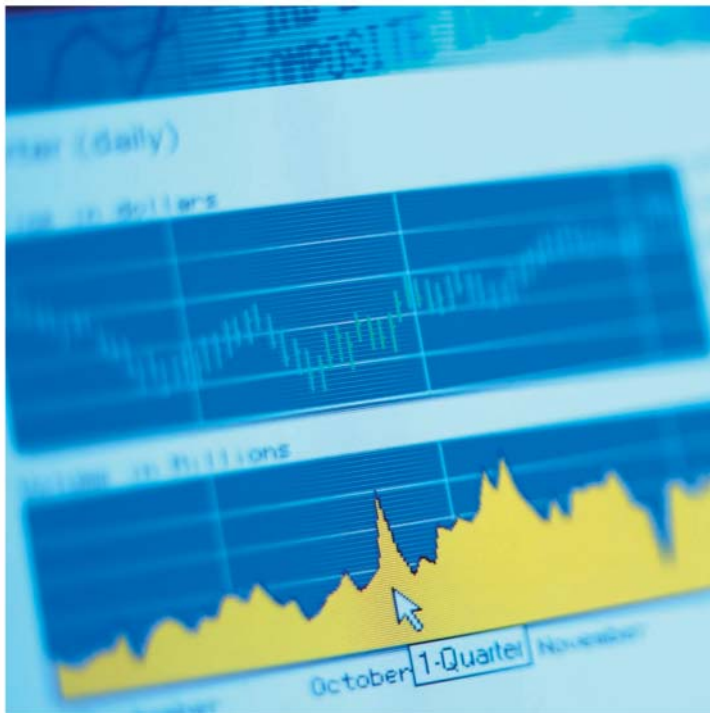


Freddie Mac Working Paper



Innovative Servicing Technology: Smart Enough to Keep People in Their Houses?

Amy Crews Cutts and Richard K. Green

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Abstract

Technological innovations in the mortgage industry have had profound impacts on every step in the homeownership process. Much of the literature has focused on the front end of the process, particularly the impacts of automated underwriting systems. Literature on loan servicing has focused on the borrower option to default with little attention paid to degrees of default or loss mitigation efforts used by lenders. This research examines the innovations that have occurred in the last ten years in mortgage servicing and their impacts on foreclosure incidence and loss mitigation.

We find strong support that recent changes in mortgage servicing policies and tools for resolving problem loans have reduced costs and helped keep delinquent borrowers in their homes. In particular, low- and moderate-income borrowers who enter a repayment plan have a 68 percent reduction in the likelihood of home loss; among all loans, the risk of home loss is decreased by 80 percent.

Innovative Servicing Technology: Smart Enough to Keep People in Their Houses?

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1. Introduction

The advent of automated credit-scoring evaluation tools in the mid-1990s has led the mortgage industry through a major technological revolution. The impact of credit scoring and automated underwriting in the loan origination process and on home-ownership has gotten a lot of attention (see, for example, Avery, et al., 2000; Straka, 2000, Gates, et al., 2002, and Gates, et al., 2003); innovations in loan servicing have received relatively little (for a rare exception, see Stegman, et al. 2003). Yet it is the case, as shown in Figure 1, that foreclosure rates have stayed below their 1998 levels throughout the 2001 recession and subsequent two years of “job-loss” recovery – at the same time, the mortgage servicing industry has undergone dramatic changes, emphasizing the use of credit scoring tools and home retention workouts to try and keep people in their homes.¹ This paper focuses on the impact of the servicing of delinquent loans on the likelihood of home loss through foreclosure. We believe it is the first empirical paper to focus on this issue.

The economics literature on mortgage defaults has long focused on two borrower options: payment of the mortgage obligation or default, generally interpreted as the borrower handing over the keys to the property in exchange for cancellation of the mortgage obligation – the borrower exercises the put option. Often, default and foreclosure are used interchangeably to imply the borrowers lose their homes. Recently, the literature has started to consider default and foreclosure separately from delinquency, but the papers are limited in scope regarding the variety of options that borrowers hold both in delinquency and default, and none are fully modeled empirical studies.

A recent paper by Lacour-Little (2000) provides an excellent history of the evolution of technology in the mortgage industry. His focus is primarily on origination and data management, however, and provides little on the innovations in mortgage servicing. We extend the work of Lacour-Little by documenting the innovations in mortgage loan servicing and loss-

¹ Source: According to the Mortgage Bankers Association National Delinquency Survey, quarterly foreclosure rates in 1998 varied between 0.58 and 0.69%. The peak foreclosure rate during the 2001 recession and subsequent recovery period (as of June 2003) was 0.56% – over that same time there were nine consecutive quarters of losses, totaling 2.6 million jobs, in non-farm payroll employment. During the 1990-91 recession and recovery period foreclosure rates peaked at 0.83%, with 1.5 million jobs lost over four quarters.

mitigation. We focus in particular on Freddie Mac's innovations in loan servicing and loss mitigation, and examine whether two programs in particular have helped stave off foreclosure and, as such, kept people in their homes.

We begin by developing a taxonomy of servicing, default, and workout options. We then review the default literature as it pertains to the innovations in loan servicing and loss mitigation. We follow with a description of technological innovations in problem loan servicing, including Freddie Mac's Early Indicator[®] tool and workout programs, and provide some descriptive statistics that suggest they have been successful in mitigating home loss. We close with an empirical model of foreclosure conditional on delinquency that attempts to quantify the extent to which a workout program can prevent foreclosure with attention to HUD-defined low- and moderate income and underserved borrowers.

2. A Taxonomy of Servicing and Default

Before engaging in a discussion of the implications of servicing innovations and economic models of mortgage default, it seems a sensible place to start is with a discussion of what loan servicing entails and what constitutes borrower default.

2.1 Servicing

Mortgage servicing, at its most basic level, is the collection of mortgage payments from borrowers and disbursement of those payments to lenders, local governments, and insurers.² Servicers also send payment notices and year-end tax statements to borrowers and tax authorities, report to investors, administer escrow accounts maintained to pay real-estate property taxes and hazard insurance, contact borrowers when payments are overdue and begin foreclosure procedures on delinquent accounts, and otherwise enforce lender policies. They collect and report payment information to national credit bureaus on the borrower's payment history, act as the customer support agent for the lender, and handle interest rate adjustments on adjustable rate mortgages.

Because loan servicing depends little on external information beyond the interactions between the borrowers and the servicers, Fabozzi and Modigliani (1992), among others, have argued that the business contains economies of scale. Loan servicing firms have started to capture economies of scale through consolidation in recent years, as shown in Figure 2. In 1989, the five largest servicers held less than 10 percent of the market share of total single-family

² Lender and investor are used interchangeably hereafter; the investor may be a secondary market player or the lender who originated the loan.

mortgage dollars outstanding in their servicing portfolios. Today, they control almost 40 percent. Among the 25 largest, market share has grown from less than 20 percent to nearly 62 percent.

To date, few studies of the impact of consolidation in the servicing industry have been done, and even fewer have appeared in the academic literature. Rossi (1998) examined the cost structure of the mortgage banking industry and found that scale economies were not yet exhausted, even at the largest output sizes. One industry study, completed by KPMG Consulting and summarized in Oliver, et al., (2001), found that servicing costs at the megaservicers, those that service more than 1 million loans annually, were more than 20 percent lower than the industry average cost, and these cost advantages held across all measures they examined. For example, the direct servicing costs, which exclude technology investments and corporate overhead costs, were just \$36 per loan at megaservicers in 2000. The industry average for that year was \$47 per loan. Similarly, megaservicers had lower technology costs at \$9 per loan versus \$12 for the industry average, and lower general and administrative costs at just \$13 per loan versus \$17 for the industry average.

According to the Mortgage Bankers Association (MBA) annual servicing costs per loan in 2001 averaged \$79 and each servicing employee annually processed an average of 1,034 loans.³ Costs in the early 1990s averaged about \$120 per loan, falling to around \$85 by 1996-1997, and have remained below \$80 since 1998. Each servicing employee processed just 938 loans on average in 1998, the first year the MBA collected this information. The MBA attributes these lowered costs to both technological developments and the use of outsourcing (or specialization) for some servicing activities.

2.2 Default, Delinquency and Foreclosure

A borrower is technically in *default* on their mortgage when they fail to meet any of the obligations of the mortgage contract. Therefore the term default can imply any failure to pay, from minor delinquency to loss of the home through foreclosure. Legal payment default occurs when one payment has been completely missed and a second is due and payable.

Delinquency is typically measured in 30-day intervals for the first three months of the default, e.g., 30-days, 60-days, and 90-days delinquent. State laws govern foreclosure processes,

³ See "Refi Boom Drives Up Servicing Costs in 2001 According to Most Recent MBA Cost of Servicing Study," press release issued by the Mortgage Bankers Association on August 8, 2002 (accessed December 30, 2002 at www.mbaa.org/news/2002/pr0808a.html). See also Walsh (2002).

and the time when the foreclosure process can start varies from state to state.⁴ Industry practice is to consider loans that are more than 90-days late as *in foreclosure* for standard statistical purposes. Loans that are at least 90-days late or in the foreclosure process are considered *seriously delinquent*.

Foreclosure implies the lender has used its legal rights to take possession of the property under state law – a foreclosed property is referred to as *real estate owned* or *REO*. Generally speaking, this is an involuntary transaction on the part of the homeowner in that a court order or similar decree has forced the owner to give up his or her rights to the property.

