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Trading Equity for Liquidity:

Bank Data on the Relationship Between
Liquidity and Mortgage Default

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Contact

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Diana Farrell
Kanav Bhagat
Chen Zhao

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Introduction

For many, homeownership is a vital part of the American dream. Beyond providing a place of refuge, owning a home offers a family a store of wealth, a long-term investment, and an asset that can be passed on to the next generation. Buying a home represents one of the largest lifetime expenditures for most homeowners, and the mortgage has generally become the financing instrument of choice. For many families, their mortgage will be their greatest debt and their mortgage payment will be their largest recurring monthly expense.

The aftermath of the Great Recession was a particularly difficult period for many homeowners. From the 2006 peak to the 2011 trough, house prices across the country fell roughly 25 to 35 percent.¹ 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.² Over the same period, the unemployment rate nearly doubled, rising from 4.6 percent to 8.9 percent,³ and delinquency rates on residential mortgages rose from 1.7 percent to 10.4 percent.⁴ In response, various mortgage modification programs were introduced to help homeowners struggling to make their mortgage payments avoid default. Furthermore, policymakers took significant steps to change mortgage underwriting, such as through establishing the definition of the Qualified Mortgage.⁵ In this report, we present a combination of new analysis and previous findings from the JPMorgan Chase Institute body of housing finance research to answer important questions about the role of liquidity, equity, income levels, and payment burden as determinants of mortgage default.

Our findings show that liquidity may have been a more important predictor of default than equity, income level, or payment burden, especially for those borrowers with little liquidity.⁶ Specifically, borrowers with little post-closing liquidity defaulted at a considerably higher rate than borrowers with at least three mortgage payment equivalents of liquidity after closing. Furthermore, during the life of their mortgage, borrowers with little liquidity but more equity defaulted at considerably higher rates than borrowers with more liquidity but less equity. In previous [research](#), we found that default closely followed a loss of liquidity, regardless of the borrower’s equity, income level, or payment burden, and that homeowners with fewer than three mortgage payment equivalents of liquidity defaulted at higher rates regardless of their income level or payment burden. Previous [research](#) also showed mortgage modifications that increased borrower liquidity reduced default rates, whereas modifications that increased borrower equity but left them underwater did not impact default rates.

Taken together, our findings suggest that a policy or program encouraging borrowers to make a slightly smaller down payment and use the residual cash to fund an “emergency mortgage reserve” account might lead to lower default rates. A pilot program could test the impact of an emergency mortgage reserve account on default rates and, if impactful and cost-effective, the program could serve as an alternative to underwriting standards based on measuring the borrower’s static ability-to-repay (ATR) using their total debt-to-income (DTI) ratio at origination.

Findings

Finding One

Borrowers with little post-closing liquidity defaulted at a considerably higher rate than borrowers with at least three mortgage payment equivalents of post-closing liquidity.

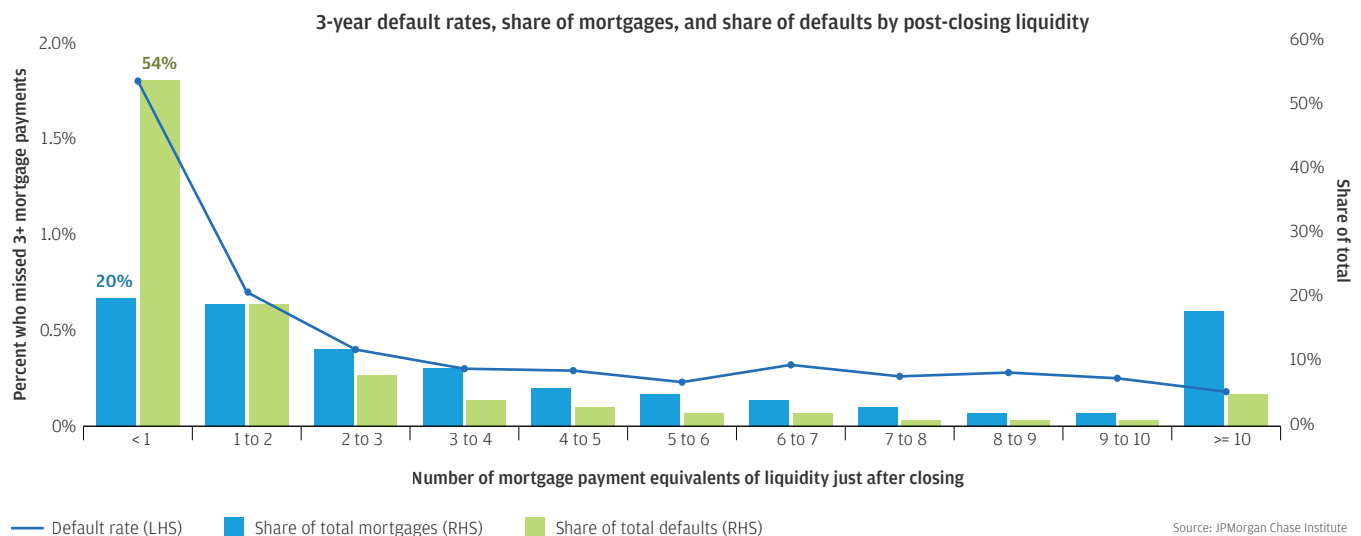
To explore the relationship between post-closing liquidity and default rates, we created a sample of de-identified Chase customers with a mortgage and a deposit account at closing.⁷ Our ability to connect the mortgage servicing and deposit account data for a large sample of households provides us with a unique, integrated lens through which we can examine the connection between default rates and liquidity. To measure liquidity, we observed the borrower's checking and savings account balances in the month after they closed on their mortgage. We then normalized the sum of their checking and savings account balances by dividing by their scheduled mortgage payment, and used this "number of mortgage payment equivalents," or MPEs, to quantify their liquidity.⁸

In Figure 1, we show three-year default rates (defined here and throughout this report as being 90 or more days past due) for borrowers against the liquidity measure described above. Figure 1 also includes the share of mortgages (blue bars) and share of defaults (green bars) at each liquidity level.

For borrowers with low levels of liquidity, there is an evident connection between default rates and liquidity. Borrowers with less than one MPE of post-closing liquidity defaulted at a rate (1.8%) that was more than five times higher than borrowers with between three and four MPEs of liquidity (0.3%). However, at higher liquidity levels, the relationship between post-closing liquidity and default rates was nearly flat: borrowers with between four and ten MPEs of liquidity had default rates between 0.2% and 0.3%.⁹

Borrowers with little in post-closing liquidity made up a disproportionately high share of defaults. Homeowners with less than one MPE in post-closing liquidity made up 20 percent of our sample but accounted for 54 percent of defaults.

Figure 1: In the first three years following origination, borrowers with little post-closing liquidity defaulted at higher rates and made up a disproportionately high share of defaults.

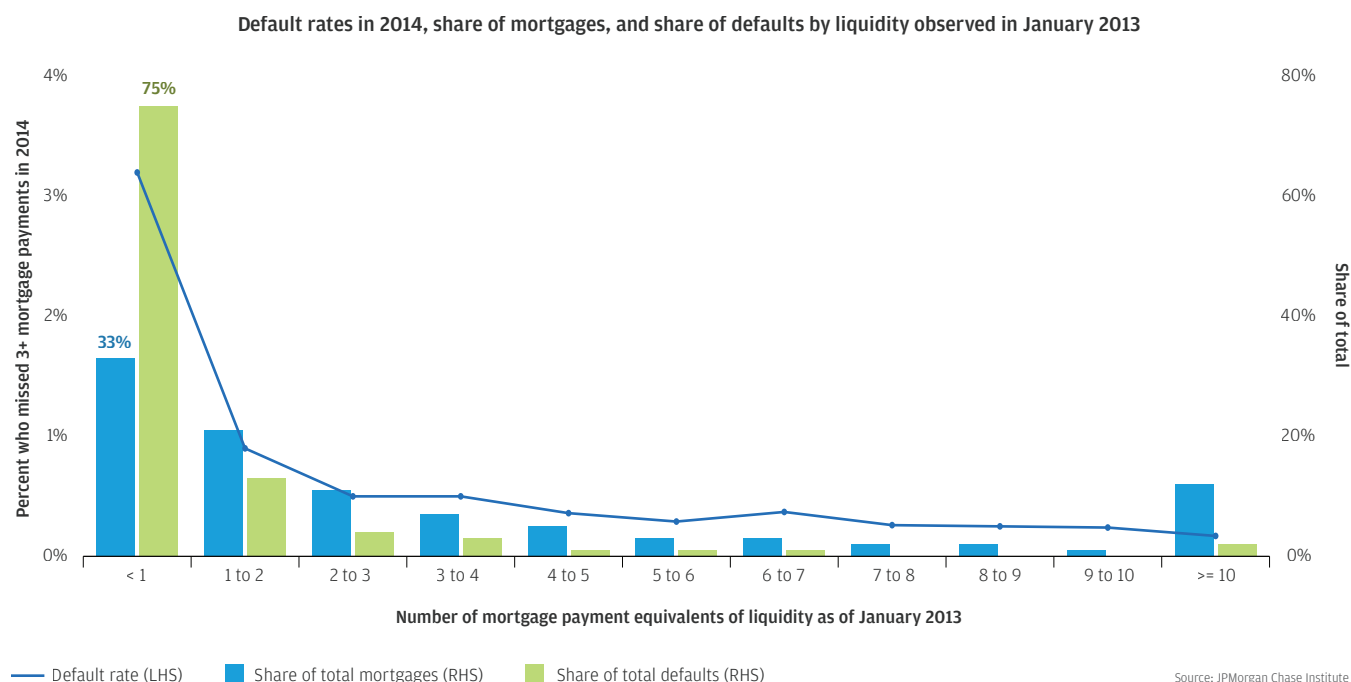


Importantly, the relationship between liquidity and default noted above seems to persist over the life of the mortgage. To reach this conclusion, we repeated the analysis using a sample of de-identified Chase customers with a mortgage and a deposit account in 2013. Figure 2 presents the one-year default rate (defined as being 90 or more days past due in any month of 2014) against liquidity levels observed in January 2013.¹⁰ Like Figure 1, Figure 2 also includes the share of loans at each liquidity level (blue bars) and the share of defaults at each liquidity level (green bars).

Borrowers with less than one MPE of liquidity in 2013 had a 2014 default rate (3.2%) that was more than six times higher than borrowers with between three and four MPEs of liquidity (0.5%). At higher liquidity levels, the relationship between 2013 liquidity and 2014 default rates was fairly flat: borrowers with between four and ten MPEs of liquidity had default rates between 0.2% and 0.4%.¹¹

As was the case at origination, borrowers with little in 2013 liquidity made up a disproportionately high share of 2014 defaults. Borrowers with less than one MPE of liquidity made up 33 percent of our sample but accounted for 75 percent of defaults.

Figure 2: Over the life of their loan, homeowners with little liquidity defaulted at higher rates and made up a disproportionately high share of defaults.



The steep relationship between default rates and liquidity at low liquidity levels observed both following origination (Figure 1) and for more seasoned mortgages (Figure 2) offers correlation-based evidence that encouraging borrowers to maintain a modest level of liquidity after closing and over the life of their mortgage could have a substantial impact on default rates.¹² For example, borrowers could establish and fund an emergency [mortgage reserve account](#) just after closing and maintain the balance over the early life of their mortgage. During periods of financial stress, they could use funds in the account to make their mortgage payment and avoid default.

With this connection between liquidity and default rates in mind, we next examine the potential trade-off between more liquidity and less equity on default rates.

Finding Two

Borrowers with little liquidity but more equity defaulted at considerably higher rates than borrowers with more liquidity but less equity.

