

# Loan Modifications and Redefault Risk: An Examination of Short-Term Impacts

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## Abstract

*One promising strategy to stem the flood of home foreclosures is to modify mortgage loans so that borrowers can remain in their homes. A primary concern of loan modification efforts, however, is the seemingly high rate of recidivism. In this article, we examine the relationship between redefault rates and different types of loan modifications based on a large sample of recently modified loans. Our findings show that the key component to making modified loans more sustainable, at least in the short run, is that mortgage payments are reduced enough to be truly affordable to the borrowers. The findings also show an even lower likelihood of redefault when the payment reduction is the result of a principal reduction. Unfortunately, our findings also show that to reduce redefault for modified loans that are currently under water (those with significant negative equity), more significant loan restructuring or refinancing may be needed.*

## Introduction

The foreclosure crisis shows no sign of abating. More than 2.3 million homeowners faced foreclosure in 2008, an 81-percent increase from 2007 (Aversa and Zibel, 2009). The foreclosure crisis and the resulting credit and financial turmoil became a full-fledged national and global recession in late 2008. Payroll employment has declined by 3.6 million since December 2007 and more than one-half of this decline occurred between November 2008 and February 2009 (Bureau of Labor Statistics, 2009). Job losses lead to more foreclosures, which, when added to the already oversupplied real estate market, further reduce home values, leading to even more foreclosures. The \$2.8 trillion

financial loss in household real estate wealth from 2006 to the third quarter of 2008 further weakens the overall economy, leading to more income loss (Board of Governors of the Federal Reserve System, 2008).

Borrowers' inability to meet mortgage payments is the core of the foreclosure problem, and a modification of the terms of mortgages has been regarded as a means to reduce the payment burden. By providing troubled homeowners with relief, modifications can be regarded as a tool for foreclosure avoidance. For instance, under the Federal Deposit Insurance Corporation's (FDIC's) streamlined loan modification program, mortgages that meet certain criteria can be modified to help borrowers achieve sustainable payments by lowering their housing payments to 38 percent of their gross income (FDIC, 2008). The Homeowner Affordability and Stability Plan creates a \$75 billion program to subsidize loan modifications that would reduce the monthly mortgage payment of a troubled homeowner to as low as 31 percent of monthly household income (U.S. Department of the Treasury, 2009). In practice, the Office of the Comptroller of the Currency (OCC) and Office of Thrift Supervision (OTS) (OCC and OTS, 2008) documented that an estimated 133,000 loans were modified in the third quarter of 2008, a 16-percent increase from the second quarter of 2008, but the number of modifications continued to fall further behind the number of new delinquencies.<sup>1</sup>

A primary concern with loan modification efforts is the seemingly high rate of recidivism. Within 6 months, more than one-half of all modified loans were 30 days or more delinquent and more than one-third were 60 days or more delinquent (OCC and OTS, 2008). Do these high rates of redefault imply that loan modifications are failing?

Unfortunately, the complexity of the many factors involved in loan modifications makes this question less straightforward than it appears. Modifications do not necessarily reduce mortgage payments, only some do. Loan modifications can lower monthly payments by extending the loan term, or by reducing the interest rate or the mortgage's outstanding balance, or by a combination of practices. Traditional modifications, however, only add the delinquent payment to the unpaid principal, thus increasing the amount of debt and often resulting in higher monthly payments (White, 2008).

Also, an important temporal aspect to loan modifications exists during an extended period of economic downturn. A loan modification may be successful in addressing the initial problem, for instance, by reducing the monthly payment to address a lack of affordability after an interest rate reset. As a result of the deepening financial and economic crisis, however, borrowers can easily face new problems shortly after a loan modification, such as loss of a job, which can lead to another mortgage delinquency and redefault. Thus, it is important to examine the short- and long-term implications of loan modifications.

Using data from a large sample of recently modified nonprime loans, we examine why some loan modifications are more likely to redefault than others. More narrowly, we examine the types of modifications that are more likely to redefault in the short term. As expected, we find that a significant reduction in mortgage payment makes modified loans more sustainable in the short

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<sup>1</sup> During the same period, the number of mortgages delinquent by 60 days or more increased by 17 percent.

term. The findings also show an even lower likelihood of redefault when the payment reduction is accompanied by a principal reduction. Of course, not all loan modifications that avoid redefault are better for the lender. Further studies are still needed to compare the relative effectiveness of different types of loan modifications based on a net present value analysis.

This article proceeds as follows. The next section reviews the current practices of loan modifications and the literature. The third section discusses the data and outlines the logistic models of the redefault behavior of borrowers with modified loans. The fourth section presents and discusses the results, and the final section concludes.

## **Literature Review**

Loan modification has been regarded by the Obama Administration as one promising strategy to stem the flood of home foreclosure, but not much solid research exists on this topic. In this section, we review some of the recent practices of loan modifications and the literature on the effect of loss mitigation efforts.

### **Implementing Loan Modifications**

As of early 2007, most modifications involved a capitalization of arrears for seriously delinquent loans and/or a principal forbearance, according to Inside B&C Lending (2008). In 2007, however, interest rate resets on the massive 2005 and 2006 vintages were starting to cause defaults, because the rate indexes were high and monthly mortgage payments were rising by large amounts. The decline of housing prices started in late 2006 in many markets, making it difficult for borrowers to refinance. In late 2007 and early 2008, the prereset modifications (interest rate freeze or reduction) on subprime adjustable-rate mortgages (ARMs) increased significantly. More recently, modification activity has focused on interest rate reductions and less seriously delinquent borrowers. The category of principal reduction is still largely theoretical, however, and has not been used to any significant degree (White, 2008).

The federal government has relied primarily on encouraging lenders to voluntarily modify the terms of existing mortgages. In October 2007, a coalition of mortgage servicers and housing counseling agencies formed the HOPE NOW Alliance to stimulate a voluntary effort to restructure mortgages. In June 2008, the HOPE NOW Alliance members issued guidelines for a streamlined foreclosure prevention process for committed servicers. In August 2008, the FDIC, which took over the former IndyMac Bank, launched the first streamlined loan modification program for struggling mortgage borrowers meeting certain criteria. This program is designed to help troubled borrowers achieve a sustainable 38-percent housing expense-to-income (HTI) ratio in the mortgage and decrease the borrower's payment by 10 percent or more.<sup>2</sup> To reach affordable levels, mortgage modifications can combine interest rate reduction, extended amortization, and partial principal

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<sup>2</sup> If the initial modification at 38 percent of HTI does not decrease the borrower's payment by 10 percent or more, the HTI ratio can be lowered to 35 percent and then to 31 percent to achieve the 10-percent savings. For cases in which a 10-percent reduction cannot be achieved, the 31-percent HTI ratio is used for affordability. FDIC (2008) provides the technical details about the loan modification program.

forbearance. In December 2008, government-sponsored enterprises (GSEs) started a streamlined modification program, applying many features of the FDIC loan modification program.<sup>3</sup> The recently announced Home Affordable Modification Program encourages lenders and servicers to bring the mortgage payments to as low as 31 percent of monthly income by providing incentives to lenders, servicers, and borrowers. Under this plan, a mortgage lender would reduce a borrower's payments to 38 percent of monthly income and the federal government would provide additional incentives, such as a \$1,000 upfront payment per modification and more payments if the borrower keeps current (U.S. Department of the Treasury, 2009). The government will also match additional reductions to bring the payment to as low as 31 percent of monthly income.