For a lender, costs accumulate as the seriousness of the contractual failure increases. These costs include the opportunity cost of principal and income not yet received, servicing costs, legal costs, costs of property preservation and costs of property disposition. Although foreclosure is a rare event, the costs of foreclosure are enormous. For example, Focardi (2002) estimated that for a sample of loans that went through the full formal foreclosure process, the total cost, including lost interest during delinquency, foreclosure costs, and disposition of the foreclosed property, ran \$58,759 and the process took an average of 18 months to resolve. Voluntary title transfer alternatives to foreclosure were less expensive and less time consuming, but still had average costs in excess of \$44,000 and took nearly one year to conclude.

State laws also affect the costs of foreclosure because not all legal foreclosures are the same. In states that allow nonjudicial foreclosure or power-of-sale foreclosure, title to property can be obtained relatively quickly, within 2 to 4 months. In states that require judicial foreclosure, title claims can take 6 months or longer, sometimes even years.⁵ Disposition of the property then takes additional time once the lender has secured title. Additionally, most, but not all, states allow a lender to try to recover monies owed on the mortgage in excess of the property value from other assets a borrower holds. A summary of state foreclosure law characteristics and foreclosure time frame is provided in Table 1.

3. A Taxonomy of Workout Options

Regardless of lender policy, the borrower can simply *fully reinstate* or *cure* the mortgage by paying all the past due amounts and fees owed, and thus retain ownership interest in the property. The borrower can do this at any time prior to the finalization of the foreclosure and

⁴ For summary of foreclosure laws in the U.S., see Dunaway (2002). A current synopsis is also available at www.myhousesaver.com/state.html or in current HUD FHA *Mortgagee Letters* such as ML 2001-19.

⁵ See Dunaway (2002) for a summary and analysis of the impacts of state foreclosure laws on default timelines.

even after foreclosure sale in states that allow redemption.⁶ But, there are many different alternatives or *workouts* to foreclosure once a borrower is in default of the mortgage contract; many of these alternatives are relatively recent innovations in loan servicing. One class of workouts allows the borrower to reinstate the mortgage over time and keep the home. The second class of workouts results in voluntary title transfers if a borrower has a demonstrated involuntary inability to pay.⁷ We examine these options below.

3.1 Home Retention Workout Options

One workout option is *partial reinstatement*. This is when the borrower resumes regular monthly payments and agrees to a *repayment plan* over a period of up to 12 months for the remainder due. In this case, the borrower's credit record will indicate that the borrower is meeting his or her obligation and that a repayment plan is in place. Nevertheless, the number of months for which the borrower was delinquent and the severity of the delinquency will continue to appear on the borrower's credit report.⁸ If the borrower partially reinstates the mortgage but does not enter into a repayment plan, then his or her credit record will indicate a continuation of the delinquency for the number of months due in arrears, e.g., the borrower would remain two or three months at "60-days delinquent" status, also known as 2x60 or 3x60 days delinquent.

Short-term forbearance allows for the suspension of up to three payments or a reduction in payments for up to 6 months with a repayment plan to follow at the end of the forbearance period. *Long-term forbearance* allows for the suspension or reduction of payments for a period of 4 to 12 months with a corresponding repayment plan for full reinstatement or payoff within 12 months of the end of the forbearance.⁹ If the borrower seeks forbearance prior to delinquency, his or her credit report will only indicate the presence of a repayment plan; otherwise, such as with the case of partial reinstatement, if the borrower pays as agreed under the repayment plan, he or she limits the damage to his or her credit history from the delinquency.

A *loan modification* is a permanent change in one or more terms of a borrower's loan that allows the loan to be reinstated and results in a payment the borrower can afford. A loan

⁶ Some states, known as pre-sale redemption states (specifically KS, WI, and VT) allow reinstatement only up to a stated number of days prior to the foreclosure sale of the property. Redemption clauses allow a borrower to reclaim the foreclosed property by essentially buying it back from the lender for the amount due rather than reinstating the loan. During the redemption period the lender cannot sell the property.

⁷ The options described here are available from the Seller/Servicer Guides from Freddie Mac and Fannie Mae and the HUD *FHA Mortgage Letters*, among other places. Involuntary inability to pay is discussed in more detail later.

⁸ Freddie Mac and Fannie Mae policy is for the servicer to report repayment plans and to note the status of the amount owed on the plan, such as how many months of originally past-due payments are covered by the plan, and to have the borrower reinstated as current and paying as agreed going forward.

⁹ FHA terminology is a *special forbearance*, without distinction between short- and long-term.

modification is negotiated when a cooperative borrower has indicated a desire to retain ownership of the property and a capacity to support a mortgage under the new terms and does not qualify for a refinance of the loan under lender/investor policies. Under a loan modification, a borrower's credit record is restored to "currently paying as agreed" status.

A *partial claim* workout is offered under the FHA loan loss mitigation program, and it is a workout in which the lender will advance funds on behalf of the borrower in an amount necessary to fully reinstate a delinquent loan (not to exceed 12 months of principal, interest, taxes and insurance (PITI)). The borrower, on acceptance of the advance, will execute a promissory note and subordinate mortgage payable to HUD.¹⁰ Currently, these promissory or partial claim notes carry no interest and are not due and payable until the borrower either pays off the first mortgage or no longer owns the property.

3.2 Voluntary Title Transfer Workout Options

In addition to the involuntary transfer of title through foreclosure, there are several options under which the borrower can voluntarily transfer title if regular sale would be too burdensome and home retention is not possible. A *deed-in-lieu* of foreclosure is the simplest case, and involves the borrower foregoing any continued ownership interest in the house in exchange of the cancellation of the mortgage obligation – essentially the borrower just hands over the keys. A *short sale* or *short payoff* or *preforeclosure sale* is a negotiated and lender approved sale where the borrower has found a buyer for the property, but the sale proceeds are less than the amount owed inclusive of sale costs and other fees. In this case, the lender either negotiates an unsecured repayment plan with the borrower for the additional amount owed or forgives the remaining debt.

A *workout mortgage assumption* permits a qualified applicant to assume title to the property and the mortgage obligation from a borrower who is currently delinquent or is in imminent danger of default because of involuntary inability to pay. Some mortgage contracts have assumption terms already in place; a workout assumption can occur regardless of whether the initial contract has an assumption stipulation.

4. Moral Hazard and Other Risks

If borrowers simply walk away from the mortgage obligation because the property is worth less than the mortgage balance even though they have not experienced an event that

¹⁰ See in particular *FHA Mortgagee Letter* 00-05 (accessible at www.hud.gov/offices/hsg/mltrmenu.cfm) for details on partial claims and other foreclosure alternatives in the FHA program

reduces their ability to pay the debt, as is frequently modeled in the economics literature, then there is a moral hazard if home values fall or grow too slowly.¹¹ The borrowers have no incentive to maintain the property and can live in the home rent-free while the foreclosure process unfolds. Or alternatively, the borrowers can purchase a nearby home at depressed prices while their credit rating is intact, stipulating that the old home would become an investor property, and then default on the original mortgage and give up that property in foreclosure.

Deficiency judgments can mitigate moral hazard caused by falling house prices. In states that allow them, other borrower assets can be claimed by the mortgage lender to cover losses incurred through the foreclosure (and foreclosure alternatives) process, and thus discourage a borrower from reneging on their obligation. Most lenders require an *involuntary inability to pay* before workouts are approved, meaning the borrower does not have the capacity to fully reinstate and carry the mortgage due to illness, job loss, significant property damage or depreciation, or other significant economic shock.

Only six states currently prohibit the lender from seeking a deficiency judgment recourse against a foreclosed borrower – refer again to Table 1 for deficiency judgment allowances by state. In the early 1990s, California, a non-recourse state, and Massachusetts, a recourse state, suffered similar declines in house prices and job losses. In 1995, the peak default year in both places, Fannie Mae saw more than 7 times the REOs and foreclosure sales in California than in Massachusetts but had only 5 times more credit-risk exposure.¹² Although only anecdotal evidence exists of California borrowers ruthlessly using their option to default through moral hazard rather than involuntary inability to repay, the Fannie Mae experience suggests that allowing deficiency judgments at least reduces the incidence of foreclosure when home values decline.

Some properties, such as those that contain an environmental hazard, carry a liability risk. In such cases, the lender can decide that the debt is uncollectable, and elect to *charge off* the debt and terminate the mortgage lien rather than acquire the property through foreclosure. This last option does not transfer title of the property. Additionally, borrowers can also exercise an option to declare bankruptcy, which could limit the lender's ability to negotiate workouts or the impact of a lender's threat to force foreclosure.

¹¹ An excellent study on moral hazard and mortgage default is Riddiough and Wyatt (1994). They examine the effect of whether the lender is a “wimp” (offering forbearance) or “tough guy” (aggressive in pursuing foreclosure) on borrower propensity to default, and find significant borrower behavior elasticities with respect to lender behavior.

¹² Inside Mortgage Finance (1995).

Workout options have been widely adopted throughout the mortgage industry, and home retention workouts have risen dramatically in recent years. In Figure 3, shows the share of problem loans held by Freddie Mac, Fannie Mae and the FHA that are worked out using home retention or voluntary title transfer options. Workouts have risen dramatically in all three cases. In 1996, roughly 30 percent of problem loans—those 60-days delinquent or worse that did not reinstate on their own—at Fannie Mae and Freddie Mac were resolved with a home-retention workout alternative.¹³ By 2002, the two companies resolved about 50 percent of problem loans were resolved via workouts.