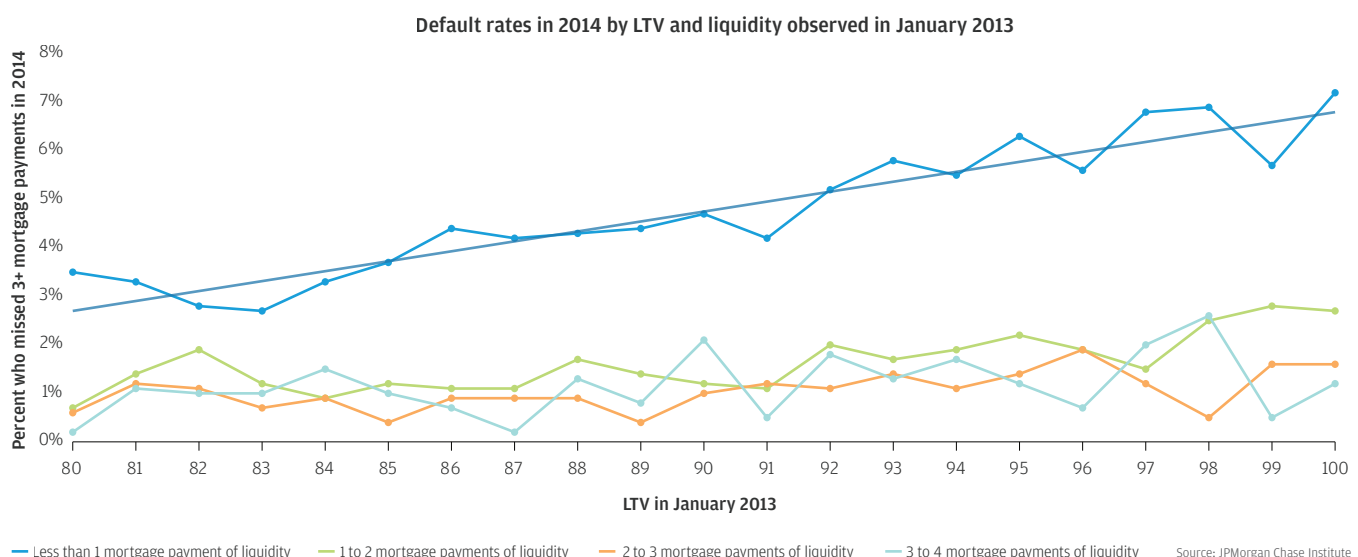
When applying for a mortgage, most would-be homeowners are offered financial incentives (often in the form of a lower interest rate) to make a larger down payment. Conventional wisdom argues that larger down payments, and therefore lower loan-to-value (LTV) ratios, lead to lower default rates and smaller losses given default. However, if the borrower is left with little-to-no liquidity after making a larger down payment, does conventional wisdom regarding lower default rates still apply?

For example, one way to create more post-closing liquidity would be for lenders to accept slightly smaller down payments; in return, borrowers would agree to set aside the residual cash in an emergency mortgage reserve account that could be used to make mortgage payments in the event of financial hardship, thus trading more liquidity for less equity.

To investigate the potential impact on default rates of exchanging more liquidity for less equity, we analyzed the cross-sectional relationship between LTV, liquidity, and default rates. That is, we measured default rates according to LTV, but examined the results separately for various levels of liquidity. Figure 3 presents these cross-sectional results, showing default rates in 2014 according to LTV observed in January 2013, shown separately for borrowers according to the number of MPEs of liquidity on hand in January 2013.¹³ The data in Figure 3 show that, regardless of their LTV, borrowers with less liquidity defaulted at a higher rate than borrowers with more liquidity. In fact, the default rate for borrowers with less than one MPE of liquidity was on average 3.6 percentage points (PP) higher than the default rate for borrowers with between three and four MPEs of liquidity.

Measuring the impact of exchanging less equity for more liquidity requires a translation between equity and liquidity, and to do so we use the fact that, at current interest rates and assuming a 95 percent LTV, 1 PP of house price is about equal to 1.5 monthly mortgage payments (including principal, interest, taxes, insurance, and association fees).¹⁴ We can then use Figure 3 to examine how the trade-off between equity and liquidity could potentially impact default rates. That is, we can compare the default rate of borrowers with a given LTV and liquidity combination to the default rate of borrowers with the given LTV + 1 PP and the given liquidity level + 1.5 MPEs.

Figure 3: Borrowers with little liquidity but lower LTVs in 2013 defaulted at higher rates in 2014 than borrowers with three to four mortgage payments of liquidity and higher LTVs.



In Finding 1, we observed that additional liquidity beyond four MPEs was not associated with lower default rates. Therefore, we focus our analysis on the steep portion of the default rate vs. liquidity curves shown in Figures 1 and 2. We measure the potential impact of trading equity for liquidity by comparing borrowers with less than one MPE of liquidity (assuming that they had on average one-half of an MPE of liquidity) to borrowers with between three and four MPEs of liquidity, noting that it would require a 2 PP higher LTV to transition from the former to the latter.

To illustrate the potential impact on default rates of trading equity for liquidity, consider that in Figure 3 borrowers with a 91 percent LTV and less than one MPE of liquidity had a default rate of 4.2%. Moving 2 PPs to the right along the dark blue line, we note that the default rate for borrowers with less than one MPE of liquidity and a 93 percent LTV (5.8%) was 1.5 PPs higher. However, borrowers with a 93 percent LTV and between three and four MPEs of liquidity had a default rate (1.3%) that was 4.4 PPs lower (moving from the blue line to the teal line), and the combined difference in default rates was a 2.9 PP reduction. In this example, the difference in default rates for borrowers with three additional MPEs of liquidity was considerably larger than the difference in default rates for borrowers with a 2 PP higher LTV (less equity).

Overall, the data in Figure 3 indicate that across the LTV spectrum, borrowers with less than one MPE of liquidity at a given LTV defaulted at a higher rate than borrowers with a 2 PP higher LTV but between three and four MPEs of liquidity. To generalize the potential impact on default rates of trading equity for liquidity during the life of the mortgage, we note that for borrowers with less than one MPE of liquidity, every 2 PP increase in LTV increased default rates by about 0.4 PPs (twice the slope of the blue line). In contrast, default rates for borrowers with a 2 PP higher LTV but between three and four MPEs of liquidity (teal line) had default rates that were at a minimum 1.3 PPs lower and on average 3.4 PPs lower than default rates for borrowers with less than one MPE of liquidity.¹⁵

It is important to emphasize that we have not established a causal relationship between default and a slightly higher LTV at origination accompanied by increased post-closing liquidity. As with the relationship between liquidity and default in Finding 1, the relationship among liquidity, LTV, and default shown in Figure 3 is correlation-based evidence across a sample of borrowers. The differences in borrower characteristics (both observed and unobserved) across different LTV or liquidity bins mean that the causal impact of changing a given borrower's liquidity or LTV on that borrower's likelihood of default will be different than the slopes of the lines shown in Figure 3 and in Finding 1. Therefore, encouraging borrowers with little liquidity to make a slightly smaller down payment and save three to four MPEs may not reduce their default rates to match the borrowers who naturally saved three to four MPEs.

While the correlation-based evidence presented in Figure 3 provides an estimate for the trade-off between the impact of equity and liquidity on default rates, there are many reasons as to why experimental or quasi-experimental evidence might show a different estimate. Overall, for the reasons outlined below, we think the treatment effect of exchanging less equity for more liquidity on default is likely to be smaller than that implied by Figure 3.

We think there are two reasons to believe that the slope of the lines shown in Figure 3 provide an upper-bound estimate of the causal impact of a decrease in **equity** on mortgage default. First, we think that because borrower credit quality decreases at higher LTV levels, a line showing the causal impact of LTV on default would be flatter than the lines in Figure 3. Second, because it is difficult for a lender to directly measure borrower preferences regarding savings, we think that lenders use LTV (i.e. the size of the down payment) and mortgage reserves measured upon application as a proxy for the borrower's willingness and ability to save (and create liquidity) in the future—and therefore as a predictor of default risk.¹⁶ However, the data in Figure 3 suggest that there is a stronger relationship between liquidity and default compared to LTV and default, because the difference in default rates between borrowers with little liquidity and borrowers with three to four MPEs of liquidity was substantial regardless of LTV. A smaller estimate of the causal impact of a decrease in equity on mortgage default than shown in Figure 3 would also be consistent with the causal evidence we discuss in Finding 5 on the negligible impact of increasing equity on default for a group of underwater borrowers receiving modifications.

We think the slope of the curve in Figure 1 and the difference in default rates between borrowers with little liquidity and borrowers with three to four MPEs of liquidity shown in Figure 3 may overestimate the causal impact of additional **liquidity** on default rates. For example, it could be the case that borrowers with three or four MPEs of liquidity were less likely to default than borrowers with less liquidity because they had different preferences with respect to consumption and savings and chose to cut consumption or draw on funds from their social networks rather than default on their mortgage. If true, an emergency mortgage reserve account would not necessarily change borrower preferences and therefore the impact of additional liquidity on default rates could be reduced.

In addition, our measure of liquidity only includes balances from Chase checking and savings accounts. If we were able to include liquidity from other accounts, the treatment effect of additional liquidity on default rates would likely be smaller. Borrowers with more observed liquidity are more likely to have unobserved liquidity and are therefore less likely to default. Including total liquid assets in our analysis would raise the default rate for borrowers with less than one MPE of liquidity but flatten the default curves in Figures 1 and 2. Likewise, including total liquid assets in our analysis would likely reduce the difference in default rates between borrowers with less than one MPE of liquidity and borrowers with between three and four MPEs in Figure 3.¹⁷

However, a countervailing measure that could partially offset the two factors above and increase the impact on default rates of exchanging less equity for more liquidity would be to attach some access requirements to the emergency mortgage reserve account described in Finding 1. Including design features that encourage the borrower to only withdraw funds during periods of financial stress and use the funds to make their mortgage payment would likely increase the impact of the emergency mortgage reserve account on default rates.¹⁸

In sum, we think the treatment effect of an emergency mortgage reserve account on defaults is likely to be smaller than implied by Figure 3. While we think the causal impact of a decrease in equity on default is smaller than shown in Figure 3, the causal impact of an increase in liquidity is likely positive but also somewhat smaller than illustrated in Figure 3. Future research could attempt to measure the trade-off between equity and liquidity while controlling for observed characteristics and could potentially limit the selection bias due to unobserved characteristics by employing an identification strategy that exploits an exogenous source of variation.

It is important to note that default rates are generally higher for more seasoned loans. For instance, the default rates shown in Figure 1 are for the three years following origination, and they are lower than the default rates shown in Figure 2 which cover a sample of more seasoned mortgages. Therefore, the actual treatment effect of an emergency mortgage reserve account on default rates would be smaller in the first year or two following origination than the impact of additional liquidity depicted in Figure 3.

In the preceding analysis, we examined the impact of trading equity for liquidity on default rates during the life of the mortgage. One natural question that arises is, “what would a similar cross-sectional analysis using LTV and liquidity observed at origination show?” If the inherent effects of liquidity and equity on default during the life of the mortgage are similar to the effects at origination, then the above analysis provides suggestive evidence that trading equity for additional liquidity at origination may also reduce default rates.

