Mortgage Modifications after the Great Recession

New Evidence and Implications for Policy

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Mortgage Modifications after the Great Recession:

New Evidence and Implications for Policy[*]

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Executive Summary

For many, homeownership is a vital part of the American dream. Beyond providing a place of refuge, owning a home offers families a store of wealth, a long-term investment, and an asset that can be passed on to the next generation. In many cases, a home serves as the primary savings vehicle: as of 2013, the median homeowner had 87 percent of their net worth in their primary residence.[1] In the US, many policies have been enacted over the past 80 years to promote home ownership, and the mortgage has become the financing instrument of choice for most home buyers.

The aftermath of the Great Recession was a particularly difficult period for many homeowners.[2] From their peak in 2006 until they bottomed in 2011, houses across the country lost considerable value. As a result, by the end of 2011 many homeowners with a mortgage were "underwater"–they owed more on their mortgage than their home was worth. To make matters worse, over the same period the unemployment rate nearly doubled and delinquency rates on residential mortgages spiked. In response, various mortgage modification programs were introduced to help homeowners struggling to make their monthly mortgage payments remain in their homes.

In this JPMorgan Chase Institute report, we investigated the relative importance of reductions in monthly mortgage payments and long-term mortgage debt on default and consumption. To do so, we utilized the variation in the amount of payment and principal reduction provided by various mortgage modification programs. Using a de-identified sample of Chase customers who received a mortgage modification, we measured the effects of payment and principal reduction on default and consumption.

Data

From a universe of over 1 million Chase mortgage customers who received a modification, we created a data asset of 450,000 de-identified modification recipients.

1 MILLION Chase Mortgage customers who received a modification

450,000 de-identified mortgage customers who met the following three sampling criteria

1. Received a modification from one of the following:
   - The Home Affordable Modification Program introduced by the Federal Government
   - A modification program of the Government Sponsored Enterprises Fannie Mae and Freddie Mac
   - A Chase proprietary modification program

2. Modification completed between July 2009 and June 2015

3. First modifications only[3]

A subset of these Chase customers also had a Chase credit card and/or a Chase checking account, which provided a unique lens on the relationships between mortgage modifications, default, credit card spending, and income.

Source: JPMorgan Chase Institute

Finding **One**

Payment reduction for borrowers with similar payment burdens varied by two to three times across different modification programs.

Borrowers with similar payment burdens (as measured by pre-modification mortgage payment-to-income (PTI) ratio) received considerably different payment reductions depending on the modification they received:

- Borrowers with a high mortgage PTI ratio (above 50 percent) received more than twice the payment reduction from the Home Affordable Modification Program (HAMP) sponsored by the Federal Government (55 percent) compared to the program from the Government Sponsored Enterprises (GSEs) Fannie Mae and Freddie Mac (27 percent).

- Borrowers with a low mortgage PTI ratio received three times the payment reduction from the GSE program (25 percent) compared to HAMP (8 percent).

Pre-modification mortgage payment-to-income ratio

50% - 70%   High

30% - 33%   Low

GSE	HAMP
-27% payment reduction	-55% payment reduction

2x

GSE	HAMP
-25% payment reduction	-8% payment reduction

3x
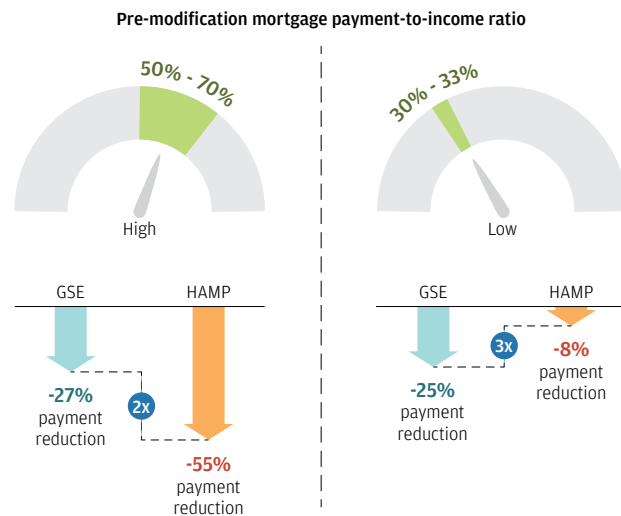
Source: JPMorgan Chase Institute

Finding **Two**

A 10 percent mortgage payment reduction reduced default rates by 22 percent.

10% mortgage payment reduction

PAST DUE

22% default rate reduction
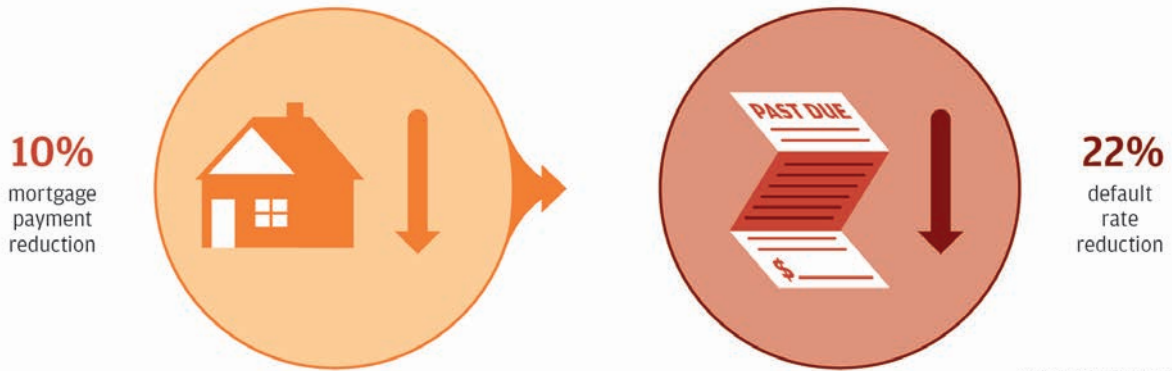
Source: JPMorgan Chase Institute

Finding Three

For borrowers who remained underwater, mortgage principal reduction had no effect on default.

There was no material difference between the post-modification default rates of borrowers who received principal plus payment reduction and borrowers who received only payment reduction. This finding suggests that "strategic default" was not the primary driver of default decisions for these underwater borrowers, meaning that they were not defaulting simply because they owed more on their mortgage than their house was worth.

Cumulative default rate

Payment reduction

Payment & principal reduction

10%

8%

6%

4%

2%

0%

At time of modification

One year after modification

Two years after modification

Note: shading indicates 95% confidence interval

Source: JPMorgan Chase Institute
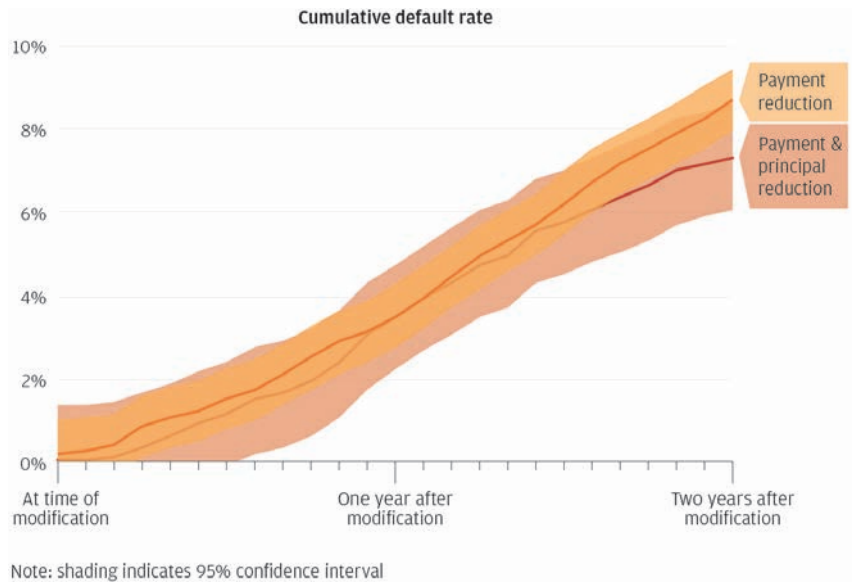
Finding Four

For borrowers who remained underwater, mortgage principal reduction had no effect on consumption.

There was no difference in the post-modification credit card spending of borrowers who received principal plus payment reduction and borrowers who received only payment reduction relative to their spending 12 months before modification.
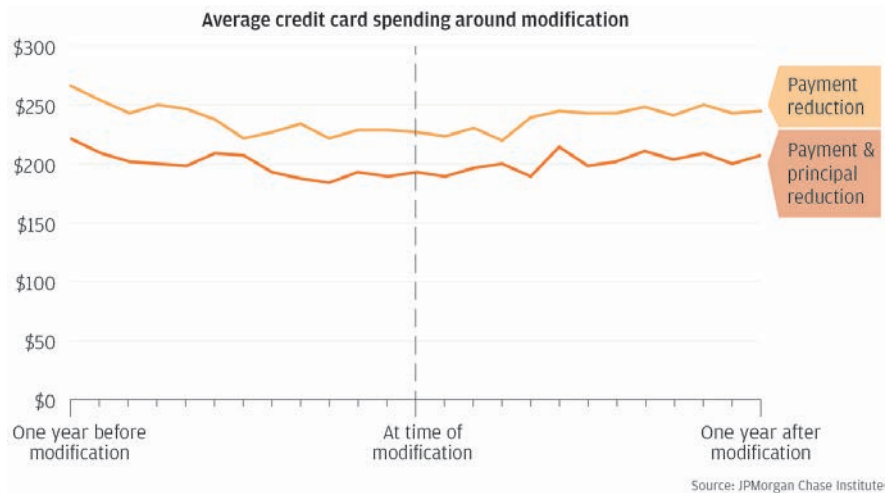
Average credit card spending around modification

Payment reduction

Payment & principal reduction

$300

$250

$200

$150

$100

$50

$0

One year before modification

At time of modification

One year after modification

Source: JPMorgan Chase Institute

4

Finding Five

Default was correlated with income loss, regardless of debt-to-income ratio or home equity.

Mortgage default closely followed a substantial drop in income. This pattern held regardless of pre-modification mortgage PTI or loan-to-value (LTV) ratio, suggesting that it was an income shock rather than a high payment burden or negative home equity that triggered default.

Change in monthly income and mortgage payment made from baseline

Source: JPMorgan Chase Institute
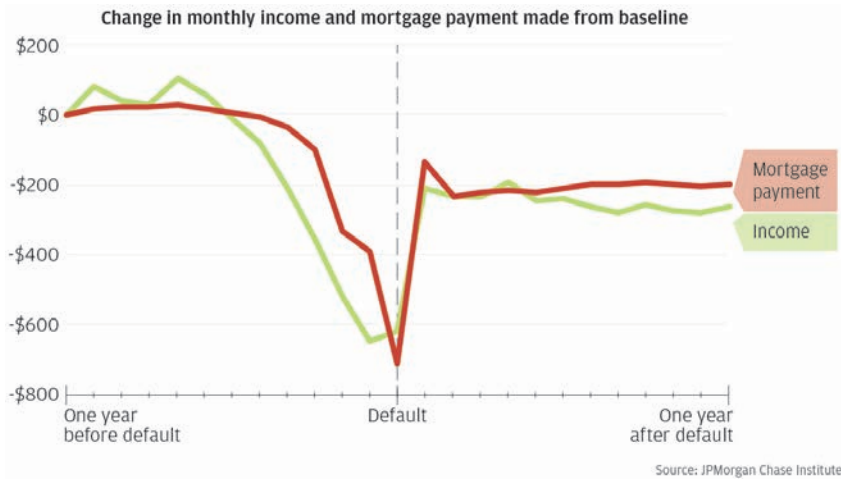
Conclusion

In this report, we measured the impact of mortgage payment and principal reduction on default and consumption. Our results have implications for both housing policy and monetary policy.

Our findings suggest that mortgage modification programs that are designed to target substantial payment reduction will be most effective at reducing mortgage default rates. Modification programs designed to reach affordability targets based on debt-to-income measures without regard to payment reduction will be less effective. Principal-focused mortgage debt reduction programs that target a specific LTV ratio but leave borrowers underwater will also be less effective at reducing defaults.

To the extent that a mortgage modification can be considered a re-origination, our findings may have application to underwriting standards as well. The fact that default was correlated with income loss provides evidence that static affordability measures such as debt-to-income ratio were not a good predictor of default. Both high and low mortgage PTI borrowers experienced a similar income drop just prior to default, suggesting that even among those borrowers whose mortgages would be categorized as unaffordable by conventional standards, it was a drop in income rather than a high level of payment burden that triggered default. Therefore, policies that help borrowers establish and maintain a suitable cash buffer that can be drawn down in the event of an income shock or an expense spike could be an effective tool to prevent mortgage default.

The housing wealth effect is one of the important mechanisms that transmits changes in monetary policy to household consumption. This transmission mechanism relies on accommodative monetary policy leading to higher house prices, and the increase in housing wealth that in turn stimulates consumption. The lack of consumption response from underwater borrowers to principal reductions suggests that the marginal propensity to consume out of housing wealth is nearly zero for these homeowners. For underwater borrowers, the inability to translate increased home equity into liquid resources (e.g., through equity extraction) may nullify the housing wealth effect and thus constrain this transmission mechanism.

