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October 2017

Updated November 2017

WORKINGPAPER SERIES

Number 442

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Punishment or Forgiveness? Loan Modifications in Private Label Residential Mortgage Backed Securities from 2008-2014

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November 24, 2017

Abstract

I estimate the extent to which modifications of privately securitized mortgages increased or forgave debt during the Great Recession and aftermath, from 2008-2014. I find that loan modifications weakened household balance sheets by adding $20 billion to household debt, with the net amount of debt added per modification doubling from 2010-2014. I also find that the increase in debt is consistent with capitalization of fees, but not missed interest payments. Capitalization of fees is significant because it has been associated with a principal-agent problem between investors and mortgage servicers preventing efficient loss mitigation, as well as consumer financial protection abuses.

1 Introduction

A major factor contributing to the Great Recession and its aftermath in the U.S., from 2008-2014, was instability in the household mortgage market. Following historic declines in house prices, the default rate on household mortgages increased from the historical average of 2% to a high of 11% in 2010.[1] These defaults were particularly concentrated in mortgages that were privately securitized, and resulted in waves of foreclosures that were highly costly to borrowers who lost their homes, investors in securities or derivatives based on these loans, and the communities in which the foreclosures occurred. Loan modifications which forgive debt in delinquent mortgages were widely discussed as a tool for mitigating losses for investors by preventing costly foreclosures, as well as

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[1] Data on the delinquency rate for U.S. household mortgages is available from the St. Louis Federal Reserve FRED database. Accessed June 15th, 2016 from: http://research.stlouisfed.org/

providing economic stimulus by deleveraging borrowers. However, delinquent mortgages can also be modified to increase debt through capitalizing either missed interest payments or fees. Increasing debt reduces the effectiveness of modifications at loss mitigation and providing stimulus.

The analysis in this paper has two related goals. First, I estimate the extent to which voluntary modification of privately securitized mortgages either increased or forgave debt during the period 2008-2014. I focus on loans used as collateral for mortgage-backed private label securities (PLS), because this is where the largest portion of subprime loans were securitized, and hence where the largest portion of defaults occurred. I account for the increase or decrease in debt from modifications using a loan-level panel data set which covers roughly 30%-40% of the PLS market, depending on year. Second, I analyze whether capitalization in loan modifications is driven by missed interest payments or fees. Missed interest payments are observed in my data, while fees assessed by servicers are not. This allows me to use a Oaxaca-Blinder decomposition to estimate the portion of increase in capitalization that can be explained by missed interest payments or other observables, and the portion that cannot be explained by observables, which is consistent with fees. My decomposition analysis uses the fact that the primary portion of the Home Affordable Modification Program (HAMP) expired in 2012 to create a benchmark for measuring capitalization of fees. The HAMP program required the capitalization of missed interest payments, but prohibited capitalization of fees. Therefore, capitalization in pre-2012 modifications provides a counterfactual for measuring the portion of capitalization in post-2012 modifications due to missed interest payments, but not fees.

There are two primary findings in this paper. First, loan modifications in the PLS market weakened household balance sheets during the Great Recession and foreclosure crisis, resulting in a total net increase to borrower unpaid principal balances of $20 billion. Modifications increased debt for all years in my sample, with only 5% of modifications resulting in net reductions of debt. I also find that capitalization increased during the later years of my sample. The net amount of debt added per modification doubled from 2010-2014, increasing from 5.6% to 11.3% of the original balance.

My second main finding is that the increase in capitalization in later years is not consistent with capitalization of missed interest payments, because missed interest payments were *declining* as capitalization was increasing. I confirm this finding with my decomposition analysis, which shows that missed interest payments have little explanatory power. In contrast, my results are consistent with capitalization of fees because the unobserved component accounts for between two-thirds to three-quarters of the increase in capitalization. Additionally, the increase is consistent with capitalization of fees because I find substantial heterogeneity among servicers in the difference between missed interest payments and capitalization. Substantial heterogeneity among servicers suggests that differences in capitalization amounts reflect differences in servicer characteristics, such as the propensity to capitalize fees, rather than systematic differences in characteristics of modified loans, such as missed interest payments.

The finding that loan modifications weakened household balance sheets is relevant for research on the role of household debt during the Great Recession. This literature has argued that a key determinant of the large declines in spending during the Great Recession was the distribution of losses from the housing bubble between debtor and creditor. Concentrating losses on borrowers, as is specified in debt contracts, would cause larger declines in spending than a more equal distribution of losses, because borrowers generally have far less financial capacity for absorbing losses than lenders. This literature has argued for the use of debt forgiveness to repair household balance sheets, thus preventing the large declines in spending (Mian and Sufi, 2014; Farhi and Werning, 2016). Prior research in this literature has shown that early modifications in the PLS market tended to increase debt, rather than forgive it. For example, White (2008) found that the average modification in privately securitized mortgages in November 2008 increased debt by roughly 5%. In addition, a 2010 study by the Congressional Oversight Panel (COP, 2010) found that 95% of modifications occurring through the HAMP program increased debt by 5%. An advantage of my data relative to these prior studies is that it allows me to calculate the entire net increase in debt in the PLS market over a much longer time period, which includes the entire Great Recession and foreclosure crisis. My findings extend the previous results by showing that the net increase in debt added per modification doubled from 2010-2014, and that modifications increased household debt by $20 billion over the period 2008-2014. To be sure, 75% of modifications in my sample did reduce borrower monthly payments, and so provided some relief even if increasing debt. However, the increase in debt blunted the ability of modifications to mitigate losses or provide economic stimulus by increasing negative equity (Mian and Sufi, 2014; Haughwout, Sutherland and Tracy, 2013; Haughwout, Okah and Tracy, 2016).

The finding that the increase in capitalization in later years is consistent with fees is relevant for the recent literature on frictions in private mortgage securitization that prevented efficient loss mitigation. Several papers in this literature have argued that a significant cause of the failure of loss mitigation in this market was a principal agent-problem between mortgage servicers, who are responsible for processing payments and managing defaults, and investors in securities based on these loans (Levitin and Twomey, 2011; Thompson, 2011; COP, 2009). Once a loan enters default, the compensation structure for mortgage servicers contains perverse incentives to increase the costliness of default, rather than mitigate losses for investors. Servicers are able to receive income from a diverse array of fees for delinquent loans, including but not limited to late fees, title search fees, property maintenance fees, appraisal fees, and other fees related to the foreclosure. These fees create a principal-agent problem between investors and servicers because they incentivize foreclosure over modification even when modification is in the investors' interest, increase the chance of redefault when they are capitalized in modifications, and can be recovered through the proceeds of foreclosure sales prior to investors receiving any revenue. Reports state that the ability to arbitrarily assess these fees effectively creates "a cost-plus contract arrangement with no oversight of either the costs or the plus

components," COP (2009).

The lack of loss mitigation due to the principal-agent problem is also significant for literature on consumer financial protection (Campbell et al., 2011), because foreclosing instead of modifying and capitalization of fees have been associated with substantial abuses. For example, one of the largest recent Consumer Financial Protection Bureau (CFPB) enforcement actions levied a $2 billion fine against one of the largest mortgage servicers, Ocwen. Among other violations, Ocwen charged "unauthorized fees for default related services," "deceived consumers about foreclosure alternatives and improperly denied loan modifications," and "engaged in illegal foreclosure practices."[2] Previous reports and CFPB actions have documented the existence of these perverse incentives, and contain case studies of individual servicers who have acted on these incentives. However, this research has not yet documented how systematic or widespread this problem was in the PLS market. My findings extend this literature by using a comprehensive loan-level data set to provide systematic evidence that the increase in debt is consistent with capitalization of fees, but not consistent with capitalization of missed interest payments.

The literature on frictions and loss mitigation has also argued that losses from foreclosure averaging over 50% of the original loan balance suggest that there was room to increase debt forgiveness to mitigate losses (Cordell et al., 2008; White, 2008). My findings are consistent with this research, and show that foreclosures occurred almost twice as frequently as modifications, with losses ranging from 45%-65% of the original balance. Additionally, my data also allow me to assess the full scale of loss through calculating total losses from foreclosure for the entire PLS market during this period. I find that losses from foreclosure totaled almost $600 billion from 2008-2014. In contrast, the gross amount of forgiveness totaled only $14.2 billion. Consistent with prior findings, the large difference between total losses and forgiveness at the market level strongly suggests that forgiveness could have been increased to mitigate losses. The tragedy of loss mitigation was that punishing borrowers by increasing debt, rather than forgiving it, also resulted in the unnecessary destruction of wealth for investors and the communities in which these foreclosures occurred.

2 Background Information

2.1 Debt Forgiveness and Stimulus

Following the historic declines in house prices that began in 2006, households significantly reduced spending to repair their balance sheets. The literature on household balance sheets has argued that a key determinant of the large declines in spending during the Great Recession was the distribution of losses from the

[2] A description of the consent order can be found at: https://www.consumerfinance.gov/about-us/newsroom/cfpb-state-authorities-order-ocwen-to-provide-2-billion-in-relief-to-homeowners-for-servicing-wrongs/. Accessed September 1, 2017.

housing bubble between debtor and creditor. Debt contracts are inherently distributional because they specify that the debtor take first losses from any decline in home prices. However, concentrating losses on borrowers also causes larger declines in spending than a more equal distribution of losses, because debtors generally have far less financial capacity for absorbing losses than lenders (Mian and Sufi, 2014; Farhi and Werning, 2016).