It is important to consider the trade-off between liquidity and equity at origination because after closing the two become much less fungible. That is, while checking and savings accounts are always liquid, borrowers cannot access their home equity via a cash-out refinancing or home equity loan without a satisfactory credit score, a sufficiently low LTV, and enough liquidity to pay for any closing costs that are not rolled into the loan balance. The financial preconditions required to refinance a mortgage limit the effectiveness of home equity as a liquidity source, particularly during the early life of the mortgage before amortization has naturally increased LTV. [Research](#) shows that during the post-Great Recession period, the financial preconditions required to refinance a mortgage limited its availability and that the [distributional effects of refinancing](#) limited the effectiveness of home equity as a liquidity tool for many homeowners.

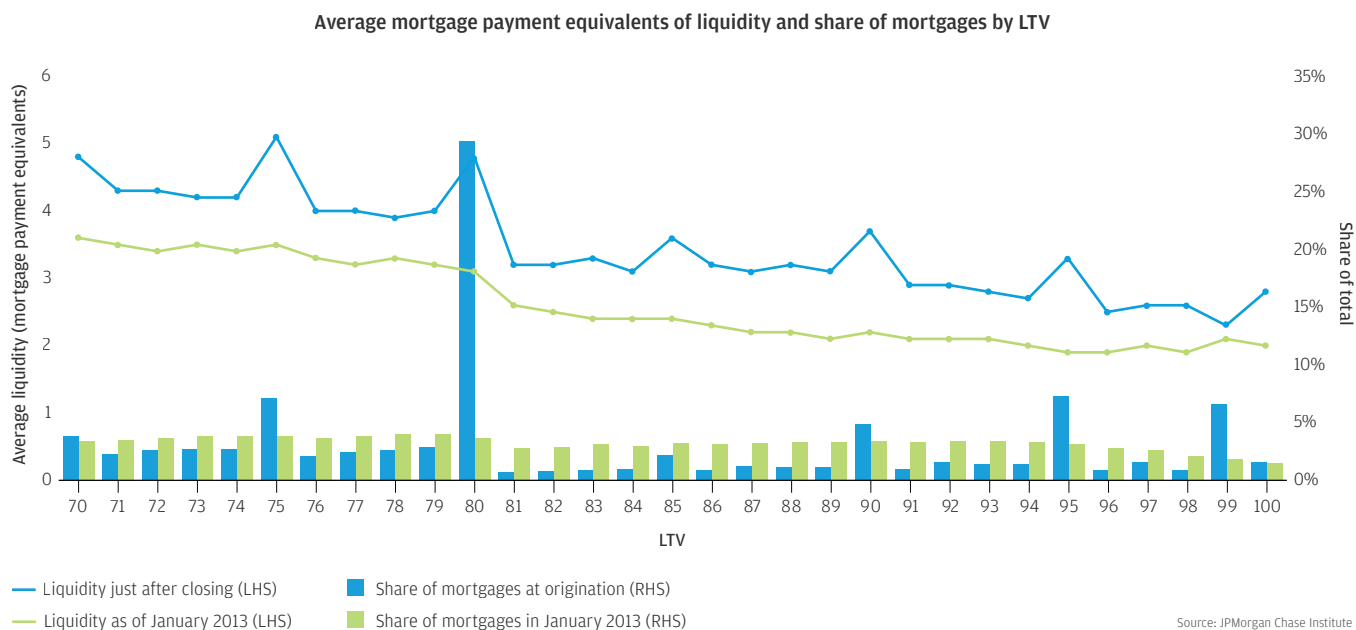
We repeated the analysis above using LTV and liquidity measured at origination. The presence of additional selection bias at origination relative to the above analysis based on LTV and liquidity observed in 2013 confounds the origination analysis, making it less robust and generating noisier, albeit consistent, results.

To illustrate the evidence of selection bias at origination, we show in Figure 4 the average borrower liquidity and share of mortgages in each LTV bin at origination and as of January 2013. Beginning with the origination data, there is clear evidence of selection bias; for example, the share of mortgages in each LTV bin exhibits bunching at “price-break” origination LTVs (i.e. 75%, 80%, 90%, 95%, and 99%). The bunching in the share of mortgages in these LTV bins is likely caused by pricing incentives and introduces large differences in sample sizes for adjacent LTV bins. These are the same pricing incentives that encourage borrowers to increase the size of their down payment, as noted above.

There are also likely important differences in borrower characteristics related to underwriting among borrowers in adjacent LTV bins, and these differences contribute to the spikes in post-closing liquidity for borrowers at the price-break origination LTVs shown in Figure 4. The same pricing incentives that encourage borrowers to hit certain LTV targets also create spikes in average borrower liquidity at the price-break origination LTVs. For example, if there is no pricing incentive for a borrower to put down more than 20 percent, many borrowers that could put down 22 percent instead put down 20 percent and keep the residual cash in their deposit account, boosting the average borrower liquidity in the 80 percent LTV bin.

It is important to consider the trade-off between liquidity and equity at origination because, after closing, homeowners cannot access their home equity without meeting financial preconditions.

Figure 4: There is clear evidence of selection bias in the share of mortgages and liquidity according to LTV bin at origination that is not evident in the share of mortgages and liquidity according to LTV bin in 2013.

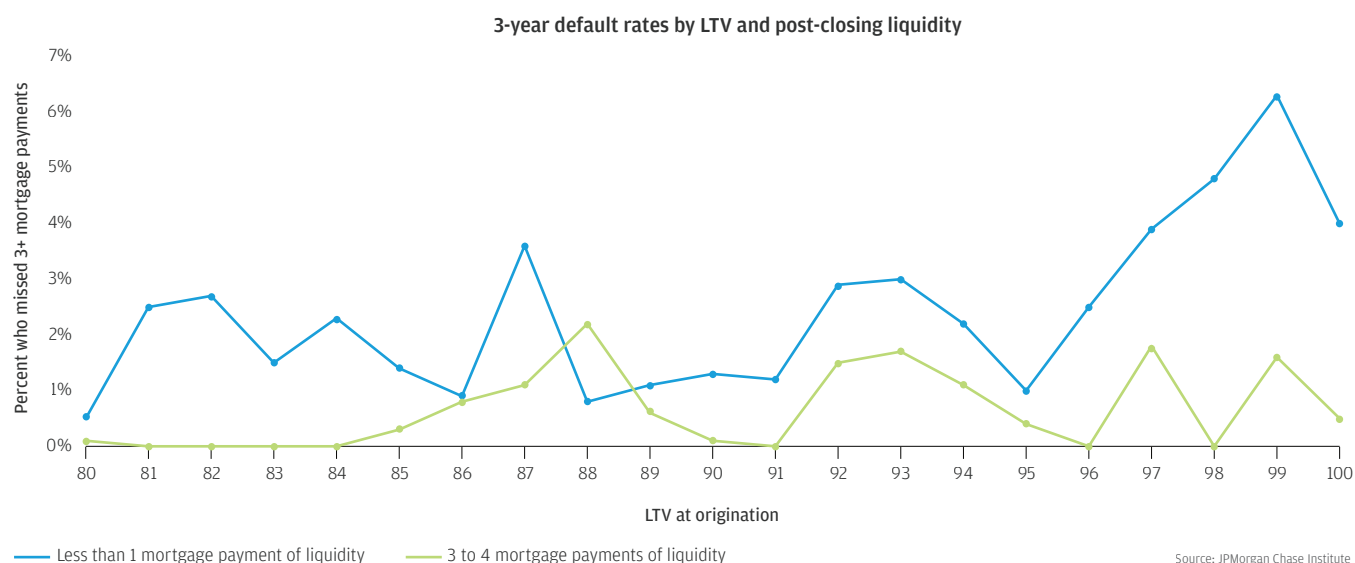


Some, but not all, evidence of the selection bias present at origination is not apparent in the January 2013 observations. By 2013, borrowers who chose a particular LTV at origination were more smoothly distributed across the LTV spectrum due to the effects of home price appreciation and amortization. In addition, average liquidity levels observed in 2013 are more smoothly distributed across the LTV spectrum.

With the selection bias noted above in mind, in Figure 5 we illustrate the cross-sectional relationship between post-closing liquidity, origination LTV, and default rates. Using the same sample of Chase customers with a mortgage and a deposit account at the time of their closing, we present three-year default rates according to their origination LTV separately for borrowers according to their liquidity observed in the month after closing.¹⁹ Figure 5 is analogous to Figure 3, but for clarity, in Figure 5 we only present data for borrowers with less than one MPE of liquidity and borrowers with between three and four MPEs of liquidity.

The data in Figure 5 show that, for most levels of origination LTV, borrowers with a smaller amount of post-closing liquidity defaulted at a higher rate than borrowers with a larger amount of post-closing liquidity. In fact, the default rate for borrowers with less than one MPE of liquidity (2.4%) was on average 1.9 PPs higher than the default rate for borrowers with between three and four MPEs of liquidity (0.4%).²⁰

Figure 5: Borrowers with little post-closing liquidity but lower origination LTVs defaulted at a similar or higher rate than borrowers with between three and four mortgage payment equivalents of liquidity but higher origination LTVs.



We use the same translation noted above (1 PP of house price is about equal to 1.5 monthly mortgage payments) to examine the potential impact of trading equity for liquidity at origination on mortgage default. Using the data in Figure 5, we compared the default rate for borrowers with a given LTV and less than one MPE of liquidity to the default rate for borrowers with the given LTV + 2 PPs and between three and four MPEs of liquidity.

Borrowers with less than one MPE of liquidity and a given origination LTV (blue line) had a similar or higher default rate than borrowers with a 2 PP higher origination LTV but between three and four MPEs of post-closing liquidity (green line). This is true for almost every origination LTV level. The average difference in default rates between borrowers with a given origination LTV and less than one MPE of post-closing liquidity and borrowers with a 2 PP higher origination LTV and between three and four MPEs of post-closing liquidity was 1.4 PPs.²¹

Our analysis of default rates by LTV and liquidity at origination shows the same directional effect of reducing equity in exchange for more liquidity. This provides additional, if imperfect, correlation-based evidence that for borrowers who would otherwise have little post-closing liquidity, reducing their down payment and holding the cash in an emergency mortgage reserve account to be used in the event of financial distress could reduce default rates. However, because of the additional selection bias noted above, the results from this analysis are less robust than would be ideal.

As with the analysis using LTV and liquidity observed in 2013, we have not established a causal relationship between a slightly higher LTV at origination accompanied by increased post-closing liquidity and default. In Figure 5, the homeowners represented by the blue line are different along many dimensions from the homeowners represented by the green line, as are the borrowers at different LTV levels, and, as discussed above, the actual treatment effect of an emergency mortgage reserve account on default rates will be different.

Finding Three

Default closely followed a loss of liquidity regardless of the homeowner's equity, income level, or payment burden.