The current government loan modification programs aim to standardize the modification process, allowing troubled borrowers to get timely and consistent help. Servicers are encouraged to examine readily available loan criteria, such as loan-to-value (LTV) ratios, loan amount, credit scores and payment history, and debt ratios, to make a quick determination of qualifications. Although the number of completed loan modifications steadily increased in 2008, a number of barriers and concerns have impeded the wider adoption of loan modifications.

## **Barriers of Loan Modification**

Eggert (2007) summarized several barriers to loan modifications and indicated that servicers' costs and self-interests are the primary hurdles. Loan modifications have been labor intensive and usually very expensive for servicers, with costs estimated at between \$500 and \$600 per modification (Eggert, 2007). Because of the high cost of the loan modification, servicers may want to save money by doing nothing, in the hope that the loan can cure itself without any action (Mayer and Gan, 2006). Furthermore, because subprime servicers can derive substantial income from late fees that can be reimbursed for the costs of foreclosure, many servicers once had more incentive to allow a loan to proceed to foreclosure than to resolve the delinquency, especially in a booming housing market in which the liquidation of foreclosed properties was not a big problem. In the current market, however, servicers are not nearly as interested as they once were in keeping borrowers in long-term delinquency; they fear their outlays may never be reimbursed. For example, servicers must advance monthly payments on loans that are not paying; that requirement is a negative to them.

For securitized loans, the Pooling and Servicing Agreement (PSA), a legal document that outlines the responsibilities of the servicer, restricts the extent of loan modifications allowed. Bound by the PSAs, servicers find that it is not easy to work with investors of securitized mortgages to achieve loan modifications and, usually, it is not clear what is legally permissible (Eggert, 2007). The differences in the type and scope of modifications that are explicitly permitted among different trustees raise operational compliance costs and litigation risks. These negative aspects of securitization seem to affect servicers' incentives and slow or reduce their propensity to modify loans—even

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<sup>3</sup> The underwriting criteria include missing at least three mortgage payments, proof of financial hardship, not in active bankruptcy, and payment on first-lien mortgage not exceeding 38 percent of a borrower's gross monthly household income (Inside Mortgage Finance, 2008). Servicers are expected to begin actively soliciting eligible borrowers with owner-occupied mortgages and loan-to-value ratios of 90 percent or more. Servicers will be compensated \$800 for each successful loan modification under the program.

when such action would be in the collective interests of investors and borrowers.<sup>4</sup> One recent study suggests that frictions due to the securitization preclude efficient loan modifications and increase the foreclosure rate. Conditional on a loan becoming seriously delinquent (60 days or more), the likelihood of a portfolio loan default is lower in absolute terms than that of a securitized loan default (19 to 33 percent, respectively, relative to the mean foreclosure rate) (Piskorski, Seru, and Vig, 2008).

By introducing foreclosure alternatives such as a loan modification that likely will have a lower cost for the borrower, the lender/servicer encounters an implicit moral hazard issue: the willingness to negotiate a less costly solution for borrowers can itself lead to more defaults (Ambrose and Capone, 1996). In other words, providing a less costly option by modifying the terms of a mortgage may signal to other borrowers that the costs associated with default have declined sufficiently, which would result in more defaults than otherwise would have occurred. To limit the moral hazard problems associated with lowering borrower default costs, Ambrose and Capone (1996) suggested that lenders or servicers should restrict foreclosure alternatives to liquidity-constrained borrowers. In practice, the requirement for the defaulted borrower to provide full financial disclosure has addressed the moral hazard problem; only true hardship cases will receive assistance (Inside Mortgage Finance, 2008).

Finally, redefault risk may be higher if modifications are not significant enough. About 53 percent of mortgages modified in the first quarter of 2008 had become delinquent again in 6 months (OCC and OTS, 2008). It seems many of the current modifications do not effectively help troubled borrowers, most likely because the modifications do not bring mortgage debt in line with declining home values or reduce the mortgage payment to a sustainable level. Other factors—such as the high-debt burden, increased unemployment rate, and continuing decline in property values—also may contribute to high redefault rates. As the subprime market worsens and housing prices continue to decline, more innovative solutions that can effectively help troubled borrowers will need to be considered.

## **The Effect of Loss Mitigation Efforts**

Why would some borrowers with modified mortgages redefault? In broad terms, two complementary theories may explain why borrowers stop making their mortgage payments: the “option” theory and the “trigger-event” theory. According to the option theory, the borrower exercises the put option and default when he has a negative equity in the property (Foster and Van Order, 1984; Kau, Keenan, and Kim, 1993; Vandell and Thibodeau, 1985). When the property value has fallen below the amount owed on the loan, the borrower has the incentive to default and to let the lender take the property. The trigger-event theory focuses on life-changing events that affect the homeowner’s ability to make mortgage payments, because of either a sudden drop in or loss of income or an unforeseen increase in expenses (Vandell, 1995). Income disruptions typically are associated with a loss of employment or adverse change in family circumstances, such as an illness, death, or

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<sup>4</sup> In June 2007, the American Securitization Forum (ASF) issued guidelines for the modification of securitized subprime residential mortgage loans (ASF, 2007). The ASF (2007) indicated that modifications were allowable to the extent they improved the net present value for the “aggregate investor”; however, investors and servicers have been sending mixed signals.

divorce. In addition, some environmental factors, such as local economic conditions and changes in underwriting standards, also influence a borrower's decision to default (Cutts and Merrill, 2008). Because most borrowers with modified loans were delinquent to some degree before the loan modifications, most, if not all, of them should have had disruptions in income or unforeseen expenses. As a result, payment relief through a loan modification should help them keep current with required mortgage payments. Of course, the level of equity in the property is also important, because, if a borrower has sufficient equity in the home, the borrower can simply sell the property or refinance it when he or she cannot make the mortgage payment. In these cases, income disruptions are usually insufficient to cause severe default. More simply put, loan to value has always been the most important determinant of default. The conventional wisdom is that the trigger-event theory explains delinquency and the option theory explains default; in this way, they are not really competing, but complementary, explanations.

