

Owner-Occupancy Fraud and Mortgage Performance*

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Abstract

We use a matched credit bureau and mortgage dataset to identify occupancy fraud in residential mortgage originations, that is, borrowers who misrepresented their occupancy status as owner-occupants rather than residential real estate investors. In contrast to previous studies, our dataset allows us to show that – during the housing bubble – such fraud was broad based, appearing in the government-sponsored enterprise market and in loans held on bank portfolios as well, and increases the effective share of investors by 50 percent. We show that a key benefit of investor fraud was obtaining a lower interest rate, particularly for riskier borrowers.

Mortgage borrowers who misrepresented their occupancy status performed substantially worse than otherwise similar owner-occupants and declared investors, and constituted one-sixth of the share of loans in default by the end of 2008. We show that these defaults were also significantly more likely to be “strategic,” further highlighting the contribution of fraud in the housing bust.

Keywords: mortgage default, consumer credit, household finance, misreporting, fraud

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I. Introduction

Policymakers and the popular press have cited anecdotal evidence to suggest that one of the contributing causes of the housing bubble was pervasive mortgage fraud.¹ Recent academic work has also verified the existence of mortgage fraud along several dimensions. Ben-David (2011) finds evidence of inflated prices. Griffin and Maturana (2015a) examine three dimensions of fraud among private securitized loans: unreported second liens, owner-occupancy misreporting, and appraisal overstatements. Piskorski et al. (2015) study second lien misreporting and occupancy fraud in the private securitized market. Mian and Sufi (2015) argue that borrowers misstated their incomes on mortgage applications.

In this paper, we use a matched credit bureau and mortgage dataset to identify occupancy fraud in loans originated between 2005 and 2007. This occurs when mortgage borrowers claim on the mortgage application that they will be the owner-occupants of the property, will not rent the property out to another individual or family, and do not intend to sell the property quickly. In contrast to previous work, our data allow us to confirm that occupancy fraud was pervasive and did not affect just private securitized loans. It appeared in government-sponsored enterprise (GSE)—guaranteed, private securitized, and portfolio-held loans (by contrast, Federal Housing Administration (FHA) and loans guaranteed by the Veterans Administration (VA)² exhibited markedly lower fraud rates). We show that accounting for fraudulent investors increases the size of the effective investor population by 50 percent.

We show that an important benefit from investor fraud was obtaining lower interest rates: 35 basis points lower, on average, than otherwise similar declared investors. For riskier borrowers, such as those with low origination FICO scores³, high loan-to-value ratios, or low documentation loans, this discount was even larger.

After we have identified these investors from the matched credit bureau and mortgage data, we compare the performance of the honest homeowners, the fraudulent investors, and the honest declared investors. We find that the fraudulent investors, after controlling for available characteristics, performed substantially worse than otherwise similar honest homeowners,

¹ See the Financial Crisis Inquiry Report, 2011.

² We group these two types of government guaranteed loans together and term them FHA/VA.

³ All FICO scores referred to in our work are FICO scores at origination, obtained from the Black Knight McDash dataset (described below).

declared investors and second-homeowners, defaulting at a nearly 40 percent higher rate. And despite making up only 5 percent of the borrower population, they constitute one-sixth of the dollar share of defaulted loans for originations during this time period. Although we show that they were somewhat more likely to be subprime than declared investors, overall they were part of the prime sector, and so our results are consistent with Adelino, Schoar and Severino (2016), and Foote et al. (2016), who have argued that much of the increase in net borrowing during the housing boom, and defaults during the bust, can be attributed to prime borrowers. We also show that the fraudulent investors are more “strategic” in their default decisions, further highlighting their role in the housing bust. First, their decision to default is more sensitive to negative equity than the decisions of other borrowers. Using the credit bureau data, we also obtain the borrowers’ other consumer liabilities, in particular bank cards. We find that those fraudulent investors who defaulted on their mortgages had significantly lower bank card utilization rates than both honest homeowners and declared investors.

Finally, we also consider the impact of state laws concerning deficiency judgments on this strategic behavior. Ghent and Kudlyak (2011) have shown that state laws that limit lenders’ ability to pursue deficiency judgments are associated with higher default rates by borrowers with negative equity. We confirm this for honest homeowners and fraudulent investors. However, we also show that declared investors’ default behavior is unaffected by these laws, which likely reflects the fact that many states restrict their prohibition against pursuing deficiency judgments to owner-occupied properties (see Pence, 2006).

The remainder of the paper is organized as follows. Section II describes the related literature. Section III describes the data we have used. Section IV documents our definition of mortgage occupancy fraud. Section V provides descriptive statistics on our sample. Section VI studies the determinants of fraud. Section VII presents the results from estimating the impact of fraud on mortgage default, and Section VIII concludes.

II. Related Literature

This paper is not the first to examine the role of owner-occupancy fraud and its impact on loan performance. Although they do not focus on fraud *per se*, Haughwout et al. (2011) were

among the first to use credit bureau data to explore the role of real estate investors during the mortgage boom and to show that the self-reported occupancy status may paint a misleading picture. They document significant increases in the share of purchase mortgages attributed to borrowers with multiple first lien mortgages in their credit files, with as many as half of all purchase mortgages attributable to investors in states that experienced the largest housing booms and busts. They also show that such investors account for a substantial share of defaults.

Several different types of mortgage misrepresentation have been studied in the literature. Garmaise (2015) explores the role of borrower misreporting of personal assets just above round number thresholds. He finds that borrowers who reported above-threshold assets were 25 percentage points more likely to default. Mian and Sufi (2015) explore the role of fraudulent income overstatement on mortgage applications. They compare the growth in income as implied by mortgage applications with the average IRS-reported income growth at the zip code level, and they find substantial divergence between these two series. Income overstatement was higher in zip codes with low credit scores and low incomes; Mian and Sufi show that borrowers in these zip codes experienced some of the most significant increases in mortgage credit during the boom.

Piskorski et al. (2015) analyze private securitized loans and find that second lien misrepresentation was widespread and occurred late in the intermediation process (e.g., by the underwriters of the residential mortgage-backed securities). More relevant to our paper, in their Internet Appendix, they detail additional analysis on the role of owner-occupancy misrepresentation in their sample of private securitized loans. They infer owner-occupancy misrepresentation by comparing the property zip code reported by the residential mortgage-backed securities (RMBS) trustee with 12 months of credit bureau-reported zip codes for the matched borrower. If none of these zip codes match, then the authors conclude that this loan was characterized by owner-occupancy fraud.

Griffin and Maturana (2015a) also examine three types of fraud (unreported second liens, owner-occupancy misreporting, and appraisal overstatements) in private securitized loans by matching to deeds data. They find that nearly half of the loans examined had at least one form of fraud and that these loans had 50 percent higher delinquency rates than otherwise comparable loans. They argue that investors appeared to be unaware of the incidence of fraud. Finally, they

explore the extent to which mortgage fraud and misrepresentation were responsible for the recent house price boom–bust cycle (2015b).

Our paper adds to the literature by showing that fraud was widespread, including, importantly, in the large GSE market. We also study the determinants of fraud, and quantify the interest-rate savings from misrepresentation. Finally, we also show that, in addition to defaulting at higher rates, these fraudulent investors’ default decisions were also more “strategic.” Our work thereby allows us to obtain a more complete picture of the impact of fraud on the housing boom and bust.

III. Data Description

We use a dataset known as CRISM: *Equifax Credit Risks Insight Servicing and Black Knight McDash Data* (henceforth CRISM).⁴ It is a match between loan-level mortgage data from Black Knight McDash (henceforth McDash) and credit bureau data from Equifax. Personally identifiable information is not included in the dataset. We restrict our data to borrowers who:

- (1) are listed as the “primary” borrower in CRISM;
- (2) are available and listed as primary borrowers in the Federal Reserve Bank of New York Consumer Credit Panel/Equifax Data (henceforth Equifax); and
- (3) originated a first lien *purchase* mortgage loan for a single-family unit in the McDash dataset between January 2005 and December 2007.

We discuss our definition of occupancy fraud in detail in Section IV.

We focus on borrowers with self-reported McDash occupancy type as owner-occupants, declared investors, and second-home buyers.⁵ We also restrict to borrowers who have scrambled address, zip code, and state data from Equifax one quarter before and four quarters after their matched McDash mortgages originated. We also exclude Equifax consumers whose address type is a post

⁴ See Beraja et al. (2015) for more detail on the CRISM dataset. Table 9 compares our sample with the loans originated during this time period from the broader McDash dataset.

⁵ We also drop the small number of loans with origination loan-to-value ratios (LTVs) either under 25% or exceeding 120%; loans whose matched borrowers’ bank card utilization at first mortgage default was greater than 150%; loans whose McDash investor type six months after origination was a Ginnie Mae buyout loan, local housing authority, Federal Home Loan Bank, or unknown; and mortgages with origination amounts exceeding \$1 million.

office box either one quarter before or four quarters after their matched McDash first lien originated. Our final dataset consists of 149,799 loans, matched to 146,291 distinct borrowers.⁶

Our house price index (HPI) data come from CoreLogic Solutions (henceforth CoreLogic), and we use zip code–level house price indices for single-family detached homes (including distressed sales). Our county-level unemployment rates come from the Bureau of Labor Statistics (BLS).

IV. Defining Occupancy Fraud

A key aspect of our experimental design is the identification of fraudulent investors. We discuss our definition and compare it with others in the literature. Importantly, the CRISM data enable us to compare the self-reported occupancy type from the Black Knight McDash loan-level data with information from the borrowers' Equifax matched credit bureau file. Our goal is to identify and classify borrowers who self-report owner-occupancy on their purchase mortgage applications (reported by the McDash data) but who appear to be investors judging by their credit history information. In our owner-occupancy fraud classification algorithm, we focus on three pieces of information:

- The self-reported occupancy type
- The count of first-lien mortgages four quarters after their matched McDash mortgage is originated
- The borrowers' Equifax scrambled address from one quarter before and four quarters after when the McDash mortgage originated

Using these data, we identify four types of borrowers:

Honest owner-occupants: These are reported in the McDash dataset as having originated an owner-occupied home purchase loan and whose Equifax scrambled addresses one quarter before and four quarters after their matched McDash mortgage origination are different.

Fraudulent investors: These are reported in the McDash dataset as having originated an owner-occupied home purchase loan and whose Equifax scrambled addresses is the same one quarter

⁶ We begin with 5,456,557 CRISM mortgages meeting criterion (3), and with non-missing investor information 6 months after origination. Among these approximately 5.5 million borrowers, about 5 percent (286,138) are primary Equifax borrowers. After we apply the additional restrictions described above, and drop borrowers with missing data or who cannot be classified, we obtain our final dataset.

before and four quarters after their matched McDash mortgage originated. The borrower's credit bureau file also reports more than one first lien mortgage four quarters after the matched first lien was originated.

Declared investors: These are borrowers who are reported in the McDash dataset as taking out a mortgage for the purchase of an investment property.

Second-home buyers: These are borrowers who are reported in the McDash dataset as taking out a mortgage for the purchase of a second home.

Note that we drop mortgages that do not fit one of these four criteria. We further restrict our attention to borrowers in the McDash data with single-family property types to avoid the possibility that our fraud classifier does not pick up an address change because of borrowers moving within a large multifamily unit. In addition, we also drop borrowers who reported themselves as homeowners who have post office box addresses, as this would make it difficult to distinguish between honest homeowners and fraudulent investors. Any concerns about the accuracy of the fraud classifier should bias downward the likelihood of finding that these borrowers behave differently.

In Figures 3a and 3b we show that these criteria lead to a clear distinction between honest homeowners and investors. The fraudulent investors are much closer to declared investors — both in terms of their likelihood to change address and their propensity to have multiple liens — than they are to honest homeowners. In addition, these figures also demonstrate that there is little drift in these variables over time after four quarters following origination, which implies that we are unlikely to simply be picking up slow updating of addresses and liens in the credit bureau files.