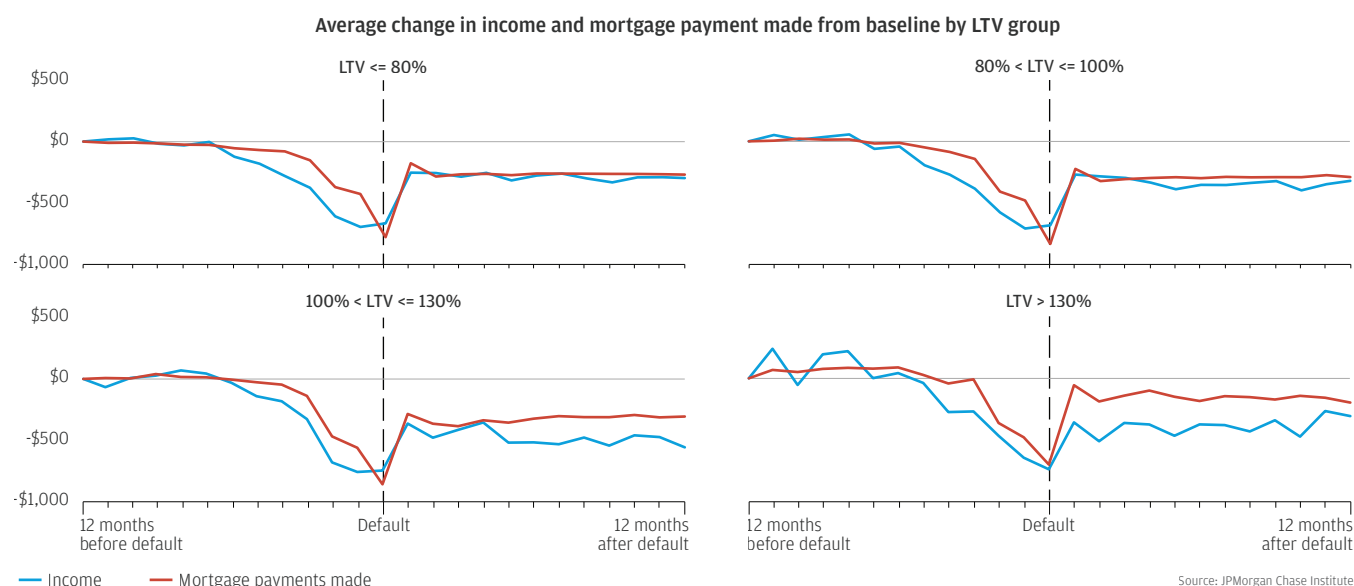
Next, we return to analysis presented in previous [research](#) to further examine the connection between mortgage default and liquidity, equity, income level, and payment burden. For a sample of Chase customers with a mortgage and deposit accounts who defaulted on their mortgage, default closely followed a negative income shock, regardless of their equity, income level, or payment burden.²²

In the analysis that follows, the negative income shock that preceded default appears to be transitory—on average, income levels recover, albeit not to the baseline income level observed 12 months prior to default. Because liquidity can counterbalance a transitory income loss, we characterize the transitory negative income shock that precedes default as a loss of liquidity.

We begin our analysis with an examination of the relationship between liquidity and mortgage default for borrowers with various levels of home equity who defaulted. In Figure 6, we chart the change in the path of monthly income and mortgage payment made over the 12 months before and after default relative to baseline (12 months before default) for borrowers who defaulted.²³ Here and throughout this finding, we define income as all checking account inflows.²⁴ The results are shown separately for homeowners according to their LTV at the time of default (LTV below 80 percent, between 80 and 100 percent, between 100 and 130 percent, above 130 percent).

The relationship between income and mortgage payment made is similar across all four LTV bands: income steadily dropped in the months leading up to default, regardless of the borrower's home equity. To the extent that income recovered after default, mortgage payments recovered as well. The similar pattern across all four equity bands provides further evidence that a loss of liquidity (represented by a temporary drop in income) was a more important determinant of default than equity level, even for borrowers with considerable amounts of negative equity. If borrowers were defaulting simply because they owed more on their mortgage than their house was worth, a type of "strategic default" behavior, our analysis would show a smaller drop in income around default for borrowers in the bottom two panels of Figure 6. Therefore, our results are inconsistent with this simple type of strategic default.

Figure 6: Default followed a temporary income loss for borrowers across the LTV distribution, suggesting a loss of liquidity was a more important determinant of default than negative equity.



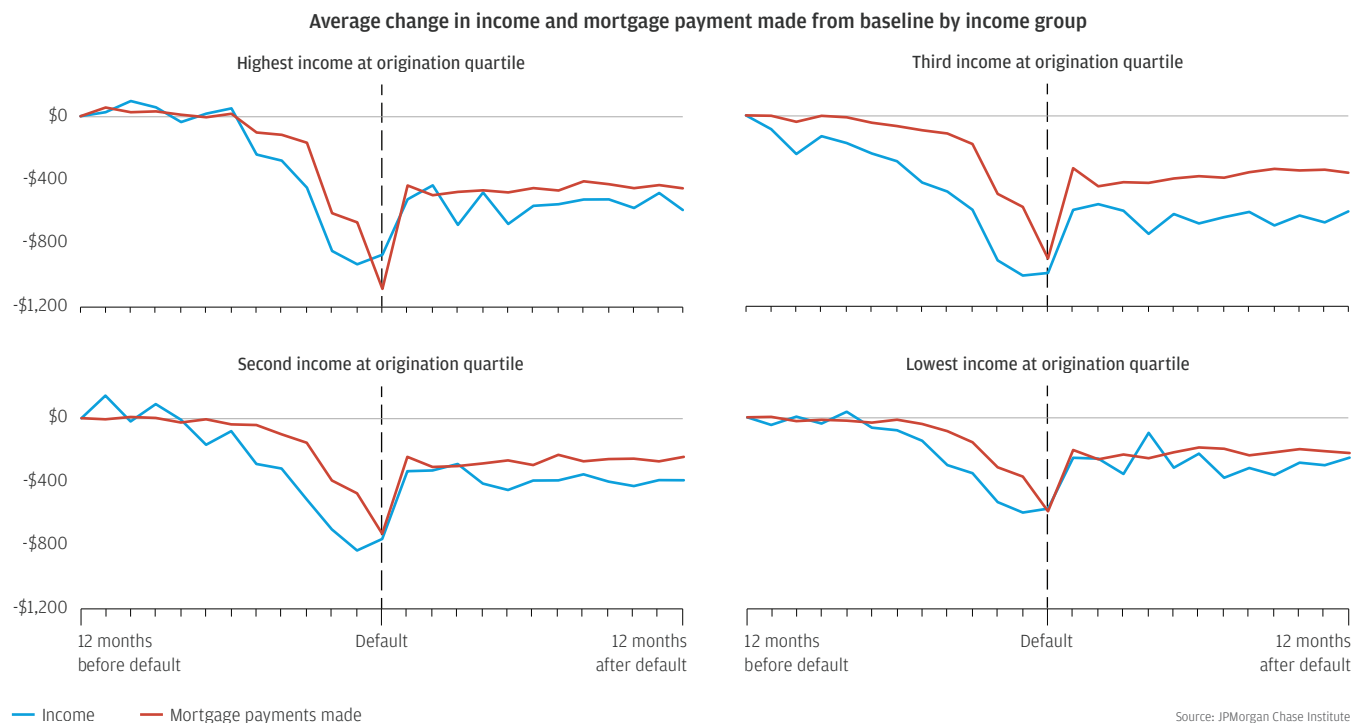
Next, we examined the relationship between liquidity and mortgage default for borrowers who defaulted according to their income at origination. We split our sample into quartiles according to the verified gross income on their mortgage application.²⁵ Figure 7 is analogous to Figure 6—we again chart the change in monthly income and mortgage payment made over the 12 months before and after default relative to baseline (12 months before default) for borrowers who defaulted. However, in Figure 7 we show separate results according to the income quartile of the borrower at origination.

On average, for borrowers in all four income quartiles, the relationship between income and mortgage payments was strikingly similar, indicating that regardless of income level, borrowers who defaulted did so after experiencing a steady drop in income in the months prior to default. Notably, even borrowers in the highest income quartile, where the average income at origination was over \$110,000 per year, may have defaulted as a result of an income drop.

Furthermore, though higher income borrowers experienced smaller percentage income losses prior to default (as expected), there was no substantial difference across the income quartiles in terms of the gap between when income started to drop and when borrowers started to miss mortgage payments. Borrowers in both the highest and lowest income quartiles were unable to make their full mortgage payment just a few months after experiencing a loss in income.

The data in Figure 7 suggest that though income and liquidity are generally correlated, the higher income households in this sample who defaulted on average did not have enough liquidity to withstand the loss in income and delay default, providing further evidence that for borrowers who defaulted, a loss of liquidity was a more important determinant of default compared to income level. The data in Figure 7 also support the idea that maintaining an emergency mortgage reserve account for use during financial stress could be an effective default mitigation tool for borrowers across the income spectrum.

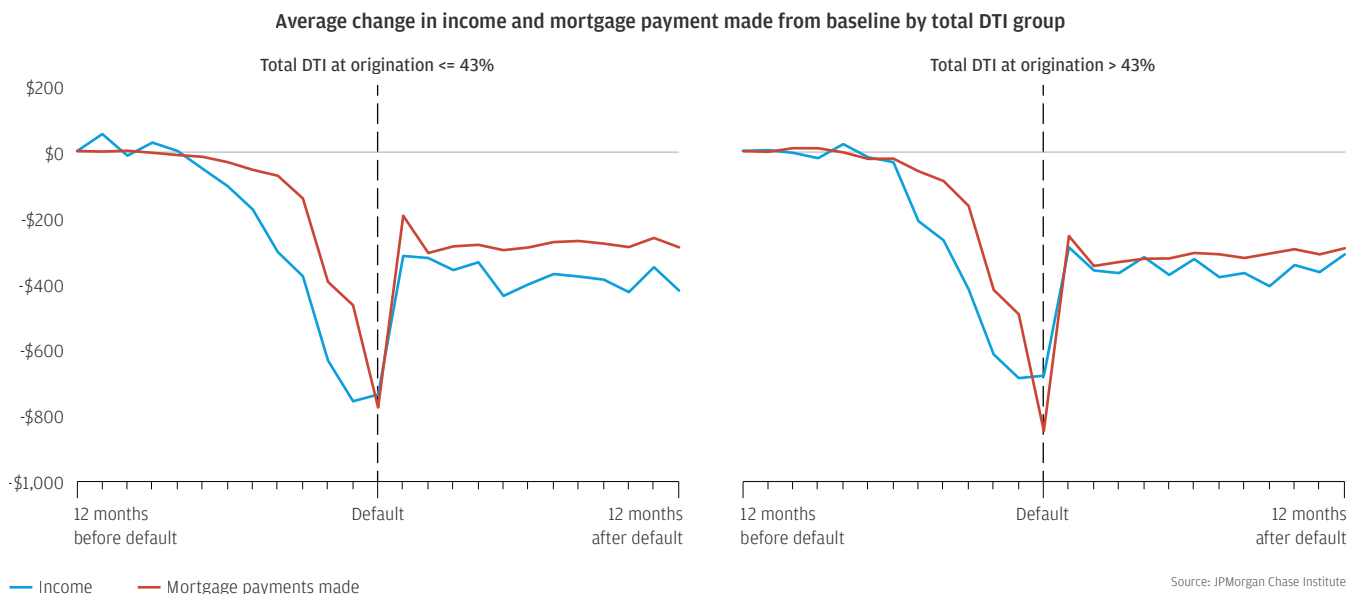
Figure 7: Default followed a temporary income loss for borrowers across the income distribution, suggesting a loss of liquidity was a more important determinant of default than income level.



Finally, we examined the relationship between liquidity and mortgage default for a sample of borrowers who defaulted and for whom we could observe their total debt-to-income (DTI) ratio at origination (a measure of payment burden). Total DTI, which includes monthly obligations on all debts (mortgage, auto loan, student loan, credit card, etc.) as well as other commitments such as alimony and child support, has become an important underwriting standard, as the ability-to-repay (ATR) standard requires that a borrower's total DTI not exceed 43 percent in order to satisfy the Qualified Mortgage rule.²⁶

Figure 8 shows the change in monthly income and mortgage payment made over the 12 months before and after default relative to baseline (12 months before default) for borrowers who defaulted, based on whether their total DTI at origination was below the 43 percent ATR threshold (left panel) or above the 43 percent ATR threshold (right panel). The income pattern that precedes default was similar for both groups, suggesting that a loss of liquidity rather than a high payment burden triggered default. If a high payment burden alone were enough to trigger default, then we would expect to see much less of an income shock or no income shock for those borrowers with a total DTI above 43 percent.