The literature on household balance sheets has widely discussed using loan modifications that forgive debt in delinquent mortgages as a tool to directly provide economic stimulus (Mian and Sufi, 2014; Liu and Rosenberg, 2013; Boyce et al., 2012; Bair, 2007). Debt forgiveness prevents the large declines in spending by restoring borrower net worth, without requiring large reductions in spending. In formal models that incorporate financial fragility mechanisms, "standard policies for fighting financial fragility can be interpreted as transfers that maintain or increase borrower net worth," (Bernanke and Gertler, 1990). Additionally, there are several successful historical examples of household debt restructuring programs, such as the U.S. during the Great Depression, or Iceland during the 2008 crisis. Based on analysis of these historical case-studies, the IMF argued that, "bold and well-designed household debt restructuring programs," could "substantially mitigate the negative effects of household deleveraging on economic activity" at relatively low fiscal cost (Liu and Rosenberg, 2013).

In addition to the stimulus provided through directly deleveraging individual borrowers, debt forgiveness can provide additional benefits by preventing foreclosures, which have significant negative externalities that lower prices for all homes in the neighborhood. Mian, Sufi and Trebbi (2015) estimate that the causal effects of foreclosures can account for roughly one-third of the total decline in home values from 2007-2009. They also estimate that the destruction of wealth from these foreclosures lowered aggregate demand, accounting for one-fifth in the reduction of residential investment and auto sales during this period.

Two earlier studies, White (2008) and COP (2010), have also shown that when modifications did occur, they tended to increase debt rather than forgive it. White (2008) found that 68% of PLS modifications which occurred during November 2008 increased the borrower's principal balance by capitalizing unpaid interest and fees, and that less than half reduced monthly payments. The average amount capitalized was $10,800 on a balance of $216,000, or 5%. In contrast, only 10% of these modifications included principal reduction. The COP (2010) study focused on HAMP modifications, and also showed that they increased borrower debt. However, this was largely due to program design. While the HAMP program prohibited the capitalization of delinquency fees, the program also mandated capitalization of missed interest payments. The HAMP program then reduced borrower monthly payments through a combination of interest rate reductions and term extensions. Overall, COP (2010) showed that 95% of HAMP modifications increased borrower negative equity by roughly 5%. Re-default rates were also quite high. For some of the early vintages of HAMP modifications, close to 50% re-defaulted within the first year (COP, 2010, 2009).

The previous studies of White (2008) and COP (2010) that documented

capitalization are the closest studies in this literature to the analysis in this paper. My study extends the previous findings by covering a much longer time period, and calculating the increase in debt at the level of the entire the PLS market, rather than at the loan-level. For example, White (2008) uses loan-level modification data to reports the average amount capitalized for modifications occurring in November 2008. My study uses the same source of data, but collects data for every modification that occurred from 2008-2014. This period is of particular historical interest because it covers the entire Great Recession and foreclosure crisis, in a market that contained the bulk of mortgage failures. My study also extends this research by showing that the problems previously identified grew through time, with the net amount of debt added per modification doubling from 2010-2014.

To be sure, 75% of modifications in my sample did reduce borrower monthly payments, and so provided some relief even if increasing debt. However, through increasing negative equity, capitalization significantly reduced the ability of modifications to provide economic stimulus through several mechanisms. First, increasing negative equity did not reduce the need for substantial cuts in borrower spending to deleverage and rebuild lost savings. Negative equity also reduced the effectiveness of monetary policy because it prevented the borrower from gaining access to external finance, such as refinancing at lower interest rates (Mian and Sufi, 2014). Negative equity also reduced aggregate demand by reducing the incentive to invest in the household, because all gains would go to the lender. Haughwout, Sutherland and Tracy (2013) find that from 2007-2012, households with negative equity decreased residential investment by 75%. Finally, modifications with capitalization had a significantly higher re-default rate than modifications that reduced debt (Haughwout, Okah and Tracy, 2016). Moreover, increasing negative equity, rather than eliminating it through debt forgiveness, guaranteed that re-defaults would result in costly foreclosure because the borrower could not sell the home without paying the lender the difference between the amount owed and the sale price. These foreclosures had substantial negative externalities for the communities in which they occurred. Foreclosures reduced house prices for all homes in the community, thus further depressing aggregate demand. Mian, Sufi and Trebbi (2015) found that the causal effects of foreclosures could account for roughly one-third of the decline in house prices, one-fifth of the decline in residential investment, and one-fifth of the decline in auto sales from 2007-2009.

2.2 Debt Forgiveness, Loss Mitigation, and Consumer Financial Protection

In many cases, loan modifications which reduce debt can also be in the lender's interest because they avoid the high costs associated with foreclosure (Maturana, 2017; Mian and Sufi, 2014; Moore and Remy, 2013; Posner and Zingales, 2009). Houses sold in foreclosure typically sell at a steep discounts, averaging roughly 27% of the home price, for two main reasons. First, housing is a classic example of an illiquid asset, but financial institutions typically have an incentive

to sell a home as rapidly as possible once it enters foreclosure. Therefore, forced sales require larger discounts than if the market were fully liquid. Second, the house may also have become physically damaged during the foreclosure process (Campbell, Giglio and Pathak, 2011).

Due to mutually beneficial gains to avoiding foreclosure, lenders tend to look for alternatives including modifying the original terms of the loan to forgive some portion of the debt. However, analysis of the PLS market has shown several frictions in the structure of private mortgage securitization that prevented modifications which forgave debt, even in cases where debt forgiveness was mutually beneficial for both borrower and investor. First, mortgages held in securitization pools are governed by a contract known as a pooling and servicing agreement (PSA). These contracts define the roles and responsibilities of all parties to the securitization, such as the transfers of the loans into the trust, management of the trust, issuance of securities to investors, servicing of the loans, and permissible actions that can be taken once a loan is in default. However, research has shown that roughly 40% of securitized mortgages are governed by PSA's with some clause that restricts servicer modification ability (Gelpern and Levitin, 2009).

Second, academic research and government reports have also shown that there is a principal-agent problem between servicers and investors that impedes restructuring even when it is in the investors' interest. A servicer's compensation is not aligned with the investors' interest in maximizing the net present value of the loan. Instead, a servicer's choice of modification or foreclosure, and type of modification, is based on the incentives in their own compensation structure. Servicers receive three main types of income: a fixed-rate fee based on the unpaid principal balance of a loan; float income from the period in which the servicer receives monthly payments but has not remitted them to the trust; and ancillary fees. The main types of ancillary fees include delinquency fees and reimbursement for costs associated with foreclosure, such as property maintenance fees, title search fees, process serving fees, appraisal fees, other legal fees, or any of a number of other fees. There is no effective oversight of the reasonableness of these fees, and servicers are able to be reimbursed for these fees out of the proceeds of the foreclosure sale prior to any revenue being given to investors (Levitin and Twomey, 2011; Thompson, 2011; COP, 2009).

This misalignment of incentives creates two related problems which prevent efficient restructuring. First, these fees can be quite lucrative and create an incentive to foreclose, even when it is in the investors' best interest to modify, because modification is costly. Modification is costly for three reasons. First, modifications require substantial labor costs such as re-underwriting the loan. Second, if the modification reduces monthly payments through reducing the unpaid principal balance, the servicer loses its fixed rate fee. Third, servicers must advance missed payments while the loan is delinquent. They can recoup these advances in cases of foreclosure or if the loan becomes current, but not in many types of modifications. In contrast, the fees associated with managing delinquency and foreclosure can be quite lucrative. For example, analysis of one major servicer, Ocwen, showed that late fees and loan collection fees made up

18% of its revenue in 2008 (Thompson, 2011). There can also be an incentive to keep a borrower delinquent so that the servicer can receive revenue from delinquency fees, until the cost of financing advances outweighs the revenue received from the fees. This has been described as keeping the borrower in a default fee "sweatbox" (Levitin and Twomey, 2011). Essentially, the servicer's choice between "modification and foreclosure is a choice between limited fixed-price income and a cost-plus contract arrangement with no oversight of either the costs or the plus components," (COP, 2009). Even worse for the investor, this cost-plus structure creates an incentive to foreclose in a more costly manner than less, because servicer's compensation is positively related to costs and has the senior claim on foreclosure sale revenue. Cost-plus compensation is typically banned from government contracts due to these perverse incentives (Levitin and Twomey, 2011; COP, 2009).

The second problem created by this compensation structure is that it provides incentives for servicers to choose types of modifications that promote their own interests, even if these modifications have a higher re-default rate and hence do not promote the investors' interests. For example, reducing monthly payments through principal reduction has been shown to be the most effective form of modification at preventing re-defaults, while modifications which increase debt have a much higher re-default rate (Haughwout, Okah and Tracy, 2016; Goodman et al., 2012). However, servicers are disincentivized to perform principal reduction because it reduces the amount of revenue they receive from their fixed-rate fee which is assessed on the unpaid principal balance. Instead, they receive more compensation from this fee when they perform modifications which increase the unpaid principal balance. Providing modifications with a higher re-default rate can also potentially be a source of profit for servicers, because they can receive the lucrative foreclosure fees described above (Thompson, 2011; COP, 2009).

An obvious question is what is preventing market competition from correcting the principal-agent problem by creating reputational incentives for "good" servicers who can meet the needs of investors? Reputation was not able to provide sufficient incentives for "good" servicers because, after the collapse of the PLS market in 2009, there was simply very little prospect for servicing large pools of subprime loans in the future (Cordell et al., 2008). Additionally, investors lacked the ability to compel servicers to provide efficient loss mitigation due to information and collective action problems. Investors faced two main collective action problems in changing this structure. First, many PSAs had collective action clauses requiring a super majority of investors to amend any contractual terms. However, there were typically large numbers of geographically dispersed investors party to most of the major securitizations. Second, investors sometimes had conflicting interest regarding type of loan modification, because they received income based on different parts of the cash flow, such as principal and interest payments. Therefore a loan modification which maximized the net present value of the mortgage might still adversely affect an individual investor. Even if investors could overcome these collective action problems, they also lacked the necessary data to evaluate loss mitigation

practices of servicers, such as loan-level data concerning the re-underwriting of modifications. Moreover, investors typically lacked detailed information on the amount of fees being assessed by servicers. These collective action and information problems effectively undermined investors' ability to perform meaningful oversight of servicers (Levitin and Twomey, 2011).