One group of studies examined whether loss mitigation efforts, including loan modifications, prove helpful to borrowers. For FHA loans, Capone and Metz (2003) found that loss mitigation programs successfully lowered the foreclosure rate; the probability of a loan reaching foreclosure is dramatically reduced when the loans goes through a forbearance agreement (from 77.6 percent in 1998 to 14.5 percent in 2002). Cutts and Green (2005) provided an excellent review of servicing literature and Freddie Mac's innovations in loan servicing and loss mitigation. Using Cox's hazard model to investigate the effect of repayment plans on foreclosure incidence, they found that borrowers who enter a repayment plan have a much lower probability of losing their home (80 percent lower for borrowers overall and 68 percent lower for low- to middle-income borrowers). They also found that borrowers who previously had a loan modification but were again in default were significantly less likely to fail than those who had not previously been through a loan modification, perhaps because of the borrower's willingness to work with the servicers to reach a positive resolution. Cutts and Merrill (2008) also documented that the success rate of modified loans varies by the amount of arrearage capitalized into the loan modification; they found a direct relationship between a lower arrearage and a lower failure rate.

Data on recent modifications are available from a number of sources;<sup>5</sup> however, scant evidence exists concerning the effectiveness of different types of loan modifications. Dubitsky et al. (2008) documented that rate-freeze modifications and principal-reduction modifications have lower redefault rates than do traditional modifications, but the analysis does not control for borrowers' risk characteristics. For example, the data found that reset modifications (primarily rate freeze) exhibited only a 15-percent delinquency rate 8 months postmodification, thus outperforming the other categories. About 10 percent of the loans that received a reset modification, however, were delinquent before modification compared with the much higher delinquency rates (usually 80 to 85 percent) for loans modified by other means. This example illustrates the need for a more precise analysis of the performance of modifications, taking into account borrower, loan, and market factors. The effect

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<sup>5</sup> Sources include at least the *OCC and OTS Mortgage Metrics Report*, the *Foreclosure Prevention Report* from the Federal Housing Finance Agency, the HOPE NOW Alliance of mortgage servicers and counselors, the Mortgage Bankers Association, and the *Mortgage Servicing Report* by the State Foreclosure Prevention Working Group. Few of these sources, however, specify the kinds of modifications implemented or attempt to understand the effect of the modifications beyond summary statistics.

of loan modification and the effectiveness of different modification types are still very new fields of research, and very little data have been available for academic study. In this analysis, we examine the short-term effect of different loan modifications by identifying which kinds of modifications are more sustainable than others and under which circumstances. In the following section, we describe the data and methods used to examine these issues.

## **Data and Methodology**

This section describes a national sample of private-label mortgages that were modified in the second quarter of 2008. It also outlines the logistic models of the redefault behavior of borrowers with modified loans.

### **Data**

Loan-level data on individual mortgages are available for a national sample of private-label securitizations, known as the Columbia collateral file (White, 2008). The data are available through remittance reports produced by the trustee on several mortgage pools, altogether representing more than 4 million outstanding mortgages. During the 2007–08 reporting period, many of the leading mortgage servicing companies serviced the pools.<sup>6</sup> The monthly performance reports provide loan-level details on loan characteristics, defaults, foreclosures, bankruptcy, and losses on foreclosed homes. The reports also have information about the loan balance, mortgage payment, and interest rate, both before and after modification, which enables us to identify whether total mortgage debt, interest rate, or mortgage payments are reduced for individual homeowners. Unfortunately, the information about mortgage debt-to-income ratio, overall debt-to-income ratio, and household disposable income are not available in the data set.

This analysis focuses on a sample of mortgage loans derived from remittance reports for 2006 securitizations, which covers about 1.3 million loans, mostly originated in 2005 and 2006. We chose to examine the 2006 deals because recent nonprime securitizations, especially subprime ARMs, have performed worse than earlier ones as a result of relaxed underwriting criteria, higher combined LTV ratios, and the popularity of risky loan terms (Immergluck, 2008). Although our sample is national in scope, about one-half of the mortgages are concentrated in California, Florida, and a few other high-growth states. As of April 2008, the top five servicers of the 2006 deals—Wells Fargo Bank, Countrywide Home Loans Servicing LP, Aurora Loan Servicing LLC, Ocwen Loan Servicing LLC, and Bank of America—accounted for about 47 percent of all the loans.

In general, the data do not allow us to explicitly identify the loan types for all the loans (59 percent have missing values for the loan type variable). As exhibit 1 shows, the credit quality of the loan types, as measured by the average FICO scores, differs, ranging from 629 for subprime mortgages, to 698 for conventional mortgages, to 702 for Alt-A mortgages. We are confident, however, that a vast majority of the loans in this sample are nonprime loans, because most of them have at least

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<sup>6</sup> As documented by White (2008), a subset of this data set includes 7 of the top 10 subprime originators in 2006 and 6 of the top 15 subprime servicers in 2007.

one risk characteristic that is more common in the subprime sector.<sup>7</sup> Restricting the analysis to modified loans further alleviates this concern to some degree. As exhibit 1 shows, the average FICO score, average LTV ratio, and average interest rate of modified loans do not differ much across loan types.

Of course, this sample of loans does not represent a statistically random sample of all mortgage loans or all nonprime mortgage loans. The loans are securitized loans, and servicers of securitized loans may have different incentives than lenders who retain ownership of mortgage loans. Therefore, this sample of voluntary loan modifications may not be representative of loan modifications by portfolio lenders. Nevertheless, given that nonprime mortgages account for more than one-half of all foreclosures<sup>8</sup> and that the vast majority of nonprime loans that led to the crisis were securitized, this sample provides important insights regarding what voluntary loan modification programs have yielded to date in the nonprime market.

## Characteristics of Modified Loans

The number of loan modifications among this sample increased sharply in 2008, from about 4,800 in March 2008, to about 6,200 in May 2008, and then to nearly 9,000 in November 2008. This pattern is consistent with the national trend, which showed a significant increase in loan modifications in 2008 (Evers, 2009). We restricted the analysis to modifications in one quarter only to alleviate concerns that policy environment and macroeconomic conditions might have changed substantially during the study period. During the second quarter of 2008, 17,592 loan modifications were in the sample—a large number considering that, in the same quarter, OCC and OTS (2008) reported 114,439 modifications based on a sample representing more than 60 percent of all outstanding mortgages, and FHFA (2008) reported 15,372 modifications by the GSEs.

After excluding second liens, originations before 2005, loans with missing data, nonowner-occupied loans, and those loans in which the final outcomes could not be identified, we had 9,693 loan modifications reported. The data also provided rich details on individual mortgage delinquency and foreclosure, enabling us to track the performance of the modified loans through December 2008. Although most of the modified loans had experienced some delinquency, 37 percent had never experienced any delinquency during the 12 months before the modification. Therefore, we divided the borrowers holding modified loans into two basic groups: those with loans that were already past due under the current terms and those that remained current but were considered to be in “imminent default” (for example, as a result of pending interest rate resets). More than 90 percent

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<sup>7</sup> As suggested in the literature, it is reasonable to assume the following characteristics significantly increase mortgage credit risk: (1) a borrower's FICO score of less than 620, (2) an interest-only loan, (3) negative amortization, (4) limited or no documentation, and (5) original LTV ratio higher than 90 percent (Foote et al., 2008; Immergluck, 2008). A vast majority of conventional loans in this sample and those with missing values (86 and 90 percent, respectively) have at least one of these risky loan features. In this sense, most of these private-label securitizations should be considered subprime or Alt-A mortgages, although they were coded as conventional, conforming, or with missing values.