Introduction

For many, homeownership is a vital part of the American dream. Beyond providing a place of refuge, owning a home offers families a store of wealth, a long-term investment, and an asset that can be passed on to the next generation. In many cases, a home serves as the primary savings vehicle: as of 2013, the median homeowner had 87 percent of their net worth in their primary residence.[4] In the US, numerous policies have been enacted over the past 80 years to promote home ownership, and the mortgage has become the financing instrument of choice for most home buyers.

Buying a home represents one of the largest lifetime expenditures for most homeowners. Their mortgage will be their greatest debt and their mortgage payment will be their largest recurring monthly expense.[5] Recent statistics confirm that mortgages are a key component of household finances. The US homeownership rate stands at nearly 64 percent[6] and 63 percent of homeowners have some type of housing debt.[7] At the end of the second quarter of 2017, outstanding mortgage balances stood at $8.69 trillion and accounted for nearly 68 percent of total household indebtedness.[8] Taken together, these facts illustrate why it is crucial to better understand the effects of mortgages on household finances.

In this report, we investigated the relative importance of changes in monthly mortgage payments and long-term mortgage debt on default and consumption.[9] To do so, we utilized the variation in the amount of payment and principal reduction received by borrowers who used one of the mortgage modification programs available in the aftermath of the Great Recession.[10] Using a de-identified sample of Chase customers who received a mortgage modification, we measured the effects of mortgage payment and principal reduction on default and consumption.

We found that reducing mortgage payments in the near term led to reduced default rates, whereas alternative debt reductions focused on reducing mortgage principal had little impact on default or consumption for underwater borrowers. Furthermore, we found that modifications designed to meet a one-size-fits-all income-based affordability target (e.g., debt-to-income ratio) regardless of payment reduction were less effective than modifications designed to simply cut payments for each struggling borrower by a substantial amount. Our findings have important implications for policymakers as they consider strategies to reduce or prevent mortgage defaults and better understand the transmission of monetary policy to household consumption.

Background

The aftermath of the Great Recession was a particularly difficult period for many homeowners. From their 2006 peak to their 2011 trough, houses across the country lost roughly 25 to 35 percent of their value.[11] The decline in house prices meant that by the end of 2011, nearly one in four homeowners with a mortgage were "underwater"–they owed more on their mortgage than their home was worth.[12] To make matters worse, over the same period, the unemployment rate nearly doubled, rising from 4.6 percent to 8.9 percent,[13] and delinquency rates on residential mortgages rose from 1.7 percent to 10.4 percent.[14]

In response, various mortgage modification programs were introduced to help homeowners struggling to make their monthly mortgage payments remain in their homes. These programs were designed to reduce the monthly mortgage payment (and in some cases principal balance) for homeowners who could document a financial hardship that led them to be in default, foreclosure, or at risk of imminent default.[15] For example, the Federal Government introduced the Home Affordable Modification Program (HAMP) in March 2009, and the Government Sponsored Enterprises (GSEs) Fannie Mae and Freddie Mac began offering proprietary, non-HAMP mortgage modifications in earnest beginning in 2010.[16] The motivations behind these two programs were different, and this led to considerable variation in the amount of payment reduction the programs delivered.

HAMP was designed to deliver relief to homeowners facing a financial hardship by providing a uniform loan modification process that would reduce their monthly mortgage payment to an affordable level.[17] To measure affordability, the program designers relied on the mortgage payment-to-income ratio (PTI),[18] and deemed a mortgage with a PTI at or below 31 percent to be affordable.[19] Therefore, HAMP reduced the monthly payment of qualified borrowers to reach the 31 percent affordability target, irrespective of the amount of payment reduction delivered. Borrowers with a mortgage PTI below 31 percent were ineligible for HAMP.[20] In 2010, the HAMP Principal Reduction Alternative (PRA) program was introduced to help underwater borrowers in areas suffering from acute home price depreciation. In this program, eligible borrowers with a loan-to-value (LTV) ratio[21] in excess of 115 percent could have a portion of their unpaid principal balance forgiven as one of the steps to achieving the target mortgage PTI. The forgiven principal was generally limited to the amount required to reach an LTV of 105 percent, and thus HAMP-PRA did not restore positive home equity.[22]

In contrast, the objective of the GSE modification programs was to save borrowers from foreclosure when possible as an effective means of mitigating credit losses. Minimizing credit losses became a central goal for the GSEs after the Federal Government takeover in 2008, and their foreclosure prevention efforts were designed accordingly.[23] Only borrowers who were experiencing a financial hardship and ineligible for or had failed to obtain a HAMP modification could apply for a GSE modification.[24, 25] Unlike HAMP, the GSE program had no specific affordability target and no mortgage PTI eligibility requirement, so borrowers with a mortgage PTI below 31 percent were eligible. And though it had no official payment reduction target, the program reduced payments by at least 20 percent.[26] Principal reduction was not offered by the GSE mortgage modification programs until 2016.[27]

Both mortgage modification programs achieved payment reduction for the borrower by altering various terms of their mortgage by specific amounts and in a specified order. Because the amount and ordering of the adjustments applied to each mortgage term differed between the two programs, otherwise similar borrowers experienced material differences in payment reduction. Box 1 has a more detailed description of the two mortgage modification programs.

In the pages that follow, we first quantify the variation in payment reduction offered by these two modification programs. We then use the variation in payment and principal reduction received by borrowers from these two modification programs (and others) to estimate the impact of payment and principal reduction on default and consumption.

Box 1. How did mortgage modification programs work?

Each mortgage modification program reduced the borrower's monthly mortgage payment by altering the terms of their mortgage in a specific order, known as a waterfall. In Table 1 we provide a summary of the HAMP and GSE program waterfalls to illustrate the different impacts on mortgage payment and principal.

For HAMP, the mortgage servicer would traverse each step in the waterfall, stopping when the borrower's post-modification mortgage PTI reached the 31 percent affordability target.[28] This was achieved primarily by principal reduction or temporary interest rate reduction. The GSE program relied on maturity extension as the primary lever to achieve payment reduction. The impact of these waterfall differences can be seen in Figure 1, which shows a comparison of the average payment owed for a sample of borrowers under the status quo and then after modification from HAMP, HAMP-PRA, or the GSE modification program.
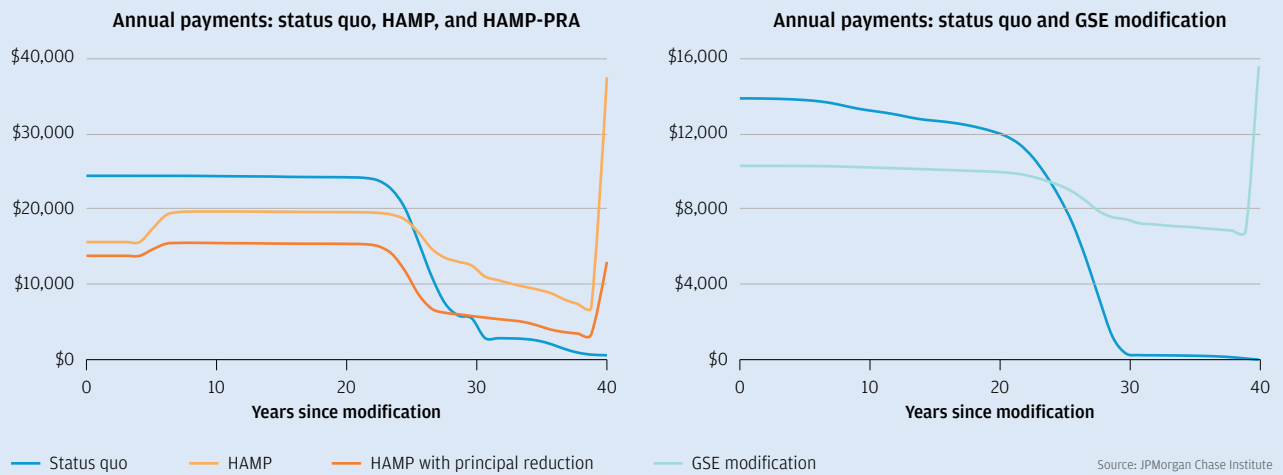
Table 1: Waterfalls for HAMP and the GSE modification programs

	HAMP	GSE Modification (LTV ≥ 80%)	GSE Modification (LTV < 80%)
Target	Post-modification mortgage PTI = 31%	Post-modification payment ≤ pre-modification payment	
Step 1	Capitalize arrearages (e.g., accrued interest)		
Step 2	Only for select borrowers who received PRA: If LTV > 115%, reduce unpaid principal balance until LTV reaches 115%[29]	Set interest rate to current primary mortgage market 30-year fixed rate	For fixed-rate loans, interest rate remains the same; For ARMs, interest rate set to the larger of contractual rate and current primary mortgage market 30-year fixed rate
Step 3	Reduce interest rate for first five years, subject to a floor of 2%. After year five, increase interest rate by 1% / year until it reaches the market rate prevailing at the time of the modification	Extend term to 480 months	Offer to extend term to: i. 480 months if modified payment amount ≤ current payment amount, ii. 360 months if payment reduction is at least 20%, iii. 240 months if payment reduction is at least 20%. If multiple conditions are met, borrower can choose their term
Step 4	Extend contractual term of mortgage by one month at a time, up to a maximum of 480 months from modification date	Forbear principal, limited to the smaller of i. 30% of the unpaid principal balance, or ii. the amount at which LTV = 115%	
Step 5	Forbear principal,[30] limited to the smaller of i. 30% of unpaid principal balance, or ii. the amount at which LTV reaches 80%		

The left panel of Figure 1 shows that both HAMP and HAMP-PRA modifications gave the borrower considerable payment reductions for the first five years after modification. HAMP recipients experienced a step-up in mortgage payments beginning in year six (as per step 3 in Table 1), and a balloon payment at maturity resulting from principal forbearance. HAMP-PRA recipients experienced a smaller increase in payments and a smaller balloon payment, as forgiven principal offset both effects.[31]

The GSE modification program achieved payment reduction by setting the interest rate on the mortgage to the prevailing 30-year fixed mortgage rate and extending the mortgage term to a maximum of 40 years, as shown in the right panel of Figure 1. As such, there was no need for a step-up in interest rate in the years after modification. However, payments after a GSE modification extended further out in time relative to payments after a HAMP modification. GSE modifications also had a balloon payment at maturity resulting from principal forbearance.

Figure 1: Average annual payment due under Status Quo, HAMP, HAMP-PRA, and GSE modification

Annual payments: status quo, HAMP, and HAMP-PRA

Annual payments: status quo and GSE modification

Status quo   HAMP   HAMP with principal reduction   GSE modification

Source: JPMorgan Chase Institute

Findings

<div>

Finding One

Payment reduction for borrowers with similar payment burdens varied by two to three times across different modification programs.

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As discussed in the previous section, the motivations and modification waterfalls behind the HAMP and GSE mortgage modification programs were different, and this led to considerable variation in the amount of payment reduction the programs delivered to borrowers with similar payment burdens. Here and in the rest of this report, we measure payment burden using pre-modification mortgage PTI.[32]

To measure the variation in mortgage payment reduction experienced by homeowners, we used a sample of Chase mortgage customers who received a HAMP or GSE mortgage modification. Figure 2 shows the average amount of payment reduction borrowers in this sample received for various levels of pre-modification mortgage PTI. The 31 percent mortgage PTI target for HAMP meant that payment reductions for these borrowers (orange line) varied depending on pre-modification mortgage PTI: HAMP recipients with a high pre-modification mortgage PTI received larger payment reductions, while those with a low pre-modification mortgage PTI received smaller reductions. In contrast, for GSE modification recipients, payment reduction (blue line) was relatively constant across all pre-modification mortgage PTI levels.

Figure 2: Mortgage payment reduction varied by modification program for similar pre-modification mortgage PTI ratios

Average payment reduction from modification

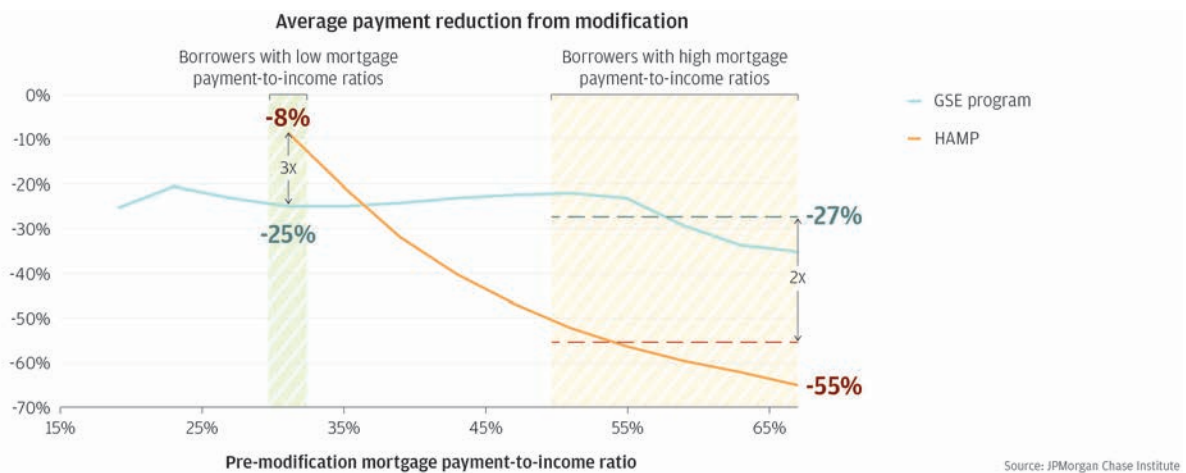Source: JPMorgan Chase Institute

Figure 2 provides two examples of how payment reduction differed for HAMP and GSE recipients with a similar mortgage PTI. First, borrowers with a high mortgage PTI ratio (above 50 percent, shown in the yellow region) received more than twice as much payment reduction from HAMP compared to the GSE program. These HAMP recipients received an average payment reduction of 55 percent ($860/month or 25 percent of their monthly income) compared to 27 percent ($370/month or 11 percent of their monthly income) for GSE modification recipients.[33]

Second, borrowers with a low mortgage PTI (shown in the green region) received three times as much payment reduction from the GSE program compared to HAMP. These GSE modification recipients experienced a 25 percent ($310/month or 6 percent of their monthly income) payment reduction, whereas HAMP recipients experienced a payment reduction of 8 percent ($100/month or 2 percent of their monthly income).