The friction due to the principal-agent problem is also relevant for the literature on consumer financial protection (Campbell et al., 2011), because capitalization of fees has been associated with significant violations. In addition to being described in academic and government reports, CFPB enforcement actions also provide important case-studies of servicer misconduct. For example, in 2013 the CFPB and Attorneys General from 49 states and the District of Columbia settled a complaint with Ocwen Financial Corporation, one of the largest non-bank mortgage servicers in the country. This settlement required Ocwen to pay $2 billion of relief to homeowners for taking, "advantage of borrowers at every step of the process." Among other improper actions, Ocwen charged "unauthorized fees for default related services," "deceived consumers about foreclosure alternatives and improperly denied loan modifications," and "engaged in illegal foreclosure practices."[3] These practices seem to be persistent as well, because the CFPB sued Ocwen again more recently in April 2017 for, "failing borrowers at every stage of the mortgage servicing process."[4]

Recent empirical research has also confirmed that the cumulative effect of the frictions associated with private mortgage securitization was to cause an inefficiently low level of modifications. For example, the difference in the amount of modifications between securitized loans and loans held in bank portfolios suggest that modifications for securitized loans are inefficiently low. Recent estimates have shown the mortgages held in private securitization pools were less likely to be modified than loans held in banks portfolios, by 26%-36% (Agarwal et al., 2011) or 13%-32% (Piskorski, Seru and Vig, 2010). Additionally, Maturana (2017) found that an additional modification for the marginal loan reduced losses by 40% relative to the average loss. This suggests that the marginal benefits to modification were substantially higher than the marginal costs, which implies that the level of modifications was inefficiently low.

The literature on friction has also argued that perverse incentives in servicers' compensation helps to explain why the public intervention to promote more modifications through the Home Affordable Modification Program (HAMP) fell short of its stated goals. The HAMP program sought to induce more voluntary modifications through providing incentive payments to servicers for performing more modifications. However, when compared to the possible fee compensation from foreclosing, these incentives were too small to promote an efficient

[3] A description of the consent order can be found at: https://www.consumerfinance.gov/about-us/newsroom/cfpb-state-authorities-order-ocwen-to-provide-2-billion-in-relief-to-homeowners-for-servicing-wrongs/. Accessed September 1, 2017.

[4] A description of the recent lawsuit can be found at: https://www.consumerfinance.gov/about-us/newsroom/cfpb-sues-ocwen-failing-borrowers-throughout-mortgage-servicing-process/. Accessed September 1, 2017.

level of modifications (Levitin and Twomey, 2011). The initial HAMP program was created in 2008 and designed to provide roughly 3-4 million modifications. However, five years into the Great Recession, it had only provided 860,000 permanent modifications (Mian and Sufi, 2014). In addition to the principal-agent problem, another reason for the failure of HAMP is that many servicers simply lacked the capacity to handle the necessary volume of modifications (Agarwal et al., 2017).

The findings from my decomposition analysis extends the previous literature by providing systematic evidence consistent with the hypothesis that the increase in capitalization is due to capitalization of fees, rather than missed interest payments. Existing research contains detailed descriptions of the conflict of interest in servicer compensation that incentivized capitalization of fees (Levitin and Twomey, 2011; Thompson, 2011; COP, 2009), and government enforcement actions provide case-studies of misconduct at individual servicers such as Ocwen. However, to date no study has systematically analyzed how widespread this problem was throughout the entire market. I fill this gap by decomposing the increase in capitalization using a comprehensive loan-level panel data set containing 30% - 40% of the PLS market, depending on year. My findings confirm this prior research with systematic evidence, suggesting that this problem was widespread, and grew worse through time.

The finding that capitalization is driven by fees is also relevant to the interpretation of redistribution inherent in modifications. To the extent that the increase in debt represents the imposition of fees by servicers due to cost-plus compensation, the increase in debt can be unambiguously interpreted as an increase in total borrower debt obligations. This is relevant because some have interpreted capitalization of missed interest payments alone as not increasing total borrower obligations (COP, 2010). The results of my decomposition analysis will show that a substantial portion of the increase in debt is consistent with increases in fees, but not consistent with increases in missed interest payments. Therefore, a large portion of the capitalization in the PLS market can unambiguously be interpreted as an increase in total borrower obligations.

3 Data Description

The sample of loans used in this study comes from the Columbia Collateral File (CCF), which is the same data set used in White (2008). The CCF is a large loan-level panel data set that includes all loans used as collateral for private label RMBS for which Wells Fargo is a trustee.[5] The full data set contains monthly observations for 139 variables such as loan characteristics and performance. The data begin in December 2006, which makes 2007 the first year for which complete data are available. The number of loans and outstanding balance peaked in December 2007, with 4.2 million loans. However, by 2014 the number of loans in the data set had fallen to roughly 1.44 million. This is primarily due to the 1.9 million completed foreclosures which occurred.

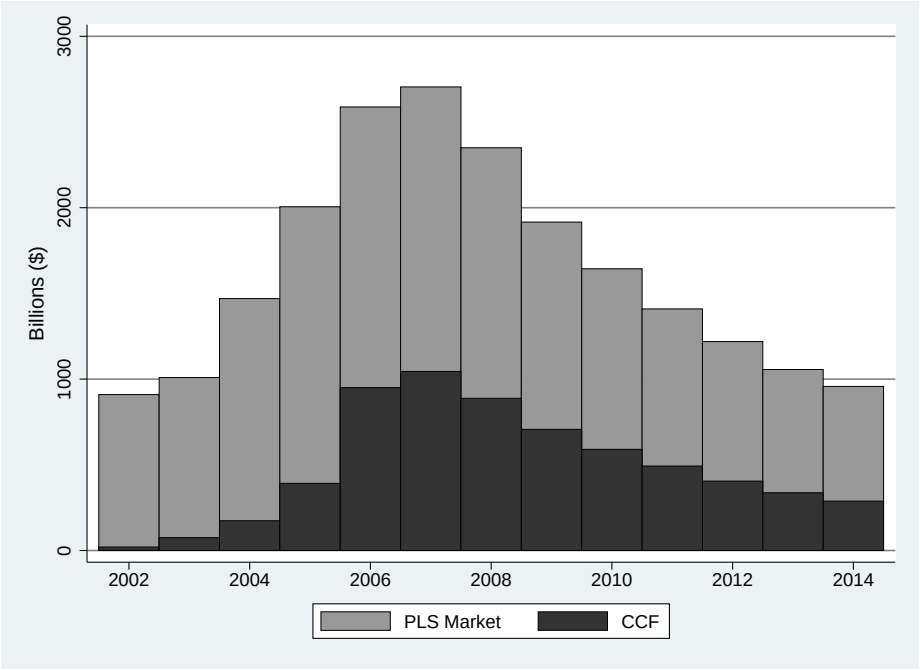
[5] This data set is publicly available from `www.ctslink.com`.

The CCF provides several variables measuring modifications including type of forgiveness or amount of capitalization. The CCF added variables to measure types of debt forgiveness or capitalization in November of 2008, which makes 2009 the first year for which we have complete data on redistribution in modifications. Types of debt forgiveness measured include principal forgiveness, interest forgiveness, and expense forgiveness. Total capitalized amount is the only variable which records the increase of debt. Capitalization in modifications occurs when missed interest payments or fees are added back to the outstanding balance of the loan. Unfortunately, the data set does not provide separate measures of capitalization due to missed interest payments or fees. The data also do not include whether the modification occurred through the HAMP program. However, servicers which sign up for the HAMP program are required to use the HAMP template for all modifications that meet HAMP requirements. Many of the servicers in this data set participated in HAMP, so it is likely that many of the modifications in the CCF data are HAMP modifications (COP, 2010).

The variable used in this study to measure loss from foreclosures is titled "loss on liquidated property." This variable measures the dollar value of losses to the investors due to having to sell the home for a price below the amount of debt owed on the loan. This variable measures any losses due to the sale of the home, which includes broader home forfeiture actions such as short sales or deeds-in-lieu, in addition to foreclosures. Foreclosures, short sales, and deeds-in-lieu are the three most common types of home forfeiture actions. These actions occur when a borrower is delinquent, but the value of the home is less than the amount owed on the loan, so that the borrower cannot sell the home. A foreclosure occurs when the lender forces the sale of the home to repay the value of the debt. A short sales occurs when the borrower finds a purchaser for the home at an amount below what is owed on the loan, and then gets the lender to consent to the sale. A deed-in-lieu of foreclosure occurs when the delinquent borrower signs over the deed to the lender to prevent foreclosure from occurring. The lender will then need to sell the home. Borrowers tend to prefer short-sales or deeds-in-lieu because they are less damaging to a borrower's credit score than foreclosure. The results for losses from foreclosure reported in the next section are actually losses due to home forfeiture actions more broadly defined. It is satisfactory to combine these broader home forfeiture actions under the label of foreclosure for the purposes of comparing losses due to home forfeiture with debt forgiveness in modifications.