<sup>8</sup> Without including Alt-A mortgages, subprime mortgages alone accounted for 48 percent of all foreclosure starts in the second quarter of 2008 (MBA, 2008).



## Exhibit 1

### Characteristics of Different Loan Types

	Loan Type	Mean FICO Score	Mean OLTV	Mean Interest Rate (%)	ARM (%)	PPP (%)	Interest Only (%)	Low/No Doc* (%)	At Least One Risky Factor** (%)	Number of Loans
All loans***	Missing	671	73.25	8.12	61.45	53.11	27.90	55.19	88.11	757,035
	Conventional	698	72.72	7.17	58.74	35.69	42.51	52.61	85.57	205,018
	Conventional w/private mortgage insurance	715	90.62	6.82	13.78	3.9	6.37	55.26	81.12	1,822
	Jumbo	740	71.00	6.64	0	0	15.61	45.73	55.46	1,839
	Conforming	674	72.12	8.24	63.24	50.39	28.78	68.59	79.52	90,244
	Nonconforming	695	76.01	7.66	70.53	48.29	37.66	66.51	94.78	35,586
	Subprime	629	71.73	9.07	57.57	62.24	19.18	37.33	91.54	171,743
	Other	694	74.45	7.25	0	11.83	29.28	85.63	91.33	2,206
	Alt-A	702	76.11	8.15	60.41	55.4	22.02	76.15	92.25	20,675
	Total									1,286,168
Modified loans sample	Missing	617	81.53	8.84	91.42	78.77	24.49	36.77	89.70	6,273
	Conventional	604	82.33	9.04	76.92	58.65	19.71	43.75	96.47	624
	Conforming	614	81.91	8.85	93.89	70.90	17.36	46.69	96.09	409
	Nonconforming	635	81.31	8.40	97.45	79.62	28.03	63.69	94.90	157
	Subprime	604	82.59	8.80	90.18	76.26	26.35	34.78	93.92	2,220
	Other	663	80.00	7.38	0.00	0.00	100.00	100.00	100.00	2
	Alt-A	675	75.03	10.06	75.00	62.50	37.50	75.00	87.50	8
Total										9,693

ARM represents adjustable-rate mortgage. OLTV represents origination loan-to-value ratio. PPP represents existence of a prepayment penalty.

\* Low/No Doc represents low- or no-documentation mortgages.

\*\*Features that are considered risky include a borrower's FICO score of less than 620, interest-only mortgages, negative amortization mortgages, limited or no documentation, and original loan-to-value ratios higher than 90 percent.

\*\*\* A few loans coded as "FHA" (Federal Housing Administration) or "VA" (Department of Veterans Affairs) (less than 0.4 percent of the total) that are likely miscoded were dropped from the sample.

of loans in this sample were ARMs and about 61 percent of those with teaser rates were modified before the interest rate reset dates.<sup>9</sup>

Descriptive statistics of the modified loans are listed in exhibit 2. Borrowers holding modified loans generally had quite low origination FICO scores, with an average of about 614. More than one-half of the loans were refinance mortgages (54 percent), about 24 percent were interest-only mortgages, and a small percentage (4 percent) were negative amortization loans. More than one-third of the loans had limited or no documentation at origination. About two-thirds originated in 2006; the remainder originated in 2005.

## Exhibit 2

### Descriptive Statistics for Modified Loans

Characteristic	Mean Value
Original FICO score	614
Interest rate	8.84
Appraisal value	\$260,194
Loan amount	\$238,726
OLTV	81.83%
CLTV	84.95%
Home purchase	46.04%
ARM	90.37%
Interest only	24.39%
Negative amortization	4.30%
Full-doc/alt-doc*	62.34%
<b>Origination year</b>	
2005	33.57%
2006	66.43%
<b>Property location</b>	
California	24.95%
Florida	11.72%
Texas	4.56%
Arizona	4.32%
Michigan	4.22%
Maryland	3.43%
Other states	46.80%
<b>Servicer</b>	
Servicer 1	30.42%
Servicer 2	23.32%
Servicer 3	13.30%
Servicer 4	7.49%
Others	25.47%
<b>Redefault as of December 2008 (30+ days)</b>	44.75%
N	9,693

ARM represents adjustable-rate mortgage. CLTV represents combined loan-to-value ratio. OLTV represents origination loan-to-value ratio.

\*Full-doc/alt-doc represents full- or alternative-documentation mortgages.

<sup>9</sup> A smaller share of the mortgages (about 11 percent of all the ARMs) kept payment unchanged and may be considered as “streamlined” reset modifications. These modifications are usually designed for borrowers who were current before reset.

Slightly more than one-half of the modifications (53 percent) led to reduced monthly principal and interest (P&I) payments (with at least a 1-percent reduction in mortgage payment; see exhibit 3); however, 23 percent of reported modifications resulted in payment increases, likely a product of recasting arrears. The remaining 23 percent of modifications had roughly the same P&I payment (less than a 1-percent change). On average, the monthly payment was reduced by \$173 for all modified loans. But the reports do not disclose whether the payment changes and rate reduction are permanent or temporary for this sample. The most common modifications were either interest reduction only (53 percent), in which the interest rate was cut but the principal remained the same or increased slightly, or a traditional modification (39 percent), in which the interest stayed the same but the principal balance and mortgage payment increased slightly (exhibit 3). These increases likely resulted from capitalization of unpaid interest or other charges.

Overall, loan modifications increased the aggregate outstanding mortgage debt, but most experienced an interest rate reduction. The amount owed on the modified loans increased from \$2.31 billion before modification to \$2.33 billion after modification. A small share of modified loans (8.4 percent) had the principal balance reduced, but only 299 loans (3 percent) reduced principal by more than 20 percent. Because principal reductions have not yet been used to a large extent, we are unable to make a clear determination of their success. More than one-half (about 59 percent) of loan modifications experienced an interest rate reduction. Because of the rate reduction, the average interest rate of modified loans dropped from 8.84 to 7.16 percent after modification, still much higher than the prevailing 30-year fixed rate on prime mortgages, which, during this period, was a little higher than 6 percent.

The modification strategy of different servicers seems to vary significantly. Exhibit 4 shows the share of different types of modifications by major servicers in this sample. Servicer 1 was the only one that had actively used principal-reduction modifications. In comparison, Servicer 2 had been more likely to use traditional modifications and Servicer 3 was more likely to use rate reduction.