Finding Two

A 10 percent mortgage payment reduction reduced default rates by 22 percent.

A 10 percent reduction in mortgage payment reduced default rates in the two years after modification by 22 percent. To provide perspective on the scale of the impact, consider that between April 2009 and October 2016 about 6.5 million mortgages were modified through HAMP or a private modification program.[34] Reducing the mortgage payments of these homeowners by an additional 10 percent would have kept roughly 169,000 more homeowners from falling 90 or more days behind on their payments in the two years after modification.[35]

We arrived at our estimate of the impact of payment reduction on default by using the fact that the amount of payment reduction delivered differed between HAMP and the GSE modification program and across pre-modification mortgage PTI levels for HAMP recipients. For this analysis, we used a sample of over 95,000 GSE-backed mortgages that were modified through one of these two programs.[36] Using data taken from this sample, we first provide visual evidence of a relationship between payment reduction and default and then describe our strategy for calculating a causal estimate.

Taken together, the two panels of Figure 3 provide visual evidence that incremental payment reductions might have lowered default rates. The left panel of Figure 3 shows the relationship between payment reduction and pre-modification mortgage PTI for this sample. Payment reductions for HAMP recipients increased as pre-modification mortgage PTI increased (orange line), while payment reductions for GSE modification recipients were relatively constant regardless of pre-modification mortgage PTI (blue line).

The right panel of Figure 3 shows the relationship between default rates in the two years following modification and pre-modification mortgage PTI. HAMP recipients with higher pre-modification mortgage PTI ratios show lower default rates than HAMP recipients with lower pre-modification mortgage PTI ratios (orange line). In contrast, default rates for GSE modification recipients (blue line) were relatively constant regardless of pre-modification mortgage PTI.

The combination of the two panels of Figure 3 suggests that payment reduction reduced default because the default rates of HAMP recipients who received larger payment reductions were lower than the default rates of HAMP recipients who received smaller payment reductions, while the default rates and payment reductions of GSE modification recipients were relatively constant.

Figure 3: Borrowers with larger payment reductions had lower default rates
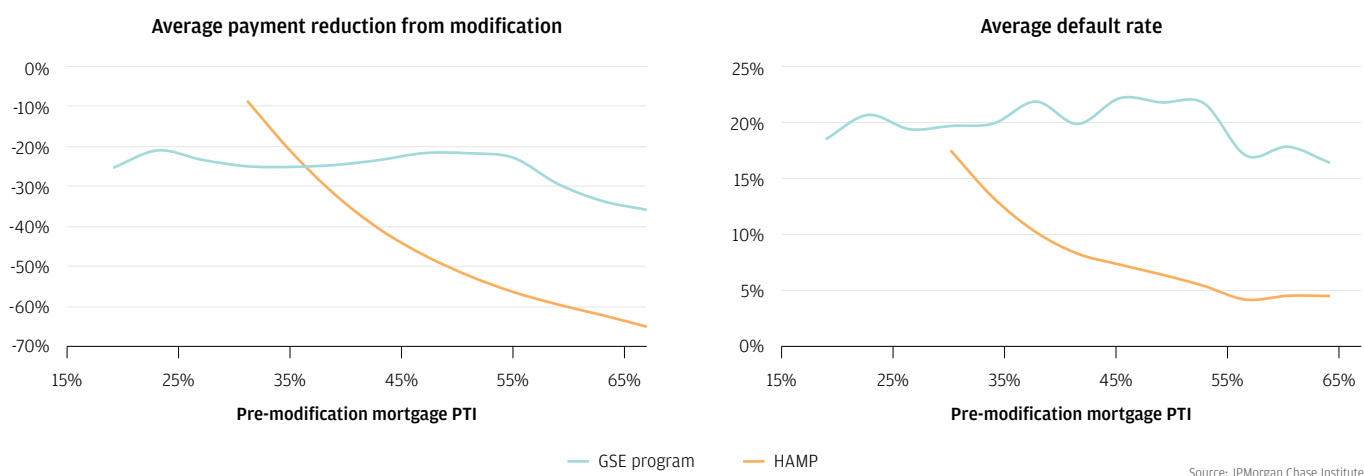
Source: JPMorgan Chase Institute

Between April 2009 and October 2016 about 6.5 million mortgages were modified through HAMP or a private modification program. Reducing the mortgage payments of these homeowners by an additional 10 percent would have kept roughly 169,000 more homeowners from defaulting.

To calculate a causal estimate of the impact of payment reduction on default, we used the variation in payment reduction noted above. Our research design utilizes the fact that within the HAMP program borrowers with a high pre-modification mortgage PTI received more payment reduction than borrowers with a low pre-modification mortgage PTI. One concern with a strategy relying on variation in payment reduction between high and low mortgage PTI borrowers is that default rates might have differed between these two sets of borrowers for many reasons. However, GSE borrowers with widely varying mortgage PTIs had similar default rates, as shown in the right panel of Figure 3, suggesting that mortgage PTI alone was not an important determinant of default.

We used an instrumental variables strategy to arrive at our causal estimate.[37] First, we calculated the payment reduction per unit of pre-modification mortgage PTI. This calculation is analogous to measuring the difference in slope between the orange line (HAMP modifications) and the blue line (GSE modifications) in the left panel of Figure 3. Second, we repeated the exercise using default rate data, measuring the difference in the slope of the two lines in the right panel of Figure 3. The second step gave us an estimate of the change in default rate per unit of pre-modification mortgage PTI. Dividing our second estimate by our first estimate generated an estimate that a 10 percent payment reduction reduced default rates by 2.6 percentage points. Finally, we divided the impact in percentage points by the 11.9 percent average default rate for this sample to recover our headline that a 10 percent payment reduction reduced subsequent default rates by 22 percent.

We used the estimate from the analysis above for our headline because it is based on a sample that spans a wide spectrum of pre-modification mortgage PTI levels (between 19 percent and 67 percent). To further test our causal estimate of the impact of payment reduction on default, we did a similar exercise using a different, smaller sample from a narrower pre-modification mortgage PTI band and a second research design that employed the HAMP 31 percent mortgage PTI eligibility requirement.
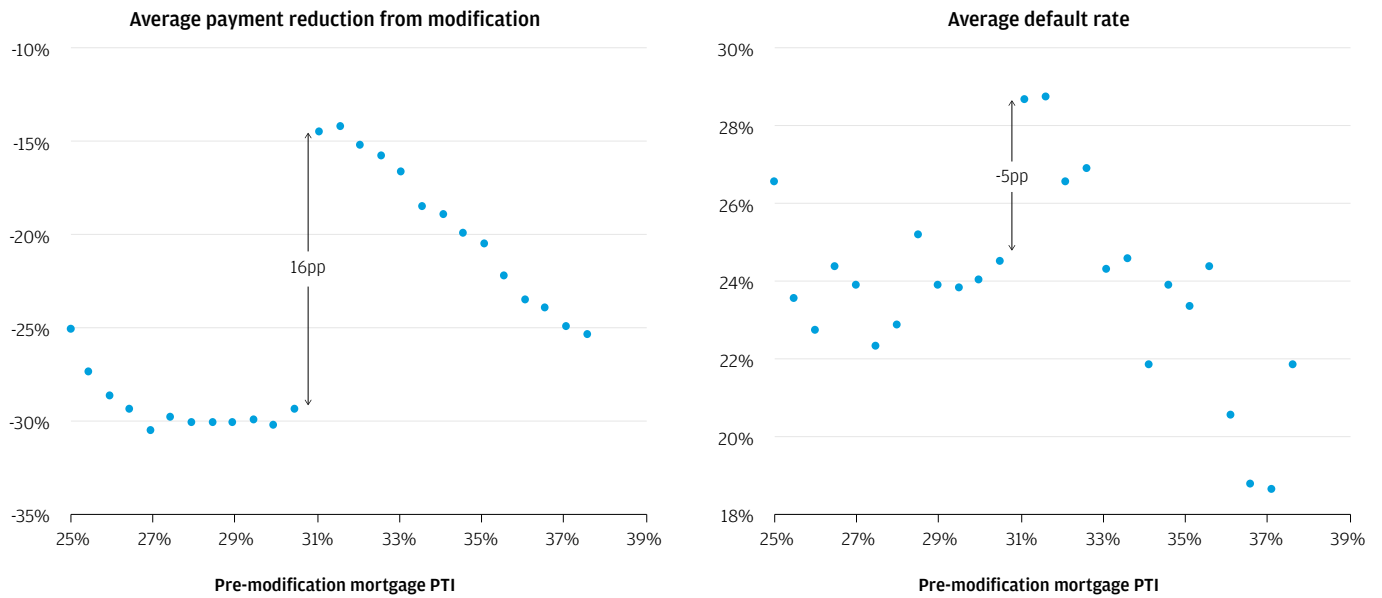
The impact of payment reduction on default for homeowners near the 31 percent HAMP mortgage PTI cutoff

We compared the default rates of borrowers with a pre-modification mortgage PTI right around the 31 percent mortgage PTI HAMP eligibility requirement and found that, for these low mortgage PTI borrowers, a 10 percent reduction in mortgage payment reduced default rates in the two years after modification by 12 percent.

For this analysis, we used a sample of nearly 37,000 non-GSE mortgages that were modified through HAMP or a Chase proprietary modification program. Again, we included first modifications only.[38] We used a regression discontinuity strategy to compare payment reduction for borrowers with a pre-modification mortgage PTI just below and just above the 31 percent mortgage PTI HAMP eligibility requirement, as shown in the left panel of Figure 4.[39]

The left panel of Figure 4 shows that borrowers just below the 31 percent cutoff received a much larger payment reduction than borrowers just above the cutoff. This is because the average borrower with a pre-modification mortgage PTI just below the cutoff was ineligible for HAMP, and through the Chase program received a payment reduction around 30 percent. This was our treatment group. In contrast, most borrowers with a pre-modification mortgage PTI just above the cutoff received a HAMP modification. The HAMP payment reduction was limited to the amount necessary to reach the 31 percent mortgage PTI affordability target, so these borrowers received relatively little relief: the average payment reduction was 14 percent. This was our control group. The difference in payment reduction received between our treatment and control group was 16 percentage points.

Figure 4: The 31 percent HAMP eligibility requirement created a large difference in payment reduction and default rate on either side of the cutoff

Source: JPMorgan Chase Institute

To measure the impact of the additional payment reduction on default, we use the default rate data for this sample, as shown in the right panel of Figure 4. For borrowers just below the 31 percent cutoff, the additional 16 percentage points of payment reduction reduced default rates by 5 percentage points relative to borrowers just above the 31 percent cutoff. Scaling this estimate to a 10 percent payment reduction yields a 3.4 percentage point reduction in default, and then dividing by the 29 percent default rate for our control group at the 31 percent cutoff recovers our estimate that a 10 percent payment reduction led to a 12 percent reduction in default rates over the two-year period following modification.[40, 41]
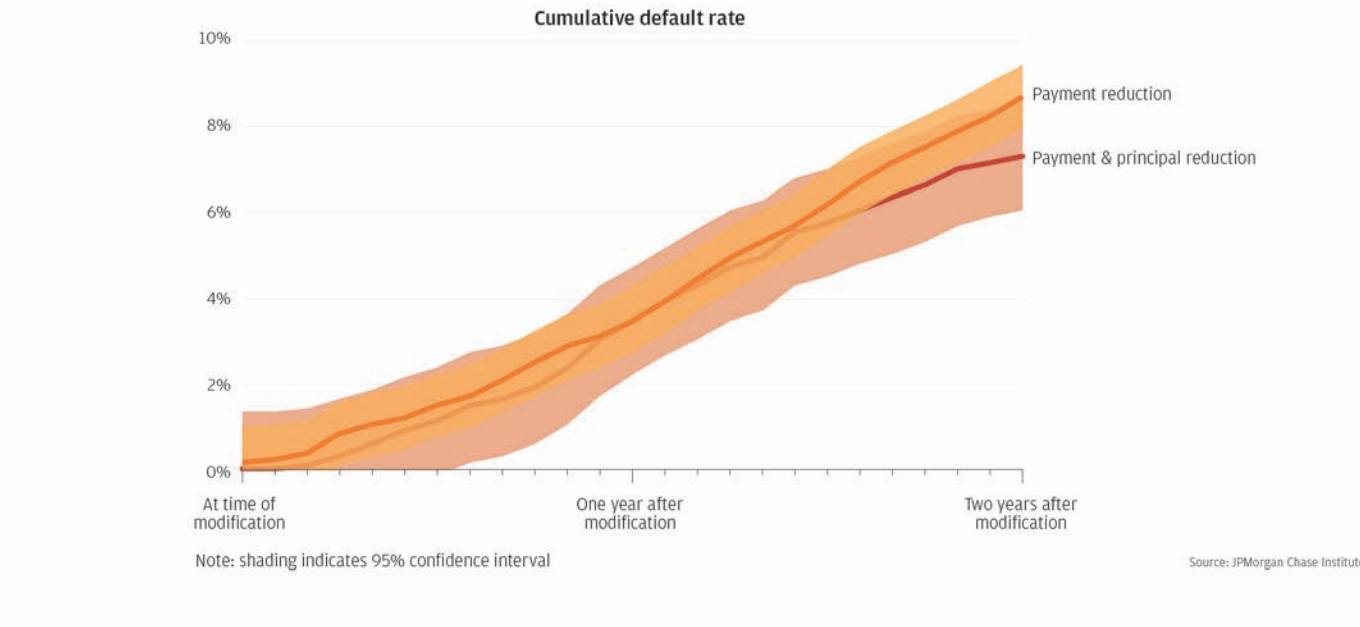
Finding Three

For borrowers who remained underwater, mortgage principal reduction had no effect on default.