The main risk measures in the data set are the FICO credit score and the loan-to-value (LTV) ratio. The FICO credit score is an index of creditworthiness that measures the borrower's chance of default over the next two years, with a higher credit score indicating a less risky borrower. The score does not provide an absolute measure of chance of default. Instead, the score provides a ranking of a borrower's creditworthiness relative to other borrowers. The score is based on the amount of debt a borrower currently owes, the borrower's payment history, types of credit in use, the length of credit history, and new credit. However, the exact formula used to calculate how each of these categories affects a credit score is proprietary, and thus not publicly available. Additionally, the weight given to

Figure 1: Outstanding Balance of the PLS Market 2002-2014



each of these categories in calculating the credit score differs for each individual based on their particular credit history (Bhardwaj and Sengupta, 2015).

FICO scores range between 300-850, and are used to classify borrowers as subprime, alt-A, and prime. Based on the definition used in the OCC Mortgage Metrics report, subprime credit scores are those with FICO scores less than 620, alt-A are between 620 and 660, and prime are greater than 660. These categories are one factor that is used to determine what type of loan a borrower can receive, the amount of the loan, and the interest rate of the loan. Typically, prime borrowers qualify for the lowest interest rates and largest loans.

The LTV ratio is the ratio of the original loan balance to the appraisal value of the home. The LTV ratio measures the amount of equity in a home which serves as a cushion to absorb house price declines. For example, a loan with an LTV of 80 can withstand a price decline of 20% of the value of the home before the borrower would have negative equity. If the home was sold in foreclosure after the borrowers positive equity was exhausted, the lender would typically take the remaining loss. Traditionally, LTV ratios of 80% or below are considered lower risk mortgages.

The growth of the outstanding balance of loans in the CCF broadly mirrors that of the PLS market. Figure 1 shows the nominal yearly outstanding balance of the PLS market and the CCF from 2002-2014. The private label market grew rapidly from 2002 to 2007, tripling in value. After peaking at an outstanding

balance of $2.7 trillion in 2007, the market experienced severe losses and declined rapidly. As of 2014, the outstanding balance of the PLS market was $957 billion, which was roughly equal to the 2002 outstanding balance. The volumes of loans in the CCF with origination dates prior to 2005 does not appear to be a large share of the total market. However, this is likely because many loans securitized prior to 2005 were refinanced. Following 2005, the CCF market share grew rapidly and accounted for just under 40% of the PLS market in 2007, with an outstanding balance of $1.05 trillion. The outstanding balance in the CCF then declined rapidly throughout the sample period, ending 2014 with roughly $350 billion outstanding (SIFMA, 2015).

The CCF data appear to be broadly representative of the entire market. In general, the data account for a substantial portion of the entire market and mirrors the growth of the market. Also, the summary statistics of observable risk measures are similar to those reported in Griffin and Maturana (2016) and Piskorski, Seru and Witkin (2015), who use data based on this market. Because it appears representative of the entire market, the full CCF data set from 2008-2014 is used to produce calculations for the entire market, based on the yearly market share of the CCF.[6] Additionally, a restricted sample of loans from the CCF is used to analyze average redistribution in modifications and losses from foreclosure. Following common practice in the literature which analyzes the PLS market, the sample of loans from this data set is restricted to all mortgages that are 1st lien, owner occupied, originated between 2002-2008, with loan-to-value ratios between 70 and 100, FICO credit scores between 300 and 850, balances greater than $30,000, and for which there is complete data.

These restrictions help to ensure that we are analyzing a consistent group of loans, prevent data errors, and to ensure that the analysis in this paper is comparable with the analysis of other papers in the literature. Loans are limited to those that are 1st lien loans because these are qualitatively different from junior liens. If a home is sold in foreclosure, junior liens are only paid back once the first lien is paid in full. Due to this difference in priority, comparing average modification and foreclosure experiences across these groups would be less informative than focusing on 1st liens exclusively. The sample is limited to owner-occupied loans because the public intervention to encourage more modifications was designed to prevent the forfeiture of a family's primary residence, rather than the loss of an investment property. The sample is restricted to loans originated from 2002-2008 because these homes were at the focal point of the foreclosure crisis. Loans are limited to LTV ratios from 70 - 100 to compare loans with similar amounts of pre-crisis equity. The sample is limited to FICO credit scores between 300 and 850, because this is the range of credit scores produced by FICO. Loans outside of this range represent some type of data error. Similarly, loans are restricted to those above $30,000, because Griffin

[6] I use 2008-2014 for the calculations in this table, rather than the full 2006-2014, because November 2008 is the first month in which redistribution information is recorded for modifications. Therefore, comparing total losses to foreclosure from 2006-2014 with total debt added in modifications from 2008-2014 would overstate the magnitude of losses to foreclosure relative to modifications.

and Maturana (2016) showed that loans below this range contained a greater proportion of data errors.

The pooled sample is built by merging the data from the month of December to provide a retrospective snap shot of the year. After these restrictions, the full 2006-2014 pooled sample includes 10 million loan-year observations. The sample also includes roughly 900,000 of the 1.9 million unique foreclosures, and 515,000 of the 900,000 modifications. A large portion of foreclosures and modifications are typically dropped from the sample during the year in which they occur, so these dropped observations are merged back into the December observations.

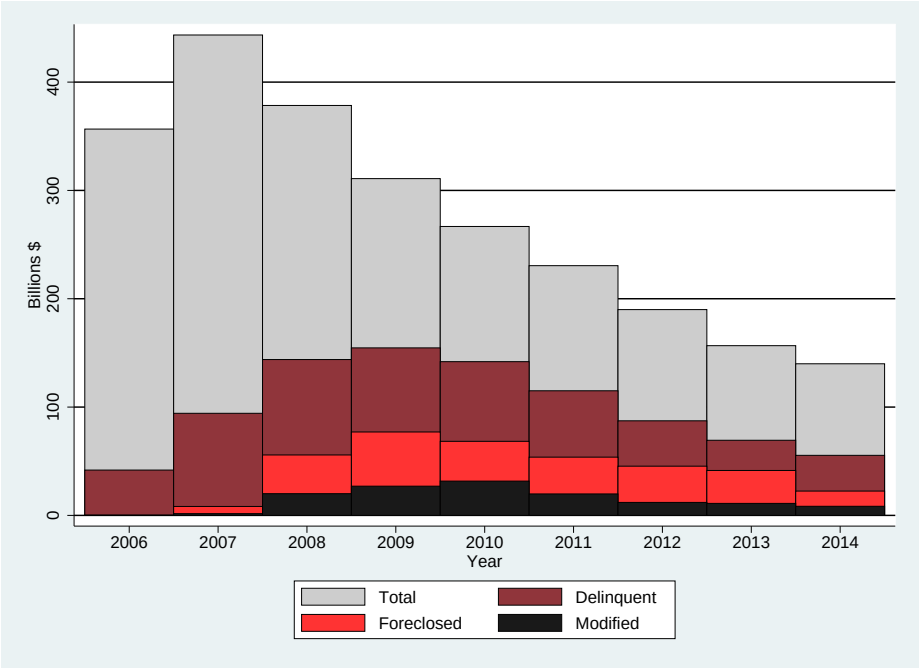
Table 1: Sample Description

Panel A: Loan Information (mean)					
	All	Current	Delinquent	Foreclosed	Modified
Original Balance ($)	276,663	282,970	267,957	272,698	259,552
Loan-to-Value	82.12	81.72	82.66	82.86	82.98
FICO Score	661.9	677	640.9	645.4	627.6
N	10,057,406	5,854,415	4,103,753	884,741	513,954
Panel B: Distribution of Risk Measures, Loan Type, and Purpose (%)					
	All	Current	Delinquent	Foreclosed	Modified
FICO Score					
Sub Prime	27.4	20.6	36.9	34.3	45.9
Alt-A	21.6	19.5	24.5	25.0	25.1
Prime	51.0	60.0	38.6	41.0	29.0
Loan-to-Value					
LTV <= 80	71.0	73.9	67.2	67.1	62.7
80 < LTV <= 95	19.4	17.1	22.6	22.2	26.6
95 <= LTV	9.6	9.0	10.3	10.7	10.7
Loan Type					
Fixed Rate	35.7	38.2	32.1	31.1	49.7
Adjustable Rate	62.8	60.6	66.1	66.1	44.9
Loan Purpose					
Purchase	47.5	48.1	46.8	48.6	40.2
Refinace	13.2	14.3	11.7	11.0	11.0
Cash-out Refinance	37.5	35.9	39.6	37.6	46.2

Table 1 presents the descriptive statistics for all loans, current loans, delinquent loans, foreclosed loans, and modified loans. The basic pattern is that loans across these groups tended to be quite similar. As expected, current loans have slightly better risk measures than delinquent loans. Somewhat unexpectedly, modified loans tended to have slightly worse risk measures than other groups. However, modified loan's risk measures were still relatively close to those of the other groups.

There were roughly 1.5 million unique loans in the full sample in 2006 and 2007. For the pooled sample, this yields 10,000,000 loan-year observations with

Figure 2: Total Balances for Current, Delinquent, Foreclosed, and Modified Loans



an average original balance of $275,000. Throughout the course of 2006-2014, roughly 40% of loans were delinquent at least once, for a total of 4.3 million delinquent loan-year observations. Delinquent observations in this sample are counted as any loan that is delinquent at least once in the preceding year. During the full 2006-2014 period, the sample contains roughly 900,000 unique foreclosures, and 515,000 unique modifications. However, about 140,000 of these modifications eventually ended up in foreclosure.

Panel B shows the distribution of risk measures, types of loans, and purpose of loans across these groups. As could be expected, risk measures were better for current loans than delinquent loans. Current loans had a much higher proportion of prime credit scores, while modified loans had the largest proportion of subprime credit scores. Current loans also had lower LTVs than delinquent loans. Current loans and delinquent loans tended to be more similar in terms of loan types and purposes. The exception is modified loans, which had a largest proportions of fixed rate mortgages and cash-out refinances.