Figure 8: Default followed a temporary income loss for borrowers above and below the 43 percent total DTI at origination threshold, suggesting that a loss of liquidity rather than payment burden at origination triggered default.



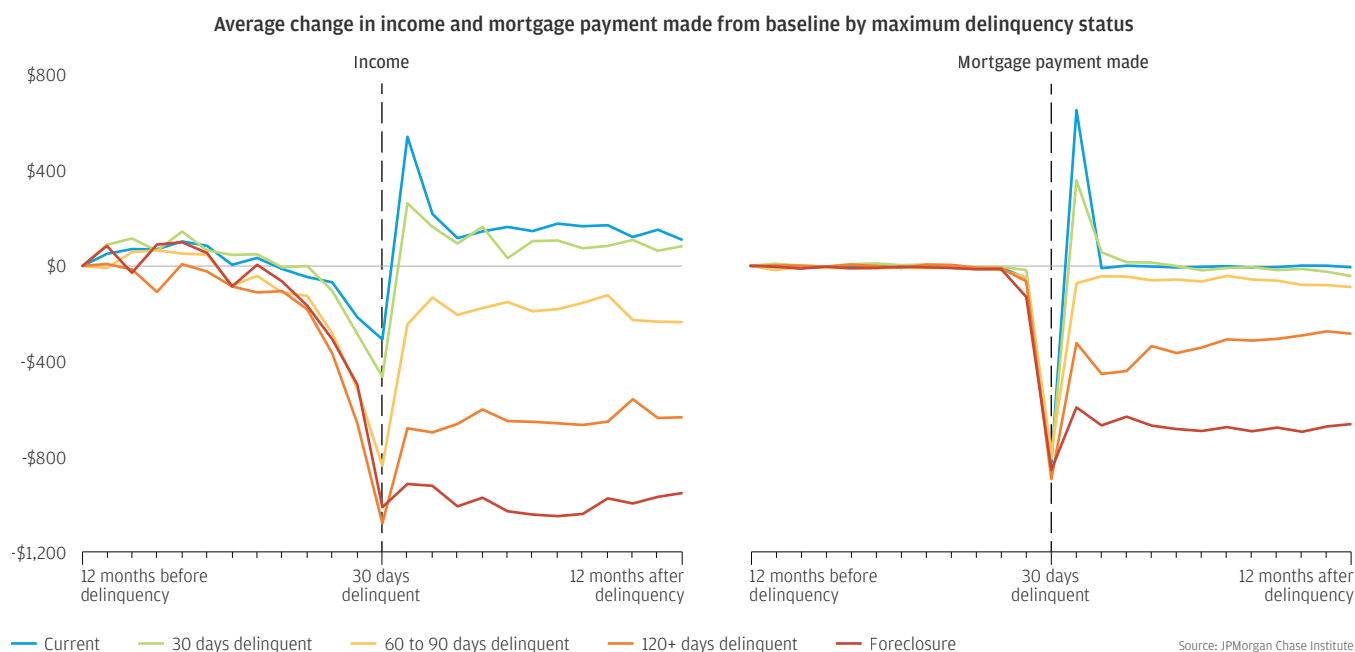
The data in Figure 8 suggest that underwriting standards reliant on affordability targets based on steady-state income measured at origination may not be the most effective method for reducing mortgage defaults, as they cannot account for future income volatility or measure a household's ability to withstand this volatility. In contrast, an emergency mortgage reserve account funded at origination and maintained over the early life of the mortgage may be a more effective default mitigation tool as the funds in the reserve account would be available during periods of financial stress.

To review, in Figures 6, 7, and 8, the negative income shock that preceded default appears to be transitory—on average, income levels recovered, albeit not to the baseline income level observed 12 months prior to default. But what happens to these borrowers after default? To better understand the connection between income loss and delinquency severity in the months that followed default, we categorized a sample of borrowers who missed just one mortgage payment according to their maximum delinquency observed over the next 12 months. The results, shown in Figure 9, indicate that homeowners who experienced larger negative income shocks and less income recovery had more severe delinquencies in the following year.

The liquidity in an emergency mortgage reserve account could help homeowners facing financial distress by providing them with a few months to assess their financial situation and make the appropriate decisions for their family.

The left panel of Figure 9 shows, for borrowers who missed one mortgage payment, the change in their monthly income over the 12 months before and the 12 months after their missed payment. The right panel shows the change in mortgage payment made for this same set of borrowers and time frame. In each panel, borrowers are grouped according to their maximum delinquency status in the 12 months after they missed their first mortgage payment. Borrowers in the current category, who made two payments in the next month and then did not miss a payment in the next 12 months, exhibited a complete income recovery. In contrast, borrowers who fell further delinquent or into foreclosure showed larger and longer duration losses in income. We conclude from the evidence in Figure 9 that recovery from delinquency was closely tied to income recovery—the degree and speed of homeowner recovery from default varied with the degree and speed of their income recovery.

Figure 9: Following an initial 30-day delinquency, homeowners who experienced larger negative income shocks and less income recovery had more severe delinquencies in the following year.



The evidence in Figure 9 provides support for our treatment of the transitory income drops we observe just prior to default in Figures 6 through 8 as a proxy for a loss of liquidity and suggests that an emergency mortgage reserve account funded with three to four MPEs could help homeowners experiencing a transitory drop in income avoid default.

For example, a household that suffers what they estimate to be a temporary income loss lasting just a few months could use the funds in their emergency mortgage reserve account to continue making their mortgage payment until their income recovers. Such a household might be included in the borrowers who fell to 60 to 90 days delinquent in Figure 9.

For homeowners with positive equity who suffer a deeper or more permanent income loss, an emergency mortgage reserve account could allow them to continue making their mortgage payment while they put their house up for sale and look for alternate accommodations or pursue a mortgage modification. This household might be included in the category of borrowers who were 120 or more days delinquent in Figure 9.

The borrowers who transitioned from one missed mortgage payment into the foreclosure process within 12 months represent homeowners who suffered acute and persistent financial distress.

In each of the examples above, an emergency mortgage reserve account might have helped homeowners simply by providing them immediate relief for a few months during which they could better assess their financial situation and make the appropriate decisions for their family.

Finding Four

Homeowners with fewer than three mortgage payment equivalents of liquidity defaulted at higher rates regardless of income level or payment burden.

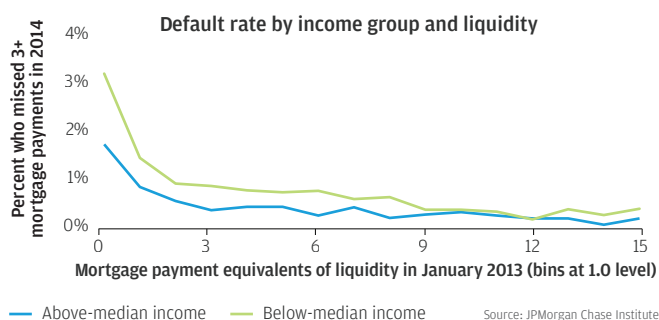
To examine the broader connection between default rates and liquidity, income level, and payment burden, we again return to analysis presented in previous [research](#). We analyzed a larger sample of Chase customers who had a mortgage and a deposit account, no longer requiring default. We found that homeowners with little liquidity defaulted at higher rates irrespective of their income level or payment burden.

Using verified gross income at origination obtained from the homeowner's mortgage application, we calculated one-year default rates for 2014 separately for homeowners with above- and below-median incomes according to their liquidity observed in January 2013. The results are shown in Figure 10. For both above- and below-median income borrowers, those with little liquidity defaulted at higher rates than those with more liquidity, just as was the case in the analysis that supports Finding 1. The default curves shown in Figure 10 are steep for borrowers with fewer than three MPEs of liquidity and flatter for homeowners with more liquidity, which is similar to what we observe in Figures 1 and 2.

For borrowers with less than one MPE of liquidity, the below-median income sub-sample defaulted at a rate (3.2%) that was 1.5 PPs higher than the above-median income sub-sample (1.7%). However, for borrowers with more liquidity, the default rates for the two sub-samples converged—for those homeowners with between four and ten MPEs of liquidity, the default rate differential between sub-samples was just 0.30 PPs. The convergence in default rates is particularly notable given the nearly \$80,000 income gap between the average above-median income borrower (\$122,000 per year) and the average below-median income borrower (\$42,000 per year).

Furthermore, 50 percent of the below-median income group and 56 percent of the above-median income group had at least three MPEs of liquidity. The observation that the default rate differential was larger for borrowers with little liquidity but smaller for the borrowers with more liquidity, combined with the fact that about half of both the above- and below-median income borrowers had at least three MPEs of liquidity, suggest that a lack of liquidity might have been a more important determinant of mortgage default than income level.

Figure 10: Default rates were higher for borrowers with lower levels of liquidity regardless of income level.



One additional observation from Figure 10 is worth noting. The difference in default rates between below-median income borrowers with less than one MPE of liquidity (3.2%) and below-median borrowers with between one and two MPEs of liquidity (1.5%), or moving along the green line to the right, was larger than the difference in default rates between below-median income borrowers with less than one MPE of liquidity (3.2%) and above-median borrowers with less than one MPE of liquidity (1.7%), or moving from the green line to the blue line. Practically speaking, the average borrower in the below-median income group with less than one MPE of liquidity would be more likely to save a few mortgage payments over time than move to the above-median income group.

To better understand the connection between mortgage default, liquidity, and payment burden, we analyzed the same sample segmented according to the borrower's total DTI at origination. We found that borrowers with little liquidity were more likely to default, regardless of their total DTI at origination.

Figure 11 is analogous to Figure 10 and presents the one-year default rates for 2014 for the sample according to their level of liquidity. However, in Figure 11, default rates are shown separately for borrowers who were above the 43 percent total DTI ATR threshold and for borrowers who were below the 43 percent total DTI ATR threshold.

Borrowers who held more liquidity had lower default rates. For both sets of borrowers, default rates decreased as the number of MPEs of liquidity increased. The slope of the function that relates default rate to liquidity was again steep at lower levels of liquidity and nearly flat at higher levels of liquidity. For borrowers with less than one MPE of liquidity, the default rate for the above 43 percent total DTI sub-sample (4.0%) was 1 PP higher than the default rate for the below 43 percent total DTI sub-sample (3.0%). However, for borrowers with more liquidity, the default rates for the two sub-samples converged—for those homeowners with between four and ten MPEs of liquidity, the default rate differential between the sub-samples was 0.5 PPs.

Just as we noted for the income level analysis shown in Figure 10, in Figure 11 the difference in default rates between borrowers with an above 43 percent total DTI and less than one MPE of liquidity (4.0%) and borrowers with an above 43 percent total DTI and between one and two MPEs of liquidity (1.9%), or moving along the green line to the right, was larger than the difference in default rates between borrowers with an above 43 percent total DTI and less than one MPE of liquidity (4.0%) and borrowers with a below 43 percent total DTI and less than one MPE of liquidity (3.0%), or moving from the green line to the blue line. Taken together, the observations based on Figure 11 suggest that a lack of liquidity might have been a more important determinant of mortgage default than the level of total DTI at origination.

Figure 11: Default rates were higher for borrowers with lower levels of liquidity regardless of total DTI at origination.