Our methodology of identifying owner-occupancy misrepresentation differs from that of other papers that have addressed the phenomenon and has a number of benefits that improve on existing work. Both Griffin and Maturana (2015a) and Piskorski et al. (2015) confine their analysis to private securitized loans (primarily subprime and jumbo mortgages). By contrast, by using the credit bureau data information on liens and addresses, we are able to study the extent of fraud across the entire universe of mortgage and loan types. As we show below, this substantially

increases the total amount of fraud. In particular, we find significant incidence of fraud amongst prime GSE-guaranteed loans and also those held on bank portfolios.

V. Descriptive Statistics

In this section, we compare descriptive characteristics by borrower type, that is, honest owner-occupants, fraudulent investors, declared investors and second-home buyers. A broad set of summary statistics is given in Table 2a.⁷ For many of our comparisons, we will focus on borrowers with multiple first liens, as these are more comparable to fraudulent investors (who have multiple first liens by construction); summary statistics for these are found in Table 2b.

We observe from Table 2a that while there is indeed high representation of private securitization amongst fraudulent mortgages, were we to restrict attention to private securitized mortgages alone, as in the previous literature, we would have accounted for less than half of all fraudulent loans. Overall, our estimate of the share of borrowers misrepresenting their occupancy status peaks in the first half of 2006 at 5.2%. We also show in Figure 1 that the fraud share continued to drop further after 2007, falling below 2 percent by 2018. In Table 3, we find a drop in the share of owner-occupancy misrepresentation among private securitized loans from the first half of 2007 to the second half 2007, consistent with the tighter standards that were reported in this market.⁸ This was also documented by Piskorski et al. (2015). As this share is declining, we also find an increase in the share of occupancy misrepresentation among other types of loans, particularly GSE-guaranteed mortgages and loans held on bank portfolios. This is consistent with the increase in GSE risk-taking that has been noted in the literature.⁹ Finally, note that, both fraudulent and declared investors were much less likely to have FHA/VA-guaranteed loans. This is likely because of the stricter enforcement of FHA/VA owner-occupancy requirements. As a result, for some of our analysis we drop these loans.

Figure 2 gives a heat map with the state-level mortgage occupancy fraud rates for purchase mortgages originated between 2005 and 2007. The areas with the highest fraud rates were California and Washington, D.C., with fraud rates in excess of 13% (and exceeding the number

⁷ See Table 1 for variable descriptions.

⁸ Similarly, there is a sharp drop in the share of private securitized subprime loans in the McDash dataset for the second half of 2007.

⁹ See, for example, Elul et al. (2019).

of declared investors). Other states with high fraud rates include Hawaii, Nevada, Florida and Arizona. Many of these correspond with the “bubble states,” and we also see in Table 2a that occupancy fraud was associated with greater-than-average prior run-ups in house prices in the originating area and subsequent declines.

Next, we show that the fraudulent investors were riskier, in a number of dimensions, than declared investors, and also riskier than honest homeowners with multiple liens. Indeed, in our multivariate analysis below, we show that one key benefit of fraud was to obtain better terms than declared investors would receive for risky loans.

Gao and Li (2012) find that most *declared* residential real estate investors are prime. While this is still the case for fraudulent investors, we do see that they are considerably more likely to be subprime than other borrowers, particularly those with multiple first liens (Table 2b). Indeed, 19 percent have FICO scores at origination below 660, as compared to only 9 percent for declared investors with multiple firsts. As we next discuss, the origination characteristics also appear to suggest that the fraudulent investors took on substantially riskier mortgages than declared investors and honest homeowners.

Fraudulent investors are also more likely to have (first-lien) high loan-to-value (LTV) ratios than declared investors or honest homeowners with multiple liens. Fifteen percent have LTV ratios at origination of 90 percent or higher, compared to roughly 10 percent for declared investors or honest homeowners. Combined with the more severe house price declines in the areas where fraud was prevalent, this led to higher updated LTV ratios in December 2008 and also, as we show below, higher default risk.

In addition to high first-lien LTV, our credit bureau data allow us to identify the existence of both closed-end and revolving second liens (HELOCs). As shown in Elul et al. (2010), for example, the presence of these second mortgages is associated with higher default risk. We find that the fraudulent investors are much more similar in this regard to the declared investors than to honest homeowners: More than half of them have second liens in their bureau files four quarters following the CRISM mortgage origination (Table 2b).¹⁰

¹⁰ Since they have multiple liens, we do not compute a combined loan-to-value, but we do control for the existence of second liens in our multivariate analysis.

Turning now to other risk characteristics, we see from Table 2b that fraudulent investors were substantially more likely to have low documentation loans, interest-only mortgages, option ARMs, and brokered mortgages, than all declared investors with multiple firsts, and also somewhat more than honest homeowners. They also are more likely to have 2/28 and 3/27 ARMs, which the literature has shown to be riskier.

Fraudulent investors also have much larger mortgages than declared investors; 18 percent have “jumbo” loans with origination amounts above \$417,000, as compared to only 4 percent for declared investors with multiple liens. This may reflect a larger interest rate benefit from committing fraud (discussed next), as well as the stricter underwriting that declared investors face. As a result, their higher default risk will translate into a much greater share of defaults: They represent one-sixth of the balances in our sample that are in default as of December 2008, despite making up only 5 percent of all purchases mortgages.

From Table 2b, when we compare interest rates paid by borrowers with multiple first liens, we see that those paid by fraudulent investors are, unconditionally, about 15 basis points lower than those for declared investors and 25 basis points higher than those for honest homeowners. But we have shown that fraudulent investors are riskier than other borrowers, and when we control for these risk characteristics in our multivariate analysis below, we will see that this discount relative to the declared investors grows, highlighting the motivation to undertake fraud. We will also see that the risk-adjusted premium relative to the honest homeowners is small, particularly for GSE and private securitized loans, suggesting that lenders either did not identify fraud or chose to ignore it.

Having shown that fraudulent investors are observably riskier at origination, we now see that they are also riskier ex-post. As of December 2008, 25 percent of all fraudulent investors were seriously delinquent (60 or more days past due) or in default. This compares to 9 percent of honest homeowners and 8 percent of declared investors (Table 2a). And even when we condition on risk characteristics, a significant difference remains. This is true for example, for borrowers with multiple first liens (Table 2b), from risky origination vintages, and also those with low FICO scores at origination (Table 4). We will confirm this result with our multivariate analysis, which controls for a full range of risk characteristics.

Finally, we will show in our analysis below that fraudulent investors' elevated default risk is driven by strategic motives, that is, greater sensitivity to house price declines. The full analysis will consider several indicators of strategic behaviors. However from the summary statistics in Table 2b, we can compare borrowers' bank card utilization rates, which can be viewed as a proxy for (il)liquidity (see Elul et al., 2010). Outside of default, fraudulent investors have a greater share of high utilization than declared investors (and similar to honest homeowners), likely reflecting the fact that they are more likely to be subprime. However, for those in default at the end of 2008, the difference is striking: Their utilization rates are significantly *lower* than those of both declared investors and, especially, honest homeowners.

VI. Estimations and Results – Determinants of Fraud

We now examine the determinants of investor fraud. We begin by showing that fraudulent investors pay lower interest rates than similar declared investors, particularly for riskier mortgages.

From the summary statistics, we saw that fraudulent investors have interest rates that are 15 basis points lower than those obtained by declared investors with multiple liens. So one natural motivation for fraud seems to be to obtain lower interest rates. Although the average difference is relatively small, we note that there are also differences in observable risk characteristics between fraudulent investors and declared investors. So we estimate multivariate models of the interest rate at origination, where we control for various borrower, mortgage, and property characteristics. For loan i , receiving interest rate Y_i at origination (in percent), we estimate models of the form:

$$Y_i = \alpha + \beta X_i + \gamma \text{Borrower Type}_i + \epsilon_i \quad (1)$$

where X_i is a set of mortgage and borrower characteristics at the time of origination, and Borrower Type_i is one of: honest homeowner, fraudulent investor, declared investor, or second-homeowner, as described above. In addition, in some of the regressions we also interact the borrower type with mortgage characteristics from X_i . This allows us to determine the premium paid by the different borrower types depending on the level of risk; in addition, by interacting the borrower type with the investor type (GSE, portfolio, private securitization) we are also able to

assess the degree to which different types of lenders identified the additional risk of fraud. The results from these estimations are reported in Table 5a.

We begin with a model for all borrowers in column (1). The control variables have the expected signs: Higher origination FICO scores are associated with lower rates; higher LTV ratios are also associated with higher rates. Shorter-maturity mortgages have lower rates, as do larger loans. Low-documentation loans and interest-only mortgages also have higher rates. Having multiple first liens or a second mortgage is associated with higher rates. 2/28 and 3/27 ARMs, known to be associated with riskier borrowers, have higher rates, whereas other ARMs have lower rates, relative to the omitted category, fixed-rate mortgages. Loans in private MBS have higher rates, relative to the omitted category, GSE loans. FHA/VA loans have lower interest rates, after controlling for LTV and borrower Equifax Risk Score (due to the FHA/VA insurance).

Turning now to the primary coefficients of interest, we see that the fraudulent pay slightly higher rates on average than do honest homeowners, roughly 9 basis points. As we have controlled for other mortgage and borrower risk characteristics, this suggests a very modest ability by lenders to identify fraudulent borrowers (or their extra risk). On the other hand, declared investors pay rates that are higher: 30 basis points more than similar honest homeowners.

Column (2) gives the results from estimating a model where we interact the key risk characteristics with borrower types (we also drop FHA/VA loans, as there is a trivial incidence of fraud for these, and they are effectively off limits for non-owner-occupants), and column (3) adds interactions with the investor type (GSE, private securitized, or portfolio). Marginal effects for the interacted terms in model (3) are given in Table 5b.

We see, first of all, that second-homeowners receive rates that are very close to those paid by honest homeowners, even for riskier loans. Comparing fraudulent investors with declared investors, we find a particularly large difference in rates for the riskiest mortgages. Fraudulent investors with origination FICO scores below 660 (the baseline category) receive rates that are only 9 basis points higher than those for honest homeowners, whereas declared investors pay 46 basis points more. Fraudulent investors with origination LTVs of 90 basis points or more pay rates that are 26 basis points higher than honest homeowners, whereas for declared investors the

premium is 80 basis points. Low documentation loans are 40 basis points more expensive for declared investors than fraudulent ones.

Finally, turning to the interaction between borrower type and investor type, we see that for both GSE and private securitized loans, the premium for fraud is very small: on the order of 8 basis points; by contrast, declared investors pay 45 basis points more, on average. Interestingly, fraudulent homeowners taking out loans that are held on bank portfolios will pay substantially more, which suggests that these lenders have either the ability or incentive to identify fraud (although they still pay 30 basis points less than declared investors).

The other columns report the results for models estimated on the subset of borrowers with multiple first liens, a sample that is more comparable to the fraudulent investors. The results are similar.

The Extensive Margin

In order to further identify the determinants of fraud, we also estimate probit models of fraud versus declared investor, restricting attention to just these two borrower types, and just to those with multiple first liens. More formally, the probability that loan i is identified as fraudulent is modeled as $\Pr(\text{fraud}) = \Pr(y \leq Y_i)$, where y is normally distributed with mean 0 and variance 1, and

$$Y_i = \beta X_i \quad (2)$$

These results, reported in Table 6, are generally consistent with the interest rate regressions discussed immediately above: Low origination FICO scores, high LTV, and low documentation status are all associated with higher likelihood of fraud. For example, relative to the overall sample average of fraud in this sample of 48 percent points, having an LTV of 90 percent or above raises the likelihood of being fraudulent by 16 percentage points. In addition, as was also evident from the summary statistics, fraudulent investors have much larger loan sizes than declared investors. This is also consistent with the interest rate motivation, as for a larger loan, the benefit of a lower rate is correspondingly larger. However, it may also reflect underwriting constraints in the jumbo market. Consistent with these larger (jumbo) loans sizes, fraud is also more common for portfolio loans.

In specification (3) we replace the state fixed effects with an indicator for “bubble states” (Arizona, California, Florida, and Nevada). Consistent with the descriptive statistics, fraud is more common in these states, which were associated with the housing boom–bust cycle.