In the FHA program, the number of loans resolved with some form of workout has risen from just over 5,000 in fiscal year 1997 to over 72,000 in fiscal years 2002 and 2003. Home-retention workouts account for all the growth in the workout numbers; they numbered 770 loans and were 15.3 percent of workout alternatives in 1997, and numbered 68,003 loans and were 94.1 percent in 2003, while voluntary title transfers barely grew from 4,249 loans in 1997 to 4,258 in 2003. Moreover, in FY 2002, workouts outnumbered foreclosures for the first time.¹⁴

5. The State of the Literature

The standard way to think of the default option in the economics and finance literature is to examine a borrower's propensity to exercise a put option when the value of the mortgage becomes greater than the value of the underlying asset (the property) (see, for example, the survey by Kau, et al., 1992). Some models also include a trigger event, such as illness, job loss or divorce, that leads the borrower to default on the mortgage (see, for example, Deng, et al., 2000). It is nearly always assumed (or modeled) that the borrower's choice is between keeping the home and losing the home. These standard models, therefore, equate any mortgage default with foreclosure, and the implied form of the foreclosure is a deed-in-lieu transfer of title to the lender – that is, the borrower stops by the bank and hands over the keys.¹⁵

Vandell in his 1992 presidential address to the members of the American Real Estate and Urban Economics Association (Vandell, 1993) observed that the state of the literature at that time was woefully behind industry practice. In particular, he noted that the then current

¹³ That is, the percentages represent the number of loans that got home retention workouts divided by the number of loans that got home retention workouts or became REO properties. This is known as the workout ratio in servicing industry terminology.

¹⁴ We have been unable to obtain detailed home retention workout data prior to 2000. However, recent data are available at <http://www.hud.gov/offices/hsg/comp/rpts/com/commenu.cfm>

¹⁵ These papers do not explicitly state whether the foreclosure is voluntary or involuntary, however the terms are often couched as a borrower decision to pay-as-agreed or default and lose the house, which is tantamount to voluntarily handing over the keys in a deed-in-lieu transfer, rather than a legal taking of the home by the lender.

literature on both commercial and residential mortgage default failed to consider: (1) transaction costs to the borrower from default including effects on future credit availability; (2) recourse considerations that allow the lender to seek other assets of the borrower if the proceeds from the sale of the foreclosed property do not cover the outstanding principal balance; (3) the magnitude and timing of the revenues and the losses associated with default; and (4) the possibility that a workout or loan modification could occur.

Little has changed in the years since Vandell's 1992 address. However, a series of papers by one author in various partnerships with two other authors has improved the state of the literature on residential defaults. Among them are Ambrose and Capone (1996) (hereafter referred to as AC'96), Ambrose, Buttimer and Capone (1997) (hereafter ABC'97), Ambrose and Capone (1998) (hereafter AC'98), Ambrose and Buttimer (2000) (hereafter AB'00) and Ambrose and Capone (2000) (hereafter AC'00). Two other studies not associated with Ambrose are notable: Pence (2001) and Stegman, et al. (2003).

The AC'96 study examines the theoretical costs and benefits of four single-family residential mortgage foreclosure alternatives – loan modifications, pre-foreclosure sales, deed-in-lieu transfers, and lender forbearance. Using a parameterized simulation model, they conclude that such alternatives can be successful at mitigating expected default costs, but, because the results depend on probabilities, the risks are better carried by large well diversified national mortgage insurers or secondary market agencies such as Fannie Mae and Freddie Mac. The authors infer that these types of institutions have invested in loss mitigation practices because they are best able to take advantage of such practices.

ABC'97 recognized that default (meaning delinquency) and foreclosure are distinct events and made that distinction in their purely theoretical model. They concluded that increases in the delay between default and foreclosure reduce the value of the mortgage and increased the likelihood of default (foreclosure). They also explicitly demonstrate the effects of transaction costs on the likelihood of default (foreclosure), including the possibility of lenders recouping losses from borrowers through post-foreclosure deficiency judgments.

Their analysis had, at the time, significant implications for the FHA and VA loan programs. Under those programs, lenders and servicers were as a matter of policy not to pursue deficiency judgments from borrowers who were foreclosed upon. They cited the practice of conventional mortgage investors and mortgage insurers of seeking deficiency judgments as the most important reason why loss rates in the FHA and VA programs were relatively high.

AC'98, in a very detailed and careful investigation, examined model misspecification resulting from differences in borrower motivation for default and find that negative equity has less influence on borrower default (delinquency) than was previously thought. Specifically, they propose that some borrowers may use the default option to temporarily fund other critical expenditures and are not, *ex ante*, intending to exercise their put option, suggesting that there are at least two types of defaulting borrowers.¹⁶ They conclude that pricing models with decision rules or boundary conditions that generate defaults solely from borrowers with negative equity are therefore prone to misspecification, and note that the likelihood that a foreclosure alternative will be successful depends on the borrowers' individual motivations for default. They further suggest that rules for offering loss-mitigation foreclosure-avoidance options should be limited to true trigger event defaulters who have demonstrated hardship and commitment to the property. Their conclusions are consistent with industry practices implemented in the early-mid 1990s.

AB'00 develops a theoretical option-pricing model that explicitly allows borrowers to reinstate their mortgage out of default. They conclude that the optimal loss-mitigation program in areas with stable house prices is to provide an economic incentive for the borrower to cure (proxied by waving default penalties) in conjunction with seeking deficiency judgments. However, they find that overall, providing incentives for borrower reinstatement (again by waving default penalties) by themselves are not effective in reducing foreclosure costs. Nevertheless, if borrowers know that default and foreclosure affect future credit availability, they will default less. It is thus in the lenders interest to reinforce the impression that default is costly to borrowers.

The AB'00 study relies on parameters not supported by empirical evidence to reach this finding. For example, default penalties are only one barrier to reinstatement; borrower capacity to reinstate and borrower willingness to keep the home are the others. (For example, in the event of divorce the home is sometimes used for revenge, to deprive the other spouse of the asset and perhaps to ruin the spouse's credit rating). If the borrower suffers a sufficiently adverse economic shock they may not be able to "afford" the burden of a repayment plan but may be eligible for a home retention workout. The relative likelihood of these alternatives is a function of their simulations, but cannot be known without estimation.

¹⁶ Cutts and Van Order (2004) posit that this behavior is likely more prevalent in the subprime market because the credit-damage cost is lower for those borrowers than for prime borrowers and subprime borrowers may have few other options for credit other than to "borrow" their mortgage payment.

Last in the Ambrose et al., series, AC'00 looked at the propensity for redefault among borrowers who have agreed to a home-retention workout plan. Using a hazard rate model for predicting defaults, they find that the risk of redefault is significantly higher than the risk first default, especially within two years of the initial default. They also conclude that economic factors helpful in predicting first defaults are not helpful in predicting subsequent defaults.

This study asks a very important question regarding recidivism rates and the ability of servicers and investors to predict future redefault. Knowing that a borrower has gone delinquent on a mortgage in the past is a highly predictive indicator that a loan will default in the future, which is why this information is used in both manual underwriting and automated underwriting systems, and why loans are re-underwritten at the time a home-retention workout is considered. The conclusion in AC'00 that factors useful in predicting likelihood of first default are not useful in predicting second default is predicated on the fact that they only have data from loan origination, not current credit, collateral and capacity data from the time of the loan reinstatement. Therefore, their principal conclusion may well be that it is important not to use (just) origination data when evaluating troubled loans. In fact, it is this very issue that provides the centerpiece for our empirical results below.

Finally, Pence (2001), in her dissertation, examined the impact of state foreclosure laws on loan origination terms. Many shocks in housing markets are local in nature, and she argues that ignoring these shocks may incorrectly lead to the interpretation of a local shock as due to differences in foreclosure laws. She controls for these regional characteristics by comparing mortgage applications in different census tracts that border each other but are located in different states and thus are subject to different foreclosure laws. She finds strong statistical evidence that the generosity of state foreclosure laws to borrowers is negatively related to loan size and suggests that policy makers should carefully consider borrower and lender reactions to foreclosure statutes.

The Pence study, however, does not examine what happens after loan origination. We cite it here because it is an innovative approach to determining what impact various foreclosure laws and deficiency judgment statutes might have on mortgage markets. Her approach could be used to do a similar study using, for example, the FHA data utilized by AC'00.

Stegman, et al. (2003) examine the efficacy of loss mitigation programs for affordable mortgage programs – those characterized by below-average loan balances and disproportionately large numbers of low- and moderate-income borrowers – and note the special challenges posed by this market segment. They conclude that the affordable side of the mortgage market has not

yet fully adopted the technological innovations that have made their way into the mainstream portion of the prime market, but these tools could be very effective at loss mitigation in this market.

6. The State of the Industry

At best, the studies by Ambrose, et al., indicate that workout alternatives are good *sometimes*, such as when house prices are stable or when borrowers perceive their ability to borrow in the future will be adversely impacted by a foreclosure today. But workout policies set by lenders need to be consistently effective to be profitable. Given that the trend in the industry has been wider adoption of workouts, particularly home retention workouts, they are almost certainly more consistently successful than the current literature would imply.

Technological innovations have occurred in (prime) mortgage servicing, and they have come along at the same time that home retention workouts have exploded. That the two have happened simultaneously is not by accident.

Lacour-Little (2000) describes how rapid consolidation in mortgage servicing has made the industry much more cost driven, forcing servicers to find ways to reduce costs and streamline processes. He notes that big breakthroughs in servicing were introduced by automated voice response (AVR) systems and network integrated voice response (NIVR) systems introduced in the early to mid-1990s. Under both systems customers inquire and companies respond to the most commonly asked questions using touch-tone telephones. These systems dramatically reduced the costs of maintaining customer service operations, especially for around-the-clock services, since they addressed basic borrower questions without requiring a live servicing agent on the other end of the call. His study does not investigate servicing technologies any further.

There are two other significant technological innovations that revolutionized loan servicing in the 1990s. The first innovation was the development of performing loan servicing management tools, which took the regular occurring reporting, remitting and tracking tasks and automated them. The second innovation is in the form of automated credit scoring based servicing tools that emerged in wide use in the late 1990s. These tools risk-rank delinquent accounts to identify loans that are likely to benefit from early interventions to avoid foreclosure. The tools also are used to underwrite loan workouts, helping borrowers keep their homes. Below we discuss data tracking and credit scoring tools in a bit more detail for the purposes of documenting the history of these innovations and their role in facilitating successful home-retention workout options.