Figure 2 provides data on the performance of loans in the sample from 2006-2014.[7] The figure shows the total balances of loans that are current, delinquent,

[7]The full 2006-2014 period is shown here, rather than the 2008-2014 period which forms the basis for the bulk of the analysis in the next section, to allow the reader to see the pre-crisis period of 2006.

foreclosed, and modified. The height of the delinquent balance shows the portion of the total balance that is delinquent. Additionally, height of the delinquent balance is subdivided into the areas that are accounted for by the total balance of foreclosed, modified, and delinquent loans that are neither foreclosed or modified. The basic pattern in this figure is that delinquencies were quite severe, and tended to result in more foreclosures than modifications.

The total balance of loans in the sample peaked in 2007 at nearly $450 billion, before rapidly declining due to poor performance. From 2009-2011, the delinquent balance was roughly the same or slightly greater than the current balance. The delinquent balance in these years ranged between $140-$155 billion. The delinquent balance remained between 85%-65% of the current balance in the remaining years of the sample. Also, in all years the foreclosed balance was larger than the modified balance. The modified balance peaked at $31 billion in 2010, which was 86% of the foreclosed balance. The modified balance ranged between 50%-60% percent of the foreclosed balance in 2008, 2009, 2011, and 2014, but was only 36% of the foreclosed balance from 2012-2013. In addition, typically between 40%-60% of delinquent loans were neither modified nor foreclosed.

4 Main Results

4.1 Loan Modifications and the Weakening of Household Balance Sheets from 2008-2014

Modifications of delinquent mortgages in the PLS market resulted in a cumulative net increase to borrowers' unpaid principal balances of $20 billion dollars from 2008-2014.[8] During this period, the total amount capitalized in modifications in this market was $34 billion, which was over twice as much as the total amount forgiven of $14.2 billion. This can be seen in panel A of Table 2, which presents the total change in debt due to modifications for the restricted sample, full CCF data set, and the entire PLS market. The results from the full CCF are projected to the level of the entire PLS market based on the CCF's yearly market share. Panel B in Table 2 also presents the cumulative total number of modifications during this period, as well as type of redistribution in modification. Consistent with the findings for aggregate change in debt, we see that the number of modifications with capitalization in the PLS market was over 4 times larger than the number of modifications with forgiveness. Overall, only 5% of total modifications during this period resulted in a net reduction of debt.

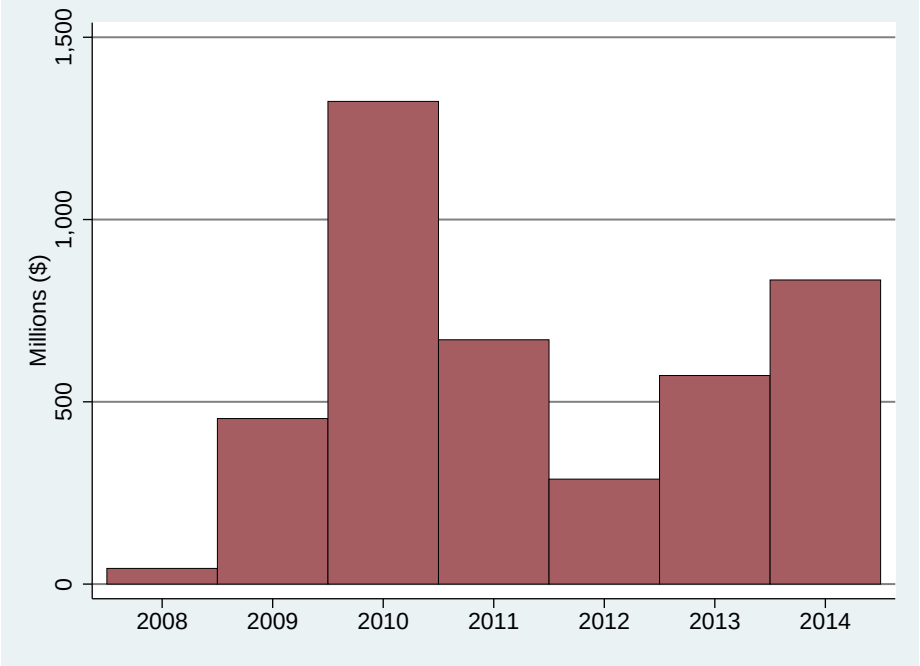
Capitalization in loan modifications also began to increase during the later years of the sample, with capitalization in 2014 larger than any other year, except for the peak crisis year of 2010. This can be seen in Figure 3, which shows the net change in debt per year in the restricted sample. This finding extends

[8] As discussed in the data description section, November 2008 is the first month for which the CCF recorded different measures of redistribution in modifications. This makes 2009 the first year for which we have complete data for redistribution in modifications.

Table 2: Total Capitalization and Forgiveness in Modifications from 2008-2014

Panel A: Total Change in Debt from Modifications (Billions $)			
	Sample	CCF	PLS Market
Redistribution Modifications			
Capitalization	7.1	11.4	34.0
Forgiveness	-3.0	-4.7	-14.2
Net	**4.1**	**6.7**	**19.8**
Type of Forgiveness			
Principal	2.1	3.33	9.92
Interest	.55	.89	2.66
Expense	.32	.52	1.58
Panel B: Total Number of Modifications			
	Sample	CCF	PLS Market
All Modifications	513,954	908,486	2,590,405
Redistribution Modifications	328,437	565,022	1,644,977
Type of Redistribution			
Capitalization	304,448	517,552	1,506,732
Forgiveness	67,673	123,099	357,712
Type of Forgiveness			
Principal	27,630	52,817	155,164
Interest	58,526	104,897	304,437
Expense	25,778	46,870	137,446

Figure 3: Net Change in Debt from Modifications



the existing literature, because it shows that the increase in debt identified in COP (2010) and White (2008) grew larger through time. The peak year for total increase in debt was 2010, where roughly $1.3 billion was added to borrowers' unpaid principal balances. Over the course of the next two years, the total amount of debt added by modifications decreased. The lowest total amount of debt added occurred in 2012, when debt was only increased by $288 million. However, following 2012 the total amount of debt added grew each year. In the final year of the restricted sample, modifications added $834 million to household debt.

Consistent with the findings in Figure 3, the average net increase in debt per modification consistently grew from 2008-2014, and increased sharply in the final two years of the sample. This can be seen in Panels A and B in Table 3, which show the mean change in debt per modification, in dollars and as a percentage of the original balance, for the restricted sample. The average net increase in debt per modification was 3.3 percent of the original loan balance in 2009, which is the first year with complete data on redistribution in loan modifications. The increase in debt grew to roughly 4.5%-5.5% of the relative balance over the next three years, but then more than doubled to 11.3% by in 2014. Average capitalization per loan roughly tripled throughout the sample period, from $12,000 in 2008 to $36,000 in 2014. This increase was from roughly 5.5% to 15% of the current loan balance. This finding also extends the earlier

research of COP (2010) and White (2008) by showing that the problems they identified grew worse through time. Consistent with COP (2010) and White (2008), only 5% of total modifications in my sample reduced debt, and 2010 modifications increased debt by roughly 5%. However, by the final year of the sample, the average net increase in borrower debt doubled to 11.3%.

Table 3: Total Number of Modifications and Mean Change in Debt

Panel A: Total Number of Modifications

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
All Mods	83,061	104,933	110,581	74,878	51,261	46,873	35,569
Redistribution Mods	9,446	57,893	82,891	59,104	44,653	41,966	32,484
Type of Redistribution							
Capitalization	8,443	54,543	80,320	53,130	38,753	38,169	31,090
Forgiveness	2,428	12,943	10,975	14,565	13,252	8,790	4,720
Type of Forgiveness							
Principal	902	3,366	2,852	6,197	7,113	5,219	1,981
Interest	2,036	11,405	9,691	13,129	11,511	6,772	3,982
Expense	1,132	3,335	2,578	6,448	6,703	3,856	1,726

Panel B: Mean Change in Debt ($)

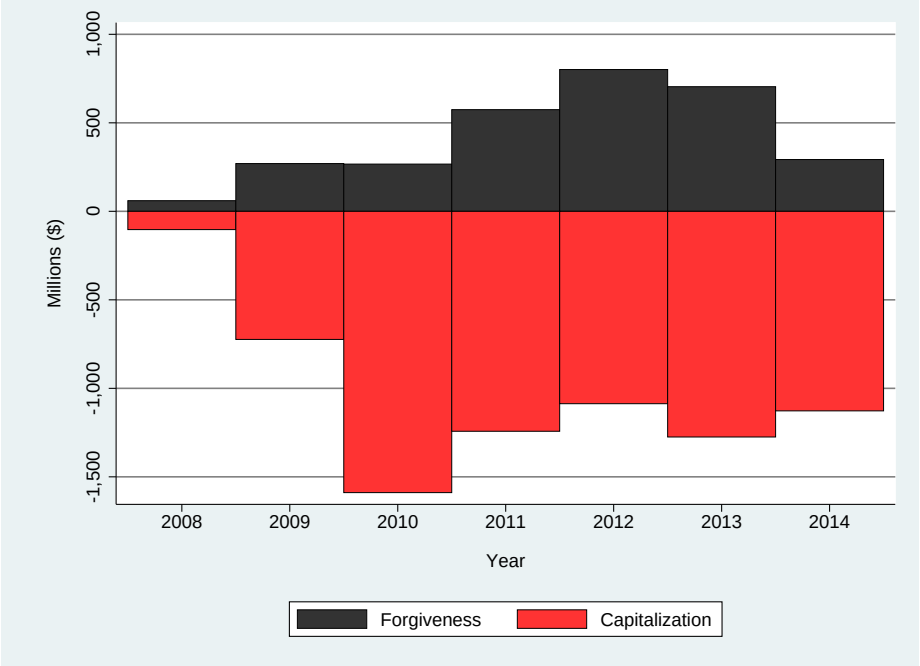
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Redistribution Modifications							
Capitalization	12,219	13,268	19,743	23,386	28,038	33,396	36,232
Forgiveness	24,758	20,832	23,849	39,296	60,264	79,934	61,921
Net	**-4,558**	**-7,843**	**-15,973**	**-11,339**	**-6,449**	**-13,632**	**-25,680**
Type of Forgiveness							
Principal	46,182	55,257	66,917	71,332	80,412	95,142	84,191
Interest	6,729	5,917	5,454	6,578	12,079	17,109	17,542
Expense	4,201	4,842	6,997	6,813	13,071	23,395	32,231