Another possible motivation for fraud is to lower local property taxes. In specification (4), we replace the state fixed effects with an indicator variable for whether the state has statutes in place that reduce property taxes for owner-occupants relative to investors (often termed “homestead exemptions”).¹¹ We find a statistically significant, but economically small impact. Finally we also consider the influence of laws prohibiting deficiency judgments (as these typically apply only to owner-occupants); we find no impact on the likelihood of fraud and we will revisit this in our default models below.

VII. Estimation and Results — Fraud and Default Behavior

We have already seen that fraudulent investors were observably riskier at origination. From the summary statistics, we have also seen that they defaulted at higher rates. In order to identify the precise contribution of fraud to default risk, we estimate multivariate probit models of default, where we also control for these other risk characteristics. That is, the probability that loan i is in default¹² is modeled as $\Pr(\text{Default}) = \Pr(y \leq Y_i)$, where y is normally distributed with mean 0 and variance 1,

$$Y_i = \beta X_i + \delta Z_i + \gamma \text{Borrower Type}_i \quad (3)$$

and Borrower Type_i is as described following equation (1) above. We also include a variety of mortgage and borrower characteristics at origination in X_i , and Z_i includes dynamic variables as of December 2008: the change in the local unemployment rate from origination through December 2008, and an estimate of what the LTV would be in December 2008 when the house price at origination is updated using the local house price index. We cannot control for lender-specific fixed effects in this dataset, but Griffin and Maturana (2015a) show that there is very

¹¹ We obtain these from the National Conference of State Legislatures (2002).

¹² Recall that a loan is deemed to be in “default” if it is seriously delinquent (60 or more days past due) or defaults, as of December 2008.

little variation in owner-occupancy misreporting across lenders, suggesting that it is likely that these decisions were made by the borrowers (perhaps in conjunction with brokers).

In the first specification in Table 7a, we estimate the probability of default by December 2008 with a variety of characteristics known to affect the likelihood of default. The covariates have the expected signs: Higher origination FICO scores are associated with lower default risk; higher loan-to-value ratios, both at origination and also market-to-market as of December 2008, are associated with higher risk. Low-documentation, brokered, and interest-only loans are riskier, as are FHA/VA and private securitized mortgages. Increases in unemployment are also associated with higher default risk. Turning to the coefficients of interest, we see a substantially elevated risk of default for fraudulent investors (from the marginal effects, not reported, this corresponds to a default rate of 6 percentage points above the sample average rate of roughly 10 percentage points). By contrast, declared investors are only very slightly riskier than the base category, honest owner-occupants.

In model (2), we add indicator variables for having multiple first liens, and for second liens. We see that about 40 percent of the additional risk of fraudulent loans can be explained by these additional liens. However, fraudulent investors remain roughly 37 percent riskier than otherwise similar borrowers. By way of comparison, this is roughly equivalent to moving from the 700–740 origination FICO score bin, to the 660–700 origination FICO score bin.

In the next specification, we estimate the probability of default with a probit model similar to specification (1) but where we allow for the possibility of interaction between our borrower types — and whether the loans was FHA/VA guaranteed, GSE, private securitized, or held in portfolio. For both declared and fraudulent investors, we find that the interaction effects are either not statistically significant or very modest in magnitude, that is, they have higher default rates regardless of investor type.

In the sixth specification, we add an indicator variable for states that prohibit deficiency judgments to the model of column (2). Ghent and Kudlyak (2011) have shown that state laws that limit lenders' ability to pursue deficiency judgments are associated with higher default rates. We confirm this for honest homeowners and fraudulent investors; interestingly, we also see that fraudulent investors are no more likely to be affected by these laws than honest homeowners. By

contrast, however, we find negative interactions for declared investors and second-homeowners, which may reflect the fact that many states restrict the prohibition against pursuing deficiency coefficients on the judgments to owner-occupied properties.

In column (7) we add an indicator variable for whether the Equifax zip code for the borrower (four quarters after origination) differs from that of the mortgage zip code as reported in McDash. Recall that this is the way in which Piskorski et al. (2015) identify fraud. We find that this accounts for a significant amount of the additional default risk associated with fraudulent borrowers. However, we also see that having multiple mortgages also makes an important contribution to default risk (as in Haughwout et al., 2011), as does not changing one's address following the mortgage origination, which is the additional element of our method of identifying fraud.

Strategic Default

We have seen that fraudulent investors are significantly more likely to default than other borrowers. We now show that these default decisions are particularly sensitive to house prices. That is, that these borrowers are more “strategic.” We approach this in two ways.

First, in column (8) of Table 7a, we give the (uninteracted) marginal effects from estimating a default model similar to that in column (2), but adding interactions between the borrower type and the following: the change in unemployment from origination to December 2008, and the updated LTV ratio, also as of December 2008. That is, to Equation (3) we add interactions of the borrower type with covariates from Z_i . The marginal effects for the interactions themselves are given in Table 7b. For each category of updated LTV or unemployment change, the columns give the marginal impact on default risk of moving from the baseline borrower type (honest homeowner) to either fraudulent investor, declared investor, or second-homeowner. We see, in particular, that fraudulent investors' default decisions are much more sensitive to high updated LTV than other borrower types. By contrast, their reaction to high unemployment is no different from that of other borrower types.

The other way we approach this question is to compare the likelihood of having high bank card utilization across borrower type and default status. We begin by recalling that high utilization rates are associated with illiquidity (see Elul et al., 2010). This is obtained from the borrower's

matched credit bureau record, as of December 2008. Strategic behavior would be evident in a borrower having relatively lower utilization, but only in case of default, capturing default in the face of smaller liquidity shocks or, equivalently, drawing down less of their liquidity buffer in order to avoid default. That is, we estimate separate probit regressions for those who are not seriously delinquent or in default by December 2008 and those that are not, where the probability that borrower i has high utilization (a ratio of aggregate bank card balances to credit limit of 80 percent or higher as of December 2008) is modeled as $\Pr(High\ Utilization) = \Pr(y \leq Y_i)$, where y is normally distributed with mean 0 and variance 1, and

$$Y_i = \beta X_i + \delta Z_i + \gamma Borrower\ Type_i \quad (4)$$

We conjecture that $\gamma_{Fraud} > 0$, but only in the regressions for defaulted borrowers. The results are in Table 8: The first set is for borrowers with active mortgages who are not seriously delinquent or in default on their first-lien mortgage as of December 2008. The results from these are in columns (1) and (2). In column (3) we estimate a similar model for the sample of borrowers with multiple first liens. Borrowers with lower origination FICO scores are more likely to have high utilization rates in December 2008, as are FHA/VA borrowers, those with interest-only loans, high updated LTV ratios, or those who experienced large increases in local unemployment rates. ARM borrowers have higher utilization; this is consistent with earlier work showing that those taking out ARMs are likelier to be borrowing-constrained (Johnson and Li, 2014). Borrowers with multiple first liens or with second liens are also more likely to have high bank card utilization. Finally, declared investors have lower utilization (likely due to stricter underwriting), but fraudulent investors or second-homeowners are not significantly different than the baseline category of honest homeowners.

In columns (4)–(6) of Table 8 we report the results of estimating the determinants of high bank card utilization for those borrowers who were in default as of December 2008 (but with their mortgage still active). Here we see striking differences. First, unlike the case of borrowers not in default, in which high updated loan-to-value ratios were associated with a greater likelihood of high utilization, for borrowers in default, we have the opposite: High updated LTV is associated with lower utilization rates at default. This reflects the “double trigger” theory of mortgage default (Elul et al., 2010): if default may be triggered by either sufficiently negative equity or sufficiently bad liquidity shocks. Turning now to the coefficients of interest, we see that

fraudulent investors are now significantly *less* likely to have high utilization than the honest homeowners, approximately 15 percentage points less likely, relative to a sample average of roughly 70 percentage points. They are also less likely to have high utilization than similar declared investors. This suggests that they are defaulting in the face of smaller liquidity shocks than either honest homeowners or declared investors. Equivalently, one could also argue that they are less likely to draw down their credit lines in order to avoid defaulting on their mortgage.

VIII. Conclusion

Using a matched credit bureau and mortgage dataset to identify occupancy fraud in residential mortgages originated between 2005 and 2007, we find that such fraud was widespread. In contrast to previous studies, our dataset allows us to show that occupancy fraud was common in the GSE market and in loans held in portfolio, and not just in the private label market. We find that mortgage borrowers who misrepresented their occupancy status performed worse than otherwise similar owner-occupants and declared investors. Fraudulent investors' bank card utilization rates and default rates relative to those of honest owner-occupants and declared investors imply that the fraudulent investors' mortgage defaults may have been strategic. Our results and estimates are large and economically significant and demonstrate the important role that occupancy fraud played during the U.S. housing boom and bust.

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Figure 1: Incidence of Mortgage Fraud and Investor Activity by Origination Vintage

Borrower categories, as defined in Section IV. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, and CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data.

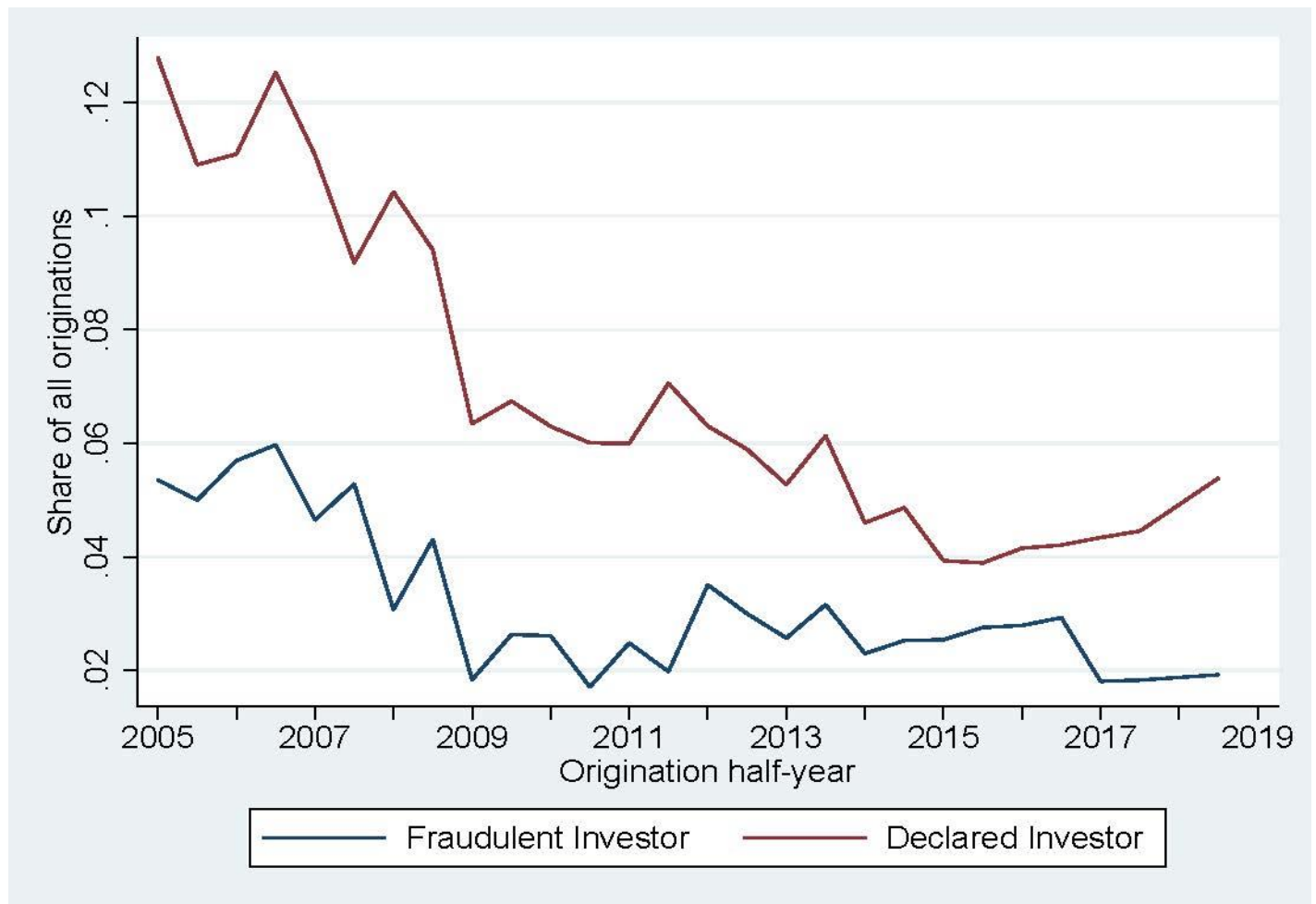


Figure 2: The Geography of Occupancy Fraud

State-Level Mortgage Occupancy Fraud Rate as a share of purchase mortgages originated between 2005 and 2007. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, and CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data.

