

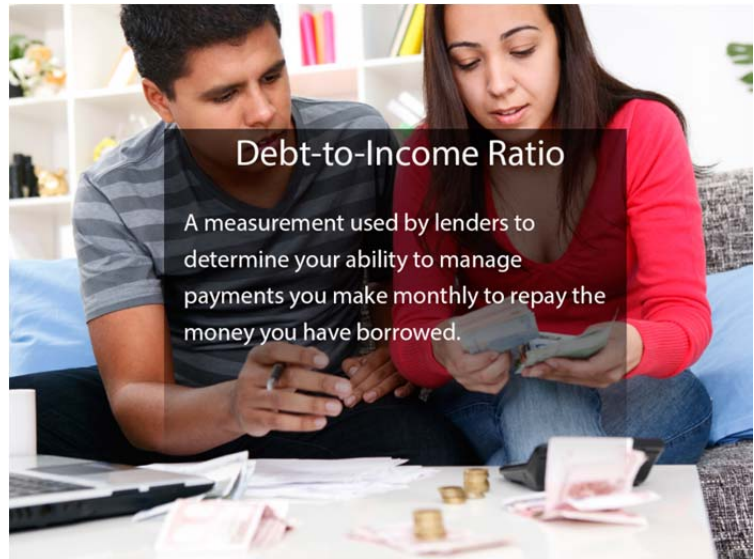
MHA LESSONS LEARNED SERIES: IMPORTANCE OF DEBT-TO-INCOME RATIO (DTI) FOR MODIFIED LOAN PERFORMANCE



October 20, 2016

Overview

In early 2009, a government-sponsored program—Making Home Affordable (MHA)—was established to provide foreclosure alternatives to homeowners impacted by the financial crisis. The Home Affordable Modification Program (HAMP), the first and largest program under MHA, provided a standard for mortgage modifications that crossed servicer and investor types, with the goal of reducing struggling homeowners' monthly mortgage payments to an affordable and sustainable level. With the termination of these programs at the end of this year, the U.S. Department of the Treasury (Treasury) in conjunction with the U.S. Department of Housing and Urban Development (HUD) and the Federal Housing Finance Agency (FHFA)—together the Agencies—are working with



stakeholders to maintain strong loss mitigation programs going forward. There is, however, more work to be done. With some exceptions, servicers will no longer be required to evaluate homeowners for a standard mortgage modification like HAMP. Instead, servicers and investors will need to utilize proprietary loss mitigation programs, and determine the appropriateness of such programs in a more economically stable, post-crisis environment. Since post-modification DTI greatly correlates with the reduction in a homeowner's monthly payment, it is necessary to use an econometric analysis to properly control for payment change and other variables known to impact modification performance to properly answer questions about the importance of DTI.

Research Questions and Analysis

The following analysis is part of a Lessons Learned Series which provides insight into the success of the Making Home Affordable (MHA) program. Fannie Mae, as Treasury's financial agent, performed an analysis of the *Importance of Debt-to-Income Ratio for Modified Loan Performance* on behalf of Treasury in order to answer two questions about the performance of HAMP modifications:

- Is the post-modification front-end debt-to-income ratio (DTI) a significant indicator of modification performance?
- Does the importance of DTI as an indicator of post-modification performance change depending on the borrower's income level (i.e., is the performance of HAMP modifications for low-income borrowers more sensitive to DTI than those for higher-income borrowers)?

Researching these questions required a dataset of HAMP modifications with meaningful differences in post-modification DTI. This requirement ruled out use of HAMP Tier 1 modifications since all such modifications have the same 31% DTI target. HAMP Tier 2, however, primarily targets payment change and allows for DTI between 10% and 55% and those modifications were able to provide the necessary dataset.

Fannie Mae used a method of statistical analysis, called logistic regression, to control for the effects from other variables before measuring the relationship between DTI and modification redefault. Fannie Mae started with a baseline model of redefault at 6 and 24 months using 16 control variables for measuring risk of the borrower and local housing market. If DTI is a predictive indicator of redefault, we would expect that adding it to the regression would improve the accuracy of the model predictions (i.e., “model fit”). However, the addition of DTI to the regression failed to improve the model fit. Fannie Mae performed an additional test to determine if DTI had significance specifically for the subset of borrowers below the median income. This “DTI plus income” test also failed.

INTERPRETATION

This analysis found that within HAMP Tier 2, the post-modification front-end DTI does not have a statistically significant impact on modification redefault. In other words, the measured effect was so small that it fell within the margin of error.

The limited context of this analysis is important to understand.

First, out of necessity, our analysis was limited to HAMP Tier 2 modifications. MHA program rules require that HAMP Tier 2 is only offered to borrowers who do not qualify for, or have already failed a HAMP Tier 1 trial or permanent modification. The possibility also remains that borrowers determined to be eligible for HAMP Tier 2 may be particularly insensitive to DTI.

Secondly, within the HAMP dataset, DTI data is limited to front-end DTI. One might hypothesize that back-end DTI, which includes all of a borrower’s monthly debt burden, would be a better predictor of modification redefault, but reliable measures of back-end DTI were not available to us. This outcome may provide an opportunity for further analysis using data from other, non-HAMP loan modification programs.

Conclusion

As noted in “Guiding Principles for the Future of Loss Mitigation”, sustainability and affordability are key points of convergence for successful mortgage modification solutions. Payment reduction—whether fixed plan versus flexible step-up plan—is a necessary component to achieve the best possible outcome for struggling homeowners. It is readily apparent that singular variables do not reliably predict redefault performance in this analysis.

Because none of the added variables improved the model fit relative to our baseline model, we can conclude that neither DTI nor income level—taken alone or together—are statistically significant factors in predicting the redefault performance of Tier 2 HAMP modifications.