7. Data Tracking and Management Tools

Innovations in the management of performing loans have been rapid and far-reaching. In Lacour-Little's (2000) study, he presented a chart of the activities that occur in loan serving. His chart is reproduced in Figure 4 with our addition of reporting to national credit repositories and mortgage insurance providers. For every arrow spanning from the center box in the diagram there are technological innovations used by servicers to streamline reporting and increase accuracy. The savings in servicing costs are enormous when taken in aggregate, from the elimination of postage costs through automated electronic data deliveries to lower labor costs due to automation of database updating and standardization of procedures. Independent financial-technology vendors, such as ALLTEL (now Fidelity) Information Services and Fiserv, and large servicers, such as Wells Fargo, developed many of these servicing innovations. Niche vendors and industry consortia are being continuously developed, pushing servicing innovations even further as better technology develops.

8. Innovative Credit-Scoring Based Servicing Tools

Automated credit scoring based servicing tools emerged in wide use in the late 1990s. They serve three very important purposes: (1) to streamline collection call campaigns by risk-ranking delinquent accounts to identify loans that are likely to benefit from early interventions to avoid foreclosure; (2) for loans past the early stages of delinquency, to identify loans most likely to create a loss without an intervention to direct servicer attention and resources towards resolving these loans; and (3) to underwrite delinquent loans for a workout. In the first two cases, the scoring tools also allow servicers to target resources much earlier in the delinquency process to contact troubled borrowers much earlier than was done before, thus reducing the time and cost of loss mitigation. In the latter case, higher success rates – defined as borrowers keeping their homes – among loans in a repayment plan or other home retention workout are achieved by using scoring tools in underwriting.

The first widely used collections scoring tool was StrategySM, developed by Jim Carroll of Carroll and Associates. In 1996, Freddie Mac and MGIC jointly developed Early Indicator[®] (EI), which incorporated the StrategySM tool, and EI was launched in 1997 in a pilot involving Wells Fargo Bank.¹⁷ This tool relied on the credit scoring technology already used in automated

¹⁷ See Comeau and Cordell (1998) for more on the testing and launch of Early Indicator. Within the Early Indicator system, two scores are produced. EI Early Collections scores range from 000 to 099 with lower scores indicating higher likelihood of worsening delinquency beyond the first month. EI Loss Mitigation scores range from 100 to

underwriting models. It also used tool that used patterns of the timing of a borrower's previous mortgage payments as an indicator of economic distress.¹⁸ In 1997, Fannie Mae launched Risk ProfilerSM. Today, servicing scoring tools are used on over 80 percent of mortgages in the \$5.2 trillion mortgage market, with EI being the dominant tool.

Early Indicator and Risk Profiler have been highly successful in helping servicers focus attention on borrowers who are at high risk of losing their homes. Table 2 shows that borrowers who achieve high EI Loss Mitigation scores are at very low risk of losing their homes – on average just one in 105 will end up losing their homes. Moreover, roughly half of the loans scored by Early Indicator are viewed as low risk even though they are currently delinquent on their mortgage. Figure 5 shows similar ability by Risk Profiler to identify delinquent loans likely to go on to foreclosure and ultimately REO.

The primary purpose of tools such as Early Indicator is to identify which borrowers are in most need of servicer attention. However, servicers must follow the guidelines set by investors in determining which borrowers should be offered home retention workouts and what type of workout would be the best option for each borrower's circumstances. Turning to the same technology and modeling techniques applied in automated underwriting, Freddie Mac and Fannie Mae developed tools specifically for use in underwriting workouts – Freddie Mac's Workout Prospector[®] was launched in 1996 and Fannie Mae's Workout ProfilerSM in 2002. These tools greatly increase the chances that a workout will result in the desired outcomes of keeping borrowers in their homes and reducing costs to the investors.

Taken together, the servicing tools created by Freddie Mac, Fannie Mae, and others have greatly increased the chances that a delinquent borrower will have the option of a home retention workout, and that a workout will be offered earlier in the process. This latter effect is important in ensuring that a workout will result in the borrower fully reinstating the loan and keeping their home. In a recent review of the FHA program, a servicer was reported to have found that the success of a workout in the FHA program decreased from a peak of more than 45% if the workout was processed in the first one or two months of delinquency to less than 10% if the workout was not accomplished within seven months.¹⁹

399, with lower scores indicating a higher likelihood of a loss-producing outcome. The score ranges are deliberately set to avoid confusion with FICO credit bureau scores, which range from 400 to 900.

¹⁸ This second tool was originally developed and marketed by Jim Carroll and Associates.

¹⁹ U.S. Department of Housing and Urban Development. 2002. *Office of the Inspector General Audit Report: Follow-Up Nationwide Review Department of Housing and Urban Development's Loss Mitigation Program, 2002-DE-0001*, February 28, 2002. Accessed December 21, 2002 at www.hud.gov/oig/ig280001.pdf.

One valid question, of course, is whether workouts work – that is, are borrowers with workouts more likely to reinstate or “cure” than borrowers who do not get into a workout plan. We turn now to this question.

9. Model, data and results

9.1 *Economic Theory*

Unlike the origination decision, which is a decision about whether to enter into a contract with a borrower based on incomplete and asymmetric information, the decision of whether to offer a workout involves an alignment of economic incentives. Specifically, the lender wants to get its money back under the contract terms (that is, the interest rate and amortization term) and the borrower wants to keep his or her home. Once a borrower becomes delinquent, the investor faces a potentially lengthy and costly process to foreclose on the house and evict the borrower – from Focardi (2002), foreclosure costs are estimated to average \$58,792 and take 18 months to resolve. The borrowers face a loss of dignity, severe damage to their credit rating, and thus damage to their future ability to obtain credit, and the loss of their home and any equity they may have in it.

Even if it is inevitable that the borrower will lose his or her home, alternatives to foreclosure where the borrower gives up the home are also incentive compatible. Again according to Focardi (2002), voluntary title transfers such as short sales and deed-in-lieu transfers cost more than \$44,000 on average and take 12 months to resolve – a savings to the lender of \$14,000 over foreclosure. For the borrower, avoiding the indignity and the credit damage that results from foreclosure makes these options preferable. Thus, it is in neither party’s interest to continue down the path to foreclosure if another option is available.

9.2 *Empirical Model*

The hypothesis we are attempting to test is whether entry into a repayment plan reduces the likelihood of home loss from the default. For now, we approach this using a simple Cox proportional hazard model:

$$H(t) = h_o(t) \exp(x\beta)$$

This model has been widely used in the literature (see Kiefer (1988) for a survey). The model attempts to explain the likelihood of and timing of a “failure,” which in our context is any loan that terminates as an REO, a deed-in-lieu transfer, a short sale, a third party sale, a charge-off or a lender repurchase. The $h_o(t)$ component of the equation gives a baseline hazard function

for failure when all covariates are zero. The covariates shift the baseline up and down: a negative coefficient means that an increase in the explanatory variable will lead to a reduction in the probability of failure at any point in time.

Our hypothesis is that, conditional on entry into delinquency, households in a Freddie Mac repayment plan will fail at a lower rate than households that are not. We therefore specify a model that models the probability of failure as a function of characteristics about the loan at the time it enters our sample and whether the borrower is put into a repayment plan.

9.3 Data

Our estimation data include 148,050 complete observations on loans owned by Freddie Mac that entered into 60-, 90-, or 120-day delinquency between January and September 2001.²⁰ We follow each loan for 18 months after inflow into the sample.

Simple summary analysis on these data suggests that workouts are effective at keeping borrowers in their homes. If we define as a cured-loan any loan that either fully reinstates, gets modified, is assumed by a new borrower or is paid off, and a failed loan as any loan that results in the loss of the home through foreclosure or foreclosure alternative, then from Table 3 we see that roughly 90% of loans that start repay plans will cure within 18 months compared with 73% for loans that are 90-days delinquent or just 61% of loans that are 120-days or more delinquent. When viewed from a fail-rate perspective the results even more strongly support the effectiveness of repay plans. Of loans that get to 120-days delinquent status, 28% will fail, but just 4% of loans in repay plans will end in home loss for the borrower.

The dependent variable in our model is the time at which the loan fails as defined above in Table 3. There are two important adjustments we need to make in creating this variable: we must deal with the fact that some observations in our sample exit without foreclosing (that is, some observations “cure”) and that some observations are censored (that is, reach the end of the sample period without either failing or curing). We use a standard competing risks model within STATA, the program used for the estimation, which identifies the exit time for each observation and incorporates censoring.

Our covariates are: length of delinquency at time of entry into the sample; Loan-to-value ratio at time of entry into sample, unpaid balance at entry into sample, the Early Indicator Loss

²⁰ The raw data sample contained 344,422 observations including both duplicate entries as loans worsened (or improved) in their delinquency status and loans that in-flowed into a repayment plan. We used only one entry per loan, and chose the worst delinquency status if more than one delinquency in-flow was observed. Repayment plan inflows were ignored because repay plans are used an independent variable in our regressions.

Mitigation score at time of entry, current coupon rate, FICO score at origination, whether the borrower is in bankruptcy at entry into sample, whether the loan qualified as a HUD low-to-moderate income goal loan at origination; whether the loan qualified as a HUD underserved area goal loan at origination; a flag for whether HUD goal information was missing; whether the loan was modified in a workout before entering the sample; whether the borrower entered a repayment plan or the loan was modified in a workout after entry; and interaction variables between repayment plan and HUD goal status. We describe each variable in a bit more detail below.