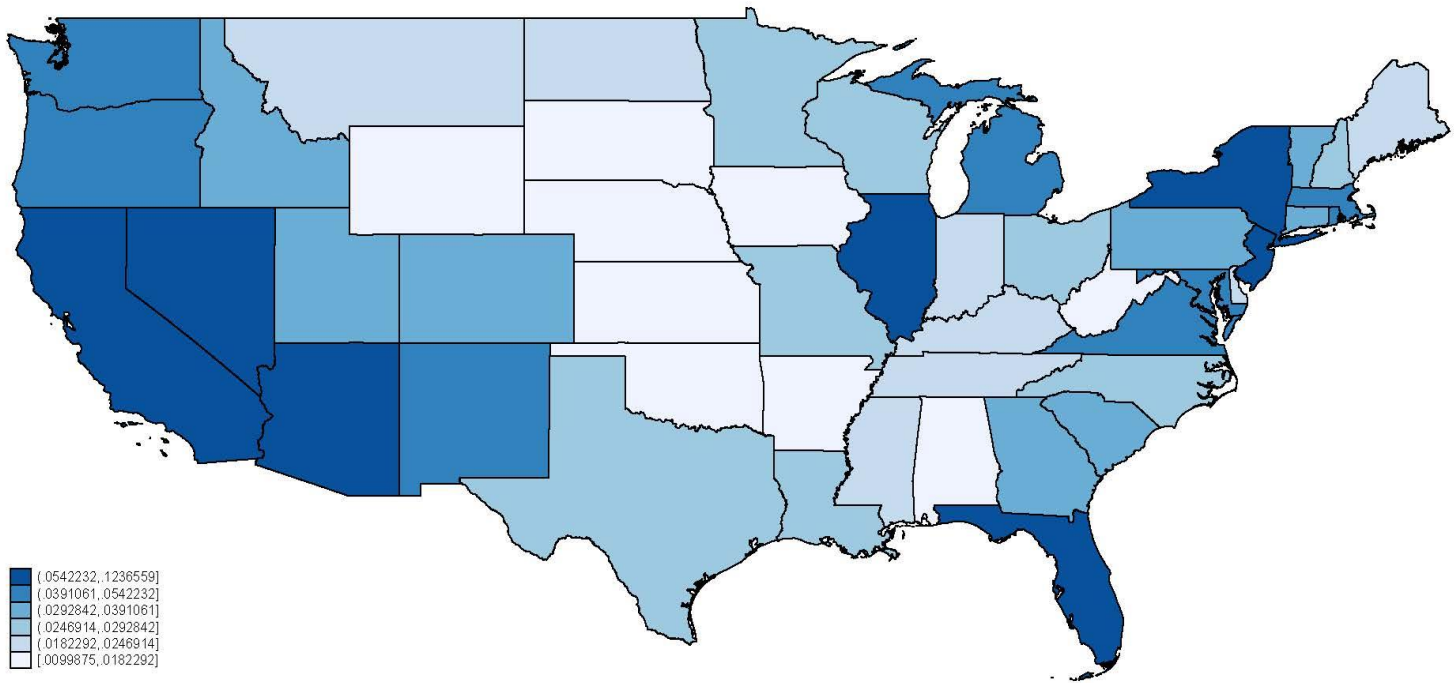


Figure 3a: Share of Loans with Borrowers who have Changed Address by Quarter after Origination

Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, and CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data

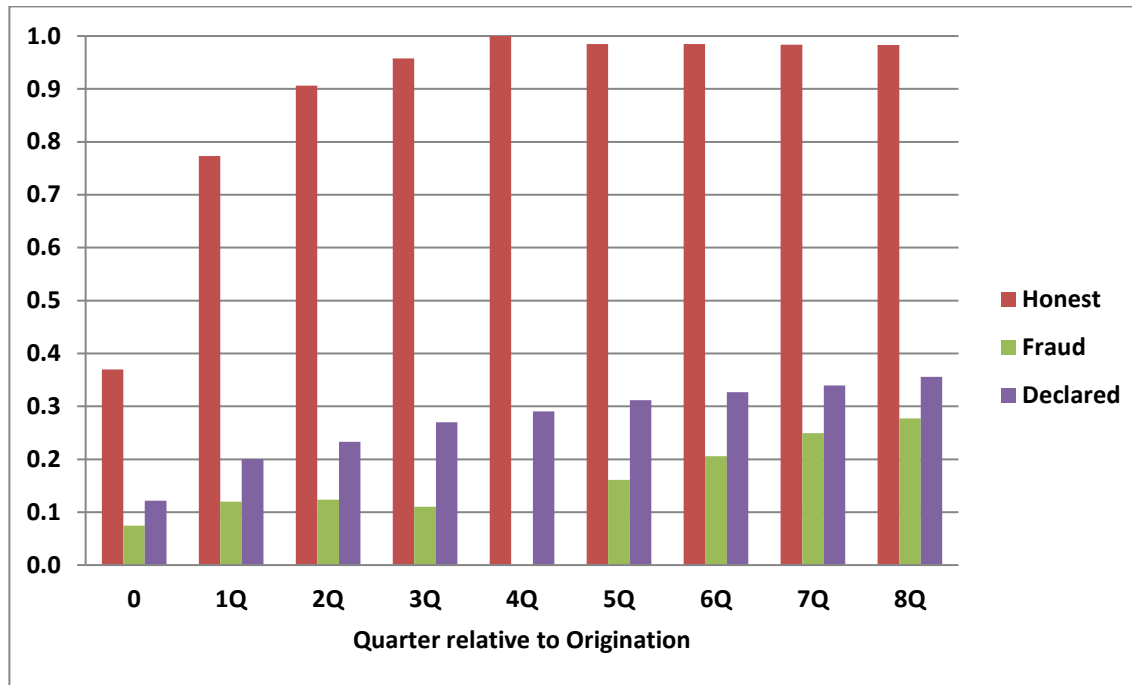


Figure 3b: Mean Number of First Liens in Credit Bureau File by Quarter relative to Origination Date of Matched First Lien

Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, and CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data

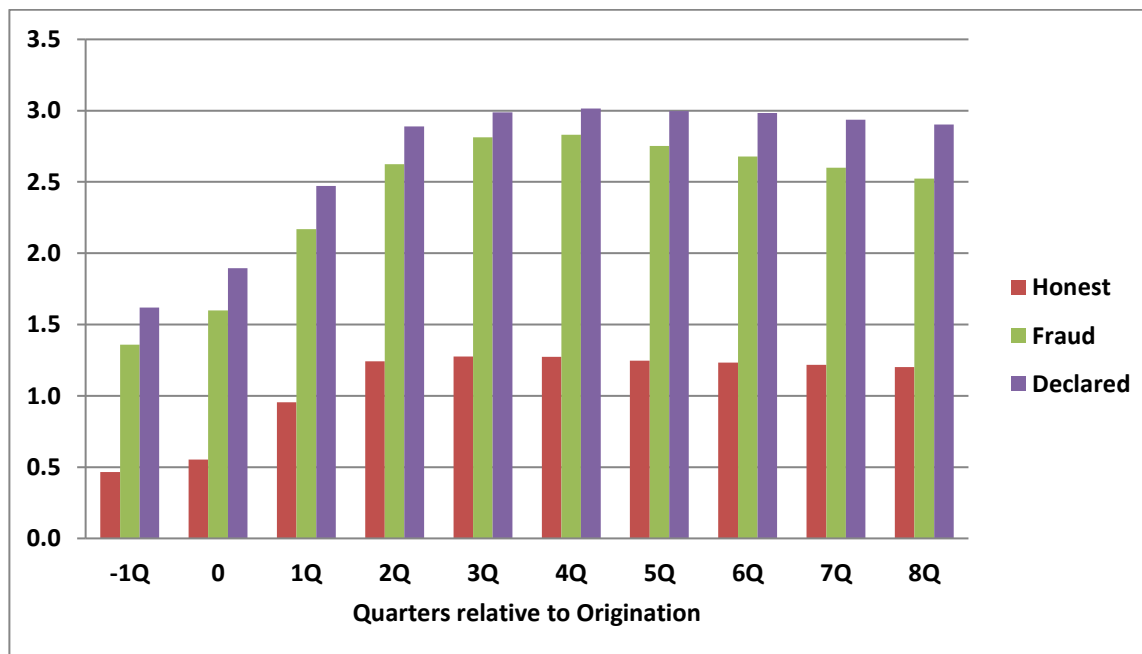


Table 1: Variable Descriptions

Source: Variables based on authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics.

Variable	Description
Borrower Type	Honest Homeowner, Fraudulent Investor, Declared Investor, or Second Home
Default	60+ days delinquent as of December 2008 or bad termination by December 2008, in McDash data
Bubble State	McDash property address in California, Nevada, Arizona, and Florida
FICO (Origination)	McDash origination FICO score
LTV Ratio (Origination)	LTV ratio of CRISM mortgage at origination
% Change HPI: Origination to Dec. 2008	Percentage change in the property's zip code-level CoreLogic house price index from origination to December 2008; if zip code level is not available, the county level is used, and if this is also unavailable, the state level is used
% Change 2-Year Lagged HPI	Percentage change in the property's zip code-level CoreLogic house price index two years before the McDash loan origination date; if zip code level is not available, county level is used, and if this is also unavailable, the state level is used
Second Lien	Borrowers have second lien (HELOC or closed-end home equity loan) in bureau data four quarters after CRISM mortgage origination
Interest Rate (Origination)	Interest rate observed when mortgage first enters the McDash data
Investor Type	McDash-reported investor type six months following origination: FHA/VA, GSE (FNMA/FHLMC), Private Securitized, or Portfolio.
Interest Rate Type	Fixed Rate vs. ARM; for ARMs, loans have either 1 year, 2 year, 3 year, 5 year, 7 year, or 10 year introductory fixed periods.
Bank Card Utilization $\geq 80\%$	1 if bank card utilization is greater than or equal to 0.80 as of December 2008
Bank Card Utilization (no default)	Total bank card balance/Total bank card limit (for bank cards with an update in the previous 3 months) as of December 2008; mortgage not in default as of December 2008 (Equifax)
Bank Card Utilization (default)	Bank Card Utilization in December 2008 if mortgage in default as of December 2008 (but not terminated)
Updated LTV Ratio (December 2008)	Origination amount/(LTV at origination \times [1 + Zip code-level HPI appreciation from origination to December 2008])
Multiple First Liens	More than one first-lien mortgage in Equifax four quarters following the CRISM mortgage origination date
Unemployment Rate at Close Date	Property's zip code-level unemployment rate at origination (BLS)
Change Unemployment (Origination) to December 2008	Percentage change in the property's zip code-level unemployment rate from origination to December 2008 (BLS)
Deficiency Prohibited	State law prohibits deficiency judgments against borrower in the event of mortgage default (Ghent and Kudlyak, 2011)
Homestead Exemption	State-level dummy variable where 0 indicates no homestead tax exemption or exemption only for seniors and 1 indicates homestead tax exemption for all ages (National Conference of State Legislatures, 2002)
Mortgage Term	Years until mortgage maturity (at orig.): 15/20 years, 30 years, or 40 years

Table 2a: Summary Statistics by Borrower Type

Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and McDash data, CoreLogic Solutions, and Bureau of Labor Statistics. FICO score at origination is from the Black Knight McDash dataset.