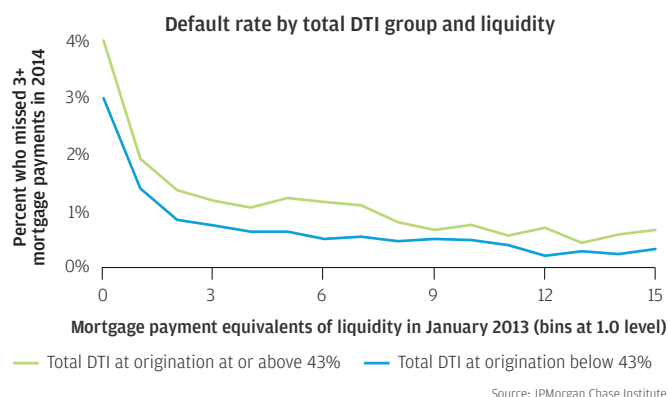
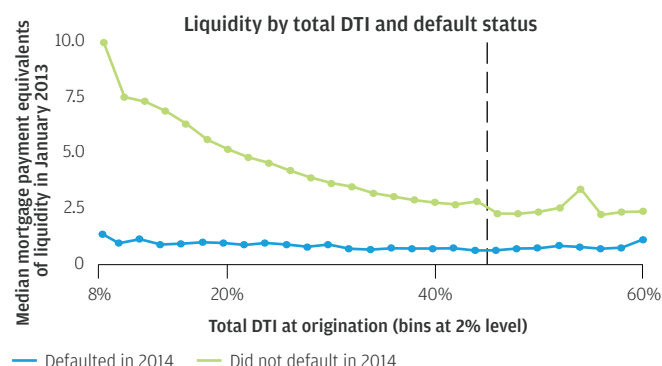


Figure 12: The median borrower who defaulted had fewer than 1.4 mortgage payment equivalents of liquidity, regardless of their total DTI at origination.



Using the same sample developed for Figure 11, we illustrate in Figure 12 the relationship between liquidity, total DTI at origination, and default in a different way. In Figure 12, each point represents the median number of MPEs of liquidity held in January 2013 for homeowners in each bin of total DTI at origination, with homeowners who defaulted and homeowners who did not default shown separately. For example, of the borrowers who had a total DTI at origination between 8 and 10 percent and did not default, the median borrower had 10 MPEs of liquidity (the left-most green dot). Of the borrowers who had a total DTI at origination between 8 and 10 percent and did default, the median borrower had just 1.4 MPEs of liquidity (the left-most blue dot).²⁷

We make three observations from Figure 12. First, half of homeowners who defaulted had fewer than 1.4 MPEs of liquidity, and this was true across all levels of total DTI at origination. Second, for all levels of total DTI, the median homeowner who did not default had more liquidity than those homeowners who defaulted. Third, overall, households with lower total DTI were also those with more liquidity. These findings suggest that any relationship between lower total DTI at origination and lower default rates may be more closely associated with lower DTI households maintaining greater liquidity over the life of their mortgage.

The observations taken from Figures 10, 11, and 12 provide additional evidence that liquidity is likely more important than income level and payment burden as a predictor of default, especially for those borrowers with little liquidity. Furthermore, establishing an emergency mortgage reserve account upon closing and maintaining the balance over the early life of the mortgage might be a better technique to help homeowners avoid default than meeting an ATR measure based on total DTI at origination. There are two important differences between our measure of liquidity (observed in January 2013) and total DTI (observed at origination): (1) the measure itself, wealth versus spending as a fraction of income, and (2) the proximity of the measure to when default does or does not occur. Our results and intuition suggest that both of these differences were important drivers of why the level of liquidity was more closely correlated with default than total DTI at origination.

Finding Five

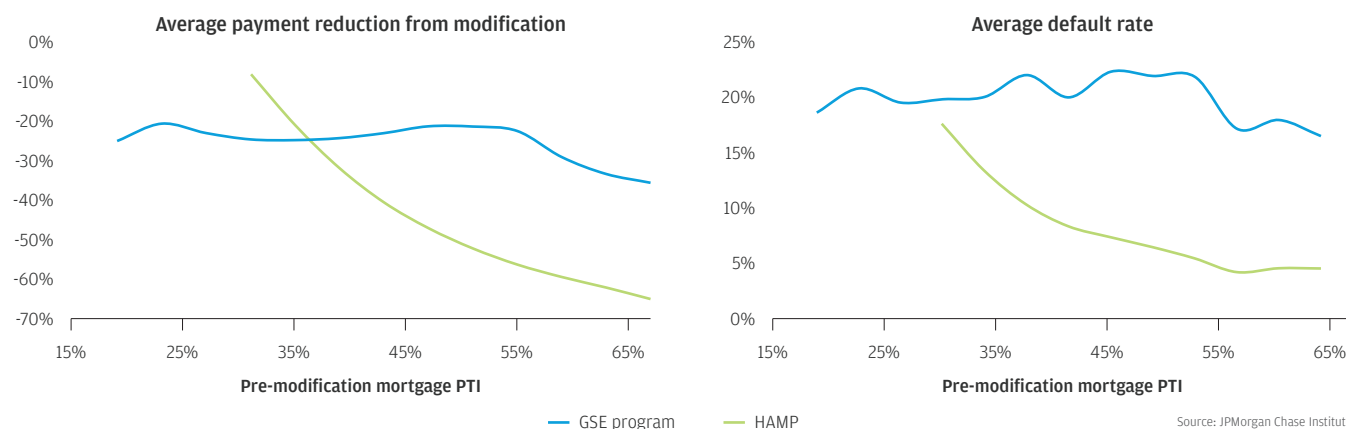
Mortgage modifications that increased borrower liquidity reduced default rates, whereas modifications that increased borrower equity but left them underwater did not impact default rates.

In our final finding on the impact of liquidity and equity on default rates, we again return to existing JPMorgan Chase Institute [research](#). Using a sample of Chase mortgage customers who received mortgage modifications with varying amounts of payment and principal reduction, we found that a 10 percent payment reduction led to a 22 percent decrease in default rates, whereas principal reduction had no effect on default rates for borrowers who remained underwater.²⁸ Under the assumption that a temporary reduction in monthly mortgage payment can be considered a proxy for an increase in liquidity, this evidence supports our conclusion that liquidity is a more important determinant of default than equity.

To arrive at our estimate of the impact of payment reduction on default, we used the fact that the Home Affordable Modification Program (HAMP) and the Government Sponsored Enterprise (GSE) modification programs delivered different amounts of payment reduction, and that the payment reduction delivered by a HAMP modification varied according to the borrower's pre-modification mortgage payment-to-income (PTI) ratio.²⁹ In the left panel of Figure 13, we present the different amounts of payment reduction delivered to borrowers from a HAMP or GSE modification according to their pre-modification mortgage PTI. In the right panel of Figure 13, we present default rates for the same sample of HAMP or GSE modification recipients in the two years following their modification according to their pre-modification mortgage PTI.

The combination of the two panels in Figure 13 provides visual evidence that borrowers who received larger payment reductions had lower default rates. HAMP recipients with higher pre-modification mortgage PTIs received larger payment reductions and showed lower default rates than HAMP recipients with lower pre-modification mortgage PTIs and lower payment reductions (green lines). In contrast, payment reductions and default rates for GSE modification recipients (blue lines) were relatively constant regardless of pre-modification mortgage PTI.

Figure 13: Borrowers that received larger payment reductions defaulted at a lower rate.



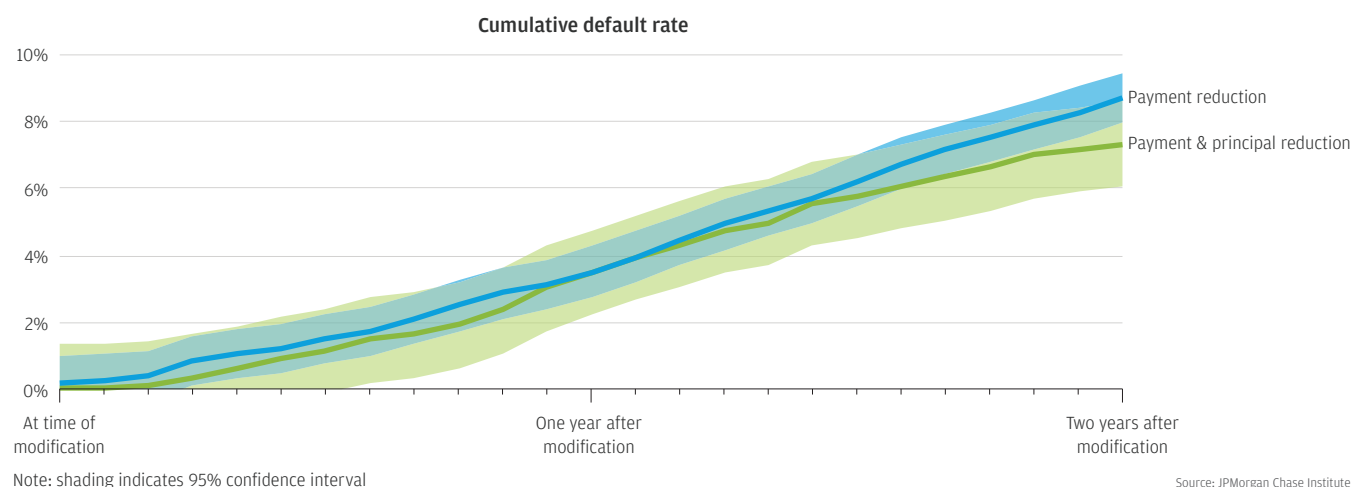
We used the variation in payment reduction to arrive at our causal estimate of the impact of payment reduction on default. First, we calculated the payment reduction per unit of pre-modification mortgage PTI by measuring the difference in slope between the green line (HAMP modifications) and the blue line (GSE modifications) in the left panel. Next, we estimated the change in default rate per unit of pre-modification mortgage PTI by measuring the difference in the slope of the two lines in the right panel. Dividing our second estimate by our first estimate revealed that a 10 percent payment reduction reduced default rates by 2.6 PPs. We then divided the impact in PPs by the 11.9% average default rate to recover our headline: a 10 percent payment reduction reduced default rates by 22 percent.

If a financially distressed homeowner could use an emergency mortgage reserve account as a source of liquidity when facing difficulty making their mortgage payment in the same way that a temporary payment reduction from a modification provides a homeowner in distress with liquidity, then one might expect that the presence of a funded emergency mortgage reserve account could lead to lower default rates. For example, an emergency mortgage reserve account funded with three to four MPEs could provide a distressed homeowner with a 25 to 33 percent payment reduction for one year and help them avoid default.

To measure the impact of principal reduction on default, we examined a sample of homeowners who received a HAMP or HAMP-Principal Reduction Alternative (PRA) modification.³⁰ Unlike the standard HAMP modification, HAMP-PRA offered principal reduction. Borrowers with an LTV above 115 percent were eligible for HAMP-PRA and would receive principal reduction such that their post-modification LTV would be 115 percent.³¹ Given the 115 percent post-modification target LTV, HAMP-PRA could not return homeowners to a positive home equity position.

The homeowners in our sample received similar amounts of payment reduction from each modification program. However, the HAMP-PRA recipients' monthly payments were reduced by forgiving an average of \$112,000 (32%) of their unpaid principal balance, allowing us to isolate the impact of principal reduction on default. As illustrated in Figure 14, default rates for these two groups were very similar two years after modification, suggesting that principal reduction had no effect on default. [Research](#) provides causal evidence that for borrowers who remained underwater, principal reduction had no impact on default.³²

Figure 14: For underwater borrowers, principal reduction had a negligible effect on default.



The fact that an increase in liquidity (via payment reduction) caused a reduction in default rates whereas an increase in equity (via principal reduction) had no discernible effect on default rates provides further evidence that liquidity was a more important determinant of default than equity.