We measured the impact of principal reduction on default by comparing outcomes of borrowers who received standard HAMP modifications to outcomes of borrowers who participated in the HAMP Principal Reduction Alternative (PRA) program (described in Box 1). This comparison showed that, for borrowers who remained underwater, principal reduction had no effect on default rates.[42]

While the standard HAMP modification offered no principal reduction, HAMP-PRA offered principal reduction to borrowers with an LTV above 115 percent. This reduction in principal was forgiven by the lender, meaning that the borrower's mortgage debt outstanding was reduced by this amount. Borrowers in the HAMP and HAMP-PRA programs received similar payment reductions in the five year period after modification, allowing us to isolate and measure the impact of principal reduction on default.[43]

To visualize the impact of principal reduction on default, we compared the post-modification default rates of about 2,000 HAMP-PRA recipients and about 7,000 HAMP recipients who were underwater but did not receive PRA.[44] On average HAMP-PRA reduced the unpaid principal balance of recipients in this sample by 32 percent ($112,000). Figure 5 shows that default rates for these two groups were very similar in the two years after modification, providing visual evidence that for underwater borrowers, principal reduction had a negligible impact on default.[45]

Figure 5: For underwater borrowers, principal reduction had a negligible effect on default

Cumulative default rate

Note: shading indicates 95% confidence interval
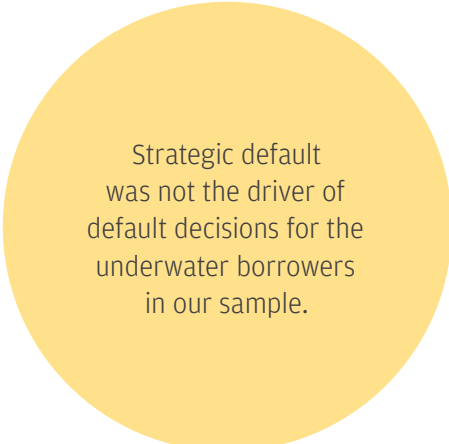
Source: JPMorgan Chase Institute

We turn to Ganong and Noel (2017) for causal evidence to support this finding.[46] They found that the $35,000 of principal reduction received by HAMP-PRA borrowers in their sample had a statistically insignificant impact on their probability of default.

If principal reduction did not impact default rates, this suggests that "strategic default" was not the primary driver of default decisions for these underwater borrowers, meaning that they were not defaulting simply because they owed more on their mortgage than their house was worth. If strategic default were evident, then reductions in mortgage principal that brought borrowers closer to being above water should have reduced default. However, while the HAMP-PRA recipients analyzed in Ganong and Noel (2017) received principal reduction that decreased their LTVs by 11 percentage points on average, the difference in post-modification default rates of HAMP-PRA and HAMP recipients was negligible.

> Strategic default was not the driver of default decisions for the underwater borrowers in our sample.

Two caveats limit the scope of the evidence from Ganong and Noel (2017). First, HAMP and HAMP-PRA were only available for mortgages on owner-occupied primary residences with an unpaid principal balance below $730,000.[47] In addition, the average borrower in this analysis had an LTV of 126 percent, while borrowers in the 90th percentile had an LTV of 163 percent. Therefore, these results may not apply to borrowers with investor properties, larger loan balances, or higher LTVs.[48] Second, forgiving principal could be an effective tool against foreclosures to the extent that it restores positive home equity. If forgiving principal takes them above water, a borrower facing financial hardship can sell their home or find alternative resolutions rather than going through foreclosure. This was not the case for HAMP-PRA recipients because the program did not restore positive home equity.
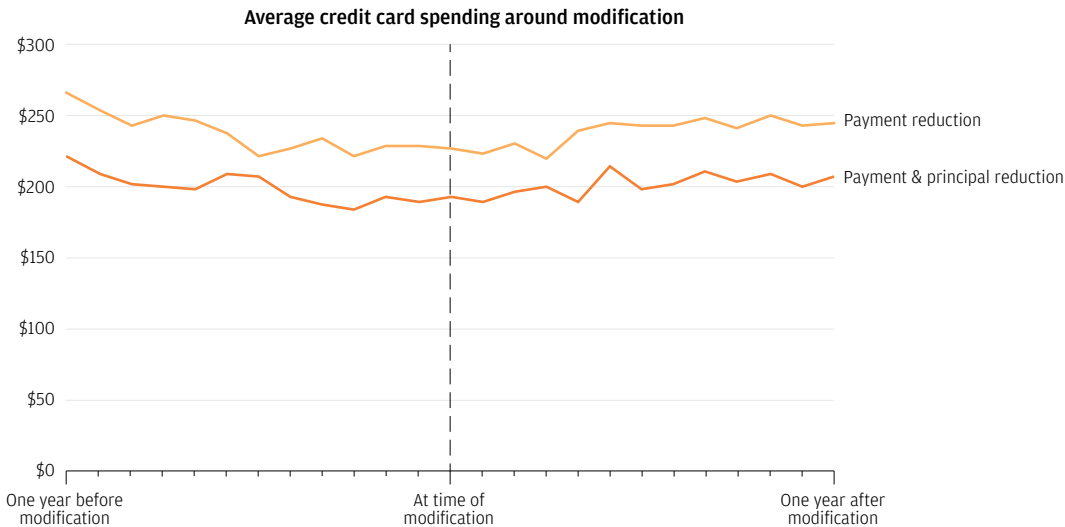
Finding Four

For borrowers who remained underwater, mortgage principal reduction had no effect on consumption.

We used a sample of over 10,000 Chase customers who had both a Chase mortgage and a Chase credit card to examine the effects of principal reduction on consumption.[49] We found that for underwater borrowers, principal reduction had no material impact on consumption.[50]
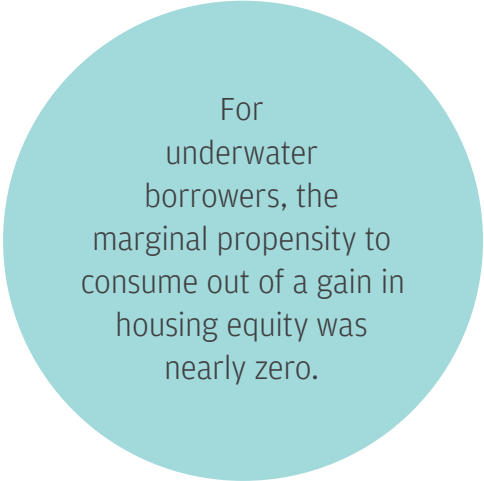
We isolated the effects of principal reduction on consumption for underwater borrowers by comparing the spending patterns of HAMP and HAMP-PRA recipients in the year following modification, in a similar manner to the analysis described in Finding 3. On average, the HAMP-PRA recipients in this sample had $109,000 of principal forgiven. Because payment reductions for these two groups were similar, we could generate a causal estimate of the impact of principal reduction on consumption by comparing the spending of HAMP-PRA recipients (our treatment group) to underwater HAMP recipients (our control group).

Our analytical framework relied on the assumption that consumption trends in the two groups would be the same in the absence of principal reduction, which is plausible if the two groups had parallel pre-trends in spending. We provide visual evidence to support this assumption in Figure 6, in which we compare credit card spending for these two groups in the 12-month period before modification.[51] The two groups exhibited similar trends in spending in the pre-modification period and little divergence after modification, indicating that principal reduction had little effect on spending.

Figure 6: Credit card spending by HAMP and HAMP-PRA recipients exhibited similar patterns both before and after modification, suggesting that principal reduction had little impact on consumption

Average credit card spending around modification

Source: JPMorgan Chase Institute

To generate a causal estimate, we calculated the difference in pre- and post-modification spending by HAMP-PRA recipients relative to the difference in pre- and post-modification spending by HAMP recipients. We found that the difference in post-modification spending between HAMP-PRA and HAMP recipients relative to their pre-modification spending was small and not statistically significant: every $1 of principal reduction decreased consumption by 0.1 cents, with a 95 percent confidence interval ranging from -2 cents to 2 cents.[52]

> For underwater borrowers, the marginal propensity to consume out of a gain in housing equity was nearly zero.

This analysis implies that for underwater borrowers, the marginal propensity to consume out of a gain in housing equity was small and statistically insignificant. We hypothesize that the lack of spending response was a function of the borrower's inability to access the gain in home equity. Equity extraction through a cash-out refinancing or home equity loan is not an option for a homeowner with an underwater mortgage.

We also attempted to measure the impact of payment reduction on consumption using the same analytical framework as in Finding 2, but found inconclusive results— our estimates were not statistically significant, though we did not have enough power to reject economically significant impacts.[53]

Finding Five

Default was correlated with income loss, regardless of debt-to-income ratio or home equity.

Why would payment reduction be more effective than principal reduction at reducing default? To answer this question, we examined the correlation between income and mortgage default for homeowners with different levels of payment and debt burden, measured in terms of mortgage PTI and LTV. Our data provides suggestive evidence that mortgage default closely followed a negative income shock, irrespective of mortgage PTI or LTV.

In Figure 7, we highlight the relationship between income loss and default for a sample of nearly 11,000 Chase mortgage customers who had a Chase deposit account and defaulted on their mortgage.[54] Figure 7 shows the change in the path of monthly income and mortgage payment made over the 12 months before and after default relative to a baseline period (12 months before default).[55] Income dropped in the five months leading up to default. A few months after the initial drop in income, mortgage payments made declined and then dropped steadily until borrowers reached default. These results are consistent with the finding in Farrell and Greig (2015) that the typical individual did not have a sufficient financial buffer to weather the degree of income volatility evident in their data. If they did, mortgage payments made would not drop two months after a drop in income. To the extent that income recovered in the months that follow default, our data indicated that homeowners returned to making mortgage payments.[56]

Figure 7: A substantial negative income shock preceded default

Average change in monthly income and mortgage payment made from baseline

Source: JPMorgan Chase Institute
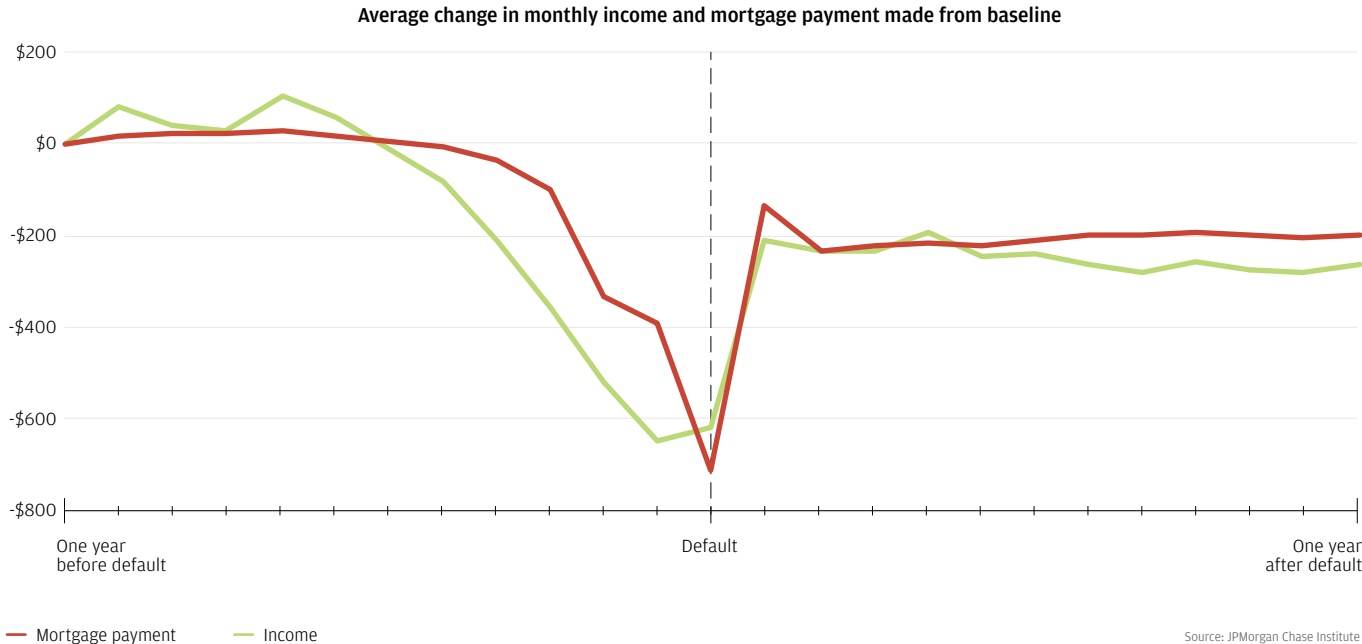
— Mortgage payment   — Income

Figure 7 helps explain why payment reduction is an effective countermeasure to reduce default: a payment reduction can help make mortgage payments affordable again for a household experiencing an income shock. Next, we explored the correlation between income and mortgage default for homeowners with different levels of payment burden, measured by mortgage PTI.