### Exhibit 3

#### Types of Loan Modifications by Payment Reduction

Loan Modification Type		Percent
By rate/principal reduction	Rate reduction and principal reduction	6.19
	Rate reduction only	52.92
	Principal reduction only (rare)	2.26
	No rate reduction and no principal reduction (traditional)*	38.63
By payment relief	>40% reduction	5.84
	30.1–40% reduction	8.71
	20.1–30% reduction	13.12
	10.1–20% reduction	15.26
	5.1–10% reduction	6.15
	1–5% reduction	4.17
	No reduction	23.44
Increase in payment*		23.32
Total number of loans		9,693

\* Reference group in the model.

Notes: Based on the 2006 deals in the Wells Fargo remittance reports. All second-liens, nonowner-occupied loans, and loans with missing information have been excluded.

Exhibit 4

Loan Modifications by Servicers

Servicer	Number of loans	Loan Modification Type	Percent
Servicer 1	2,949	Rate reduction and principal reduction	19.46
		Rate reduction only	49.34
		Principal reduction only	7.12
		Traditional	24.08
Servicer 2	2,260	Rate reduction and principal reduction	0.04
		Rate reduction only	30.97
		Principal reduction only	0.13
		Traditional	68.85
Servicer 3	1,289	Rate reduction and principal reduction	0.23
		Rate reduction only	77.04
		Principal reduction only	0.00
		Traditional	22.73
Servicer 4	726	Rate reduction and principal reduction	0.00
		Rate reduction only	58.13
		Principal reduction only	0.00
		Traditional	41.87
Other servicers*	2,469	Rate reduction and principal reduction	0.89
		Rate reduction only	63.18
		Principal reduction only	0.24
		Traditional	35.68

\* Reference group in the model.  
Notes: Based on the 2006 deals in the Wells Fargo remittance reports. All second-liens, nonowner-occupied loans, and loans with missing information have been excluded.

Servicer 4 made no principal-reduction modifications. We used data from only one quarter, so some servicers may have changed their strategy over time.

Servicers report, however, that loan modification is not always a successful strategy. For loans modified in the second quarter of 2008, about 44.7 percent were foreclosed or delinquent by 30 or more days as of December 2008, slightly lower than the 55-percent, 6-month redefault rate reported by OCC and OTS (2008). More than 25 percent were delinquent by 90 or more days or were in the foreclosure process. Redefault rates varied, however, by type of loan modification. Modifications with a reduced mortgage payment have a lower redefault rate than those with the same or a larger mortgage payment (38, 46, and 60 percent, respectively). A similar pattern can also be found for the interest rate reduction modifications, in which a loan modification with a rate reduction has a lower redefault rate than loan modifications without (39 versus 52 percent).

Modeling

In our empirical analysis, we wanted to identify the kinds of loan modifications that are more successful than others. That is, we examined why some loan modifications are more sustainable than others and why some loans redefault quickly. The simplest approach for this analysis is in the use of the following specifications:

$$\Pr(Y_i = 1 | Modify_i) = f(\alpha + \beta * Modify_i + \gamma * X_i + \eta * S_i + \kappa * \delta_i + \epsilon_i) \tag{1}$$

where *Modify* is the type of modification,  $X_i$  contains a set of loan and borrower characteristics,  $S_i$  is a servicer dummy, and  $\delta_i$  is a control for state, all further described in the following paragraphs. The dependent variable ( $Y_i$ ) is an indicator variable for a modified loan  $i$  that takes a value of 1 if the loan redefaults. A loan is considered to be a redefault if it was in delinquent status as of December 2008 (including foreclosures before December 2008). In this analysis, we tried the 30+day delinquency as a measure of delinquency and the 90+day delinquency as a proxy of default.<sup>10</sup>

$X_i$  is a vector of factors that may influence the outcome of a modified loan. Specifically, we controlled the following loan and borrower characteristics: FICO score at origination, documentation type, adjustable interest rate, interest-only loan type, loan amount (in log), loan purpose, and estimated current LTV ratio<sup>11</sup> when modified. We estimated the current LTV ratio by dividing the unpaid balance when the loan was modified by the estimated house price in the second quarter of 2008, using the original house price and the House Price Index (HPI) at the metropolitan statistical area (MSA) level provided by the Federal Housing Finance Agency (FHFA). If the property was located outside an MSA, we used the state HPI. We used the county unemployment rate as of October 2008 to represent local economic conditions.

It is possible that, after conditioning on a host of observables, the assumption of a random assignment into different modifications at the time of modification may be violated, making the estimate biased. As exhibit 4 shows, different servicers may adopt different loan modification strategies, and they may also decide the types of modification based on unobservable private information about the borrower's quality at the time of modification. As a result, the differences in redefault rates among modified loans might simply reflect the unobservable information of the practices of servicers and conditions of modified loans. Consequently, our results could be driven by selection on unobservables at the time of modification and the estimated value of  $\beta$  may be biased.

We mitigate this concern by controlling for the delinquency status and prior delinquency history of the borrower *at the time* of modification. We expect the delinquency severity represented by the delinquency status at the time of modification and the number of months in delinquency during the preceding 12 months to capture some of the information regarding the quality of the borrower that is revealed between origination and modification. We hypothesize these variables to be important factors when servicers decide the type of modifications and to be predictors for redefault. We further controlled the dummies ( $S_i$ ) of major servicers to capture unobservable information of different servicers. We also included dummies for two major states ( $\delta_i$ , California and Florida) to

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<sup>10</sup> OCC and OTS report 30+day, 60+day, and 90+day delinquency as measures of postmodification default. The industry has focused on the 90+day event because investors are more concerned with foreclosures rather than with delinquencies. In fact, because the 60+day delinquent borrower behavior is similar to the 90+day delinquency from the modeling perspective, we focus on 30+day and 90+day delinquencies in this article.

<sup>11</sup> Consumers usually do not observe home equity in static terms, and recent movement (trends and volatility) matters as much as absolute changes. The trend (house price appreciation rate) and volatility variables, however, are highly correlated with the estimated LTV variables. In fact, the estimated current LTV ratio is determined by the original LTV ratio and recent house price changes, which are highly correlated with house price change postmodification. Because the observation period is quite short, we decided not to include the house price movement variables in this analysis.

account for variation of socioeconomic conditions across regions and inserted a time dummy for all originations in 2006. These controls should reduce the bias in the estimation.<sup>12</sup>

*Modify* is a set of indicators of different types of loan modifications. Specifically, we tried two sets of loan modification variables. The first set of variables focuses on the level of payment relief induced by the loan modification. We were interested in testing how the mortgage payment reduction affects the redefault probability of modified mortgages. By using a set of variables capturing the level of payment relief after the modification, we could determine the sensitivity of the redefault risk to the change in mortgage payment. The second set of variables focuses on the different changes in loan terms. By considering two features of loan modifications—interest rate change and principal change—we constructed four mutually exclusive dummy variables for the combinations of these two characteristics. These dummy variables are *r0p0* for “rate reduction and principal reduction,” *r1p0* for “principal reduction only,” and *r0p1* for “rate reduction only.” The variable *r1p1*, “no rate reduction and no principal reduction,” which can be roughly regarded as the traditional loan modification, is set as the reference group.