Panel C: Mean Change in Debt (%)

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Redistribution Modifications							
Capitalization	5.6	5.7	7.1	9.2	13.0	14.7	14.6
Forgiveness	13.6	9.0	10.1	16.4	21.9	25.2	18.3
Net	**-1.5**	**-3.3**	**-5.6**	**-4.6**	**-5.1**	**-8.1**	**-11.3**
Type of Forgiveness							
Principal	26.3	25.1	31.4	35.1	35.5	37.1	32.0
Interest	3.5	2.8	2.5	4.1	7.0	8.2	7.1
Expense	2.5	2.6	4.0	5.1	8.4	11.7	14.1

Average forgiveness per loan also grew throughout the sample period, peaking in 2013 at close to $80,000 or 25% of the loan balance. Average forgiveness per loan tended to be far larger than average capitalization, and principal forgiveness was much more generous than any other form of forgiveness. Principal forgiveness was over 30% of the current loan balance from 2010-2014, and peaked at almost $100,000 in 2013. However, as can be seen in Panel C of Table 3, far fewer loans received forgiveness. In 2009 the ratio of modifications with capitalization to those with forgiveness was slightly higher than 4:1. However, this increased to over 7:1 in 2010, which was the year with the greatest increase in

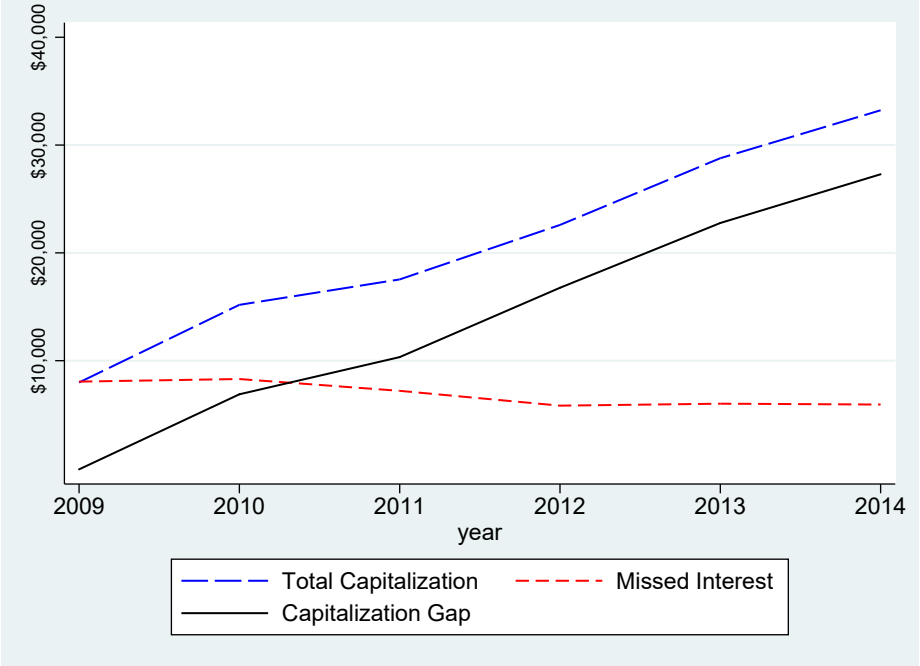
Figure 4: Total Forgiveness and Capitalization from Modifications



debt. The ratio then fell to approximately 3:1 for the next two years, before increasing sharply in 2013 and 2014. In 2014 the ratio grew to almost 7:1, resulting in a larger net increase in debt in 2014 than in any other year, except the peak year of 2010.

The yearly changes in the ratio of modifications with capitalization to those with forgiveness also helps to show that change in total debt is driven more by variation in forgiveness than capitalization. This can be seen in Figure 4, which presents total forgiveness and capitalization per year in the restricted sample. Total amounts capitalized peaked at over $1.5 billion in 2010, and then remained fairly consistent at slightly over $1 billion per year for the remainder of the sample period. In contrast, total forgiveness was quite low until 2011, when it reached roughly $500 million. Total forgiveness peaked in 2012 at almost $800 million, before returning to pre-2011 levels in 2014. The total amount of capitalization was relatively constant from 2011-2014, so variation in total net change in debt was driven largely by the increase and decrease in total forgiveness. A probable explanation for this pattern is that 2012 was the final year of the primary portion of the HAMP program, and so total forgiveness decreased after the program expired.

Figure 5: Capitalization and Missed Interest Payments



4.2 Was the Increase in Capitalization Driven by Missed Interest Payments or Fees?

4.2.1 Missed Interest Payments, Delinquencies, and Capitalization

Figure 5 helps to show why missed interest payments lack explanatory power for the increase in capitalization. This figure plots the average amount of capitalization and missed interest per year, as well as the difference between capitalization and missed interest payments, which is labeled the capitalization gap. The primary finding in this figure is that, as capitalization was increasing, the average amount of missed interest payments per modification *declined* due to falling interest rates. Therefore, the increase in capitalization could not be due to increases in missed interest payments because missed interest was decreasing.

Over the full period for my sample, total missed interest payments only account for roughly 45% of total capitalization, leaving a total capitalization gap of 55%. However, as can be seen in Figure 6, missed interest payments accounted for progressively less of total capitalization in each year. In 2009 missed interest payments accounted for 97% of total capitalization in my sample, before declining sharply to 50% in 2010, and then to 25% in 2012. By the final year of the sample, missed interest payments only accounted for 17% of total capitalization.

A further reason missed payments lack explanatory power can also be seen in

Figure 6: Total Capitalization and Missed Interest Payments

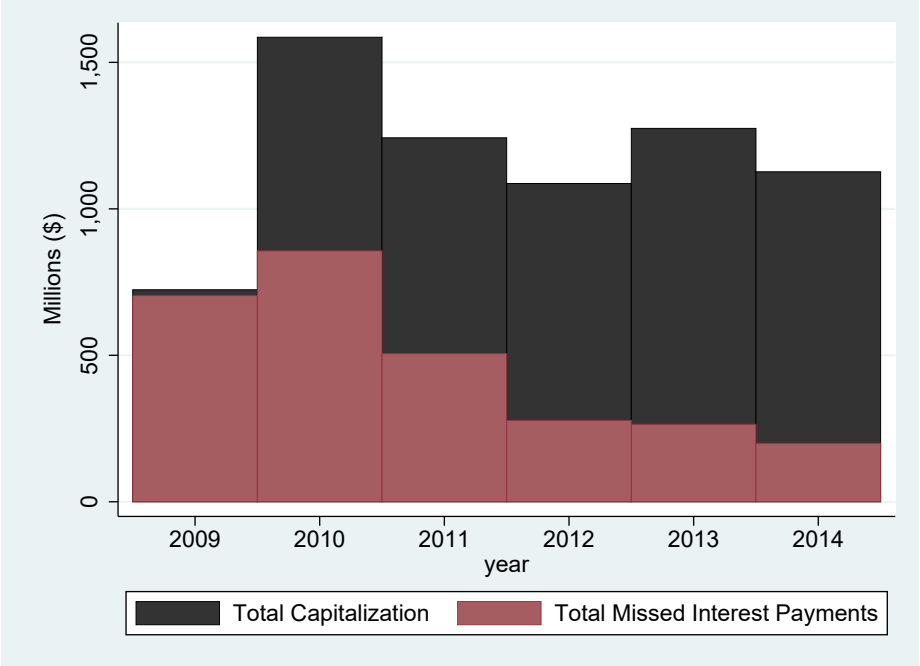
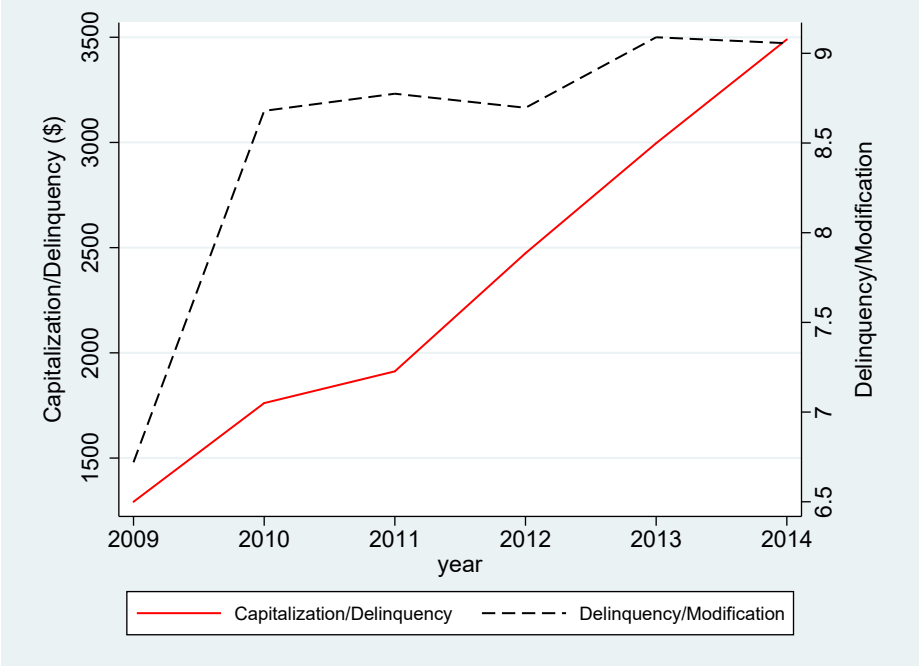


Figure 7, which shows the average number of months delinquent per modification and capitalization per delinquency. The basic trend here is that the average number of months delinquent per modification only varied by four-tenths of one month delinquent from 2010 - 2014, ranging from 8.7 - 9.1 months delinquent per modification. However, while delinquencies per modification stayed relatively constant, capitalization increased during this period, so that the amount of capitalization per delinquency increased. Capitalization per delinquency in 2010 was roughly $1,700, but doubled to $3,500 by 2014. Simply put, the increase in capitalization from 2010-2014 could not have been driven by an increase in the number of months delinquent per modification because delinquencies remained constant during this period.