In Figure 8, we reconstructed Figure 7, but split our sample by pre-modification mortgage PTI.[57] The left panel of Figure 8 shows borrowers with a below-median mortgage PTI (< 31 percent), while the right panel shows borrowers with an above-median mortgage PTI (≥ 31 percent).[58] In both cases, the pattern was the same: income steadily dropped in the five months leading up to default. After default, income and mortgage payments partially recovered.

Figure 8: On average, a substantial negative income shock preceded default for both below-median and above-median mortgage PTI borrowers

Change in monthly income and mortgage payment made from baseline (below-median mortgage PTI)

Change in monthly income and mortgage payment made from baseline (above-median mortgage PTI)

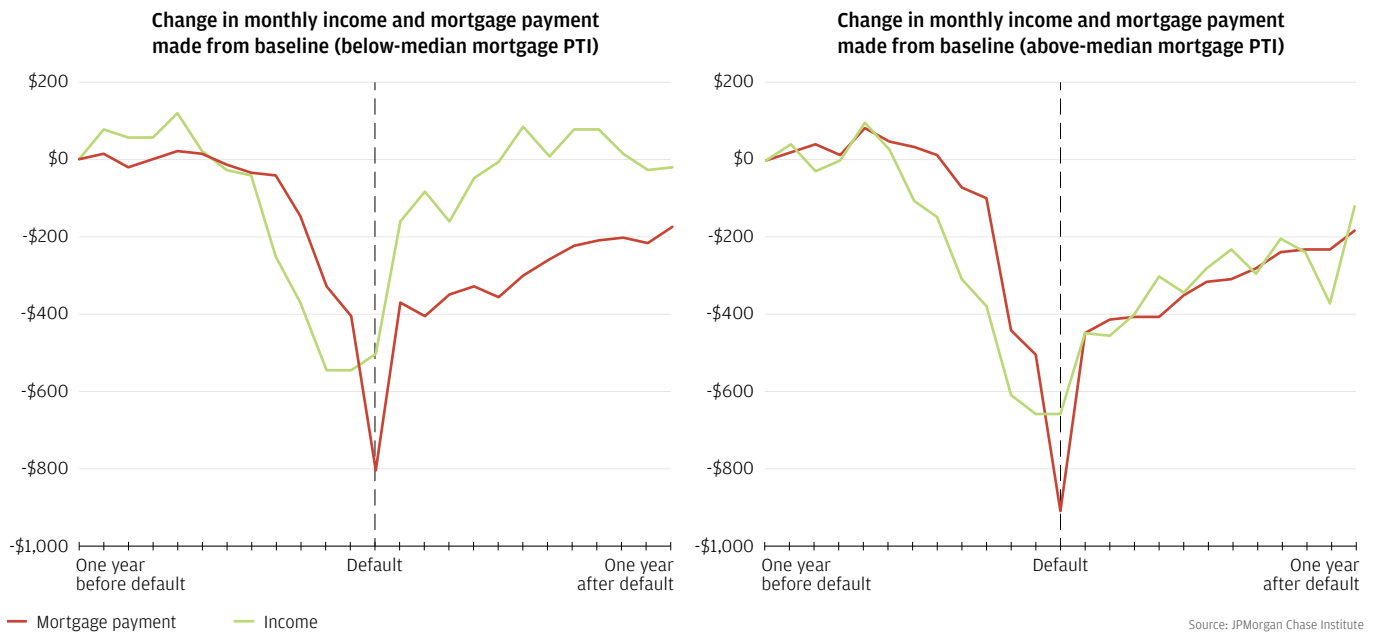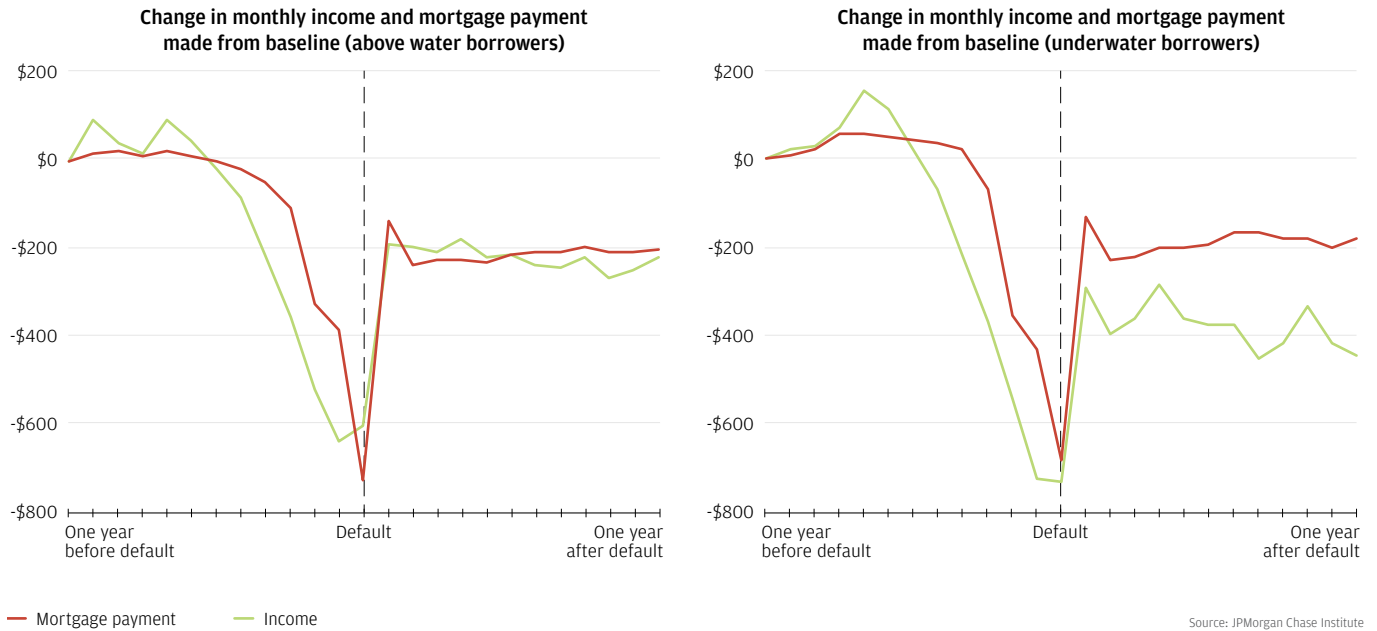— Mortgage payment   — Income

Source: JPMorgan Chase Institute

Figure 8 shows that the income pattern that precedes default was similar for both below- and above-median mortgage PTI borrowers, suggesting that it was a loss in income rather than a high payment burden that triggered default. This similarity in response suggests that affordability targets based on regular income may be a less effective method of reducing mortgage defaults. For example, HAMP had a 31 percent affordability target for payment reduction, suggesting that borrowers with a mortgage PTI at or below 31 percent had "affordable" mortgages, while borrowers with higher mortgage PTIs had "unaffordable" mortgages. Our data did not support such a distinction.

Finally, we explored the relationship between income and mortgage default for homeowners with different levels of home equity. We show analogous results for above water and underwater borrowers in the left and right panels of Figure 9 respectively.[59] Again, for both groups the pattern was the same: default closely followed a sharp drop in income, and mortgage payment made recovered as income recovered.

Income loss preceded default by a few months, suggesting borrowers in our sample did not hold enough financial reserves to weather a drop in income.

Figure 9: On average, a substantial negative income shock preceded default for both above water and underwater borrowers

Change in monthly income and mortgage payment made from baseline (above water borrowers)

Change in monthly income and mortgage payment made from baseline (underwater borrowers)

— Mortgage payment   — Income

Source: JPMorgan Chase Institute

The results shown in Figure 9 led us to two conclusions. First, default was triggered by cash flow shocks for both underwater and above water borrowers, which may explain why principal reduction was ineffective at reducing default. Principal reduction that didn't result in an incremental reduction in monthly mortgage payment had little impact on immediate cash flows and therefore little impact on default. Second, the similarity in the relationship between income shock and default for both above water and underwater borrowers provides further evidence that underwater borrowers were not defaulting simply because they owed more on their mortgage than their house was worth. While there was speculation that strategic default was prevalent in the face of negative home equity during the Great Recession, it was not apparent in our data.

Taken together, the results described above indicate that the design of mortgage modification programs should not focus on borrower debt-to-income and LTV and the trade-offs inherent in trying to reduce one or the other. Modifications that simply deliver substantial monthly payment reduction will be more effective at reducing default than modifications that focus on achieving a certain debt-to-income ratio or reducing the LTV of underwater borrowers.

Implications

The findings in this report inform policy on two fronts. First, our findings on the impact of payment and principal reduction on default can help policymakers as they develop future programs and standards aimed at reducing or preventing mortgage defaults. In addition, our finding on the lack of spending response to gains in home equity for underwater borrowers can assist policymakers focused on understanding the link between monetary policy and consumption.

Future Mortgage Modification Programs

The HAMP program ended at the close of 2016. As the mortgage industry and policymakers consider the optimal framework for future mortgage modification programs, our findings suggest that these programs will be most effective at reducing default rates if they focus on providing homeowners who are struggling to make their monthly payments with material payment reductions. In contrast, programs that optimize according to a payment-to-income ratio or LTV target will be less effective at reducing default.

For modification programs intended to reduce defaults, the payment reduction should not be limited to an amount that reaches a pre-determined affordability target, without regard to the amount of payment reduction delivered. A one-size-fits-all affordability target did not prove effective in this context, as illustrated by our comparison of default rates for borrowers on either side of the HAMP 31 percent mortgage PTI cutoff. Furthermore, we have shown that default was correlated with negative income shocks regardless of the borrower's mortgage PTI, and income shocks are hard to account for when setting a one-time affordability target.

Mortgage debt reduction programs that target a specific LTV ratio in an attempt to reduce default rates will be less effective if they leave homeowners underwater. Our data showed that for borrowers who were underwater, payment-focused mortgage debt reduction was more effective at slowing default than principal-focused mortgage debt reduction.[60] In addition, it was income shocks, not negative home equity, that correlated with default decisions and our data presented no evidence of strategic default. Two caveats are important to highlight. First, principal reductions could be an effective tool against foreclosures to the extent that they restore positive home equity, as above-water borrowers who encounter income shocks can sell their home or find alternative resolutions rather than going through foreclosure. Second, principal reductions undertaken when borrowers still have positive equity may be more effective at increasing consumption than our data suggested.

Both the "Flex Modification" introduced by the GSEs and the "One Mod" principles for loan modifications produced by the Mortgage Bankers Association are consistent with the implications of our findings in that they target a minimum payment reduction of 20 percent. However, both programs keep in place an affordability target, which we found to be a less valuable feature of modifications.[61]

Underwriting Standards and Measures of Ability-to-Repay

With respect to setting underwriting standards aimed at preventing default in the first instance, our analysis indicates that certain financial measures available at origination may not be helpful in predicting defaults. The ability-to-pay rule requiring a borrower's total debt-to-income ratio (DTI) not exceed 43 percent to satisfy Qualified Mortgage (QM) requirements is one such example.[62,63] The fact that default was correlated with income loss regardless of mortgage PTI provides evidence that affordability measures were not a good predictor of default. Both high and low mortgage PTI borrowers experienced a similar income drop just prior to default, suggesting that even among those borrowers whose mortgages would be categorized as unaffordable by conventional standards, it was a drop in income rather than a high level of payment burden that triggered default.[64] To the extent that a mortgage modification can be considered a re-origination, our findings may have application to underwriting standards as well. DeFusco et al. (2017) provides support for this reasoning, showing evidence that had the QM 43 percent total DTI limit been in effect after 2004, it would have resulted in a minimal reduction in five-year default rates on mortgages originated between 2005 and 2008.

There are two additional factors to consider with respect to using total DTI as an affordability measure for mortgage origination or modification. First, a rule based on total DTI may unfairly penalize borrowers who have difficulty producing proof of income (e.g., the self-employed or small business owners) by limiting their access to a new or modified loan or increasing their cost of credit.

In fact, the most frequent reason borrowers were denied a HAMP modification was because they did not provide the financial and/or hardship verification documentation required to complete the evaluation of their request in a timely manner. As of April 2015, over 1 million homeowners had been denied a HAMP modification for this reason.[65] Second, total DTI may in practice be difficult to measure. For example, although credit card debt is included in total DTI, mortgage originators may struggle to distinguish credit card borrowing from credit card spending.