To illustrate the effect of loan modifications on a borrower’s monthly mortgage payment obligation, we assume we have a fixed-rate mortgage originated in January 2006 with an original principal of \$238,726, the average of our study sample. The interest rate is 8.84 percent annually (0.74 percent monthly), the average of all modified loans in this sample. Therefore, the monthly mortgage payment is \$1,893. As of May 2008, the borrower was 90 days delinquent on this mortgage, which means his last payment was in February 2008 and the outstanding balance on his mortgage was \$234,878. Under the traditional loan modification structure, the arrearages and the amount to bring the escrow account current will be added to the principal and reamortized over the remaining 331 months. The borrower’s new mortgage balance will be \$241,827 and his mortgage payment will be \$1,953, a 4-percent increase.<sup>13</sup> To lower the borrower’s payment (for example, by 10 percent), servicers can either lower the interest rate to 7.33 percent from 8.84 percent, reduce the principal to \$210,949, or use a combination of the two. For example, reducing the principal to \$223,134 and the rate to 8.20 percent lowers the mortgage payment by 10 percent. A rate reduction to 8.12 percent and a term extension to 40 years can also reduce the payment by 10 percent.

## Empirical Results

This section describes the results from the logit regression models. The dependent variable is whether the loan was 30 or more days delinquent or 90 or more days delinquent (and includes those loans that had been foreclosed) as of December 2008, as shown in exhibits 5 and 6, conditional on the loan being modified during the second quarter of 2008. In Model 1, we used

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<sup>12</sup> We acknowledge that the current model cannot completely address the endogeneity issue, and that the model can only address the issue with data on borrower updated credit scores, employment status, debt ratios, household income, and other information that servicers collected when underwriting the modification.

<sup>13</sup> The three missed interest payments total \$5,187. If we assume that property taxes and insurance together total 3 percent of the original principal annually, then we add another \$1,762 to bring the escrow account current, making the total amount due \$241,827.

the measures of the change in mortgage payment, and, in Model 2, we tried different types of loan modifications. In exhibit 7, we summarized the predicted redefault rate for different types of loan modifications based on the regression results. In exhibit 8, we further tested the relationship between redefault risk and the level of equity in the property for those modified loans with significant payment relief. We report the estimated coefficients, *p*-values, and marginal effects of different models in the exhibits.

## Exhibit 5

### Logit Regression of Redefault (30 or More Days)

Parameter	Model 1			Model 2		
	Estimate	P-Value	Marginal Effect	Estimate	P-Value	Marginal Effect
Intercept	– 4.769	0.000		– 5.111	0.000	
FICO score	– 0.003	0.000	– 0.001	– 0.003	0.000	– 0.001
30 or 60 days delinquent when modified	0.488	0.000	0.121	0.489	0.000	0.121
90 or more days delinquent when modified	0.572	0.000	0.141	0.574	0.000	0.141
Times in delinquency in prior 12 months	0.118	0.000	0.029	0.127	0.000	0.031
Loan balance (in log)	0.397	0.000	0.098	0.406	0.000	0.100
Estimated CLTV	0.314	0.054	0.077	0.421	0.011	0.104
ARM	0.184	0.020	0.045	0.203	0.010	0.049
Interest only	0.070	0.203	0.017	0.119	0.030	0.029
Full documentation	– 0.106	0.032	– 0.026	– 0.096	0.052	– 0.024
Home purchase	0.343	0.000	0.084	0.334	0.000	0.082
Unemployment rate	0.058	0.000	0.014	0.052	0.000	0.013
Year 2006	0.123	0.015	0.030	0.156	0.002	0.038
California	0.075	0.334	0.018	0.064	0.407	0.016
Florida	0.330	0.000	0.082	0.318	0.000	0.079
Servicer 1	0.131	0.043	0.032	0.155	0.021	0.038
Servicer 2	0.202	0.002	0.050	0.231	0.000	0.057
Servicer 3	0.030	0.711	0.007	– 0.046	0.555	– 0.011
Servicer 4	– 0.025	0.796	– 0.006	0.087	0.359	0.022
Payment reduced >40%	– 1.052	0.000	– 0.229			
Payment reduced 30.1–40%	– 0.802	0.000	– 0.183			
Payment reduced 20.1–30%	– 0.577	0.000	– 0.136			
Payment reduced 10.1–20%	– 0.470	0.000	– 0.112			
Payment reduced 5.1–10%	– 0.432	0.000	– 0.103			
Payment reduced 1.1–5%	– 0.215	0.064	– 0.052			
Payment same (99%–101%)	0.043	0.557	0.011			
<i>r0p0</i> : Rate and principal reduced				– 0.840	0.000	– 0.189
<i>r0p1</i> : Rate reduced only				– 0.543	0.000	– 0.133
<i>r1p0</i> : Principal reduced only				– 0.420	0.007	– 0.100
Pseudo R-square		0.1520			0.1477	

ARM represents adjustable-rate mortgage. CLTV represents combined loan-to-value ratio.

Note: *n*=9,693.