We note that there are two important differences between the causal evidence cited here and the correlation-based evidence discussed in Finding 2. First, we believe that the identification strategies employed for the analysis of modification recipients allows us to address the selection bias issues mentioned in Finding 2 when comparing different borrowers with different liquidity or LTV levels. Second, the results for equity described above were derived from underwater borrowers who had already defaulted and received a modification on their mortgage which was originated before the Great Recession. The causal relationship between equity and default at origination for above-water borrowers for mortgages underwritten using more recent underwriting practices could be different.

The two differences noted above could account for why we found no causal effect of equity on default for underwater borrowers but observe higher default rates for borrowers with higher LTVs (Figures 3 and 5). However, to the extent that the relationship between equity and default rates is similar for underwater borrowers and above-water borrowers, then the evidence presented here shows that the effect of increasing LTV at origination by a small amount would essentially be zero, while the effect of the additional liquidity would reduce default rates.

Implications

Our analyses suggest that liquidity is likely more important than equity, income level, and payment burden as a predictor of default, especially for those borrowers with little liquidity. A pilot program could test the impact of an emergency mortgage reserve account on default rates and, if successful, could have implications for underwriting standards. We also highlight how our findings might influence mortgage modifications and mortgage design.

Testing the Benefits of an Emergency Mortgage Reserve Account

For borrowers with little post-closing liquidity, underwriting their mortgage with a slightly smaller down payment (and therefore a slightly higher LTV) where the borrower then retains the residual cash in an emergency mortgage reserve account could lead to lower default rates. A lender could test this hypothesis through a pilot program for a sample of mortgage applicants who, according to conventional underwriting standards, have a higher risk of default, such as those who have lower credit scores and make small down payments.³³ As such, the lenders that serve the majority of these would-be homeowners may be best positioned to test this theory in a pilot program that could be designed as described below.

Borrowers with little post-closing liquidity and similar underwriting characteristics (e.g., credit score, income, loan amount, LTV, total DTI) would be randomly assigned into a treatment group or a control group. The treatment group would make slightly smaller down payments, have slightly higher LTVs, and use the residual cash to fund an emergency mortgage reserve account. The control group would make the usual down payment and have no emergency mortgage reserve account. As an alternative, a lender or third-party program that would traditionally subsidize the borrower's down payment could instead fund the reserve account of the treatment group.³⁴

As described above, the treatment group would have a slightly larger mortgage balance and, therefore, a slightly larger mortgage payment, which could increase their default rates relative to the control group. To avoid confounding the results of the pilot program and to reflect the expectation of lower default rates, the lender or mortgage insurer could reduce the mortgage interest rate for the treatment group and the lender could pay interest on the balance held in the emergency mortgage reserve account, equalizing the monthly outlays of the treatment and control groups.³⁵

Program designers would have to decide what conditions—if any—should apply to when the homeowner can use the funds in the account. In doing so, it is important to find the appropriate balance between **restrictions** that compel borrowers to only use this liquidity pool if under financial distress and to pay their mortgage and **accessibility**, as liquidity is only helpful if it can be accessed quickly and easily in a time of need.

In its most restrictive form, the reserve account could automatically be debited if the homeowner missed a mortgage payment, without any action by the borrower or the lender. This design would likely maximize the treatment effect of the program. However, removing the borrower's discretion as to when and how to use the liquidity may be difficult to implement, especially if borrower-provided funds were used to establish the account at origination. In its most accessible form, the borrower could withdraw funds from the reserve account at any time and for any purpose. This design would likely show the smallest treatment effect.

There are, of course, many choices between these two extremes. Importantly, our analysis suggests that frictions causing a delay in fund disbursement could prove to be counterproductive. For example, restricting access to the emergency mortgage reserve account until after a homeowner is in default would defeat the purpose of the account. In addition, just as was the case with modification programs, requiring borrowers to provide documented evidence of financial hardship may result in delays that allow arrearages to build and lead to default.³⁶ Instead, program designers could ask borrowers to simply attest to financial hardship or answer a few survey questions about their financial hardship before accessing their reserve account.

Research on emergency savings related to [mortgages](#) and [retirement](#) points to three important design elements that could increase the impact of the program. First, the reserve account should be separate and distinct from other bank or escrow accounts to encourage separate mental accounting by the homeowner and reduce the likelihood that they increase consumption due to the existence of the additional liquidity. The account name can be a signaling device as to the appropriate circumstances for using the funds (i.e. "emergency mortgage reserve" account). Second, implementing a specific, stated target balance (e.g., three MPEs) will encourage borrowers to maintain that balance. The program designer could also create a financial incentive that provides additional motivation

for the homeowner to maintain the target balance, such as increasing the interest rate on the account when the balance is at or above the target. Third, while the pilot program treatment group should be randomly selected as described above, in general, automatic enrollment with an opt out feature will likely increase program participation.

To evaluate the program, the lender should track default rates over time and test for a statistically significant difference between treatment and control groups. Default rates are generally higher later in the life of a mortgage, and therefore the potential treatment effect of a reserve account on default will likely be smaller closer to origination. Examining results over one to two years would test the persistence of the treatment effect. Implementation of the emergency mortgage reserve account could create legal and operational requirements that would be important for a lender or program designer to consider that are beyond the scope of this report. If successful, an emergency mortgage reserve account could become a useful alternative to the ATR rule based on meeting the 43 percent total DTI threshold.

Alternative Underwriting Standards

If the strategy based on maintaining a minimum amount of post-closing liquidity in an emergency mortgage reserve account is impactful and cost-effective, it may be a better approach to default prevention than underwriting standards based on meeting a total DTI threshold at origination. Greater consideration given to post-closing liquidity may also serve as an effective method of increasing access to a mortgage for some credit-worthy borrowers who fall short of current underwriting standards.

The purpose of the ATR/QM Rule was to ensure that consumers received mortgages on terms that reasonably reflected their ability to repay the loan.³⁷ If we use default rates as a proxy for the inability of the borrower to repay their loan, then research suggests that the ATR rule has not necessarily been effective at ensuring that borrowers could repay their loan. For example, [research](#) has shown evidence that if the 43 percent total DTI limit had been in effect after 2004, it would have resulted in a minimal reduction in five-year default rates for mortgages originated between 2005 and 2008.

Our analysis suggests that underwriting standards reliant on meeting a total DTI threshold at origination may not be the most effective method for reducing mortgage defaults, as they cannot account for future income volatility or measure a household's ability to withstand this volatility. Placing a limit on total DTI as part of the underwriting process is inherently limited as a default prevention tool precisely because (1) total DTI will likely change over the life of the mortgage and (2) the ATR standard creates no additional incentive for the homeowner to maintain liquidity to counter a future negative income shock. Even if total DTI measured at origination has some predictive power for default, the considerable heterogeneity in housing costs, incomes, and income volatilities makes it difficult to find a single level of total DTI that indicates affordability across all households and regions.

Meeting the ATR rule also comes at a cost. The Consumer Financial Protection Bureau's [Ability-to-Repay and Qualified Mortgage Rule Assessment Report](#) notes that while there have been fewer high DTI loans made in the post-rule period (perhaps reflecting that the rule eliminated loans that could not be repaid), the ATR rule likely led to decreased access to credit for some high income, low LTV, high credit score borrowers and may have unfairly penalized borrowers who had difficulty producing proof of income (e.g., the self-employed or small business owners) by limiting their access to a loan. Estimates of the increase in interest rates for high DTI loans resulting from the ATR rule range from [10 - 15 basis points](#) to [30 - 40 basis points](#). It is important to note that, to the extent that the total DTI threshold was also intended to limit the potential negative impacts of unconstrained house price growth and subsequent sharp house price declines on the economy, it would be important to take those intentions and economic impacts into account when assessing the overall effectiveness of the Rule.

Our analyses suggest that liquidity was likely more important than total DTI at origination as a predictor of default, as default closely followed a loss of liquidity regardless of whether or not the borrower met the 43 percent ATR threshold for total DTI at origination. If a pilot program confirms the effectiveness of an emergency mortgage reserve account, policymakers should consider changes to the ATR/QM framework that would provide a method of reducing defaults that better aligns interests across the relevant mortgage stakeholders (borrower, servicer, investor, GSEs, and insurer).

Mortgage Modifications

As the mortgage industry and policymakers consider the optimal framework for future mortgage modification programs, our findings suggest three important insights. First, modifications should focus on delivering material payment reductions rather than meeting a pre-determined affordability target. Second, principal reduction that leaves borrowers underwater will have little impact on default rates. Third, while we do not see evidence of strategic default in our analysis, the risk created by a modification-induced moral hazard could be mitigated by employing modifications that rely on maturity extension to reduce payments.

Modification programs intended to help homeowners struggling to make their monthly payments avoid default should deliver liquidity through substantial payment reduction that is not 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.

Modification programs that focus on principal reduction and target a specific LTV ratio in an attempt to reduce default rates will be less effective if they leave homeowners underwater. Our analysis shows that for borrowers who were underwater, principal reduction had no discernible impact on default rates. In addition, default was correlated with a loss of liquidity due to a temporary income drop, not negative home equity. One caveat is important to highlight: 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.

The term “strategic default” is used to describe a variety of behaviors that involve homeowners choosing to default on their mortgage even when they are able to pay. For example, borrowers could stop paying their mortgage simply because they are underwater, owing more on their mortgage than their house is worth. We do not observe evidence of this behavior in our analysis—default closely followed a loss of liquidity, regardless of the homeowner’s equity. As another example, borrowers could [purposely stop their mortgage payments in order to become eligible for a mortgage modification](#) that reduced their monthly payment by reducing their interest rate or unpaid principal balance. To the extent mortgage modification program designers are concerned that modifications could create a moral hazard by encouraging strategic behavior, the designers should focus on reducing monthly payments by extending the maturity of the mortgage. [Research](#) has shown that modifications based on maturity extension offer borrowers substantial payment reduction without reducing their long-term debt obligations.

The Impact of Mortgage Design on Consumption and Default

Our analyses have shown that a loss of liquidity was an important correlate with mortgage default. To the extent that housing policymakers are interested in automatically creating liquidity for mortgage borrowers during an economic downturn, our analysis suggests they may want to consider the trade-offs between adjustable-rate mortgages (ARMs) and fixed-rate mortgages (FRMs). The automatic reset feature of ARMs provides the borrower with additional liquidity via lower mortgage payments, and therefore may offer benefits relative to FRMs through the economic cycle.

After a fixed period (usually between three and seven years), the interest rate on ARMs [resets periodically and is usually closely related to the Federal Reserve’s federal funds target rate range](#). The reset feature means that ARM monthly payments will automatically reset lower to increase borrower liquidity during a recession. As such, the income channel, which transmits monetary policy to borrowers with an ARM, is automatic, and the impact of this channel was evident in the post-Great Recession recovery—ARMs automatically reset to lower interest rates and lower mortgage payments, leading to a considerable [increase in consumer spending](#) and [reduction in default rates](#).

In comparison, FRMs offer borrowers the certainty of constant monthly payments until maturity, regardless of prevailing economic conditions. While known payments may facilitate household budgeting, a borrower with an FRM facing a negative income shock may need to refinance their mortgage or obtain a mortgage modification to reduce their payment and avoid default. Research shows that the refinancing channel that transmits monetary policy to borrowers with an FRM suffers from three limitations that hamper its effectiveness. Specifically, this transmission channel is [difficult to activate with conventional interest rate policy](#), has [frictions that reduce its bandwidth](#), and has [uneven distributional effects](#) such that it provides the most benefits to those homeowners with high levels of liquidity and low LTVs. The refinancing channel of FRMs will have little (if any) impact on personal consumption during an environment in which interest rates are rising. Once the primary mortgage rate exceeds the rate on an existing fixed-rate mortgage, there is no incentive to refinance and any further increases in the primary mortgage rate will have no impact on homeowner income.