Policies that help borrowers establish and maintain a suitable cash buffer that can be drawn down in the event of an income shock or an expense spike could be an effective tool to prevent mortgage default. In prior work, the Institute found that individuals lacked a sufficient cash buffer to weather the degree of income volatility evident in their data.[66] The fact that mortgage default closely followed a drop in income could be symptomatic of homeowners who did not have enough cash reserves to weather an income shock.

Policymakers should also be mindful of the long-term financial impact of mortgage modification on borrowers. In the absence of government subsidies, borrowers who accept a mortgage modification with term extensions or principal forbearance are making a trade-off: make smaller monthly payments now in exchange for a payment schedule in which the monthly payments persist for a longer period or with a balloon payment at maturity (e.g., as shown in Figure 1).[67] To weather the long-term post-modification arrangement, borrowers may need to increase their income or postpone retirement to generate the cash flow necessary to offset the new payment schedule. To reduce their debt obligations, underwater borrowers may find themselves reliant on an increase in home prices that pushes their home equity well above zero and allows them to sell their home or refinance their mortgage. The Federal Reserve is currently in the process of tightening monetary policy by increasing the Federal Funds target rate range and normalizing its balance sheet.[68] If either of these steps slows the pace of home price appreciation or raises the primary mortgage rate enough to remove the financial benefits of refinancing, the circumstances in which borrowers can reduce their debt obligations may be limited.

Mortgages as a Link between Monetary Policy and Consumption

Our findings also have implications for policymakers as they consider the effectiveness of the housing wealth effect in transmitting changes in monetary policy to household consumption.[69] This transmission mechanism relies on accommodative monetary policy leading to higher house prices, and an increase in housing wealth that in turn stimulates consumption. The lack of consumption response from underwater borrowers to principal reduction suggests that the marginal propensity to consume out of housing wealth was nearly zero for these homeowners. The inability to translate increased wealth into liquid resources (e.g., through equity extraction) may nullify the housing wealth effect and thus constrain this transmission mechanism for those borrowers who are unable or unwilling to spend out of gains in home equity. Similarly, to the extent that housing policy limits homeowner access to their home equity, for example through LTV limits on borrowing, it can hamper the effectiveness of accommodative monetary policy in stimulating personal consumption.[70]

Finally, housing policymakers should consider the trade-offs between fixed-rate and adjustable-rate mortgages (ARMs) in the context of how mortgage payments vary with economic conditions. Fixed-rate mortgages offer borrowers the certainty of constant monthly payments, regardless of prevailing economic conditions. While this certainty may be helpful, a borrower with a fixed-rate mortgage facing a negative income shock could require a modification to reduce their payment and avoid default. Modifications can take time to process and often have eligibility requirements. As discussed in Farrell et al. (2017), the interest rates on ARMs that are beyond the initial fixed rate period automatically reset with policy rates, so ARM monthly payments may better adjust in accordance with economic cycles. During economic downturns, the automatic drop in ARM payments will be an advantage relative to fixed-rate mortgages. However, during economic expansions ARMs may exacerbate the idiosyncratic factors that create negative income shocks and lead to default. Home price appreciation experienced during the expansion may not be sufficient to allow homeowners struggling to make their higher mortgage payments to sell their home and avoid foreclosure. A better understanding of the impact of rising rates and increasing ARM payments on consumption and default would help housing policymakers assess the impact of the promotion and standardization of ARMs for the appropriate borrowers (given demographic and other characteristics) relative to other mortgages.

Data Asset

For this report, the JPMorgan Chase Institute assembled a de-identified data asset of Chase customers who received a mortgage modification to study how payment and principal reductions impacted default and consumption. In conducting this research we went to great lengths to ensure the privacy of customer data.

Data Privacy

The JPMorgan Chase Institute has adopted rigorous security protocols and checks and balances to ensure all customer data are kept confidential and secure. Our strict protocols are informed by statistical standards employed by government agencies and our work with technology, data privacy, and security experts who are helping us maintain industry-leading standards.

There are several key steps the Institute takes to ensure customer data are safe and secure:

- The Institute's policies and procedures require that data it receives and processes for research purposes do not identify specific individuals.

- The Institute has put in place privacy protocols for its researchers, including requiring them to undergo rigorous background checks and enter into strict confidentiality agreements. Researchers are contractually obligated to use the data solely for approved research and are contractually obligated not to re-identify any individual represented in the data.

- The Institute does not allow the publication of any information about an individual consumer or business. Any data point included in any publication based on the Institute's data may only reflect aggregate information.

- The data are stored on a secure server and can be accessed only under strict security procedures. The data cannot be exported outside of JPMorgan Chase's systems. The data are stored on systems that prevent them from being exported to other drives or sent to outside email addresses. These systems comply with all JPMorgan Chase Information Technology Risk Management requirements for the monitoring and security of data.

The Institute provides valuable insights to policymakers, businesses, and nonprofit leaders. But these insights cannot come at the expense of customer privacy. We take precautions to ensure the confidence and security of our account holders' private information.

Constructing our Samples

From a universe of over 1 million Chase mortgage customers who received a modification, we created a data asset composed of over 450,000 mortgages modified through HAMP, the GSE modification programs, or a proprietary Chase modification program. Loans in our sample were modified between July 2009 and June 2015, and we only included the first modification for each loan. We limit our sample to first modifications because we would expect subsequent modifications to be different along many observable and unobservable dimensions.

In this data asset, we included data elements related to the borrower and their mortgage at origination (e.g., property value, loan amount, term, LTV), just prior to modification (e.g., current property value, borrower income, monthly mortgage payment, unpaid principal balance, LTV, remaining term), and after modification (e.g., new monthly mortgage payment, new unpaid principal balance, principal forbearance, principal forgiven, new LTV, new term). We also observe mortgage data at a monthly frequency (e.g., payment due, payment made, unpaid principal balance, delinquency status). Summary statistics for these borrowers and their loans are shown in Table 1.

Table 1: Mortgage and borrower statistics[71]

	At origination			
	Property Value	Loan Amount	Term (years)	LTV
Mean	339,769	254,959	29.6	81%
Median	263,904	205,562	30.0	80%

	At modification						
	Property Value	Unpaid Principal Balance	Term (years)	CLTV	Monthly Payment	Borrower Monthly Income	Mortgage PTI
Mean	258,557	250,773	25.1	104%	1,440	5,128	44%
Median	202,567	199,039	26.0	98%	1,182	4,370	41%

Change in	Change from origination to modification		
	Property Value ($)	Property Value (%)	Term (years)
Mean	-81,211	-24%	-4.5
Median	-61,337	-23%	-4.0

	After modification					
	Unpaid Principal Balance	Term (years)	CLTV	Monthly Payment		Mortgage PTI
Mean	270,113	32.1	111%	1,012		32%
Median	213,618	30.4	105%	838		31%

	Change from modification				
Change in	Unpaid Principal Balance	Term (years)	Monthly Payment ($)	Monthly Payment ($)	Mortgage PTI (pp)
Mean	19,340	7.0	-428	-30%	-12
Median	14,580	4.4	-344	-29%	-10

Note that monthly payment in the table above includes only principal and interest, and that the increase in unpaid principal balance and CLTV (combined LTV, which includes second lien loans) after modification is driven by the capitalization of arrearages. While principal forbearance does not accrue interest, it remains a part of unpaid principal balance and is due as a balloon payment at the end of the mortgage or when the mortgage is paid off. Principal forgiven as a result of HAMP-PRA vests over a three year period following modification and is therefore not reflected in the post-modification data in Table 1.

For each analysis in this report, we created specific samples composed of particular sets of mortgages taken from this initial data set.

Instrumental Variables Sample

For this identification strategy, we included modifications that met the following criteria:

1. Mortgages backed by one of the GSEs that were modified through HAMP Tier 1 or the standard GSE modification program

2. Modifications completed between April 2010 and November 2013

3. For GSE modifications, pre-modification mortgage PTI greater than or equal to 19 percent and less than 67 percent

4. For HAMP modifications, pre-modification mortgage PTI greater than or equal to 31 percent and less than 67 percent

5. Mortgages for which we observe monthly data for at least 24 months after the modification date

After applying these filters, we had 95,202 distinct mortgage modifications, of which 77,451 received a HAMP modification and 17,751 received a GSE modification.

Regression Discontinuity Sample

For this identification strategy, we included modifications that met the following criteria:

1. Mortgages not backed by one of the GSEs that were modified through HAMP Tier 1 or a Chase proprietary modification program

2. Modifications completed between October 2011 and January 2014

3. Pre-modification mortgage PTI greater than or equal to 25 percent but less than 31 percent (to the left of the 31 percent cutoff) or mortgage PTI greater than or equal to 31.1 percent but less than 38.1 percent (to the right of the 31 percent cutoff)

4. Mortgages for which we observe monthly data for at least 24 months after the modification date

This sample included 36,756 distinct mortgage modifications, of which 16,080 received a HAMP modification and 20,676 received a Chase proprietary modification. We removed 275 mortgages with a pre-modification mortgage PTI greater than or equal to 31 percent and below 31.1 percent. Analysis of this sub-sample revealed that these mortgages received an amount of payment reduction which was about halfway between how mortgages below 31.0 percent were treated and how mortgages above 31.1 percent were treated. Therefore, we dropped these observations and our primary analysis sample has a "donut hole" between 31.0 percent and 31.1 percent. We believe that the correct specification omits these observations, and note that adding these observations back to the sample did not materially change our estimate of the effect of payment reduction on default.[72]

HAMP vs. HAMP-PRA Comparison

To support the analysis in Findings 3 and 4, we included modifications that met the following criteria:

1. Chase customers with only one mortgage and a Chase credit card

2. Mortgages not backed by one of the GSEs that were modified through HAMP or HAMP-PRA

3. Modifications completed between July 2010 and November 2014

4. Mortgages with an LTV > 100 percent one month prior to modification

For the analysis in Finding 3, we measured the impact of principal reduction on default in the 24 months after modification, so we limited our sample to mortgages for which we observed monthly data for at least 12 months before and 24 months after the modification date. This sample had 9,136 mortgage modifications, of which 2,287 received a HAMP-PRA modification and 6,849 received a HAMP modification.

For the analysis in Finding 4, we measured the impact of principal reduction on consumption in the 12 months after modification, so we limited our sample to mortgages for which we observed monthly data for at least 12 months before and 12 months after the modification date. This sample had 10,741 mortgage modifications, of which 2,875 received a HAMP-PRA modification and 7,866 received a HAMP modification.

Income Shock Analysis

For the analysis in Finding 5, we included homeowners that met the following criteria:

1. Chase customers with only one mortgage and a Chase deposit account

2. First default date between October 2013 and October 2014

3. Had monthly mortgage data and an active deposit account for at least 12 months before and 12 months after default

We used this sample of 10,815 mortgages to analyze the correlation between income and default. We then split this sample into above and underwater borrowers and analyzed each sub-sample separately.

To examine the correlation between income and default split by above- and below-median pre-modification mortgage PTI, we used the sample above but added a restriction that the borrower must have received a modification in the 12 months before or after default. This limitation is necessary because we sourced borrower income from their modification application. This generated a sample of 1,807 mortgages.

Methodology

Estimating the impact of payment reduction on default using an instrumental variables identification strategy

In our first research design, we analyzed borrowers across the mortgage PTI spectrum who had a mortgage securitized by the GSEs and received a modification either through HAMP or the GSE modification programs. We limited our sample to first modifications only (eliminating subsequent modifications for borrowers who had multiple modifications) and required borrowers to remain in our sample for 24 months following modification.

We employed an instrumental variables (IV) approach, where we used the interaction of pre-modification mortgage PTI and a dummy variable for modification program as an instrument for payment reduction.

(1) $\quad \Delta Payment = \beta_0 + \beta_1\ MPTI \times HAMP + \beta_2\ MPTI + \beta_3\ HAMP + \varepsilon$

(2) $\quad Default = \partial_0 + \partial_1\ \Delta \widehat{Payment} + \partial_2\ MPTI + \partial_3\ HAMP + \eta$

In the first stage regression (Equation 1), we used the interaction between pre-modification mortgage PTI and a dummy variable for a HAMP modification as an instrument for the amount of payment reduction a borrower received to generate predicted payment reduction. In the second stage (Equation 2), we estimated the impact of predicted payment reduction on default, controlling for pre-modification mortgage PTI and modification type.

The estimated coefficient ∂_1 gave us an estimate that a 1 percent payment reduction reduced default rates in the two years after modification by 0.26pp. Applying this estimate to the average default rate after two years for our sample of 11.9 percent and scaling by 10 recovers our estimate that a 10 percent payment reduction reduced default rates in the subsequent two years by 22 percent, with a 95 percent confidence interval that ranged from 20 percent to 24 percent.[73]

Our instrumental variables strategy relies on the normal assumptions about the validity of the instrument associated with this estimation method. In our application, the key assumption was that the effect of pre-modification mortgage PTI on default was independent of modification program assignment (i.e. that the interaction of mortgage PTI and program assignment was independent of default except through their impact on the amount of payment reduction received).