4.2.2 Decomposition Analysis

In this section, I formally confirm the findings presented visually in Figures 5 through 7 by using a decomposition analysis to estimate the ability of missed interest payments, or other observables, to explain the increase in capitalization. Missed interest payments are observed in my data, while fees assessed by servicers are not. This allows me to use a Oaxaca-Blinder decomposition to estimate the portion of the increase in capitalization observed for the later years that can be explained by missed interest payments or other observable characteristics, and what portion cannot be explained by observables, and hence is

Figure 7: Capitalization and Delinquencies



consistent with capitalization of fees. My analysis takes advantage of the fact that the primary portion of the HAMP program expired in 2012 to create a counter-factual benchmark.[9] For all servicers enrolled, which was roughly 90% of servicers of privately securitized mortgages, the HAMP program required the capitalization of missed interest payments, but forbade the capitalization of delinquency or other fees (COP, 2010). Therefore, modifications which occurred before 2012 provide a benchmark for capitalization due to missed interest payments, but without capitalization of fees.

It is important to note the research design for my decomposition is conservative for two reasons. The decomposition should therefore be seen as a diagnostic for estimating the explanatory power of missed interest payments, rather than an estimate of a causal effect. First, my identifying assumption concerning the prohibition of fees by the HAMP program is likely violated in ways that would negatively bias the estimate of the increase in capitalization due to fees after 2012. For example, while the HAMP program prohibited the capitalization of late fees, it did not prohibit the capitalization of all fees. The HAMP program allowed servicers to capitalize advances made to third parties. However, many of the third parties were in fact affiliated with the servicer, and servicers of-

[9] To be sure, HAMP was extended beyond 2012. However, HAMP modifications accounted for a much smaller portion of total modifications in the PLS market after 2012. For reference, see the quarterly OCC Mortgage Metrics reports from 2013-2014.

ten received a percentage of the advances made to these affiliates (Thompson, 2011).[10] To the extent that these fees were capitalized in pre-2012 modifications, we would expect the decomposition analysis to understate the true difference in capitalization between periods, and therefore overstate the contribution of the explained component. Additionally the HAMP program only covered 90% of servicers. If the remaining 10% of servicers capitalized fees, this would underestimate the difference in capitalization, hence overstating the contribution of the explained component. Finally, while the primary portion of the HAMP program expired in 2012, the HAMP program was actually extended until 2016, although it covered a much smaller portion of the market. To the extent that it successfully prevented capitalization of fees post-2012, this would also understate the true causal effect.

In addition to the conservative identifying assumption, the decomposition analysis itself is also expected understate the true effect of fees on capitalization. For example, using simulated data Elder, Goddeeris and Haider (2010) show that the standard Oaxaca-Blinder decomposition systematically overestimates the contribution of the explained component, and hence underestimates the size of unexplained component. Taken together, the conservative research design implies any null finding regarding the explanatory power of missed interest payments or other observables is stronger than it would be absent these conservative assumptions. However, the conservative assumptions also imply that the decomposition should not be interpreted as a causal effect.

My decomposition estimates the difference in capitalization between pre- and post-2012 modifications, and what portion of this difference can be explained by missed interest payments or other observables. To perform this analysis, I use a panel model with ZIP code level fixed effects separately for pre- and post-2012 modifications. The decomposition analysis is then conducted with the reference coefficient estimated in the pooled sample, as suggested in Neumark (1988) and Jann (2008). However, the results are also consistent when using either pre- or post-2012 modifications as reference group. The regression model is:

$y_{iz} = \alpha_z + \beta_0 + \Lambda X_{iz} + e_{iz}$,

where y_{iz} is one of two outcomes for loan i in ZIP code z, α_z is a ZIP code level fixed effect, and X_{iz} is a vector of controls The two outcome variables are the amount of capitalization, and capitalization as a percent of the current balance. The vector of controls includes the number of months delinquent per loan, total missed interest payments per loan, the original balance, and sets of indicators of for risk measures including FICO, LTV, loan purpose/type, loan type, and origination year. These controls allow me to use the power of regression as a matching estimator to ensure that I am comparing modifications that are similar in terms of delinquencies, size, and observable risk measures. Additionally, the fine-grained geographical detail of the data allows me to use ZIP code level fixed effects to control for local economic conditions. To ease estimation, ZIP code

[10] This practice was one practice described in the 2013 Consumer Financial Protection Bureau complaint against Ocwen, the largest servicer of privately securitized mortgages. Full text of complaint available from: `http://files.consumerfinance.gov/f/201312_cfpb_consent-order_ocwen.pdf` Accessed June 15th, 2016.

Table 4: Decomposition Results

	Capitalization ($)		Capitalization/Balance (%)	
	Difference	**Percentage**	**Difference**	**Percentage**
Total Difference	7982.9***	100%	3.84%***	100%
	(62.76)		(71.86)	
Explained	2519.4***	31.6%	0.9%***	24.3%
	(36.10)		(48.78)	
Missed Interest	-37.21**	-0.5%	0.2%***	4.8%
	(-2.63)		(24.70)	
Delinquency	1120.2***	14%	0.6%***	15.2%
	(44.20)		(43.72)	
Risk Measures	155.2***	1.9%	0.0%***	.1%
	(12.58)		(7.12)	
Balance	1281.2***	16%	0.1%***	3.3%
	(22.57)		(17.48)	
Unexplained	5463.5***	68.5%	2.9%***	75.52%
	(56.53)		(63.38)	
Missed Interest	-155.5***	-2.0%	0.09%***	2.3%
	(-9.31)		(14.59)	
Delinquency	259.2***	3.3	0.2%***	5.2%
	(25.95)		(32.45)	
Risk Measures	-62.32***	-.8%	-0.1%***	-1.22%
	(-6.64)		(-11.26)	
Balance	191.8***	2.4%	0.0%***	0.8%
	(12.28)		(7.59)	
Constant	5230.2***	65.5%	2.63%***	68.5%
	(52.00)		(59.37)	
N	420712		420712	

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

level fixed effects and origination year fixed effects are partialed out prior to estimation.

The results are reported in Table 4. The total difference in capitalization between the two time periods is just under $8,000, or 4% of the current loan balance. Only between one-third and one-quarter of this variation can be explained by observables. Missed interest payments alone have almost no explanatory power, and can explain only 5% of the difference at most. The number of months delinquent has the highest consistent explanatory power, but can still only explain 15% of the difference. The original balance explains 16% of the difference in capitalization measured in dollars. However, when the difference in capitalization is normalized as a share of the loan balance, the size of the original balance loses almost all explanatory power. Risk measures including the LTV or FICO also have almost no explanatory power. Overall, the null finding regarding the explanatory power of observables is not consistent with the hypothesis that the increase in capitalization observed in later years in my sample is driven by missed interest payments.

4.2.3 Robustness and Limitations of Decomposition

The results from the decomposition rule out missed interest payments as the source of capitalization, and are consistent with the hypothesis that capitalization is driven by fees. However, the decomposition analysis alone cannot tell us what portion of the unexplained component is consistent with fees, and what portion is consistent with differences along unobservable dimensions. To formally test for the effect of selection along unobservables on the unexplained component, I use the test developed in Oster (2016). This analysis tests for the stability of coefficients due to bias from selection on unobservables by comparing co-movements of coefficients and R^2 in models which include and exclude controls. To the extent that selection along unobservables significantly biases estimated coefficients, we would expect large changes in estimates across specifications. To the extent that the results are not heavily influenced by unobservables, we would expect the estimated coefficients to be stable across specifications. The test is performed by calculating a bias-adjusted estimate. If the estimate remains non-zero after adjustment, then the estimate is stable to selection along unobservables.

The bias adjusted coefficients are defined as:

$\beta = \beta_{long} - (\beta_{short} - \beta_{long}) \frac{(R^2_{max} - R^2_{long})}{R^2_{long} - R^2_{short}}$,

where β is the bias adjusted beta, β_{long} and R^2_{long} are the coefficient and R^2 from the regression which includes controls, β_{short} and R^2_{short} are the coefficient and R^2 from the regression without controls, and R^2_{max} is the maximum R^2. The test is performed under the conservative assumption of equal selection, which assumes unobservables are equally as important as observables. I also use the recommended R^2_{max} of $1.3 * R^2_{long}$. As described in Oster (2016), this assumption for R^2_{max} is also conservative because only 90% of true results based on simulated data remain non-zero when using this threshold. To per-

form this test, my long regression is a panel model identical to the one in the Oaxaca-Blinder decomposition above, with the exception that it includes an indicator variable for post-2012 modifications. As described in Elder, Goddeeris and Haider (2010), the coefficient on this indicator will provide an unbiased estimate of the unexplained increase in capitalization between the time periods. The short regression corresponds to a model which only includes an indicator variable for post-2012 modifications, with delinquencies and the original balance as covariates.