Characteristic	Honest Owner-Occupant	Fraudulent Investor	Declared Investor	Second-Homeowner
Number Loans	120817	6860	16381	5741
Share (count)	80.7%	4.6%	10.9%	3.8%
Share by Origination Dollars	81.4%	6.0%	8.5%	4.1%
Share of Delinq/Defaults -- Count (as of Dec. '08)	77.0%	11.7%	9.0%	2.3%
Share of Delinq/Defaults -- \$ (as of Dec. '08)	75.0%	15.9%	6.6%	2.5%
Serious Delinq/Default (60+ DPD) as of Dec. '08	9.1%	24.5%	7.9%	5.7%
Equifax Zip (4Q after Orig.) = McDash Zip	91.6%	29.5%	56.8%	20.8%
Multiple First Liens (4Q after Orig.)	18.5%	100.0%	44.2%	50.9%
Second Lien (4Q after Orig.)	30.4%	49.9%	39.0%	42.4%
Bubble State	17.1%	38.5%	16.2%	29.3%
Deficiency Prohibited in State	24.2%	38.7%	22.7%	25.1%
FICO at Orig. <660	26.2%	20.1%	17.5%	7.3%
FICO at Orig. in [660,700)	17.5%	21.3%	16.3%	13.8%
FICO at Orig. in [700,750)	24.5%	29.0%	26.4%	27.4%
FICO at Orig. in [750,800)	27.0%	25.9%	33.6%	41.5%
FICO at Orig. ≥800	4.9%	3.7%	6.2%	10.0%
FICO Score at Orig. (Avg.)	705.10	709.68	720.32	741.33
LTV at Orig. ≤70	13.7%	13.2%	19.4%	22.9%
LTV at Orig. (70,80]	47.0%	64.5%	48.6%	56.4%
LTV at Orig. (80,90)	6.4%	6.0%	8.0%	9.7%
LTV at Orig. ≥90	32.9%	16.4%	24.0%	11.0%
LTV at Orig. (Avg.)	81.91	78.95	78.94	75.45
Share Underwater as of Dec. 2008 (not delinquent Dec. '08)	35.0%	37.7%	25.7%	25.8%
Share Underwater as of Dec. 2008 (delinquent Dec. '08)	66.3%	72.7%	60.8%	68.4%
Updated LTV Dec. '08 <80	22.4%	18.0%	29.7%	30.4%
Updated LTV Dec. '08 [80,90)	20.7%	18.2%	24.0%	23.6%
Updated LTV Dec. '08 [90,100)	19.1%	17.4%	17.8%	17.7%
Updated LTV Dec. '08 [100,120)	27.0%	24.4%	20.4%	17.1%
Updated LTV Dec. '08 ≥120	10.9%	21.9%	8.1%	11.1%
Loan amount at Orig. ≤200k	59.1%	38.7%	72.0%	55.9%
Loan amount at Orig. (200k,359650]	27.5%	34.6%	22.5%	28.9%
Loan amount at Orig. (359650,417k]	4.9%	9.4%	3.2%	5.1%
Loan amount at Orig. (417k,700k]	6.8%	13.8%	2.0%	7.5%
Loan amount at Orig. >700k	1.8%	3.4%	0.4%	2.6%
Loan amount at Orig. (avg, \$)	219348	285165	169987	231813
HPI % Chg: Orig. to Dec. '08	-11.6%	-19.1%	-10.7%	-13.8%
HPI % Chg: 2 years prior to Orig.	16.7%	23.2%	18.6%	23.3%
Interest Rate at Orig.	6.40	6.70	6.57	6.28
Brokered	18.2%	26.2%	10.4%	14.1%
FRM	78.6%	56.9%	85.4%	72.1%
ARM: 1 year intro rate	1.2%	1.7%	1.0%	3.3%
ARM: 2 year intro rate	6.3%	15.3%	3.5%	2.2%
ARM: 3 year intro rate	2.1%	4.3%	1.7%	2.0%
ARM: 5 year intro rate	7.6%	16.5%	6.3%	13.5%
ARM: 7 year intro rate	2.1%	2.6%	1.2%	2.9%
ARM: 10 year intro rate	2.2%	2.8%	0.9%	3.9%
Interest-only Loan	12.7%	28.9%	8.5%	19.7%
Option ARM	3.1%	9.5%	3.3%	0.6%
Low/No-Documentation	40.5%	51.1%	24.4%	52.3%
Unknown Documentation	8.9%	10.8%	6.6%	10.3%
FHA/VA	13.5%	2.6%	19.3%	0.0%
GSE	55.7%	45.9%	58.5%	70.7%
Portfolio	9.6%	11.9%	3.9%	10.0%
Private Securitized	21.3%	39.6%	18.3%	19.2%
Bank card Utilization (in default as of Dec. '08)	78.6%	55.9%	69.3%	56.0%
Bank card Util. ≥80% (in default as of Dec. '08)	79.4%	56.8%	71.6%	58.0%
Bank card Util. (not in default as of Dec. '08)	34.9%	32.9%	30.3%	26.2%
Bank card Util. ≥80% (not in default as of Dec. '08)	27.7%	25.0%	23.2%	19.9%

Table 2b. Summary Statistics for Borrowers with Multiple First Liens

Borrowers with multiple first liens in Equifax four quarters after CRISM loan origination. Borrowers with a CRISM FHA or VA loan are excluded. FICO score at origination is from the Black Knight McDash dataset. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics.

Characteristic	Honest Owner-Occupant	Fraudulent Investor	Declared Investor	Second-Homeowner
Number Loans	21511	6681	7052	2921
Share (count)	56%	18%	18%	8%
Share by Origination Dollars	62%	19%	12%	7%
Share of Delinq/Defaults -- Count (as of Dec. '08)	54%	30%	12%	4%
Share of Delinq/Defaults -- \$ (as of Dec. '08)	58%	31%	7%	4%
Serious Delinq/Defaults (60+ DPD) as of Dec. '08	14%	25%	10%	8%
Equifax Zip (+4Q after Orig.) = McDash Zip	85%	29%	37%	13%
Bubble State	30%	39%	22%	33%
Deficiency Prohibited in State	33%	39%	26%	27%
FICO at Orig. <660	16%	19%	9%	7%
FICO at Orig. in [660,700)	20%	21%	18%	14%
FICO at Orig. in [700,750)	31%	29%	32%	30%
FICO at Orig. in [750,800)	29%	26%	36%	42%
FICO at Orig. ≥800	4%	4%	5%	7%
FICO Score at Orig. (Avg)	716.60	711.22	730.60	739.61
LTV at Orig. ≤70	12%	14%	21%	20%
LTV at Orig. (70,80]	73%	66%	57%	60%
LTV at Orig. (80,90)	4%	6%	12%	10%
LTV at Orig. ≥90	11%	15%	10%	10%
LTV at Orig.	78.22	78.53	76.13	76.33
Share Underwater as of Dec. 2008 (not delinquent Dec. '08)	29.5%	36.7%	21.4%	28.2%
Share Underwater as of Dec. 2008 (delinquent Dec. '08)	71.0%	72.8%	59.1%	71.6%
Updated LTV Dec. '08 <80	21%	18%	31%	27%
Updated LTV Dec. '08 [80,90)	25%	19%	27%	23%
Updated LTV Dec. '08 [90,100)	18%	17%	17%	18%
Updated LTV Dec. '08 [100,120)	20%	24%	16%	18%
Updated LTV Dec. '08 ≥120	15%	22%	9%	14%
Loan amount at Orig. ≤200k	35%	38%	71%	49%
Loan amount at Orig. (200k,359650]	39%	35%	21%	31%
Loan amount at Orig. (359650,417k]	9%	10%	3%	6%
Loan amount at Orig. (417k,700k]	14%	14%	3%	10%
Loan amount at Orig. >700k	4%	4%	1%	3%
Loan amount at Orig. (avg, \$)	294417.36	288397.64	170911.07	254494.50
HPI % Chg: Orig. to Dec. '08	-16%	-19%	-13%	-15%
HPI % Chg: 2 years before Orig.	21%	24%	20%	25%
Second Lien (+4Q after Orig.)	36%	51%	57%	54%
Interest Rate at Orig.	6.45	6.71	6.86	6.31
Brokered	22%	27%	17%	14%
FRM	64%	56%	76%	67%
ARM: 1 year intro rate	2%	2%	2%	5%
ARM: 2 year intro rate	10%	16%	6%	2%
ARM: 3 year intro rate	3%	4%	3%	2%
ARM: 5 year intro rate	15%	17%	11%	17%
ARM: 7 year intro rate	3%	3%	2%	3%
ARM: 10 year intro rate	3%	3%	1%	5%
Interest-only Loan	27%	30%	15%	24%
Low/No-Documentation	46%	52%	39%	54%
Unknown Documentation	10%	11%	10%	10%
GSE	53%	47%	64%	66%
Portfolio	11%	12%	6%	11%
Private Securitized	36%	41%	30%	23%
Bank card Utilization, Avg. (in default as of Dec. '08)	69%	55%	63%	57%
Bank card Utilization ≥80% (in default as of Dec. '08)	70%	56%	63%	56%
Bank card Utilization, Avg. (not in default as of Dec. '08)	34%	33%	28%	26%
Bank card Utilization ≥80% (not in default as of Dec. '08)	24%	24%	19%	18%
Option ARM	5%	10%	6%	1%

Table 3: Fraud Share (%) by Origination Vintage and Investor Type

Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions data.

	FHA/VA	GSE	Portfolio	Private Securitized	All
2005h1	0.66	3.32	5.89	7.07	4.28
2005h2	0.65	3.25	5.72	7.53	4.53
2006h1	0.82	3.52	6.29	9.77	5.16
2006h2	0.79	3.65	5.36	8.61	4.52
2007h1	1.13	4.06	5.75	10.07	4.56
2007h2	1.33	4.51	6.89	8.06	4.39

Table 4: Share (%) Seriously Delinquent or in Default as of December 2008, by Borrower Type

FICO at origination is from the Black Knight McDash dataset. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics.

	Honest Owner-Occupant	Fraudulent Investor	Declared Investor	Second-Homeowner
2005 Origination	8.82	22.19	8.14	5.65
2006 Origination	11.82	33.18	9.76	7.92
2007 Origination	6.65	16.92	4.96	2.89
FICO at Orig. <660	21.74	44.12	20.90	17.70
FICO at Orig. [660,700)	9.79	32.42	12.19	10.84
FICO at Orig. [700,750)	5.13	21.17	5.80	7.05
FICO at Orig. [750,800)	1.62	9.49	1.91	2.23
FICO at Orig. ≥800	0.58	4.38	1.19	0.35