This assumption would be violated if there was some reason correlated with default that caused borrowers to have a high MPTI ratio and be pushed into one modification program or another. We implemented a test to assess the appropriateness of this assumption based on observable borrower characteristics. For this test, we first built a measure of predicted default for the borrowers in our sample of HAMP and GSE modification recipients using observable variables that program administrators and mortgage servicers would have had as part of the modification application process: property value, monthly mortgage payment, unpaid principal balance, interest rate, LTV, and borrower income. We then used predicted default as the outcome in equation (2) above and found that the effect of payment reduction on predicted default was an economically insignificant 0.026 percentage points. This result suggested that, at least based on observable borrower characteristics, borrowers were not differentially selected between the two modification programs in a way that was correlated with MPTI.

Generally, delinquent borrowers with a pre-modification mortgage PTI above the 31 percent HAMP cutoff failed to get a HAMP modification for four reasons: (1) they could not produce documentation that verified their income, (2) they failed to make their first modified payment, (3) their mortgage was originated after the 2008 HAMP origination cutoff, or (4) the home was non-owner occupied and more than 60 days delinquent.[74] While we believe that the assumptions required for a valid instrumental variables estimation holds for our analysis, we used the regression discontinuity strategy outlined below to further test our headline result.

Estimating the impact of payment reduction on default at the 31 percent mortgage PTI cutoff using a regression discontinuity identification strategy

In our second research design, we used a regression discontinuity identification strategy to measure the impact of payment reduction on default for borrowers with a pre-modification mortgage PTI around the 31 percent HAMP cutoff. For this analysis, we used a sample of Chase mortgage customers that received a modification from HAMP or a proprietary Chase modification program. We limited our sample to first modifications only (eliminating subsequent modifications for borrowers who had multiple modifications) and required borrowers to remain in our sample for 24 months following modification.

We used the large difference in the amount of payment reduction received by modification recipients just above the 31 percent cutoff (mostly from HAMP) compared to modification recipients just below the 31 percent cutoff (from a Chase modification program) to measure the impact on default rates for these borrowers who fell on either side of the cutoff but were otherwise similar.

Figure 10 shows mortgage payment reduction as a function of pre-modification PTI for borrowers with a pre-mortgage PTI between 25 percent and 38 percent, and highlights the discontinuity in payment reduction at the 31 percent HAMP mortgage PTI cutoff. We used a local linear regression on either side of the cutoff to estimate that recipients just below the 31 percent cutoff received 16pp larger payment reductions than modification recipients just above the cutoff.[75]

Figure 11 shows default rates for the same sample of borrowers in the 24-month post-modification period as a function of pre-modification mortgage PTI. There is a discontinuity in the default rate at the 31 percent cutoff. Borrowers on the left side of the cutoff received larger payment reductions and experienced lower default rates relative to borrowers on the right side of the cutoff who received smaller payment reductions. We again used a local linear regression on either side of the cutoff to estimate a 5 percentage point difference in default rates over the two-year post-modification period at the 31 percent cutoff.

Implementing the standard fuzzy regression discontinuity estimator, we took the ratio of these two estimates and scaled to a 10 percent mortgage payment reduction, which gave us an estimate that 10 percent of additional payment reduction reduced default rates in the subsequent 24 months by 3.4 percentage points.[76] After dividing this estimate by the 29 percent baseline default rate for our HAMP control group above the 31 percent cutoff, we arrived at our final result: an additional 10 percent of payment reduction reduced default rates by 12 percent, with a 95 percent confidence interval ranging from 5 percent to 18 percent.

Figure 10: There was a 16 percentage point difference in payment reduction at the 31 percent HAMP mortgage PTI cutoff.

Average payment reduction from modification

Pre-modification mortgage PTI
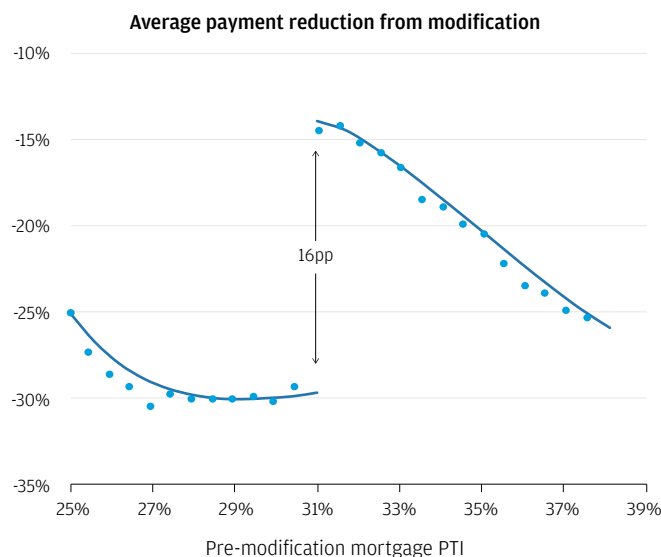
Source: JPMorgan Chase Institute

Figure 11: There was a 5 percentage point difference in default rate at the 31 percent HAMP mortgage PTI cutoff.

Average default rate

Pre-modification mortgage PTI
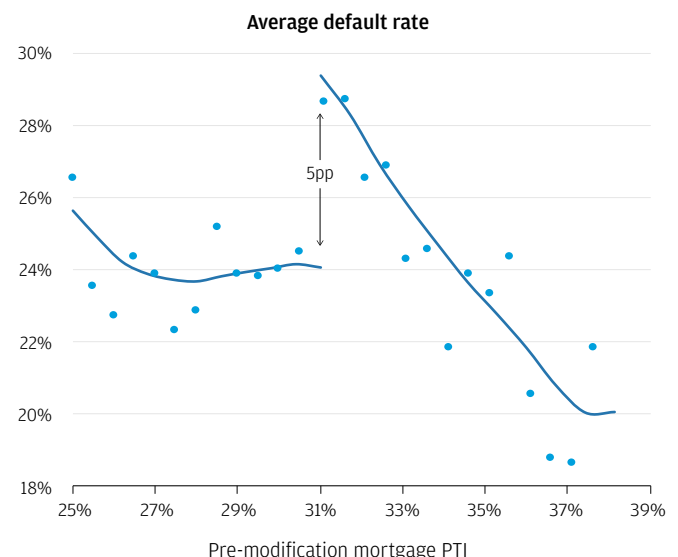
Source: JPMorgan Chase Institute

The validity of our regression discontinuity identification strategy rests on the assumption that borrowers on either side of the cutoff were otherwise similar except for the amount of payment reduction received. As the first test of this assumption, we plotted the number of observations on either side of the discontinuity. Figure 12 shows the number of modifications in each pre-modification mortgage PTI bin. Sample counts were smooth across the 31 percent discontinuity, implying that borrowers and mortgage servicers did not manipulate application data to influence borrower eligibility for the two modification programs.

Figure 12: The number of observations was smooth across the 31 percent threshold

Number of observations in each mortgage PTI bin

Pre-modification mortgage PTI
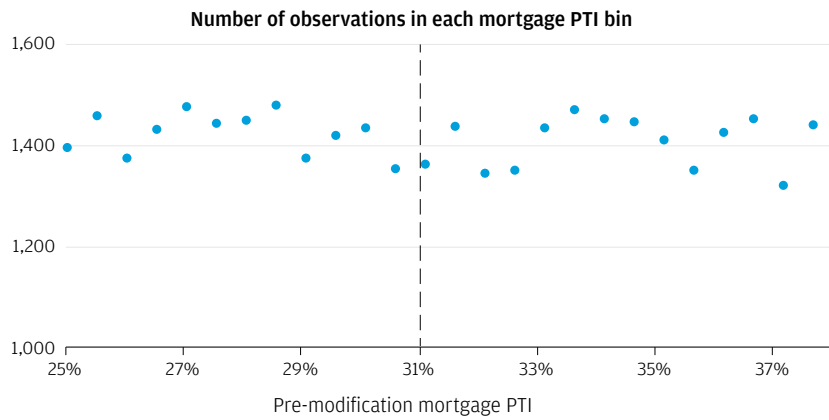
Source: JPMorgan Chase Institute

As the second test of our identification assumption, we examined whether observable borrower characteristics trend smoothly across the discontinuity. To do so, we built a measure of predicted default for borrowers in our sample using as inputs observable variables that program administrators and mortgage servicers would have had as part of the modification application process: property value, monthly mortgage payment, unpaid principal balance, interest rate, LTV, and borrower income. Predicted default trends smoothly across the 31 percent mortgage PTI discontinuity, as shown in Figure 13. We also examined each covariate individually, and all trend smoothly over the 31 percent mortgage PTI discontinuity.

Figure 13: Predicted default trends smoothly across the 31 percent discontinuity

Predicted default

Pre-modification mortgage PTI
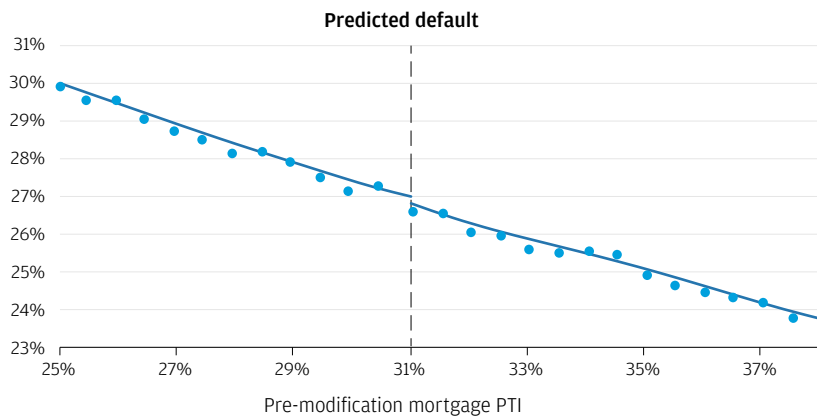
Source: JPMorgan Chase Institute

The 95 percent confidence interval for our first estimate ranged from 20 to 24 percent, while the 95 percent confidence interval for our second estimate ranged from 5 percent to 18 percent. The second estimate based on the discontinuity at the 31 percent cutoff had a wider confidence interval because this sample was smaller; this research design required that we limit this sample to only those borrowers with a pre-modification mortgage PTI around 31 percent.

Measuring the impact of principal and payment reduction on consumption

We measured the impact of principal and payment reduction on consumption by examining changes in the credit card spending of homeowners who received a mortgage modification.

For principal reduction, we generated an estimate of the impact on consumption using a difference-in-differences research design. Our treatment group was composed of borrowers who received a HAMP-PRA modification, and our control group was composed of underwater borrowers who received a HAMP modification. Both groups received similar payment reductions, allowing us to isolate the impact of the principal reduction in the treatment group. Our analytical framework relied on the assumption that consumption trends in the two groups would be the same in the absence of principal reduction, which was plausible given the parallel pre-trends exhibited by the two groups (Figure 6). Our formal regression specification is given in the equation below.

$$Y_{ig\tau t} = Y_g + Y_\tau + \beta \ (Principal \ Reduction_g \times Post_\tau) + x_{it}\partial + \varepsilon_{ig\tau t}$$

Our main outcome variable $Y_{i,g,\tau,t}$ is monthly credit card spending for borrower i in calendar month t. g denotes the modification group (HAMP or HAMP-PRA), and τ is the number of months since modification. Y_g captures the modification group fixed effect and Y_τ captures a fixed effect for each month relative to modification. *Principal Reduction$_g$* is a dummy variable that equals 1 for HAMP-PRA recipients only, while *Post$_\tau$* is a dummy variable equal to 1 when $\tau \geq 0$. The coefficient of interest is β, which captures the difference-in-differences effect of principal reduction on credit card spending. x_i is a vector of loan characteristics intended to capture any residual heterogeneity between treatment and control groups. Loan characteristics include LTV at origination and pre-modification unpaid principal balance, LTV, and property value. Standard errors are clustered at the borrower level.[77]

We found that HAMP-PRA recipients in this sample had an average of $109,000 of principal forgiven, and had a statistically insignificant change in their credit card spending as a result. Our point estimate was that monthly credit card spending decreased by 72 cents.

To gross up credit card spending to a measure of total household retail spending, we used the ratio of average household monthly retail spend ($3,351 in 2012) to the average monthly spending by homeowners with a Chase credit card in the 12 months before and after they received a mortgage modification ($226).[78] This gave us a scaling factor of 14.8, which we used to scale our estimates of changes in credit card spending into changes in consumption.[79] After applying the 14.8 scaling factor, annualizing our results and then dividing by the average principal forgiven, we recovered our result that $1 of principal reduction led to a 0.1 cent decrease in consumption. The 95 percent confidence interval ranged from -2 cent to 2 cents.

One potential concern with using credit card spending as a measure of total consumption is that there might be switching to or from other spending channels (e.g., cash, checks, debit cards, or electronic transfers) around modification date. This is a weakness to the extent that there is some reason to believe a mortgage modification would trigger a change in household spending preferences between payment channels, and particularly in a way that was differential between the treatment and control group. While we didn't address this directly, it is unlikely that there is an effect that could cause spending preferences to not only vary between credit card and other payment channels exactly at modification date but also do so differentially for the treatment vs. the control group. To further address this weakness, we note that Ganong and Noel (2017) used auto expenditures as another measure of consumption and found that principal reduction had no impact on auto expenditures, in accordance with our results in Finding 4.