Housing policy plays an important role in influencing the share of ARMs versus FRMs and therefore impacts the potency of monetary policy on consumer spending and default. Consequently, as reforms for various housing policies are deliberated, careful consideration should be given to the types of mortgages that housing policy promotes. Additional research is needed to understand how higher ARM interest rates impact default and if they have the expected contractionary effects on consumer spending during an economic expansion. Armed with the full understanding, housing policymakers should consider the impact of the promotion and standardization of ARMs for the appropriate borrowers (given demographic and other characteristics) on the effectiveness of monetary policy.

Data Asset

In this research report, we analyzed a sample of de-identified Chase customers who had both a Chase mortgage and a Chase deposit account. For each specific finding and figure, we focused on a slightly different part of this population, as described below.

Finding	Base Requirements	Figure	Additional Requirements	Sample Size
1	Had one or more Chase mortgages (excluding home equity products) and one or more Chase deposit accounts with at least five transactions in each month observed	1	See Origination Sample	Almost 295,000
		2	See 2014 Sample	Over 480,000
2	Origination Sample: <ul style="list-style-type: none"> Mortgage originated between October 2012 and early 2016 Observe three years of mortgage data starting from origination Observe Chase deposit account data one month after mortgage origination 	3	See 2014 Sample	Over 480,000
		4	See Origination and 2014 Sample	See above
		5	See Origination Sample	Almost 295,000
3	2014 Sample: <ul style="list-style-type: none"> Mortgage originated after 2008 and serviced between January 2013 and December 2014 Had Chase deposit account data in January 2013 	6	Observed LTV at default	Over 11,200
		7	Observed verified income at origination	Almost 4,100
		8	Observed total DTI at origination	Over 8,200
		9	Default = missed one mortgage payment	Over 22,000
4	Had one Chase mortgage and Chase deposit account(s) with at least five transactions between October 2012 and August 2015 Defaulted on mortgage; default date is used to define $t=0$ No more than one negative mortgage payment Observe mortgage and deposit data for 12 months before and 12 months after default (we include homeowners who drop out of our mortgage data after default due to foreclosure, but we drop those who prepay their loan)	10	Observed verified income at origination	Over 580,000
		11	Had observed total DTI at origination	Over 820,000
		12		

Finding	Base Requirements	Figure	Additional Requirements	Sample Size
5	<p>GSE-backed mortgages that were modified through HAMP Tier 1 or the standard GSE modification program</p> <p>Modification completed between April 2010 and November 2013</p> <p>Observe monthly mortgage data for at least 24 months after modification date</p>	13	<p>For GSE modifications, pre-modification mortgage PTI greater than or equal to 19 percent and less than 67 percent</p> <p>For HAMP modifications, pre-modification mortgage PTI greater than or equal to 31 percent and less than 67 percent</p>	Over 95,000
	<p>Chase customers with one mortgage and a Chase credit card</p> <p>Non-GSE-backed mortgages that were modified through HAMP or HAMP-PRA</p> <p>Modification completed between July 2010 and November 2014</p> <p>Observe monthly mortgage data for at least 12 months before and 24 months after modification</p>	14	Mortgages with an LTV > 100 percent one month prior to modification	Over 9,000

The sample used for the origination analysis conducted for Findings 1 and 2 begins in October 2012, coincident with the earliest observations in our deposit account data. The sample used for the 2014 analysis in Findings 1 and 2 is restricted to mortgages originated after 2008 to avoid capturing the effects of pre-Great Recession underwriting standards. Additional details regarding the sub-samples used for Findings 3 and 4 are available [here](#) and additional details regarding the samples used for Finding 5 are available [here](#).

Endnotes

- 1 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.
- 2 Source: CoreLogic Negative Equity Report Q4 2011. See <https://www.reuters.com/article/usa-housing-corelogic/share-of-us-mortgages-underwater-up-in-q4-corelogic-idUSL2E8E1BFH20120301>.
- 3 Source: Bureau of Labor Statistics, Seasonally Adjusted Unemployment Rate.
- 4 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>.
- 5 As described in https://files.consumerfinance.gov/f/201301_cfpb_final_rule_ability-to-repay.pdf.
- 6 Unless otherwise specified, we define default as a loan being 90 or more days past due.
- 7 See the Data Asset section for a more complete description of this sample.
- 8 The number of mortgage payment equivalents held as liquidity = (average daily balance in checking account + average daily balance in savings account) / scheduled mortgage payment. The scheduled mortgage payment includes principal, interest, taxes, insurance, and association dues. As a robustness check, we also performed the analyses described in Findings 1 and 2 using the average daily balance in checking and savings accounts across the three months following the month of mortgage closing and found similar results.
- 9 In the analyses that support Findings 1 and 2, we do not control for the borrower characteristics that would typically be inputs into the mortgage underwriting process (e.g., borrower income, credit score, LTV, and total debt-to-income ratio) because we do not have access to credit score data. In the absence of credit scores, controlling for borrower characteristics would be a materially incomplete exercise.
- 10 We introduced a 12-month gap between our observation of deposit account balance and delinquency status to mitigate the risk that we were observing deposit account balances just after a draw down due to a negative income shock but just prior to default. In previous [research](#), we also examined 2014 default rates against deposit account balances in January 2014 and found a similar relationship between default rates, income level, and deposit account balances. See the Data Asset section of this report for a more complete description of this sample.
- 11 We conducted the same analysis of default rates for the years 2015 through 2018 and found very similar results to the default rates shown in Figure 2.
- 12 We address the potential impact of unobserved liquidity in Finding 2.
- 13 See the Data Asset section of this report for a more complete description of this sample.
- 14 Using a 30-year fixed mortgage rate of 4% and a 95 percent LTV, principal + interest = 0.45% of house price. On average, for this sample the ratio of principal + interest + taxes + insurance + association dues (PITIA) to principal + interest (PI) was 1.49, and so PITIA = 0.676% of house price. Therefore, 1 PP of house price = 1.5 PITIA payments. We chose a 95 percent LTV to be conservative in translation. At the extreme, a 100 percent LTV would result in 1 PP of equity being worth about 1.4 MPEs and our findings would not change materially.
- 15 We arrive at the minimum and average by taking the default rate at a given LTV (e.g., 85 percent) for borrowers with less than one MPE of liquidity and subtracting the default rate for borrowers with the given LTV + 2 PPs (e.g., 87 percent) and between three and four MPEs of liquidity. While we present results using default rates for 2014, we also conducted similar analysis for 2015 through 2018 and found very similar results to the default rates shown in Figure 3.
- 16 While down payment size may not be predictive of default, it nonetheless serves as an important factor in underwriting because a larger down payment reduces the lenders' loss given default.
- 17 If we were to include total liquid assets in our analysis, it is likely that the default rate for borrowers with less than one MPE shown in Figures 1 and 2 would increase, as some borrowers would be re-allocated to higher liquidity bins and these borrowers were less likely to default. However, default rates for borrowers with between three and four MPEs of liquidity would increase more, as more borrowers at this liquidity level who did not default would be re-allocated to higher liquidity bins. The default rate for borrowers with the higher liquidity bins (more than four MPEs) would then be lower than shown in Figures 1 and 2. The net impact would be a smaller difference in default rates between borrowers with less than one MPE of liquidity and borrowers with between three and four MPEs of liquidity than shown in Figures 1, 2, and 3.
- 18 In certain cases, it may be more appropriate for homeowners to use the funds in their emergency mortgage reserve account for expenses other than their mortgage.
- 19 See the Data Asset section of this report for a more complete description of this sample.
- 20 Numbers may not sum due to rounding.
- 21 See endnote 15.
- 22 See the Data Asset section for a more complete description of this sample.

- 23 Default is defined as loans that are 90 or more days past due. While we only show the results for defaults defined as 90 or more days past due, the relationship between income and mortgage payments made for homeowners who defaulted is robust to our definition of default. The pattern showing a drop in income followed by a drop in mortgage payment made a few months later was evident regardless of how we define default (e.g., 30, 60, 90, 120, 150 or 180 days delinquent).
- 24 Throughout this report we use a broad measure of income that includes all checking account inflows. As such, it combines labor and capital income, government support, and transfers from savings or retirement accounts, family members, and friends, etc. It includes inflows from all channels, including electronic transfers, paper check deposits, cash deposits, etc.
- 25 See the Data Asset section for a more complete description of this sample.
- 26 As described in https://files.consumerfinance.gov/f/201301_cfpb_final-rule_ability-to-repay.pdf.
- 27 We limit the x-axis in the left panel of Figure 12 to capture the vast majority of the observations in our sample. Specifically, we include observations where the total DTI at origination was between 8 percent and 60 percent, which covers 93 percent of our sample.
- 28 For a more in-depth discussion of various mortgage modification programs and this analysis, see the JPMorgan Chase Institute report on [Mortgage Modifications](#).
- 29 HAMP modifications reduced the monthly mortgage payment of qualified borrowers such that their post-modification mortgage PTI hit the 31 percent affordability target. Borrowers with a pre-modification mortgage PTI below 31 percent were not eligible for a HAMP modification. The GSE modification program had no affordability target, and in general reduced mortgage payments by at least 20 percent in our data. For a more in-depth discussion of the HAMP and GSE mortgage modification programs and this analysis, see the JPMorgan Chase Institute report on [Mortgage Modifications](#). See the Data Asset section for a more complete description of this sample.
- 30 For a more in-depth discussion of the HAMP and HAMP-PRA mortgage modification programs and this analysis, see the JPMorgan Chase Institute report on [Mortgage Modifications](#).
- 31 While HAMP-PRA 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.
- 32 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. [Research](#) uses a regression discontinuity empirical strategy that uses this jump to measure the impact of principal reduction on default.
- 33 For default rate, credit score, and LTV data by lender type, see https://www.urban.org/research/publication/housing-finance-glance-monthly-chartbook-april-2019/view/full_report.
- 34 While the results in this report are not dependent on the source of the liquidity, borrower or otherwise, borrower behavior might be different if the liquidity is not borrower-provided. For example, if subsidizing the emergency mortgage reserve account leads borrowers to save less than they otherwise would save if they had provided the funding for the reserve account, the subsidy could make the program less effective. [Research](#) on subsidies associated with retirement accounts shows that subsidies were more likely to lead to substitution between accounts rather than increased savings.
- 35 For example, on a pre-tax basis, a 97 percent LTV 30-year fixed-rate mortgage with a 4.00% interest rate on a \$250,000 home would have a monthly payment \$36 higher than a 95 percent LTV 4.00% mortgage on the same home. To equate the monthly mortgage payments (including principal, interest, taxes, insurance, and association dues) of the 97 percent and 95 percent LTV loans, the interest rate on the 97 percent LTV mortgage would need to be 17 basis points lower (3.83%). This assumes a PITIA/PI ratio of 1.49, as described in endnote 14. To offset the \$36 difference in mortgage payments, the emergency mortgage reserve account of three MPEs for the 97 percent LTV mortgage above would need to pay an annual interest rate of nearly 8.00%. A 12.5 basis point mortgage interest rate reduction on the 97 percent LTV mortgage and a 2.24% interest rate on the emergency reserve account balance would create similar monthly mortgage payments for the 97 percent and 95 percent LTV mortgages.
- 36 Documentation requirements reduced the effectiveness of HAMP—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 noted in https://www.sig tarp.gov/Quarterly%20Reports/July_29_2015_Report_to_Congress.pdf.
- 37 As described in https://files.consumerfinance.gov/f/documents/cfpb_ability-to-repay-qualified-mortgage_assessment-report.pdf.

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