Table 5a: Fraud and Interest Rates

OLS regression models for the interest rate at the time of origination (or when first available). Columns (2)–(7) exclude FHA/VA loans, and columns (6)–(7) make the additional restriction to borrowers with multiple first-lien mortgages in Equifax four quarters after origination. Columns (4) and (7) provide marginal effects for models (3) and (6), respectively. All specifications include origination half-year fixed effects. FICO at Origination is from the Black Knight McDash dataset. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fraud	0.094*** (0.008)	-0.023 (0.030)	-0.071** (0.032)	0.118*** (0.009)	0.145*** (0.034)	0.075** (0.036)	0.120*** (0.009)
Investor	0.297*** (0.005)	0.180*** (0.023)	0.140*** (0.024)	0.458*** (0.007)	0.525*** (0.035)	0.456*** (0.037)	0.480*** (0.010)
Second home	0.047*** (0.008)	0.049 (0.037)	0.006 (0.038)	0.045*** (0.011)	0.186*** (0.056)	0.128** (0.058)	0.041*** (0.015)
Multiple First Liens	0.085*** (0.004)	0.064*** (0.004)	0.062*** (0.004)	0.062*** (0.004)			
Second Lien Indicator	0.039*** (0.004)	0.031*** (0.004)	0.031*** (0.004)	0.031*** (0.004)	0.013 (0.009)	0.014 (0.009)	0.015** (0.007)
FICO at Orig in [660,700)	-0.296*** (0.005)	-0.371*** (0.006)	-0.371*** (0.006)	-0.360*** (0.006)	-0.300*** (0.015)	-0.311*** (0.015)	-0.342*** (0.012)
FICO at Orig. in [700,750)	-0.390*** (0.005)	-0.457*** (0.006)	-0.457*** (0.006)	-0.454*** (0.006)	-0.407*** (0.014)	-0.420*** (0.014)	-0.470*** (0.011)
FICO at Orig. in [750,800)	-0.467*** (0.005)	-0.526*** (0.006)	-0.525*** (0.006)	-0.528*** (0.006)	-0.491*** (0.014)	-0.505*** (0.014)	-0.571*** (0.012)
FICO at Orig ≥800	-0.471*** (0.008)	-0.524*** (0.010)	-0.524*** (0.010)	-0.528*** (0.009)	-0.500*** (0.025)	-0.516*** (0.025)	-0.581*** (0.019)
LTV at Orig. in (70,80]	0.047*** (0.005)	0.054*** (0.006)	0.053*** (0.006)	0.054*** (0.005)	0.080*** (0.013)	0.084*** (0.013)	0.072*** (0.010)
LTV at Orig. (80,90)	0.348*** (0.007)	0.297*** (0.009)	0.298*** (0.009)	0.326*** (0.008)	0.369*** (0.024)	0.365*** (0.024)	0.390*** (0.016)
LTV at Orig. ≥90	0.365*** (0.006)	0.326*** (0.007)	0.328*** (0.007)	0.381*** (0.006)	0.445*** (0.018)	0.439*** (0.018)	0.503*** (0.013)
Orig. Amt. in (200k,359650]	-0.177*** (0.004)	-0.174*** (0.004)	-0.174*** (0.004)	-0.174*** (0.004)	-0.157*** (0.008)	-0.158*** (0.008)	-0.158*** (0.008)
Orig. Amt. (359650,417k]	-0.246*** (0.008)	-0.237*** (0.008)	-0.237*** (0.008)	-0.237*** (0.008)	-0.243*** (0.013)	-0.244*** (0.013)	-0.244*** (0.013)
Orig. Amt. (417k,700k]	-0.352*** (0.007)	-0.329*** (0.008)	-0.329*** (0.008)	-0.329*** (0.008)	-0.343*** (0.012)	-0.335*** (0.012)	-0.335*** (0.012)
Orig. Amt. >700k	-0.360*** (0.013)	-0.333*** (0.013)	-0.336*** (0.013)	-0.336*** (0.013)	-0.346*** (0.020)	-0.338*** (0.020)	-0.338*** (0.020)
Unemp. Rate at Orig.	0.013*** (0.001)	0.012*** (0.001)	0.012*** (0.001)	0.012*** (0.001)	0.005** (0.002)	0.005** (0.002)	0.005** (0.002)
Interest-only loan	-0.055*** (0.007)	-0.075*** (0.007)	-0.065*** (0.007)	-0.059*** (0.007)	-0.059*** (0.012)	-0.040*** (0.012)	-0.044*** (0.011)
Low Doc.	0.106*** (0.003)	0.080*** (0.004)	0.075*** (0.004)	0.112*** (0.004)	0.131*** (0.009)	0.128*** (0.009)	0.178*** (0.007)
Unknown Doc. Status	0.127*** (0.006)	0.089*** (0.007)	0.087*** (0.007)	0.124*** (0.006)	0.153*** (0.015)	0.155*** (0.015)	0.192*** (0.011)
Correspondent Lender	-0.016*** (0.004)	0.003 (0.004)	0.002 (0.004)	0.002 (0.004)	-0.015* (0.008)	-0.013 (0.008)	-0.013 (0.008)
Brokered	0.116*** (0.004)	0.120*** (0.005)	0.120*** (0.005)	0.120*** (0.005)	0.093*** (0.008)	0.095*** (0.008)	0.095*** (0.008)
FHA/VA	-0.466*** (0.006)						
Portfolio	0.015** (0.006)	0.005 (0.006)	-0.047*** (0.007)	0.021*** (0.007)	0.250*** (0.012)	0.182*** (0.016)	0.245*** (0.012)
Private Securitized	0.455*** (0.005)	0.424*** (0.005)	0.417*** (0.006)	0.427*** (0.005)	0.441*** (0.009)	0.386*** (0.011)	0.439*** (0.009)
Term is 15/20 years	-0.324*** (0.008)	-0.327*** (0.009)	-0.329*** (0.009)	-0.329*** (0.009)	-0.379*** (0.017)	-0.378*** (0.017)	-0.378*** (0.017)
Term is 40 years	-0.004 (0.011)	-0.010 (0.011)	-0.003 (0.011)	-0.003 (0.011)	0.134*** (0.019)	0.137*** (0.019)	0.137*** (0.019)
ARM: 1 year fixed	-0.153*** (0.014)	-0.089*** (0.015)	-0.095*** (0.015)	-0.095*** (0.015)	-0.143*** (0.024)	-0.144*** (0.024)	-0.144*** (0.024)
ARM: 2 year fixed	1.039*** (0.008)	1.031*** (0.009)	1.030*** (0.009)	1.030*** (0.009)	0.753*** (0.015)	0.757*** (0.015)	0.757*** (0.015)
ARM: 3 year fixed	0.372*** (0.011)	0.447*** (0.012)	0.443*** (0.012)	0.443*** (0.012)	0.256*** (0.019)	0.259*** (0.019)	0.259*** (0.019)
ARM: 5 year fixed	-0.134*** (0.007)	-0.120*** (0.008)	-0.124*** (0.008)	-0.124*** (0.008)	-0.127*** (0.012)	-0.127*** (0.012)	-0.127*** (0.012)

ARM: 7 year fixed	-0.124*** (0.012)	-0.112*** (0.012)	-0.113*** (0.012)	-0.113*** (0.012)	-0.141*** (0.021)	-0.141*** (0.021)	-0.141*** (0.021)
ARM: 10 year fixed	0.003 (0.012)	0.021 (0.013)	0.020 (0.013)	0.020 (0.013)	-0.058*** (0.021)	-0.056*** (0.021)	-0.056*** (0.021)
OptionARM	0.116*** (0.010)	0.087*** (0.011)	0.097*** (0.011)	0.066*** (0.011)	0.104*** (0.020)	0.121*** (0.021)	0.076*** (0.017)
Second Lien# Fraud		-0.022 (0.016)	-0.026* (0.016)		-0.008 (0.018)	-0.010 (0.018)	
Second Lien# Investor		0.032*** (0.012)	0.028** (0.012)		0.029* (0.017)	0.025 (0.017)	
Second Lien# Second home		-0.028 (0.018)	-0.032* (0.018)		-0.016 (0.025)	-0.019 (0.025)	
FICO Orig. in [660,700) # Fraud		0.116*** (0.025)	0.112*** (0.025)		-0.027 (0.028)	-0.007 (0.028)	
FICO Orig. in [660,700) # Investor		0.021 (0.024)	0.029 (0.024)		-0.172*** (0.033)	-0.146*** (0.033)	
FICO Orig. in [660,700) # 2 nd Home		0.062 (0.038)	0.062 (0.038)		-0.053 (0.055)	-0.038 (0.055)	
FICO Orig. in [700,750) # Fraud		0.050** (0.024)	0.039 (0.024)		-0.093*** (0.026)	-0.068** (0.027)	
FICO Orig. in [700,750) # Investor		-0.015 (0.022)	0.000 (0.022)		-0.232*** (0.031)	-0.195*** (0.032)	
FICO Orig. in [700,750) # 2 nd Home		0.028 (0.035)	0.031 (0.035)		-0.058 (0.051)	-0.031 (0.051)	
FICO Orig. in [750,800) # Fraud		0.016 (0.024)	0.001 (0.025)		-0.123*** (0.027)	-0.093*** (0.028)	
FICO Orig. in [750,800) # Investor		-0.049** (0.021)	-0.032 (0.022)		-0.284*** (0.031)	-0.244*** (0.032)	
FICO Orig. in [750,800) # 2 nd Home		0.015 (0.034)	0.017 (0.034)		-0.091* (0.050)	-0.063 (0.050)	
FICO Orig. ≥800 # Fraud		-0.006 (0.045)	-0.021 (0.045)		-0.129*** (0.050)	-0.096* (0.050)	
FICO Orig. ≥800 # Investor		-0.059** (0.029)	-0.039 (0.029)		-0.277*** (0.048)	-0.232*** (0.049)	
FICO Orig. ≥800 # Second home		-0.002 (0.041)	0.004 (0.042)		-0.096 (0.066)	-0.062 (0.066)	
LTV Orig. in (70,80) # Fraud		0.006 (0.024)	0.015 (0.024)		0.001 (0.026)	-0.006 (0.027)	
LTV Orig. in (70,80) # Investor		-0.005 (0.014)	0.001 (0.014)		-0.036 (0.023)	-0.035 (0.023)	
LTV Orig. in (70,80) # Second home		0.001 (0.021)	0.007 (0.021)		-0.044 (0.033)	-0.046 (0.033)	
LTV Orig. in (80,90) # Fraud		0.083** (0.039)	0.078** (0.039)		0.021 (0.045)	0.028 (0.045)	
LTV Orig. in (80,90) # Investor		0.285*** (0.024)	0.278*** (0.024)		0.175*** (0.036)	0.174*** (0.036)	
LTV Orig. in (80,90) # Second home		-0.087*** (0.033)	-0.081** (0.033)		-0.169*** (0.051)	-0.158*** (0.051)	
LTV Orig. in ≥90 # Fraud		0.207*** (0.030)	0.200*** (0.030)		0.087** (0.034)	0.096*** (0.034)	
LTV Orig. in ≥90 # Investor		0.469*** (0.024)	0.454*** (0.024)		0.348*** (0.034)	0.340*** (0.034)	
LTV Orig. in ≥90 # Second home		-0.094*** (0.031)	-0.090*** (0.031)		-0.213*** (0.048)	-0.202*** (0.048)	
Interest-only loan # Fraud		0.012 (0.018)	-0.023 (0.019)		-0.005 (0.020)	-0.047** (0.021)	
Interest-only loan # Investor		0.127*** (0.019)	0.089*** (0.020)		0.083*** (0.024)	0.039 (0.025)	
Interest-only loan # Second home		0.016 (0.022)	-0.041* (0.023)		0.006 (0.029)	-0.037 (0.031)	
Low Doc. # Fraud		0.112*** (0.017)	0.152*** (0.017)		0.083*** (0.019)	0.092*** (0.019)	
Low Doc. # Investor		0.262*** (0.013)	0.265*** (0.013)		0.181*** (0.018)	0.178*** (0.018)	
Low Doc. # Second home		0.027 (0.018)	0.047*** (0.018)		0.012 (0.026)	0.016 (0.026)	
Unknown Doc. # Fraud		0.107*** (0.027)	0.130*** (0.027)		0.071** (0.030)	0.069** (0.030)	
Unknown Doc. # Investor		0.282*** (0.022)	0.262*** (0.022)		0.143*** (0.030)	0.128*** (0.030)	
Unknown Doc. # Second home		0.068** (0.030)	0.076*** (0.030)		0.030 (0.044)	0.019 (0.044)	
OptionARM # Fraud		0.035 (0.028)	-0.040 (0.029)		0.065** (0.032)	0.015 (0.033)	
OptionARM # Investor		0.014	-0.078**		-0.017	-0.044	

	(0.030)	(0.031)		(0.038)	(0.039)	
OptionARM # Second home	-0.357***	-0.479***		-0.485***	-0.523***	
	(0.106)	(0.107)		(0.123)	(0.124)	
Portfolio # Fraud		0.393***			0.188***	
		(0.026)			(0.029)	
Portfolio # Investor		0.355***			0.117***	
		(0.028)			(0.036)	
Portfolio # Second home		0.265***			0.110***	
		(0.030)			(0.042)	
Private Securitized # Fraud		0.006			0.111***	
		(0.019)			(0.021)	
Private Securitized # Investor		0.063***			0.132***	
		(0.015)			(0.021)	
Private Securitized # Second home		0.065***			0.124***	
		(0.023)			(0.031)	
Constant	6.378***	6.456***	6.464***	6.460***	6.489***	
	(0.009)	(0.010)	(0.010)	(0.021)	(0.022)	
R^2	0.51	0.53	0.53	0.54	0.54	
Observations	149799	130137	130137	130137	38165	38165