Even if the results had been significant, they still would have been viewed as weak. We illustrate this below using the modeled 6-month redefault rate. If we were to use the estimated DTI coefficients to illustrate the effect of altering DTI on a single hypothetical median loan, the redefault probabilities fluctuate by less than 1%.

APPENDIX: Modeling Approach

LOAN POPULATION

Tier 1 HAMP modifications target a 31% DTI as part of the modification structure. With no meaningful variation in DTI, traditional Tier 1 HAMP modifications are not suitable for answering these questions. By contrast, Tier 2 HAMP modifications focus primarily on payment reduction and allow for the resulting DTI to fall between 10% and 55%. As a result, we limited our analysis to Tier 2 HAMP modifications.

MODEL ESTIMATION

When a HAMP modification becomes 90 days delinquent, it is considered to have lost *good standing*, an event also referred to as *redefault*. After a loss of good standing, investor, servicer and borrower incentives stop, and loan performance is no longer reported into IR/2, the program's official system of record.

We began by fitting a logistic regression model to predict redefault using a familiar set of control variables from previous research in the HAMP vs. non-HAMP Performance Study¹ and The Effects of Principal Reduction on HAMP Early Redefault Rates². We used control variables for

- Post-modification LTV
- Investor Category (Private Label Security, Held on Portfolio)
- P&I Payment Change (% of original payment)
- Loan Delinquency at time of trial
- Credit Score
- Origination LTV
- Months since origination
- Principal Forgiveness
- Property Occupancy Status (Owner, Tenant, Vacant)
- Unit Count (1-4)
- Capitalized UPB
- Months Spent in Trial
- 12 Month HPI Change
- State (12 states)
- Servicer (9 servicers)
- Modification Effective Date (by quarter)

NULL HYPOTHESIS: DTI

Our null-DTI hypothesis is that post-modification front-end DTI is not a significant factor in the performance of a modified loan. Controlling for other risk factors, modified loans with lower DTIs will not have a lower probability of redefault.

To test our null-DTI hypothesis, we constructed an alternate model ("A-Model") building upon the baseline by adding a set of 4 categorical indicators of DTI ranges between 10% and 55%. We compared the models using a likelihood ratio test for relative goodness of fit. The alternate "A-Model" fails the test with a relative p-value of 0.2883, offering little reason to reject the null-DTI hypothesis.

¹ Scott, Walter L. "Treatment Effects of Subprime Mortgage Modifications Under the Home Affordable Modification Program." Mar. 2015. <https://www.treasury.gov/initiatives/financial-stability/TARP-Programs/housing/mha/Pages/Surveys.aspx>

² Making Home Affordable, "The Effects of Principal Reduction on HAMP Early Redefault Rates." Jul. 2012. https://www.hmpadmin.com/portal/programs/docs/hamp_servicer/MHAPRARresearch.pdf

Table 1: Regression coefficients for DTI (“A-Model”).

Analysis Of Maximum Likelihood Parameter Estimates						
Parameter	Value	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
LN_AFT_MDFC_FRNT_RTO_PCT	c [10,20)	1	-0.0708	0.0523	1.83	0.1757
LN_AFT_MDFC_FRNT_RTO_PCT	d [20,30)	1	-0.0238	0.0522	0.21	0.6487
LN_AFT_MDFC_FRNT_RTO_PCT	e [30,40)	1	0.0075	0.0593	0.02	0.899
LN_AFT_MDFC_FRNT_RTO_PCT	f [40,55]	0	0	0	.	.

Table 2: Log likelihood ratio test against baseline model

BASELINE		A-Model		Pr
Log Likelihood	DF	Log Likelihood	DF	
-20122.9682	71	-20121.0871	74	0.2883

NULL HYPOTHESIS: INCOME

Our second null hypothesis is that lower-income borrowers are as sensitive to the impact of DTI on post-modification performance as higher-income borrowers.

To test the null-income hypothesis we created a dummy variable to identify modifications to borrowers with gross monthly income below \$3,333—the median for our population of HAMP Tier 2 modifications. We then created our “B-Model” of redefault by adding the lower income flag to our baseline redefault model. We then added DTI as a separate variable, and also connected it with the low income flag (“C-Model”). In order to reject the null-income hypothesis, C-model would have to provide a better fit than our baseline and both models A and B.

C-Model fails all of these tests with p-values above the customary threshold of 5%. Indeed, none of the model variants represent an improvement in fit over the baseline or any of the simpler model specifications. These results do not support rejection of the null-income hypothesis.

Table 3: Relative log likelihood ratio tests against nested model

Test Pair		DF diff	2 * LL2 - LL1	Pr
BASELINE	A-Model	3	3.7622	0.2883
BASELINE	B-Model	1	0.0282	0.8666
A-Model	C-Model	4	2.1964	0.6997
B-Model	C-Model	6	5.9304	0.4310
BASELINE	C-Model	7	5.9586	0.5446

Table 4: Comparison of model predictions using rejected control variables for DTI and income.

HAMP Tier 2 Redefault Probability at Month 6	
Modeled without DTI or Income Group	
Baseline	8.4%

HAMP Tier 2 Redefault Probability at Month 6		
Modeled with DTI & Income Group		
After Mod DTI	Below Median Income	Above Median Income
c [10,20)	8.0%	7.6%
d [20,30)	8.3%	8.5%
e [30,40)	8.6%	8.5%
f [40,55]	8.9%	8.2%

To illustrate this another way, we can calculate the relative importance of the variables from our rejected C-Model regression. Initial delinquency, payment change and credit score have the strongest impacts. DTI has very little predictive power.

Figure 1: Relative importance at 6 months and 24 months after modification completion.