**Exhibit 6****Logit Regression of Redefault (90 or More Days)**

Parameter	Model 1			Model 2		
	Estimate	P-Value	Marginal Effect	Estimate	P-Value	Marginal Effect
Intercept	− 6.344	0.000		− 6.428	0.000	
FICO score	− 0.001	0.026	0.000	− 0.001	0.026	0.000
30 or 60 days delinquent when modified	0.513	0.000	0.098	0.459	0.000	0.088
90 or more days delinquent when modified	0.707	0.000	0.130	0.620	0.000	0.114
Times in delinquency in prior 12 months	0.089	0.000	0.016	0.094	0.000	0.017
Loan balance (in log)	0.329	0.000	0.058	0.340	0.000	0.060
Estimated CLTV	0.490	0.006	0.086	0.585	0.001	0.104
ARM	0.247	0.005	0.041	0.294	0.001	0.049
Interest only	− 0.011	0.862	− 0.002	0.027	0.654	0.005
Full documentation	− 0.168	0.002	− 0.030	− 0.160	0.003	− 0.029
Home purchase	0.410	0.000	0.073	0.407	0.000	0.073
Unemployment rate	0.052	0.000	0.009	0.047	0.001	0.008
Year 2006	0.142	0.013	0.025	0.176	0.002	0.031
California	0.204	0.016	0.037	0.215	0.011	0.039
Florida	0.380	0.000	0.072	0.375	0.000	0.071
Servicer 1	− 0.023	0.755	− 0.004	− 0.049	0.514	− 0.009
Servicer 2	0.161	0.024	0.029	0.226	0.001	0.041
Servicer 3	− 0.078	0.396	− 0.014	− 0.184	0.042	− 0.031
Servicer 4	− 0.204	0.054	− 0.034	− 0.144	0.166	− 0.025
Payment reduced >40%	− 0.884	0.000	− 0.123			
Payment reduced 30.1–40%	− 0.651	0.000	− 0.098			
Payment reduced 20.1–30%	− 0.523	0.000	− 0.082			
Payment reduced 10.1–20%	− 0.362	0.000	− 0.059			
Payment reduced 5.1–10%	− 0.300	0.007	− 0.049			
Payment reduced 1.1–5%	− 0.151	0.222	− 0.026			
Payment same (99%–101%)	0.347	0.000	0.064			
<i>r0p0</i> : Rate and principal reduced				− 0.776	0.000	− 0.113
<i>r0p1</i> : Rate reduced only				− 0.517	0.000	− 0.092
<i>r1p0</i> : Principal reduced only				− 0.179	0.291	− 0.030
Pseudo R-square		0.103			0.0971	

ARM represents adjustable-rate mortgage. CLTV represents combined loan-to-value ratio.

Note:  $n=9,693$ .



## Exhibit 7

### Predicted Redefault (90 or More Days) Rate and Type of Modifications

	No Payment Reduction (%)	5.1–10% Payment Reduction (%)	10.1–20% Payment Reduction (%)	20.1–30% Payment Reduction (%)
Rate reduction only	39.44	32.59	31.25	27.88
Rate reduction and principal reduction	39.44	31.98	30.32	26.60
Principal reduction only	39.44	31.62	29.64	25.58

Notes: Estimation is based on the results of Model 1 in exhibit 6. Estimation is for an average borrower holding a 30-year home purchase mortgage originated in January 2006 with an adjustable interest rate of 8.84 percent in the second quarter of 2008. The original loan amount is \$238,726. The property is not in California or Florida and not served by the major four servicers. The loan has an average value for other regressors.

## Exhibit 8

### Logit Regression of Redefault for Modifications With Significant Payment Reduction

Parameter	30 or More Days			90 or More Days		
	Estimate	P-Value	Marginal Effect	Estimate	P-Value	Marginal Effect
Intercept	– 4.669	0.000		– 5.796	0.000	
FICO score	– 0.002	0.002	– 0.001	– 0.001	0.320	0.000
30 or 60 days delinquent when modified	0.437	0.000	0.103	0.309	0.013	0.046
90 or more days delinquent when modified	0.762	0.000	0.177	0.652	0.000	0.097
Times in delinquency in prior 12 months	0.105	0.000	0.024	0.097	0.000	0.014
Loan balance (in log)	0.309	0.000	0.070	0.274	0.000	0.038
ARM	0.142	0.272	0.032	0.079	0.611	0.011
Interest only	0.073	0.362	0.017	0.083	0.387	0.012
Full documentation	– 0.037	0.606	– 0.008	– 0.049	0.559	– 0.007
Home purchase	0.254	0.000	0.058	0.305	0.000	0.043
Unemployment rate	0.054	0.000	0.012	0.068	0.000	0.010
Year 2006	– 0.027	0.696	– 0.006	– 0.088	0.281	– 0.012
Servicer 1	0.163	0.058	0.037	– 0.087	0.393	– 0.012
Servicer 2	– 0.181	0.127	– 0.040	– 0.210	0.125	– 0.028
Servicer 3	– 0.106	0.298	– 0.024	– 0.326	0.010	– 0.043
Servicer 4	– 0.030	0.862	– 0.007	– 0.059	0.773	– 0.008
Estimated CLTV 70–79.9%	0.167	0.189	0.038	0.083	0.595	0.012
Estimated CLTV 80–89.9%	0.319	0.010	0.074	0.175	0.244	0.025
Estimated CLTV 90–94.9%	0.344	0.020	0.081	0.356	0.144	0.055
Estimated CLTV 95–99.9%	0.406	0.006	0.096	0.275	0.129	0.041
Estimated CLTV ≥100%	0.304	0.024	0.070	0.300	0.063	0.044
Pseudo R-square	0.1255			0.0708		

ARM represents adjustable-rate mortgage. CLTV represents combined loan-to-value ratio.

Note: n=4,757.

## Redefault Risk and Payment Relief

Relative to a modification with an increased mortgage payment, a loan modification that lowers the mortgage payment by at least 5 percent can significantly lower the redefault risk. Based on Model 1 in exhibit 5, the estimated 6-month redefault rate for an average borrower will be about 55.6 percent if the mortgage payment is increased. As exhibit 5 shows, a modification reducing the borrower's payment by just 5.1 to 10 percent lowers the probability of redefault (30 or more days) by 10.3 percent compared with a modification with an increased mortgage payment. If the payment is lowered by 30.1 to 40 percent, the probability of redefault is more than 18 percent lower. As expected, when redefault is measured by 90+day delinquency, the results are consistent but the magnitude of the effect is less. Overall, the results indicate that modifications that reduce the borrower's monthly payment reduce the redefault rate. This finding suggests that the key component of a successful loan modification is whether the modification is able to reduce the mortgage payments enough to be truly affordable to the borrowers.<sup>14</sup>

To illustrate the effect of payment relief on redefault rate, we estimated the 6-month, 90+day delinquency probability for an average nonprime borrower who was 90 or more days delinquent as of May 2008. As exhibit 7 shows, when the mortgage payment is reduced by 5.1 to 10 percent by lowering the interest rate, the probability of a 90+day delinquency drops from more than 39 percent to 33 percent. And if the payment is cut by 20.1 to 30 percent, the 90+day redefault rate drops further to about 28 percent.

Because a loan modification with a principal reduction can also reduce the LTV ratio, such a modification has an even lower redefault rate, even when it results in the same level of mortgage payment. Among all approaches that can lower the payment by 5.1 to 10 percent, the redefault rate for a modification based on a principal reduction is 0.9 percent lower than for one based on an interest rate cut. When the payment is reduced by 20.1 to 30 percent, the redefault rate of a principal-reduction modification is 2.2 percent lower than that of a rate-reduction modification. The difference in the redefault rate seems modest, likely because we used a continuous LTV variable; in reality, however, the effect of loan to value on default may be nonlinear. We revisit this issue later in this section.