Table 5b: Marginal Effects on Interest Rates

This table reports the marginal effect on origination interest rate of changing the borrower type variable, relative to the baseline category of honest owner-occupant, separately for different risk characteristics. Columns (1)–(3) report effects for model (3) in Table 5a; columns (4)–(6) report effects for model (6). FICO at Origination is from the Black Knight McDash dataset. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1) Fraud	(2) Decl. Investor	(3) Second- Homeowner	(4) Fraud; Multiple First Mortgages	(5) Decl. Investor; Multiple First Mortgages	(6) Second- Homeowner; Multiple First Mortgages
FICO Orig. <660	0.089*** (0.020)	0.465*** (0.019)	0.020 (0.031)	0.175*** (0.021)	0.653*** (0.028)	0.080* (0.046)
FICO Orig. in [660,700)	0.201*** (0.018)	0.495*** (0.015)	0.082*** (0.023)	0.168*** (0.019)	0.508*** (0.020)	0.042 (0.033)
FICO Orig. in [700,750)	0.128*** (0.016)	0.465*** (0.011)	0.051*** (0.017)	0.108*** (0.016)	0.458*** (0.016)	0.049** (0.024)
FICO Orig. in [750,800)	0.090*** (0.016)	0.433*** (0.011)	0.037*** (0.015)	0.082*** (0.017)	0.409*** (0.015)	0.017 (0.021)
FICO Orig. ≥800	0.069* (0.041)	0.426*** (0.022)	0.024 (0.028)	0.080* (0.045)	0.421*** (0.040)	0.018 (0.048)
LTV Orig. ≤70	0.062*** (0.022)	0.343*** (0.013)	0.065*** (0.019)	0.112*** (0.024)	0.454*** (0.021)	0.105*** (0.030)
LTV Orig. in (70,80]	0.078*** (0.012)	0.344*** (0.009)	0.072*** (0.013)	0.106*** (0.011)	0.419*** (0.012)	0.059*** (0.018)
LTV Orig. in (80,90)	0.141*** (0.033)	0.621*** (0.020)	-0.016 (0.028)	0.140*** (0.037)	0.628*** (0.030)	-0.053 (0.043)
LTV Orig. ≥90	0.262*** (0.021)	0.797*** (0.021)	-0.025 (0.025)	0.208*** (0.024)	0.794*** (0.027)	-0.097** (0.039)
GSE	0.075*** (0.012)	0.405*** (0.009)	0.001 (0.012)	0.063*** (0.013)	0.422*** (0.013)	-0.014 (0.019)
Portfolio	0.469*** (0.024)	0.760*** (0.027)	0.266*** (0.028)	0.251*** (0.026)	0.539*** (0.034)	0.097** (0.038)
Private Securitized	0.082*** (0.015)	0.468*** (0.013)	0.066*** (0.021)	0.174*** (0.015)	0.554*** (0.016)	0.111*** (0.027)
Not Interest-only	0.122*** (0.010)	0.444*** (0.008)	0.051*** (0.011)	0.132*** (0.011)	0.470*** (0.011)	0.050*** (0.017)
Interest-only loan	0.098*** (0.017)	0.534*** (0.019)	0.010 (0.022)	0.085*** (0.017)	0.509*** (0.023)	0.013 (0.028)
Not Low Doc	0.054*** (0.013)	0.346*** (0.008)	0.025* (0.014)	0.078*** (0.013)	0.397*** (0.012)	0.034 (0.021)
Low Doc.	0.206*** (0.013)	0.612*** (0.011)	0.072*** (0.014)	0.170*** (0.013)	0.575*** (0.015)	0.050** (0.019)
Not Unknown Doc	0.106*** (0.010)	0.433*** (0.008)	0.037*** (0.011)	0.114*** (0.010)	0.467*** (0.010)	0.039** (0.016)
Unknown Doc.	0.236*** (0.026)	0.695*** (0.021)	0.114*** (0.028)	0.182*** (0.028)	0.595*** (0.029)	0.058 (0.041)
Not OptionARM	0.120*** (0.010)	0.461*** (0.008)	0.063*** (0.010)	0.120*** (0.009)	0.482*** (0.010)	0.071*** (0.014)
OptionARM	0.080*** (0.028)	0.383*** (0.030)	-0.416*** (0.107)	0.134*** (0.032)	0.438*** (0.037)	-0.451*** (0.124)
No Second Lien	0.128*** (0.012)	0.448*** (0.009)	0.056*** (0.013)	0.125*** (0.012)	0.469*** (0.013)	0.049** (0.020)
Second Lien	0.101*** (0.013)	0.475*** (0.010)	0.024* (0.015)	0.115*** (0.013)	0.493*** (0.013)	0.031 (0.019)
Observations	130137	130137	130137	38165	38165	38165

Table 6: Determinants of Fraud

Probit models for the probability that a declared investor or fraudulent investor is fraudulent. All specifications restricted to borrowers who have multiple first-lien mortgages in Equifax four quarters after origination and exclude FHA/VA loans. Column (2) gives the marginal effects for model (1). All specifications include origination half-year fixed effects and columns (1)–(2) include state fixed effects. FICO at Origination is from the Black Knight McDash dataset. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. N=13,733.

	(1)	(2)	(3)	(4)	(5)
Second Lien	-0.199*** (0.024)	-0.064*** (0.008)	-0.198*** (0.024)	-0.196*** (0.024)	-0.197*** (0.024)
FICO at Orig. in [660,700)	-0.392*** (0.043)	-0.127*** (0.014)	-0.389*** (0.043)	-0.387*** (0.043)	-0.387*** (0.043)
[700,750)	-0.531*** (0.041)	-0.173*** (0.013)	-0.533*** (0.041)	-0.531*** (0.041)	-0.533*** (0.041)
[750,800)	-0.618*** (0.042)	-0.202*** (0.013)	-0.631*** (0.042)	-0.629*** (0.042)	-0.632*** (0.042)
≥800	-0.540*** (0.066)	-0.176*** (0.022)	-0.558*** (0.066)	-0.552*** (0.066)	-0.556*** (0.066)
Orig. LTV in (70,80]	0.288*** (0.033)	0.094*** (0.010)	0.263*** (0.032)	0.255*** (0.032)	0.257*** (0.032)
(80,90)	-0.120** (0.051)	-0.038** (0.016)	-0.131*** (0.050)	-0.142*** (0.050)	-0.135*** (0.050)
≥90	0.499*** (0.045)	0.163*** (0.015)	0.472*** (0.044)	0.461*** (0.044)	0.467*** (0.045)
Orig. Amt (200k,359650]	0.592*** (0.030)	0.209*** (0.011)	0.650*** (0.028)	0.665*** (0.028)	0.660*** (0.028)
(359650,417k]	0.907*** (0.053)	0.316*** (0.017)	0.992*** (0.051)	1.011*** (0.051)	1.007*** (0.051)
(417k,700k]	1.110*** (0.054)	0.378*** (0.016)	1.182*** (0.051)	1.207*** (0.051)	1.205*** (0.051)
>700k	1.408*** (0.099)	0.456*** (0.024)	1.493*** (0.097)	1.521*** (0.097)	1.520*** (0.097)
Lagged 2 yr. HPI Change	-0.056 (0.095)	-0.018 (0.031)	-0.133 (0.082)	-0.009 (0.073)	-0.007 (0.075)
Unemployment Rate @ Orig.	0.009 (0.010)	0.003 (0.003)	0.024*** (0.008)	0.028*** (0.008)	0.026*** (0.008)
Interest-only Loan	0.375*** (0.041)	0.124*** (0.014)	0.359*** (0.041)	0.374*** (0.041)	0.371*** (0.041)
Low Documentation	0.274*** (0.026)	0.090*** (0.008)	0.289*** (0.025)	0.291*** (0.025)	0.292*** (0.025)
Unknown Documentation	0.039 (0.041)	0.012 (0.013)	0.056 (0.040)	0.054 (0.040)	0.056 (0.040)
Correspondent Lender	-0.260*** (0.030)	-0.084*** (0.010)	-0.257*** (0.030)	-0.262*** (0.030)	-0.264*** (0.030)
Broker	0.117*** (0.031)	0.038*** (0.010)	0.134*** (0.031)	0.132*** (0.031)	0.134*** (0.031)
Portfolio	0.172*** (0.047)	0.055*** (0.015)	0.170*** (0.047)	0.170*** (0.047)	0.172*** (0.047)
Private Securitized	-0.231*** (0.033)	-0.073*** (0.010)	-0.221*** (0.033)	-0.220*** (0.033)	-0.219*** (0.033)
Term: 15/20 years	-0.164*** (0.058)	-0.053*** (0.019)	-0.181*** (0.057)	-0.190*** (0.057)	-0.186*** (0.057)
40 years	0.405*** (0.080)	0.131*** (0.025)	0.404*** (0.080)	0.411*** (0.080)	0.412*** (0.080)
ARM: 1 year	-0.231** (0.095)	-0.074** (0.030)	-0.233** (0.094)	-0.231** (0.094)	-0.232** (0.094)
2 years	0.338*** (0.053)	0.109*** (0.017)	0.359*** (0.052)	0.364*** (0.052)	0.365*** (0.052)
3 years	0.024 (0.070)	0.008 (0.023)	0.040 (0.069)	0.040 (0.069)	0.039 (0.069)
5 years	-0.105** (0.048)	-0.034** (0.015)	-0.096** (0.047)	-0.091* (0.047)	-0.092* (0.047)
7 years	-0.279*** (0.087)	-0.089*** (0.027)	-0.265*** (0.086)	-0.262*** (0.086)	-0.266*** (0.086)
10 years	-0.140 (0.090)	-0.045 (0.029)	-0.135 (0.089)	-0.133 (0.089)	-0.135 (0.089)
OptionARM	-0.279*** (0.052)	-0.088*** (0.016)	-0.275*** (0.051)	-0.274*** (0.051)	-0.274*** (0.051)
Bubble State			0.120*** (0.032)		
Owner Occup. Prop. Tax Exemption				0.066** (0.026)	
Deficiency Judgment Prohibited					0.028 (0.028)