Length of Delinquency at Time of Entry

We have flags for whether loans are 60 days or 90 days delinquent at the time they enter the sample. The left out category is 120 days delinquent. Loans deeper into delinquency are likely “more troubled,” and therefore more prone to fail.

Current Loan-to-value Ratio at Inflow

Current loan-to-value ratio gives a proxy for how “in the money” the default option is.²¹ We would expect higher LTV loans to have higher incidence of failure. That said, over the sample period, house prices were generally rising, so there are relatively few loans where the default option was deeply in the money. Consequently, it might be difficult to identify the effect of this variable on failure.

Unpaid Principal Balance

For very low loan balance loans, it is generally in everyone’s interest to cure the loan, and we would rarely expect to see them fail. We otherwise have no particular prior on the relationship between UPB and propensity to fail.

Early Indicator Score

Early Indicator[®] Loss Mitigation scores are used here as a proxy for current credit condition. EI values range from 100-400, with high scores corresponding to lower risk of home loss.

Coupon

The coupon rate gives us a proxy for the value of the competing risk to default—the prepayment option. High coupon mortgages have an incentive to prepay. Higher current

²¹ We use the standard economics terminology of “default option” here to denote the borrowers option to “put” the loan, that is, to exchange the loan obligation for the collateral.

coupons also offer more room to negotiate a loan modification in the event that the borrower would be unable to refinance the loan. On the other hand, households may become delinquent because they do not have access to the refinance market. It is therefore possible that a high coupon rate, conditional on delinquency, reveals information about the borrower not captured by such things as the EI score, and therefore could be positively related to failure.

FICO Score at Origination

This variable has been used in past studies (see AC'00 above). We include it to test our view that it has little impact on failure probabilities conditional on delinquency. We also perform regressions omitting it, because we have many observations where it is missing. Loans originated before 1994 do not have FICO scores since Freddie Mac did not use credit scores as an underwriting criterion before then.

Bankruptcy

Ironically, bankruptcy reduces the probability of failure at any point within the 18 months that we follow the loans, because foreclosure proceedings may not take place until after bankruptcies are settled.

HUD Affordable Goal Qualifying Mortgage

The focus of the conference for which this study was prepared is wealth accumulation for underserved areas and low-to-moderate income households. HUD has developed standards for identifying loans that go to low-to-moderate income borrowers and/or underserved neighborhoods. We use these standards in our empirical model to set up underserved and low-to-moderate income flags, and then we interact these dummy variables with the existence of a repayment plan, which will be described below. The interaction terms will tell us the effectiveness of the repayment plan for these special areas and households relative to other areas and households.

Previous Loan Modification

Recidivism is a concern with home retention workouts, and some of the loans in our sample (4,399) were previously modified. At issue is whether loans that have previously been modified have a higher propensity to fail than loans that have not. Unfortunately, data on whether the borrower previously entered a repayment plan or other workout besides a loan

modification are not available in our sample; however the structure of our data sample will allow this question to be examined in the future once a longer time series is available.

Repayment plan

This is the featured variable. We use indicators of whether a borrower entered (1) a repayment plan, ignoring other workout options or (2) entered a repayment plan or loan modification to identify impacts of home retention workouts on failure propensities among delinquent borrowers. In theory, repayment plans and loan modification will always extend the time to failure, but the proportional hazard allows us to evaluate their impact on the overall rate of failure—we expect the plans to prevent failure and therefore shift the baseline hazard function downward.

10. Results

Results are presented in Table 4. For the models that include FICO as an explanatory variable, we have 63,613 observations;²² for those that do not, we have 148,050 observations.

The results are remarkably robust. We find: loans arriving 60 days delinquent are less likely to fail than those arriving later; High CLTVs lead to slightly higher failure probabilities; UPB has no impact (statistically or otherwise) on failure probabilities; Early Indicator Loss Mitigation score is a powerful predictor of failure; high current coupon sometimes reduces failure probability a little; goal qualifying loans are more likely to fail; and we are less likely to observe failure among those in bankruptcy. None of these results surprise us.

What is interesting is the coefficient on FICO score for those regressions that include it. Higher FICO scores at origination have a statistically significant but small impact on failure probability—it pushes it upward. We speculate that because we control for current FICO score to some extent by including Early Indicator Loss mitigation score, people with high origination FICOs in the sample saw their circumstances change markedly, and therefore are more likely to fail.

The coefficients on previously modified loans in all model specifications strongly indicate that these loans are less likely to fail, even though they became delinquent after modification. One reason for this may be that these borrowers have identified themselves as being experienced with the options available to them if they cooperate with servicers.

²² The lack of FICO scores is almost always attributable to loan origination prior to 1994, the year in which Freddie Mac made credit scores part of its underwriting criteria for loans it would consider “investment quality” and therefore eligible for purchase by the company under its charter.

We now turn to our featured variable: whether the borrower is in a repayment plan. Our results are robust—for all four model specifications, the probability of failure drops sharply when borrowers get into a repayment plan. And while such plans are not quite as effective for low-to-moderate income borrowers or for those who live in underserved areas, they are nevertheless still very effective. At samples means, being in a repayment plan lowers the probability of failure by *68 percent* for low-to-moderate income borrowers. While this is not quite as impressive as is the result for non-low-mod borrowers (where failure probability is reduced by almost *80 percent*), it remains nevertheless remarkable. Based on the results from our analysis, we believe that repayment plans are both statistically significant and economically important – that is, they work very well at keeping delinquent borrowers in their homes.

Our result becomes even stronger when we recognize that the majority of loans in our sample did not have the benefit of being underwritten with state-of-the-art automated underwriting since more than 58 percent of the loans evaluated in our data were originated prior to 1998 – automated underwriting for mortgages was introduced by Freddie Mac in 1995, but it was 1998 before AU was a significant contributor to the mortgage origination process.²³ This helps clarify that it may well have been the servicing process rather than initial loan quality that led to surprisingly low default rates in the early 2000's, which featured high job losses during the recession and 18 months into the economic recovery. It is important to note that selection bias might be an issue—although we have controlled for a number of important borrower characteristics (especially borrower credit condition using the Early Indicator score), there could be omitted characteristics among those in repayment plans that vary substantially from those that are not.

11. Conclusions

The mortgage literature is vast—it contains many papers on mortgage originations, prepayment and default (meaning foreclosure). Despite its vastness, it has nearly ignored an event that happens more often than foreclosure itself—delinquency without failure. This study is among the first papers to explore empirically the transition between delinquency and foreclosure, and that investigates home-retention workout options that can reduce failure probabilities conditional on delinquency.

²³ Loan Prospector reviewed 38,248 loans in 1995; 203,424 in 1996; 528,809 in 1997; 2.1 million in 1998; 3.0 million in 1999; 3.8 million in 2000; 7.4 million in 2001; 8.2 million in 2002 and 9.5 million loans in 2003. See Freddie Mac (2004).

We know that automation has brought tremendous benefits to the loan origination market, particularly among borrowers previously believed to be too high risk for prime credit. For example, Straka (2000) and Gates et al. (2002) and Gates et al. (2003) demonstrated that significant gains in underwriting accuracy using automated systems (specifically Freddie Mac's Loan Prospector) have both expanded homeownership opportunities for borrowers targeted by affordable loan programs (such as first-time homebuyers, low and moderate income borrowers and minority households) and reduced credit risk for investors.

There is a *prima facie* case that improvements in servicing are important innovations, and parallel many improvements in the underwriting and origination process. Just as the underwriting and origination process has had a profound impact on the market for new mortgages, so it would seem that the servicing process has had a profound impact on the disposition of delinquent loans. The mortgage origination market has become much more sensitive to interest rates cycles, while the share of delinquent mortgages that result in home loss has become much less sensitive to the business cycle (see again Figure 1). Despite serious job losses in the early 2000s, mortgage foreclosure has risen by only half as much as it did in the early 1990s – in fact by the peak in serious delinquencies in 2003, 90-day delinquency and foreclosure rates in the prime market had only risen back to 1998 levels.

We have identified one potential reason for this: the institution of credit scoring tools for identifying at-risk loans and underwriting workouts and policies that encourage home-retention workouts. Owners of mortgages can now better identify who has the capacity to repay their loans, and then to make appropriate arrangements to allow them to do so. We have found that across a variety of specifications, the total population of delinquent borrowers, and among them low-to-moderate income borrowers and borrowers in underserved areas, are less likely to lose their home if they are in a repayment plan or other workout. We need to be a bit careful about our interpretation of these results because it is possible that borrowers in repayment plans have unobserved characteristics that differ from other borrowers. Nevertheless, it is heartening to note the large correlation between the likelihood of not failing and being in a repayment plan, even after controlling for variables that by themselves are important predictors of default and foreclosure.