## Redefault Risk and Different Types of Modifications

Conditional on being modified, a loan with a reduced interest rate, a reduced principal, or both is less likely to redefault, relative to a loan modification in which neither the principal nor the interest rate is reduced. In the latter, a loan is modified either by extending the loan term or by adding the unpaid interest and escrow payment to the total loan balance, which usually results in an increased mortgage payment. As exhibit 5 shows, the coefficients of three loan modification dummies ( $r0p0$ ,  $r0p1$ , and  $r1p0$ ) are consistently negative and significant. The effects are large: after controlling for other variables, a combination of principal reduction and rate reduction lowers the

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<sup>14</sup> One caveat is that the findings are based on the assumption that borrowers have similar income level. Because borrowers' income information is missing in the data set, it is difficult to precisely identify the level of payment relief that is truly affordable for different borrowers.

probability of redefault by 19 percent. When the modification involves a rate reduction only, the probability of redefault is lowered by 13 percent. The principal reduction itself has a similar effect but the magnitude is slightly smaller (10 percent). The results are generally robust enough when we use the 90+day delinquency as the outcome variable, except that the principal-reduction group (*r1p0*) becomes insignificant.

Although it seems the combination of principal reduction and rate reduction is more effective in reducing the redefault rate, we cannot conclude on the relative effectiveness of different loan modifications here, because these variables do not account for the magnitude of the rate reduction or principal reduction. For example, if the level of principal reduction has been marginal, as in this case, it is reasonable to expect that the effect of the principal-reduction modification would be quite small. The evidence supports the view, however, that the type of loan modification has substantial effect on the performance of modified loans and that modifications need to be tailored to the particular borrower based on household and product characteristics.

## **Redefault Risk and Home Equity**

In the short run, the principal reduction may influence the performance of modified loans by lowering both the mortgage payment and the total debt. Because the results suggest that redefault risk will be significantly lower if the mortgage payment is reduced by at least 5 percent, we examined the effect of home equity on redefault risk for those loans with significant payment relief (exhibit 7). Instead of using a continuous variable, we ran a separate regression in which the LTV ratio was coded into buckets for all modified loans with a 5-percent or more reduction in the mortgage payments. When we used 30+day delinquency as the measure of default, the results suggest the equity in the home does matter. Relative to borrowers with substantial equity in the property (with estimated LTV ratios of less than 70 percent), borrowers with less equity or negative equity in the property are more likely to default (most coefficients are significant at the 0.05 level, except the coefficient with estimated LTV ratios of 70 to 80 percent).

When we used serious delinquency (90 or more days) as the measure of default, only borrowers with negative equity remain significantly more likely to default (significant at the 0.1 level). This finding suggests households with less or negative equity in the property are more likely to redefault even when the modifications lower their mortgage payments. They usually would not default (foreclosure or serious delinquency), however, unless they had negative equity. In fact, according to the option-based theory of default, as long as the equity in the home is negative, the option to default remains in the money (see, for example, Foster and Van Order, 1984), and borrowers will be more likely to default when confronting a crisis. Further studies are needed to identify the effect of home equity on the long-term performance of the modified loans.

## **Results of Other Controls**

Across all models in exhibits 5, 6, and 8, the sign and significance of the coefficients of other variables are generally as we expected. Loans originated with less than full documentation, ARMs, and home-purchase mortgages are more likely to redefault. Nonprime purchase mortgages originated during the peak of the subprime bubble seem to have a very high risk of redefaulting.

As expected, early intervention seems to result in lower redefault risks. Relative to borrowers who are current on their mortgage payment, those whose loans were modified after only one or two missed payments are 12 percent more likely to default compared with 14 percent for those whose modifications occurred after three or more missed payments (Model 1 in exhibit 5). The results suggest that loans should be modified as early as possible after a missed payment; ideally, serious consideration should be given to modifying loans preemptively.

Local economic conditions are a crucial factor affecting the ability of borrowers to meet their debt obligations, even after a loan modification. The local unemployment rate is a significant predictor of redefault in all models, with redefault rates higher in places with a high unemployment rate: a 1-percent increase in the area unemployment rate increases the probability of redefault by about 1.4 percent.

Consistent with findings elsewhere, market and servicing seem to matter. Loans in Florida, those serviced by Servicer 2, and those originated in 2006 are more likely to redefault after being modified, even after controlling for important determinants.

## Conclusions

Confronted with the worst financial and economic crisis in decades, government and industry are considering strategies to deal with the flood of home foreclosures. One promising strategy is to modify mortgage loans so that borrowers can remain in their homes. Unfortunately, scant evidence exists regarding the effectiveness of loan modifications, and the evidence that does exist suggests a high rate of recidivism. In this article, we examine the relationship between postmodification redefault rates and different types of loan modifications. We attempt to identify those modifications that work and those that are more likely to lead to redefault. Findings show that, in general, the greater the reduction in the mortgage payment, the lower the redefault risk. Unfortunately, this finding is contrary to many practices in the industry. According to White (2008), most loan modifications do not lead to lower payments; in fact, many result in higher payments and higher balances because traditional modifications add the payments owed plus any penalties and fees to the outstanding balance without changing other terms of the loan. In contrast, to successfully enable troubled homeowners to meet their obligations, loan modifications need to reduce a mortgage payment enough to make it truly sustainable.

Moreover, the findings show an even lower level of redefault when payment reduction is accompanied by principal reduction. Among the different types of modifications, the principal forgiveness modification has the lowest redefault rate, most likely because it addresses both the short-term issue of mortgage payment affordability and the longer term problem of negative equity. The results indicate that households with negative home equity are more likely to redefault over time, even when a modification has initially lowered the mortgage payment. More significant loan restructuring or refinancing may be needed to minimize redefault risks for these loans. This finding is consistent with current efforts to include principal reduction when modifying loans.

One caveat is that the redefault rate is only one measure for the success of loan modifications. The optimal loss mitigation solution should be in the collective interests of borrowers, investors, and other stakeholders. Although loan modifications that can lower the redefault risk more than other

modifications are ideal for borrowers, servicers have fiduciary responsibilities to the bondholders who own the mortgages to maximize their net present value. If the costs related to the loan modifications outweigh the benefits from the reduced foreclosures, foreclosure may be the better option for the lender. Considering the huge social and economic costs of foreclosures on the borrower, neighborhood, community, and the entire economy, however, a study focusing on how to minimize the redefault risk has its own merit.

Overall, the findings in this study illustrate that not all modifications are created equal. The industry clearly needs standards and directives for making more modifications and for making those modifications more sustainable than they are in the current practice. To the extent practicable, modifications need to be tailored to the particular conditions of the borrower, loan product, and market. Because this study relies on data from one particular quarter and because the study observed the short-term performance of modified loans only, further research is needed to verify these findings to see whether the conclusions hold for modifications in different time periods, for modifications of different types of mortgages, and after controlling for borrowers' income levels. Further studies are also needed to answer questions such as these: What is the level that makes a modified loan "truly affordable"? What is the ideal combination of principal reduction and rate reduction for achieving this affordable level? How can we develop guidelines to better tailor modifications to the particulars of individual borrowers in specific housing markets?

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