For payment reduction, we measured the marginal propensity to consume by employing the same two identification strategies we used in our analysis of the effect of payment reduction on default, but in this instance, the outcome variable was credit card spending. In both cases, our estimates were not statistically significant, though we did not have enough power to reject economically significant impacts. Using the instrumental variables identification strategy, we estimated that $1 of payment reduction increased consumption by 13 cents and the 95 percent confidence interval ranged from -22 cents to 48 cents. Using the regression discontinuity identification strategy, we estimated that $1 of payment reduction decreased consumption by $1.91 and the 95 percent confidence interval ranged from -$5.22 to $1.40. In both cases, our sample was not large enough to provide us with economically meaningful results.

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Endnotes

1   Ratio of Median Family Holding of Non-Financial Assets, Primary Residence to Median Family Net Worth among Homeowners from the 2013 Survey of Consumer Finances, sourced from Haver Analytics.

2   As per the National Bureau of Economic Research, the Great Recession began in December 2007 and lasted until June 2009.

3   We limit our sample to first modifications only because we would expect subsequent modifications to be different along many observable and unobservable dimensions.

4   See note 1 above.

5   Consumer Expenditure Survey—2016, Bureau of Labor Statistics, source: https://www.bls.gov/cex/.

6   As of June 30, 2017, source: https://www.census.gov/housing/hvs/files/currenthvspress.pdf.

7   As of 2015, source: http://www.urban.org/sites/default/files/publication/82556/2016.07.13%20Measuring%20American%27s%20Net%20Housing%20Wealth_final4.pdf.

8   Quarterly Report on Household Debt and Credit, Federal Reserve Bank of New York, August 2017.

9   Throughout this report, we define default as a loan being 90 or more days past due, unless noted otherwise.

10 See note 2 above.

11 Calculated as the percentage change in the annual averages from 2006 to 2011 for the S&P/Case-Shiller Home Price Index: US National Index, the Freddie Mac House Price Index, CoreLogic National House Price Index, FNC Residential Price Index (Composite - 20 MSAs), all sourced from Haver Analytics.

12 Source: CoreLogic Negative Equity Report Q4 2011. See http://www.corelogic.com/about-us/news/corelogic-reports-negative-equity-increase-in-q4-2011.aspx.

13 Source: Bureau of Labor Statistics, Seasonally Adjusted Unemployment Rate.

14 In this instance, delinquency is defined as loans 30 days or more past due. Source: Federal Reserve Bank of St. Louis, Delinquency Rate on Single-Family Residential Mortgages, Booked in Domestic Offices, All Commercial Banks. See https://fred.stlouisfed.org/series/DRSFRMACBS.

15 The MHA Handbook suggests "a borrower is at risk of imminent default and will be evaluated for a HAMP modification if the borrower is at least 15 days delinquent, has documented a financial hardship, and has represented that he or she does not have sufficient liquid assets to make the monthly mortgage payment. When making an imminent default determination, the servicer must evaluate the borrower's hardship as well as the condition of and circumstances affecting the property securing the mortgage loan. The servicer must consider the borrower's financial condition, liquid assets, liabilities, combined monthly income from wages and all other identified sources of income, monthly obligations (including personal debts, revolving accounts, and installment loans), and a reasonable allowance for living expenses such as food, utilities, etc. The hardship and financial condition of the borrower must be verified through documentation." See MHA HAMP Handbook for more details, https://www.hmpadmin.com/portal/programs/docs/hamp_servicer/mhahandbook_51.pdf.

16 In our data, the number of GSE modifications completed increases considerably in April 2010. The 2010 FHFA annual report to Congress (page 5) notes that the number of completed loan modifications tripled in 2010 relative to 2009.

17 For example, see the Making Home Affordable Program Performance Report through the Second Quarter of 2015.

18 Mortgage payment-to-income is the ratio of monthly mortgage payment, including principal, interest, taxes, insurance, and association fees, to monthly income. It is also referred to as front-end debt-to-income (DTI) ratio. Income is sourced from mortgage modification applications, as all borrowers who applied for a standard modification from HAMP or the GSE program had to provide documentation of income.

19 Schwartz and Wilson (2008) describes how 30 percent of income became the standard for housing affordability.

20 We focus our discussion on the first iteration of the HAMP program introduced in March 2009, commonly referred to as HAMP Tier 1. Later, additional modification programs such as HAMP Tier 2 and Streamlined HAMP were introduced by the Federal Government, and the eligibility requirements for these programs were different than the eligibility requirements for HAMP Tier 1.

21 The loan-to-value of a mortgage is the ratio of the unpaid principal balance of the loan to the current appraised value of the home.

22 While the HAMP-PRA program had a target LTV ratio of 115 percent, investors received incentive payments from the program for principal reductions that reduced LTV to as low as 105 percent, but not beyond. See page 152 of the MHA HAMP Handbook for more details, https://www.hmpadmin.com/portal/programs/docs/hamp_servicer/mhahandbook_51.pdf.

23 The GSEs Fannie Mae and Freddie Mac entered conservatorship in 2008. The goals of their foreclosure prevention efforts are outlined in the Federal Housing Finance Agency Report to Congress, 2009. See https://www.fhfa.gov/AboutUs/Reports/ReportDocuments/2009_AnnualReportToCongress_508.pdf.

24 Our analysis focused on the standard GSE modification program that was available during our period of analysis (2010 – 2015).

25 For a discussion of the reasons borrowers with a pre-modification mortgage PTI above 31 percent might fail to get a HAMP modification, see the Methodology section of this report.

26 In our data, the average payment reduction for GSE modifications in each pre-modification mortgage PTI bin between 19% and 67% was at least 20 percent (see Figure 2).

27 The FHFA announced their principal reduction modification program on April 14, 2016, as per https://www.fhfa.gov/Media/PublicAffairs/Pages/FHFA-Announces-PRM-Program-and-Further-Enhancements-to-NPL-Sales-Reqts.aspx. For a full description of the GSE modification programs, see https://www.fanniemae.com/content/guide/servicing and http://www.freddiemac.com/singlefamily/guide/.

28 See note 20 above.

29 See note 22 above.

30 A borrower who receives principal forbearance no longer accrues or pays interest on the amount of principal forbearance, and the principal forbearance amount is non-amortizing. The borrower must repay the principal forbearance amount upon the earlies of transfer of property, payoff of the mortgage, or at maturity of the loan.

31 In Figure 1, we have made the simplifying assumption that the final rate at which all HAMP modifications reset is 4.11%, which is the average of the weekly Freddie Mac primary mortgage market rate from July 2010 to November 2014 (the period during which the mortgages in this sample were modified).

32 See note 18 above for a definition of mortgage PTI.

33 Payment reduction includes reductions in principal and interest.

34 As per the US Department of Housing and Urban Development's November 2016 and December 2016 scorecards, sourced from https://www.hud.gov/sites/documents/SCORECARD_2016_12_508C.PDF and https://www.hud.gov/sites/documents/SCORECARD_2016_11_508C.PDF

35 We arrived at this result by applying our treatment effect expressed in percentage point terms (a 10 percent payment reduction reduced default rates by 2.6 percentage points) to the 6.5 million modification recipients. Note that while our treatment effect is calculated using first modifications only, the 6.5 million figure includes both first and any subsequent modifications. See the Methodology section of this report for a complete description of our treatment effect.

36 See the Data Asset section of this report for a complete description of this sample.

37 For a complete description of this analysis, see the Methodology section of this report.

38 See the Data Asset section of this report for a complete description of this sample.

39 Under standard assumptions, this strategy can be thought of as a randomized experiment for borrowers in a narrow region around 31 percent pre-modification mortgage PTI, as in Lee (2008).

40 Figures may not sum correctly due to rounding.

41 See the Methodology section of this report for a complete discussion of this analysis.

42 These results are only valid for underwater borrowers because HAMP-PRA modifications did not restore positive equity.

43 As described in Box 1, HAMP-PRA inserted a step early in the standard waterfall in which principal would be forgiven for eligible borrowers with an LTV above 115 percent as a way to reduce their mortgage debt and mortgage payment. As a result, principal forgiveness became a substitute for interest rate reduction or term extension as a lever to reach the HAMP 31 percent affordability target.

44 See the Data Asset section of this report for a complete description of this sample.

45 These 2 estimates are not statistically different from each other.

46 In evaluating loans for HAMP or HAMP-PRA, mortgage servicers computed the expected net present value (NPV) of the mortgage under HAMP and HAMP-PRA, and generally chose the program that had the largest positive impact for the mortgage investor. This created a large jump in the share of borrowers who received HAMP-PRA when the NPV model showed it would be more beneficial to investors than the HAMP alternative. Ganong and Noel (2017) use a regression discontinuity empirical strategy that uses this jump to measure the impact of principal reduction on default.

47 See the MHA HAMP Handbook for a full description of eligibility requirements, https://www.hmpadmin.com/portal/programs/docs/hamp_servicer/mhahandbook_51.pdf.

48 Bhutta et al. (2017) shows evidence that the median borrower in their sample did not walk away from their home until they were deeply underwater (e.g., at CLTVs of 174 percent).

49 See the Data Asset section of this report for a complete description of this sample.

50 See note 42 above.

51 Our sample is limited to mortgage holders with a credit card, so our estimate applies to that subset of homeowners.

52 See the Methodology section of this report for a more detailed description of this identification strategy and our method for grossing up credit card spending to estimate total household retail spending.

53 See the Methodology section of this report for more detail.

54 See the Data Asset section of this report for a complete description of this sample.

55 The income measure we use for this analysis includes all checking account inflows, and combines labor and capital income, government support, electronic transfers, and paper check deposits, and is therefore different than the income measure used in other JP Morgan Chase Institute Reports. For example in Farrell and Greig (2017), inflows are categorized such that 57 percent of inflow dollars are tagged as income.

56 For a discussion of how income recovers following unemployment shocks and the role of unemployment insurance, see Farrell et al. (2016).

57 For this analysis, we have to further restrict the sample used to the roughly 1,800 borrowers who also received a modification within a year of their first default. This restriction is required because borrower income and mortgage PTI data is associated with accepted modification applications.

58 In order to meet minimum aggregation standards, throughout this report medians are calculated as the average of all observations lying between the 49th and 51st percentiles.

59 For the analysis of monthly income and mortgage payment broken out by LTV, we use a sample of Chase mortgage customers who defaulted, which is the same, larger sample used to generate the results shown in Figure 7.

60 This empirical finding is consistent with theoretical work by Eberly and Krishnamurthy (2014) who argue that when borrowers are liquidity constrained, as is often the case in an economic crisis, that reducing current mortgage payments is more effective than reducing future payments.

61 For a full description of the GSE Flex Modification programs, see https://www.fanniemae.com/content/announcement/ll1606.pdf and http://www.freddiemac.com/learn/pdfs/service/flex_mod_ref_guide.pdf. For a full description of the "One Mod" proposal, see http://www.onemod.org/.

62 Total DTI, or back-end DTI, includes monthly obligations on all debts (mortgage, auto, student loan, credit card, etc.) as well as other commitments such as alimony and child support.

63 From Schwartz and Wilson (2008), we infer that the 43% total DTI limit is a combination of the 30 percent of income standard for housing affordability and the 12 percent limit on consumer debt for FHA-insured mortgages.

64 The considerable heterogeneity in housing supply and demand make it difficult to find a single level of mortgage PTI or total DTI that indicates affordability across households and regions.

65 See the SIGTARP July 29, 2015 Quarterly Report to Congress, Table 3.2.

66 See Farrell and Greig (2015) for a discussion of how the typical household lacks a sufficient financial buffer to weather the degree of income and consumption volatility observed in our data.

67 HAMP modifications offered a temporary reduction in interest rate for five years, followed by a step-up in interest rate that increased monthly payments annually. While modification programs have moved away from this type of step-up up feature, should it return, borrowers would be asked to make an additional trade-off between lower near-term payments and higher long-term payments.

68 At its September 20, 2017 meeting, the Federal Open Market Committee announced that they will initiate a balance sheet normalization program and reduce their holdings of Treasury and agency securities in October 2017. The program is described in https://www.federalreserve.gov/newsevents/pressreleases/monetary20170614c.htm.

69 For example, see Mishkin (2007) for a discussion of monetary policy and the housing wealth effect.

70 For example, DiMaggio et al. (2016) shows evidence that temporarily raising the LTV cutoff for refinancing a GSE-backed mortgage from 80 percent to 90 percent during the December 2008–May 2009 period would have led to a 16 percent increase in refinanced loans and a 20 percent increase in the amount of equity extraction, further supporting aggregate demand.

71 See note 58 above.

72 See Ganong and Noel (2017) for results that include this sub-sample.

73 Figures may not sum correctly due to rounding.

74 See SIGTARP July 29, 2015 Quarterly Report to Congress, Table 3.2.

75 The local linear regression is estimated using the recommended bandwidth selection procedure from Imbens and Kalyanaraman (2012).

76 Figures may not sum due to rounding.

77 One concern with our research design is that different regions might have been experiencing different trends in their house price recoveries, which affected consumption results. Ganong and Noel (2017) uses a similar research design and addresses this issue through the inclusion of Metropolitan Statistical Area (MSA) by calendar-month fixed effects and finds similar results to our analysis.

78 Average household monthly retail spend calculated as Sales from the Annual Retail Trade Survey divided by the number of total households, both sourced from Census (2012).

79 Our results use a sample of homeowners with a credit card and therefore may differ from estimates based on a broader sample of homeowners.