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Table 1
Foreclosure Characteristics and Time Frame By State

State	Security Instrument	Foreclosure Type	Initial Step in Process	# of Months to Start	Redemption Period	Deficiency Judgement
Alabama	Mortgage	Nonjudicial	Publication	1	12 months	Allowed
Alaska	Deed of Trust	Nonjudicial	Record Notice of Default	3	None	Allowed
Arizona	Deed of Trust	Nonjudicial	Record Notice of Sale	3	None	Allowed
Arkansas	Mortgage	Judicial	Record Notice of Default	4	None	Allowed
California	Deed of Trust	Nonjudicial	Record Notice of Default	4	None	Prohibited
Colorado	Deed of Trust	Nonjudicial	File FCL Documents with Public Trustee	2	75 Days	Allowed
Connecticut	Mortgage	Judicial	Complaint to Sheriff	5	None	Allowed
Delaware	Mortgage	Judicial	Complaint	3	None	Allowed
Dist. of Columbia	Trust Deed	Nonjudicial	Record Notice of Default	2	None	Allowed
Florida	Mortgage	Judicial	Complaint	5	None	Allowed
Georgia	Security Deed	Nonjudicial	Publication	2	None	Allowed
Hawaii	Mortgage	Nonjudicial	Publish Notice of Intent	3	None	Allowed
Idaho	Deed of Trust	Nonjudicial	Record Notice of Default	5	None	Allowed
Illinois	Mortgage	Judicial	Complaint	7	None	Allowed
Indiana	Mortgage	Judicial	Complaint	5	3 months	Allowed
Iowa	Mortgage	Judicial	Petition	5	6 months	Allowed
Kansas	Mortgage	Judicial	Complaint	4	6-12 months	Allowed
Kentucky	Mortgage	Judicial	Complaint	6	None	Allowed
Louisiana	Mortgage	Judicial	Petition for Executory Process	2	None	Allowed
Maine	Mortgage	Judicial	Complaint	6	None	Allowed
Maryland	Deed of Trust	Nonjudicial	File Order to Docket	2	None	Allowed
Massachusetts	Mortgage	Judicial	File Complaint Relative to S&SR Act	3	None	Allowed
Michigan	Mortgage	Nonjudicial	Publication	2	6 months	Allowed
Minnesota	Mortgage	Nonjudicial	Publication	2	6 months	Prohibited
Mississippi	Deed of Trust	Nonjudicial	Publication	2	None	Prohibited
Missouri	Deed of Trust	Nonjudicial	Publication	2	None	Allowed
Montana	Deed of Trust	Nonjudicial	Record Notice of Sale	5	None	Prohibited
Nebraska	Mortgage	Judicial	Petition	5	None	Allowed
Nevada	Deed of Trust	Nonjudicial	Record Notice of Default	4	None	Allowed
New Hampshire	Mortgage	Nonjudicial	Publication	2	None	Allowed
New Jersey	Mortgage	Judicial	Complaint	3	10 Days	Allowed
New Mexico	Mortgage	Judicial	Complaint	4	None	Allowed
New York	Mortgage	Judicial	Complaint	4	None	Allowed
North Carolina	Deed of Trust	Nonjudicial	Notice of Hearing	2	None	Allowed
North Dakota	Mortgage	Judicial	Complaint	3	60 days	Prohibited
Ohio	Mortgage	Judicial	Complaint	5	None	Allowed
Oklahoma	Mortgage	Judicial	Petition	4	None	Allowed
Oregon	Deed of Trust	Nonjudicial	Record Notice of Default	5	None	Allowed
Pennsylvania	Mortgage	Judicial	Complaint	3	None	Allowed
Rhode Island	Mortgage	Nonjudicial	Publication	2	None	Allowed
South Carolina	Mortgage	Judicial	Complaint	6	None	Allowed
South Dakota	Mortgage	Judicial	Complaint	3	180 days	Allowed
Tennessee	Deed of Trust	Nonjudicial	Publication	2	None	Allowed
Texas	Deed of Trust	Nonjudicial	Post & File Notice of Sale	2	None	Allowed
Utah	Deed of Trust	Nonjudicial	Record Notice of Default	4	None	Allowed
Vermont	Mortgage	Judicial	Complaint	7	None	Allowed
Virginia	Deed of Trust	Nonjudicial	Publication	2	None	Allowed
Washington	Deed of Trust	Nonjudicial	Record Notice of Sale	4	None	Allowed
West Virginia	Deed of Trust	Nonjudicial	Publication	2	None	Prohibited
Wisconsin	Mortgage	Judicial	Complaint	Varies	None	Allowed
Wyoming	Mortgage	Nonjudicial	Publication	2	3 months	Allowed

Source: U.S. Dept. of Housing and Urban Development *Mortgagee Letter* 2001-19; www.myhomesaver.com/state.html accessed December 23, 2002;

Table 2 Early Indicator[®] Loss-mitigation Scores Rank Loans Accurately by Risk of Home Loss				
El Score Range	Number of Loans Scored	Borrowers Retain Homes	Borrowers Lose Homes	Odds Ratio of Borrowers Retaining to Losing Homes
101-200	14,321	2,675	8,587	1:3
201-250	6,923	2,566	2,184	1:1
251-310	13,181	6,365	2,149	3:1
311-360	28,770	16,001	2,329	7:1
361-390	83,471	53,122	2,512	21:1
391-400	143,790	110,047	1,045	105:1
Total	290,456	190,776	18,806	10:1
Source: Authors' calculations on a sample of delinquent Freddie Mac loans scored in 4Q 1998. Performance measured through 4Q 2000.				

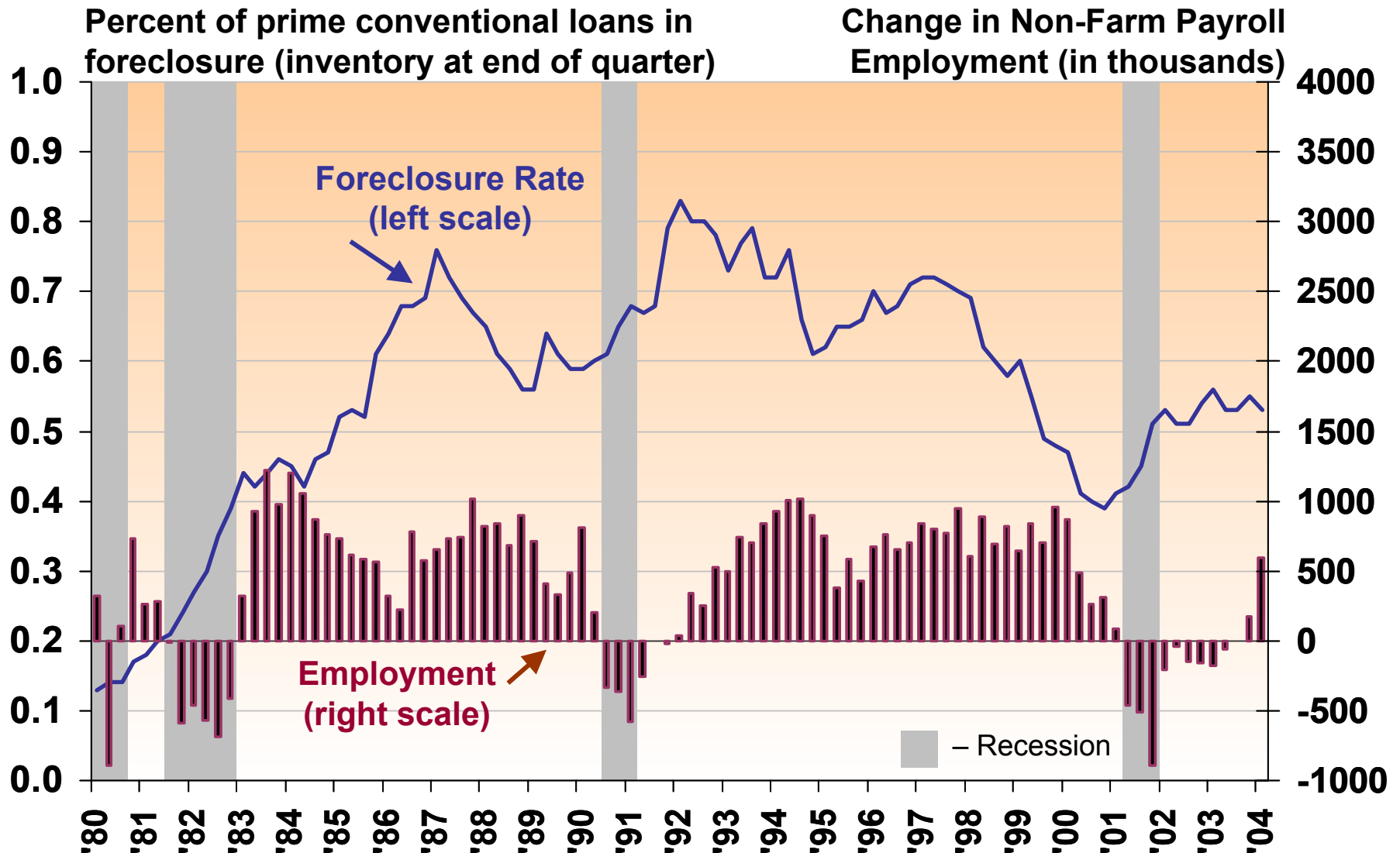
Table 3
Fail and Cure Rates By Inflow Delinquency Status

Fail Rates¹				
Status at Inflow into Sample	Inflow Sample	Time Since Entry into Sample		
		6 months	12 months	18 months
Repayment Plan	48,962	1.1	3.0	4.2
60-Days Late	182,829	2.5	6.2	7.8
90 Days Late	75,043	8.1	15.8	18.7
120+ Days Late	37,588	13.3	24.1	27.6
Cure Rates²				
Status at Inflow into Sample	Inflow Sample	Time Since Entry into Sample		
		6 months	12 months	18 months
Repayment Plan	48,962	71.6	85.4	89.7
60-Days Late	182,829	72.8	83.6	87.0
90 Days Late	75,043	57.1	68.4	72.6
120+ Days Late	37,588	46.1	56.9	61.3
¹ Loans fail when the borrower loses the property through foreclosure REO, Deed-in Lieu transfer, short sale, or the loan is a charge-off or lender repurchase. ² Loans cure when the borrower fully reinstates the loan, the loan is prepaid, modified or assumed. Source: Authors' calculations on a sample of delinquent loans owned by Freddie Mac; inflow into delinquency or repay plan occurred between January 2001 and September 2001				