Table 5: Oster Test for Selection on Observables

	Short	Long	Bias Adjusted
Difference in Capitalization ($)	12,856.82	11,263.4	9,825.59
R^2	.1590	.1732	-

The results from the Oster (2016) test are reported in Table 5. The results from this test are not consistent with a substantial effect of unobservables on the unexplained component. The fully saturated model estimates an unexplained difference in capitalization of $11,263, compared with an estimate of $12,857 in the short model, and a bias adjusted estimate of $9,825. This implies that even using the conservative assumption that unobservables are equally as important as observables, under which only 90% of true results remain non-zero, the effect of unobservables is not substantial. A final observation is that the estimate of the unexplained difference in capitalization from the long regression above is larger than the estimate of the unexplained gap from the decomposition analysis. This is consistent with the negative bias inherent in Oaxaca-Blinder decompositions described in Elder, Goddeeris and Haider (2010), and provides further confirmation that my estimate of the explanatory power of missed interest payments should be seen as an upper limit.

In total, the weight of evidence from the findings of the decomposition analysis is not consistent with the hypothesis that missed interest payments, observable risk measures, and selection along unobservable dimensions are the primary factors explaining the increase in capitalization post-2012. The decomposition analysis shows that at most, missed interest payments and delinquencies can explain 15% of the increase in capitalization. Additionally, the large unexplained component does not seem to be due to selection along unobservables, because the bias-adjusted coefficient produced by the Oster (2016) test is very similar to non-adjusted coefficient. This implies that even if we even if we make the conservative assumption that unobservables are equally as important as observables, they have little ability to explain the increase in capitalization. Overall, the lack of explanatory power of delinquencies and robustness of the unexplained component are consistent with capitalization being caused by fees, but not consistent with capitalization driven by missed interest payments.

4.2.4 Servicer Heterogeneity

A final finding which is consistent with the increase in capitalization being driven by fees, but not missed interest payments, is the substantial heterogeneity in the capitalization gap between servicers. I calculate the average capitalization gap for servicers by including a fixed effect for the servicer in the panel model similar to that used above for the decomposition analysis. The model is,

$y_{iszt} = \alpha_z + \gamma_s + \delta_t + \beta_0 + \Lambda X_{iszt} + e_{iszt}$

where y_{iszt} is the capitalization gap, γ_s is the servicer fixed effect, δ_t is a fixed effect for year, and the rest of the variables are the same as those used for the decomposition analysis. This model is run during the post-2012 years of my sample.

There are 46 servicers with modification activity in my sample during this period, and the capitalization gap is not statistically different from zero for the bottom half of the distribution. In contrast, the top quarter of the distribution have statistically significant coefficients ranging from \$47,500 to \$56,157. The high level of heterogeneity in the capitalization gap between servicers suggests that the capitalization gap is likely more reflective of differences in characteristics among servicers, such as different propensities to capitalize fees, rather than differences in characteristics of modified loans, such as missed interest payments. The ten servicers with the largest estimated coefficients for the capitalization gap, ranked highest to lowest, are: Saxon Mortgage Services, EMC Mortgage Corporation, Chase Home Finance, Select Portfolio Servicing, Wells Fargo Bank, Aurora Loan Services, Bank of America, JP Morgan Chase, Bayview Loan Servicing, and Ocwen Loan Servicing. The inclusion of Ocwen in the servicers with the top 10 highest capitalization gaps is also significant due to the documented history of consumer protection violations described above. This suggests that the findings from the analysis of servicer heterogeneity are not spurious.

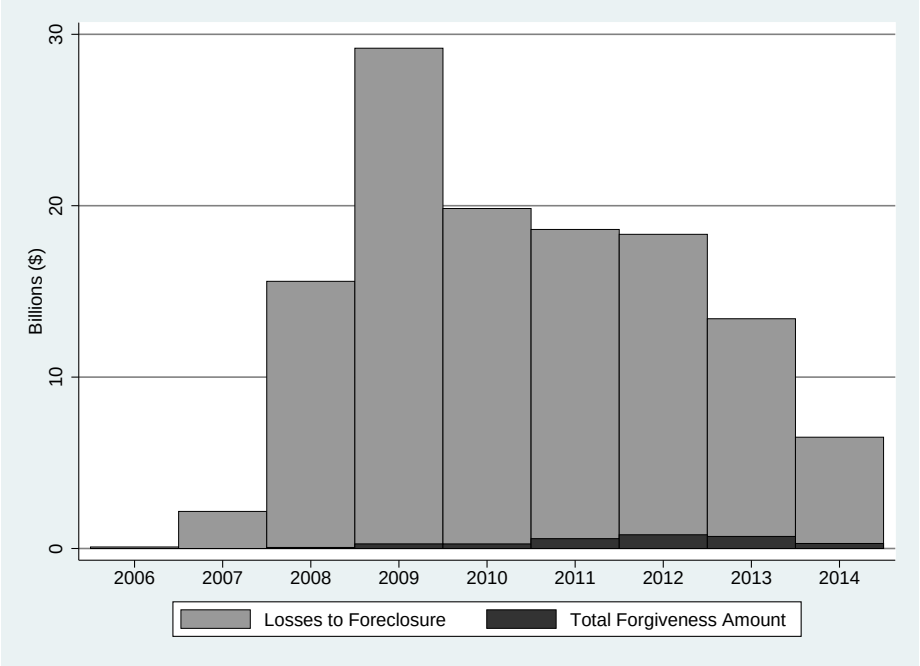
4.3 Losses from Foreclosures

Prior research has also argued that the combination of lack of modifications and loss severities of over 50% for foreclosures suggests that there was room to increase debt forgiveness to mitigate losses (Cordell et al., 2008; White, 2008). My data contains detailed information on losses from foreclosure, which allows me to extend prior findings to the level of the entire market.

From 2008-2014, there were just over 1.7 million foreclosures in the full CCF data set, which is 89% larger than the 900,000 modifications which occurred. Projected to the level of the PLS market, the results imply that there were slightly under 5 million foreclosures. The biggest difference between foreclosures and modifications occurred in 2012-2013, when there were over twice as many foreclosures as modifications. Compared with Corelogic's estimate of 5.7 million total foreclosures since 2008 this figure is unexpectedly high, even when considering that the PLS market accounted for the lion's share of foreclosures during the Great Recession and weak recovery.[11] However, the variable which

[11] Corelogic is a leading data provider which constructs widely used foreclosure reports.

Figure 8: Total Losses from Foreclosure and Forgiveness



measures foreclosures in the CCF includes home forfeiture actions more broadly, such as short sales or deeds-in-lieu, rather than just narrow foreclosures. This factor can likely account for the difference in estimates.

These foreclosures were also highly costly. At an aggregate level during this time period, there were roughly $120 billion in losses from foreclosure in the sample, and $210 billion in the full CCF. This implies total losses from foreclosure in the PLS market for this period reached almost $600 billion. This level of loss is equal to 22% of the December 2007 peak outstanding balance for the entire PLS market of $2.7 trillion. At the loan level, the average loss from foreclosure ranged between roughly $110,000-$160,000, which was between 45%-62% of the original balance of the loan. In contrast, total forgiveness in the PLS market during this period was only $14.2 billion.

Figure 8 compares total losses from foreclosure to the gross amount of forgiveness in my restricted sample.[12] Aggregate losses from foreclosure in the restricted sample were several orders of magnitude larger than the gross amount of forgiveness. Indeed, losses from foreclosure per year in the sample are most usefully measured in the tens of billions of dollars, while total forgiveness is more usefully measured in the hundreds of millions. Losses from foreclosure peaked

The reports can be found here: `http://www.corelogic.com/about-us/researchtrends/national-foreclosure-report.aspx?WT.mc_id=prnw_160510_IrWNB#.V1dDVJErKhc`.

[12] Gross forgiveness is used here, instead of net, because modifications resulted in net increase in debt in each year.

at close to $30 billion in 2009, and remained close to $20 billion for the next 3 years. In contrast, gross forgiveness was not larger than $800 million in any year. At $30 billion, losses from foreclosure in the peak year were roughly ten times larger than the combined total forgiveness for all years in the sample, which was just under $3 billion. Consistent with prior findings at the loan-level, the large difference between aggregate losses from foreclosure and debt forgiveness in my data strongly suggests that there was ample room to increase forgiveness to mitigate losses from foreclosure.

5 Conclusion

The findings in this paper show that voluntary household debt restructuring through loan modifications in the PLS market increased borrower debt rather than reduced it. From 2008-2014, loan modifications added $20 billion to borrower unpaid principal balances. The net increase in debt per modification also grew larger through time, roughly doubling from 2010-2014. This resulted in the net increase in debt in 2014 being larger than in any other year of the sample, with the exception of the peak crisis year of 2010, despite having fewer modifications than other years. This increase in debt weakened household balance sheets, rather than strengthened them, contributing to the weakness of the recovery.

I also find that the increase in capitalization is consistent with increased fees imposed by servicers, but not by increased numbers of missed interest payments. This finding is consistent with a principal-agent problem between servicers and investors, based on perverse incentives in servicers' cost-plus compensation structure, that prevented efficient loss mitigation. Servicers were incentivized to foreclose rather than modify, or to provide unsustainable mortgages that increased the borrower's debt. Loan modifications which forgave borrowers by reducing debt, rather than punishing borrowers by increasing debt, likely would have prevented a significant portion of the 5 million foreclosures, which resulted in $600 billion lost in the PLS market from 2008-2014.

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