Table 4
Time to Default Survival Function Estimates

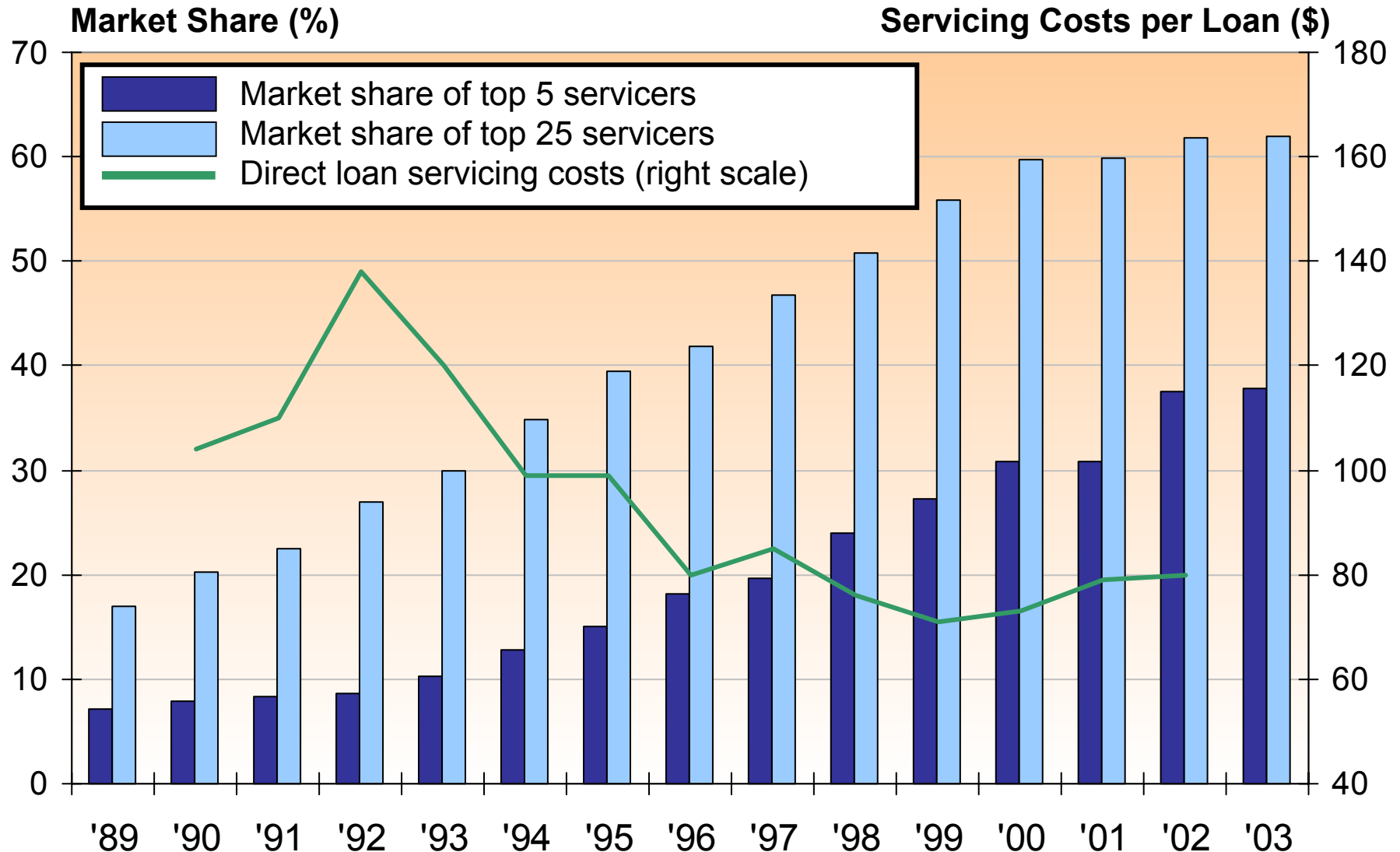
Variable	Description	Model A		Model B		Model C		Model D	
		Hazard Ratio	T-statistic	Hazard Ratio	T-statistic	Hazard Ratio	T-statistic	Hazard Ratio	T-statistic
Inflow60	Loan was delinquent 60 days at inflow into sample	0.516	-13.134	0.298	-41.645	0.509	-13.380	0.296	-41.761
Inflow90	Loan was delinquent 90 days at inflow into sample	1.034	0.636	0.799	-12.099	1.012	0.229	0.802	-11.895
CLTV	Current LTV at inflow into sample (\$)	1.007	4.565	1.019	28.894	1.008	5.027	1.020	29.757
UPB	Unpaid principal balance on delinquent loan (\$)	1.000	-0.731	1.000	-7.987	1.000	-0.346	1.000	-6.742
EI Score	Early Indicator Score at inflow into sample	0.991	-20.954	0.995	-21.380	0.991	-20.644	0.995	-20.675
Coupon	Current interest rate on delinquent mortgage (%)	0.998	-0.090	0.967	-3.978	0.997	-0.130	0.972	-3.416
FICO Score	Borrower FICO score at origination	1.002	6.204	x	x	1.002	6.026	x	x
Bankruptcy	Borrower in Bankruptcy	0.504	-12.202	0.672	-14.813	0.492	-12.651	0.655	-15.778
Low-Mod	At origination, loan qualified for HUD GSE low- & moderate-income goal	1.001	0.024	0.997	-0.089	1.005	0.129	1.003	0.098
Underserved	At origination, loan qualified for HUD GSE Underserved Area goal	1.152	3.653	1.162	4.306	1.152	3.642	1.161	4.277
HUD_Missing	Pre 1993 origination or loan missing information on HUD Affordable Goal Status	2.022	1.217	1.321	9.470	2.026	1.220	1.326	9.577
PreviousLoanMod	Loan modification prior to inflow into sample	0.458	-7.614	0.537	-14.154	0.480	-7.156	0.552	-13.537
Repay	Borrower entered home retention workout (repayment plan) post inflow	0.234	-15.533	0.209	-48.095	x	x	x	x
LowMod_Repay	Interaction variable: low- or moderate income borrower loan enters home retention workout (repayment plan)	1.367	2.654	1.553	4.792	x	x	x	x
Underserved_Repay	Interaction variable: HUD underserved area goal loan enters home retention workout (repayment plan)	1.055	0.444	1.119	1.065	x	x	x	x
Workout	Borrower entered home retention workout (repayment plan or loan modification) post inflow	x	x	x	x	0.203	-17.061	0.174	-53.755
LowMod_Workout	Interaction variable: low- or moderate income borrower loan enters home retention workout (repayment plan or loan modification)	x	x	x	x	1.366	2.648	1.580	4.952
Underserved_Workout	Interaction variable: underserved loan enters home retention workout (repayment plan or loan modification)	x	x	x	x	1.054	0.439	1.132	1.173
Number of Observations		63,613		148,050		63,613		148,050	

Figure 1: Foreclosure Rates Today Are Below 1998-1999 Levels Despite Continued Job Losses



Source: Mortgage Bankers Association of America, Freddie Mac, National Bureau of Economic Research, Bureau of Labor Statistics

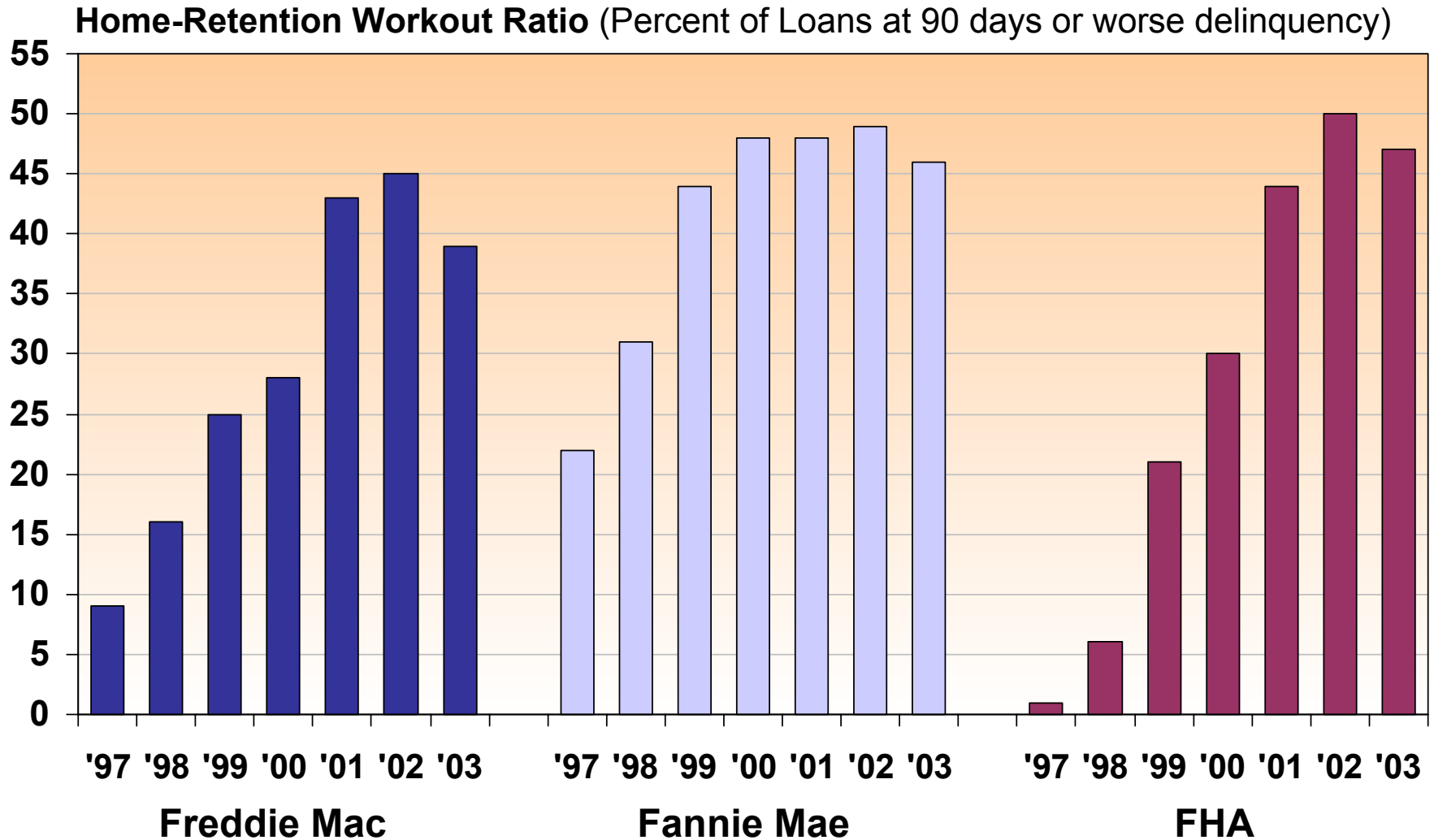
Figure 2: Market Shares Among Top Servicers Have Grown Rapidly and Economies of Scale Have Lowered Costs



Note: Market shares as a fraction of total single-family mortgage dollars outstanding.

Source: Inside Mortgage Finance Publications, Inc. (2001, 2004); Mortgage Bankers Association.

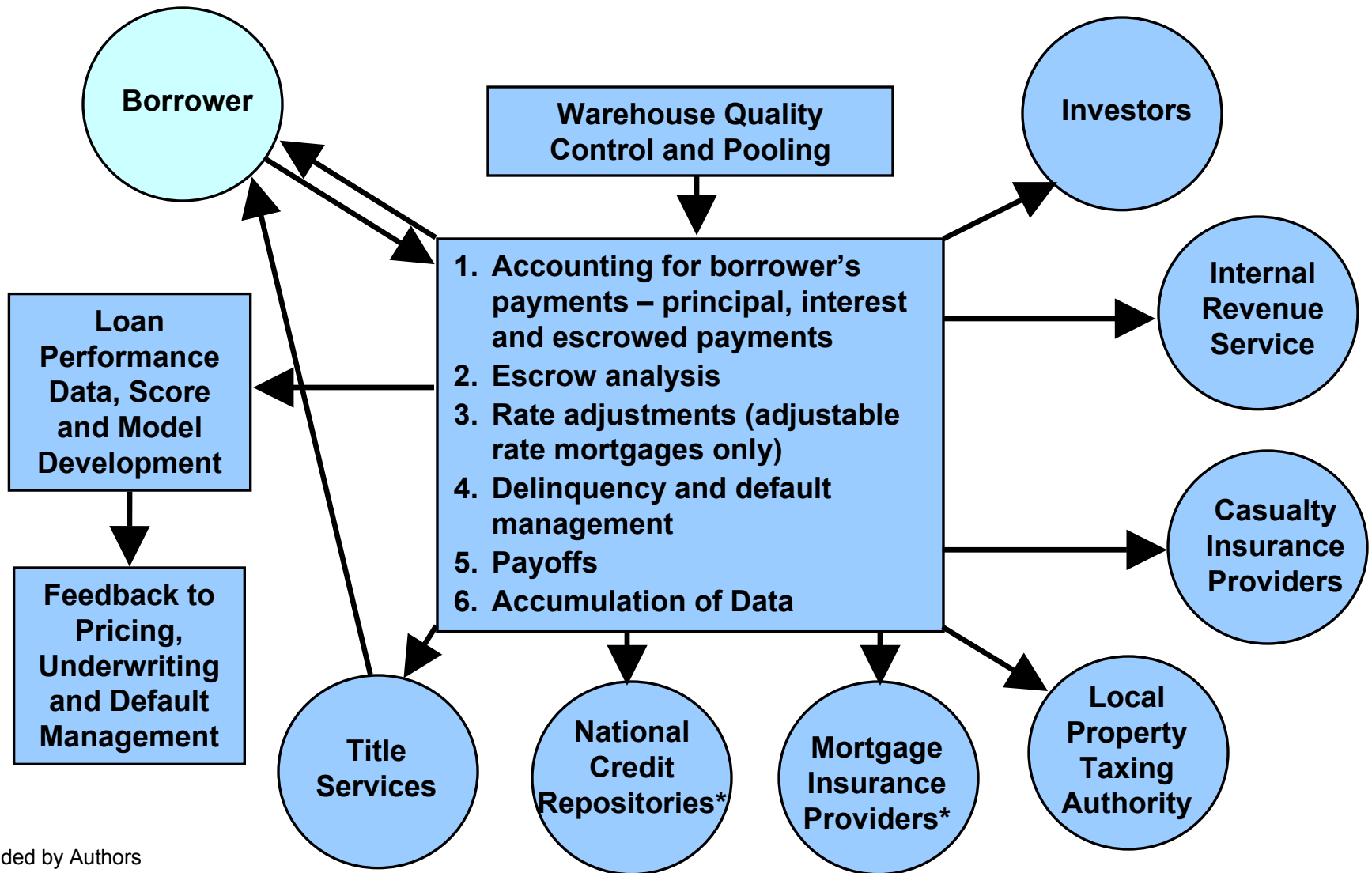
Figure 3: In the Late 1990s, The Use of Workouts Grew Rapidly in the Servicing of Problem Loans



Note: Freddie Mac ratios do not include repayment plans or forbearances prior to 2001

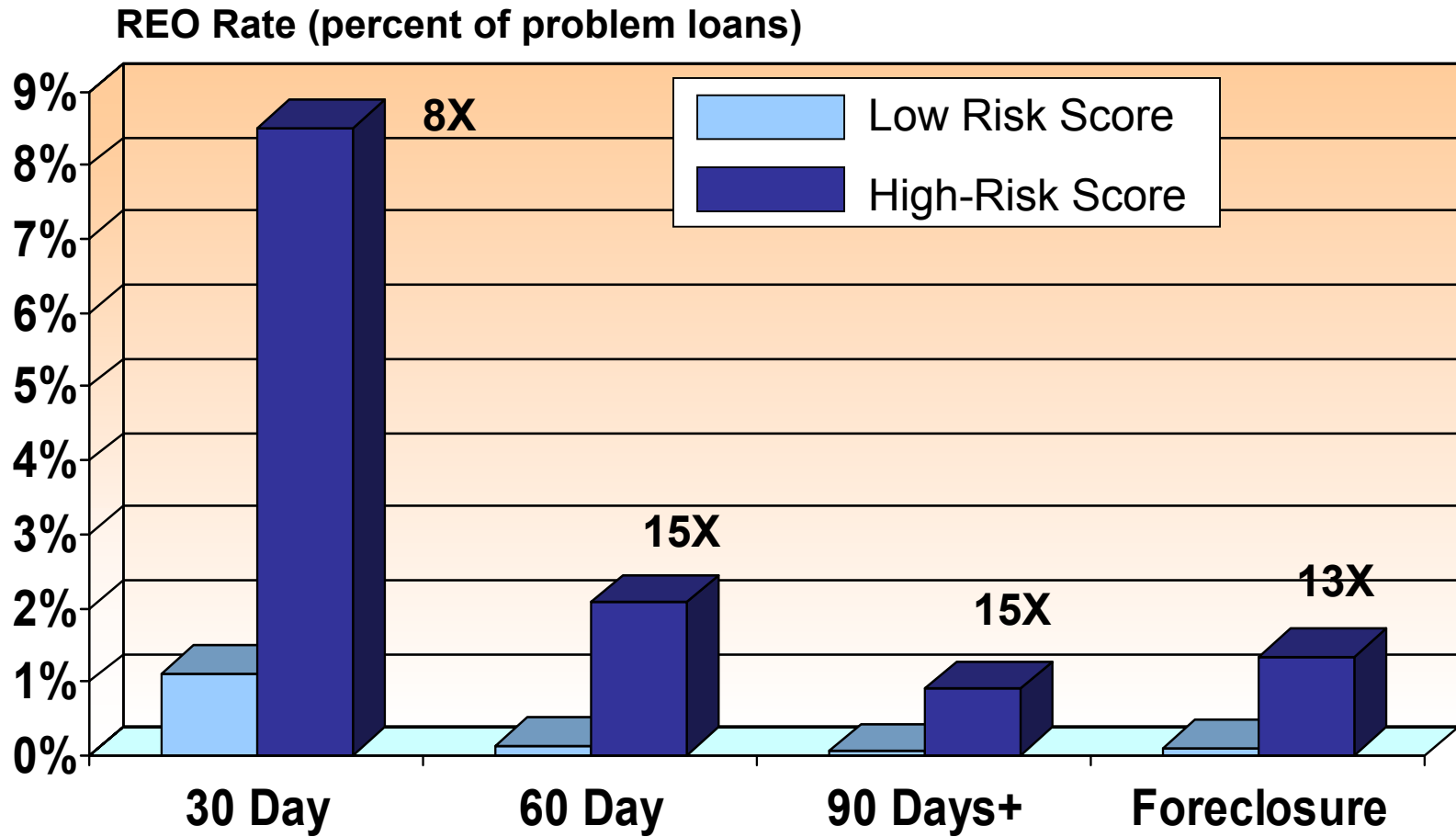
Sources: Freddie Mac, Fannie Mae and HUD.

Figure 4: (Mostly) Lacour-Little's (2000) Simplified Flow of Loan Servicing Activities



* Added by Authors

Figure 5: Loans With Risk Profiler® High-risk Scores Default Significantly More Than Low-risk Scores



Source: Fannie Mae. Based on 10.6 million loans scored