Table 7a: Fraud and Mortgage Default

Probit models of mortgage default as of December 2008. Column (3) reports marginal effects for model (2), and column (4) implements specification (2) in a linear probability model. Column (8) reports the uninteracted marginal effects for a model that interacts unemployment, LTV in Dec. 2008, and origination FICO score with borrower type but that is otherwise identical to (2). All models include origination half-year fixed effects; standard errors are clustered at the county level. Except for column (6), all models include state fixed effects. FICO at Origination is from the Black Knight McDash dataset. Source: calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fraud	0.441*** (0.022)	0.272*** (0.023)	0.037*** (0.004)	0.065*** (0.006)	0.239*** (0.040)	0.282*** (0.032)	0.105*** (0.024)	0.031*** (0.004)
Investor	0.091*** (0.026)	0.002 (0.026)	0.000 (0.003)	-0.002 (0.003)	-0.139*** (0.040)	0.058** (0.025)	-0.128*** (0.027)	-0.000 (0.003)
Second-home	0.026 (0.037)	-0.054 (0.038)	-0.006 (0.004)	-0.012*** (0.003)	-0.043 (0.049)	-0.001 (0.046)	-0.270*** (0.040)	-0.012*** (0.005)
Term is 15/20 years	-0.252*** (0.055)	-0.247*** (0.055)	-0.027*** (0.005)	0.018*** (0.002)	-0.244*** (0.055)	-0.251*** (0.055)	-0.254*** (0.056)	-0.027*** (0.005)
Multiple First Liens		0.242*** (0.015)	0.031*** (0.002)	0.026*** (0.002)	0.252*** (0.015)	0.242*** (0.015)	0.200*** (0.015)	0.032*** (0.002)
Second Lien		0.156*** (0.013)	0.020*** (0.002)	0.011*** (0.002)	0.160*** (0.013)	0.154*** (0.013)	0.144*** (0.013)	0.019*** (0.002)
Term is 40 years	0.245*** (0.032)	0.241*** (0.032)	0.033*** (0.005)	0.083*** (0.010)	0.240*** (0.032)	0.240*** (0.032)	0.242*** (0.032)	0.033*** (0.005)
ARM: 1 year fixed	-0.026 (0.050)	-0.037 (0.051)	-0.004 (0.006)	0.003 (0.006)	-0.037 (0.050)	-0.036 (0.051)	-0.041 (0.051)	-0.004 (0.006)
ARM: 2 year fixed	0.301*** (0.026)	0.289*** (0.025)	0.040*** (0.004)	0.146*** (0.007)	0.288*** (0.025)	0.287*** (0.025)	0.281*** (0.025)	0.040*** (0.004)
ARM: 3 year fixed	0.267*** (0.033)	0.250*** (0.033)	0.034*** (0.005)	0.080*** (0.008)	0.251*** (0.033)	0.245*** (0.033)	0.239*** (0.033)	0.034*** (0.005)
ARM: 5 year fixed	0.136*** (0.026)	0.119*** (0.026)	0.015*** (0.003)	0.025*** (0.005)	0.119*** (0.026)	0.118*** (0.026)	0.107*** (0.025)	0.015*** (0.003)
ARM: 7 year fixed	-0.104** (0.042)	-0.106** (0.042)	-0.012*** (0.005)	-0.012** (0.005)	-0.108** (0.042)	-0.104** (0.043)	-0.115*** (0.043)	-0.012*** (0.005)
ARM: 10 year fixed	-0.200*** (0.038)	-0.203*** (0.038)	-0.022*** (0.004)	-0.030*** (0.005)	-0.203*** (0.038)	-0.192*** (0.037)	-0.202*** (0.038)	-0.022*** (0.004)
Orig. Int. Rate	0.262*** (0.010)	0.259*** (0.010)	0.032*** (0.001)	0.054*** (0.003)	0.262*** (0.010)	0.260*** (0.010)	0.253*** (0.010)	0.032*** (0.001)
FICO Orig. in [660,700)	-0.394*** (0.017)	-0.418*** (0.017)	-0.071*** (0.003)	-0.074*** (0.003)	-0.418*** (0.017)	-0.418*** (0.017)	-0.426*** (0.017)	-0.069*** (0.003)
FICO Orig. in [700,750)	-0.657*** (0.019)	-0.688*** (0.019)	-0.102*** (0.003)	-0.104*** (0.003)	-0.686*** (0.019)	-0.687*** (0.019)	-0.698*** (0.019)	-0.101*** (0.003)
FICO Orig. in [750,800)	-1.048*** (0.025)	-1.071*** (0.025)	-0.132*** (0.003)	-0.119*** (0.003)	-1.066*** (0.025)	-1.070*** (0.025)	-1.082*** (0.025)	-0.131*** (0.003)
FICO Orig. ≥800	-1.294*** (0.063)	-1.289*** (0.063)	-0.143*** (0.004)	-0.113*** (0.003)	-1.281*** (0.063)	-1.293*** (0.063)	-1.306*** (0.063)	-0.142*** (0.004)
Orig. Amt. in (200k,359650]	0.057*** (0.018)	0.040** (0.018)	0.005** (0.002)	0.012*** (0.002)	0.036** (0.018)	0.061*** (0.019)	0.049*** (0.018)	0.005** (0.002)
Orig. Amt. in (359650,417k]	0.165*** (0.032)	0.136*** (0.032)	0.018*** (0.004)	0.023*** (0.005)	0.130*** (0.032)	0.183*** (0.033)	0.143*** (0.032)	0.017*** (0.004)
Orig. Amt. in (417k,700k]	0.016 (0.031)	-0.012 (0.031)	-0.001 (0.004)	-0.000 (0.005)	-0.016 (0.031)	0.048 (0.032)	0.000 (0.031)	-0.001 (0.004)
Orig. Amt. >700k	-0.164*** (0.060)	-0.201*** (0.059)	-0.022*** (0.006)	-0.027*** (0.007)	-0.206*** (0.060)	-0.125** (0.058)	-0.180*** (0.061)	-0.022*** (0.006)
LTV Orig. in (70,80]	0.219*** (0.033)	0.188*** (0.033)	0.021*** (0.003)	0.005* (0.003)	0.186*** (0.033)	0.140*** (0.032)	0.200*** (0.033)	0.020*** (0.003)
LTV Orig. in (80,90)	0.079** (0.039)	0.113*** (0.039)	0.012*** (0.004)	-0.017*** (0.004)	0.111*** (0.039)	0.061 (0.038)	0.116*** (0.039)	0.011*** (0.004)
LTV Orig. ≥90	0.169*** (0.038)	0.228*** (0.039)	0.026*** (0.004)	-0.007* (0.004)	0.219*** (0.039)	0.158*** (0.037)	0.233*** (0.039)	0.025*** (0.004)
Interest-only loan	0.330*** (0.020)	0.312*** (0.020)	0.042*** (0.003)	0.043*** (0.005)	0.310*** (0.020)	0.307*** (0.020)	0.306*** (0.020)	0.042*** (0.003)
Low Doc.	0.175*** (0.013)	0.165*** (0.013)	0.020*** (0.002)	0.024*** (0.002)	0.166*** (0.013)	0.171*** (0.013)	0.153*** (0.013)	0.021*** (0.002)
Unknown Doc. Status	-0.198*** (0.030)	-0.200*** (0.029)	-0.023*** (0.003)	-0.028*** (0.004)	-0.199*** (0.029)	-0.195*** (0.029)	-0.216*** (0.029)	-0.022*** (0.003)
Correspondent Lender	0.003	0.018	0.002	0.004**	0.011	0.012	0.032**	0.002

	(0.015)	(0.015)	(0.002)	(0.002)	(0.015)	(0.015)	(0.015)	(0.002)
Brokered	0.117***	0.115***	0.015***	0.017***	0.114***	0.120***	0.115***	0.014***
	(0.017)	(0.017)	(0.002)	(0.003)	(0.017)	(0.017)	(0.017)	(0.002)
Updated LTV in [80, 90)	0.165***	0.160***	0.014***	0.002	0.159***	0.176***	0.158***	0.015***
	(0.025)	(0.025)	(0.002)	(0.002)	(0.025)	(0.028)	(0.025)	(0.002)
Updated LTV in [90,100)	0.309***	0.303***	0.029***	0.017***	0.300***	0.347***	0.298***	0.030***
	(0.027)	(0.027)	(0.002)	(0.003)	(0.027)	(0.029)	(0.027)	(0.002)
Updated LTV in [100,120)	0.490***	0.484***	0.052***	0.046***	0.481***	0.531***	0.474***	0.053***
	(0.029)	(0.029)	(0.003)	(0.004)	(0.029)	(0.030)	(0.029)	(0.003)
Updated LTV ≥120	0.824***	0.812***	0.106***	0.143***	0.811***	0.830***	0.799***	0.106***
	(0.036)	(0.036)	(0.005)	(0.006)	(0.035)	(0.045)	(0.036)	(0.005)
1.4 ≤ Chg Unemp < 2.2	-0.009	-0.008	-0.001	-0.001	-0.008	0.006	-0.010	-0.001
	(0.018)	(0.018)	(0.002)	(0.002)	(0.018)	(0.017)	(0.018)	(0.002)
2.2 ≤ Chg Unemp < 3.4	0.006	0.009	0.001	-0.002	0.010	0.033*	0.009	0.001
	(0.023)	(0.023)	(0.003)	(0.003)	(0.023)	(0.018)	(0.023)	(0.003)
3.4 ≤ Chg Unemp < 20	0.094***	0.096***	0.012***	0.010***	0.097***	0.165***	0.095***	0.012***
	(0.027)	(0.027)	(0.003)	(0.003)	(0.027)	(0.019)	(0.027)	(0.003)
FHA/VA	0.183***	0.208***	0.026***	0.024***	0.189***	0.215***	0.226***	0.025***
	(0.021)	(0.021)	(0.003)	(0.003)	(0.021)	(0.021)	(0.021)	(0.003)
Portfolio	0.129***	0.131***	0.016***	0.008**	0.122***	0.137***	0.130***	0.016***
	(0.024)	(0.025)	(0.003)	(0.004)	(0.026)	(0.024)	(0.025)	(0.003)
Private Securitized	0.183***	0.167***	0.020***	0.020***	0.146***	0.171***	0.164***	0.020***
	(0.019)	(0.018)	(0.002)	(0.003)	(0.020)	(0.019)	(0.018)	(0.002)
Fraud # FHA/VA					-0.427***			
					(0.136)			
Fraud # Portfolio					-0.015			
					(0.064)			
Fraud # Private Securitized					0.071			
					(0.051)			
Investor # FHA/VA					0.267***			
					(0.052)			
Investor # Portfolio					0.143*			
					(0.085)			
Investor # Private Securitized					0.153***			
					(0.051)			
Second-home # Portfolio					-0.039			
					(0.092)			
Second-home # Private Securitized					-0.057			
					(0.073)			
State Prohibits Deficiency Judgmts.						-0.025		
						(0.051)		
Fraud # Deficiency Prohibited						-0.014		
						(0.043)		
Investor # Deficiency Prohibited						-0.257***		
						(0.063)		
Second home # Deficiency Prh.						-0.203**		
						(0.082)		
Updated LTV in [80, 90)#Def. Prh.						0.026		
						(0.053)		
Updated LTV in [90,100)#Def. Prh.						-0.028		
						(0.060)		
Updated LTV in [100,120)#Def. Prh.						0.016		
						(0.055)		
Updated LTV ≥120#Def. Prh.						0.152**		
						(0.069)		
Equifax ≠ McDash Zip Code							0.345***	
							(0.017)	
Observations	149799	149799	149799	149799	149797	149799	149799	149799

Table 7b. Marginal Effects on Default: Updated LTV, Origination FICO Score, and Unemployment Change

This table reports the marginal effects on the default, for the interacted model (8) in the previous table, of changing the borrower type variable category from the baseline category of honest owner-occupant, for the interacted variables: updated LTV in December 2008, FICO score at origination, and change in unemployment from origination to December 2008. FICO at Origination is from the McDash dataset. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics. Standard errors in parentheses; * p<0.10, ** p<0.05, *** p<0.010.

	(1) Updated LTV < 80	(2) Updated LTV [80, 90)	(3) Updated LTV [90, 100)	(4) Updated LTV [100, 120)	(5) Updated LTV ≥ 120
Fraud	-0.002 (0.003)	0.029*** (0.006)	0.027*** (0.008)	0.049*** (0.009)	0.071*** (0.012)
Investor	-0.002 (0.002)	0.001 (0.004)	0.011** (0.005)	0.009 (0.007)	-0.040** (0.018)
Second-homeowner	-0.009** (0.003)	-0.008 (0.006)	-0.014 (0.009)	-0.017 (0.012)	-0.013 (0.021)
Observations	34902	31524	28230	38563	16580

	(1) FICO < 660	(2) FICO in [660, 700)	(3) FICO in [700, 750)	(4) FICO in [750, 800)	(5) FICO ≥ 800
Fraud	0.019* (0.010)	0.055*** (0.007)	0.044*** (0.006)	0.019*** (0.003)	0.008* (0.005)
Investor	0.001 (0.009)	0.002 (0.007)	-0.004 (0.004)	-0.001 (0.002)	0.005 (0.004)
Second-homeowner	-0.052*** (0.018)	-0.004 (0.010)	0.006 (0.006)	-0.001 (0.002)	-0.004** (0.002)
Observations	36303	26032	37502	42237	7725

	(1) Chg. Unemp. [-17.2, 1.4)	(2) Chg. Unemp. [1.4, 2.2)	(3) Chg. Unemp. [2.2, 3.4)	(4) Chg. Unemp. [3.4, 20)
Fraud	0.022*** (0.006)	0.031*** (0.007)	0.031*** (0.007)	0.043*** (0.006)
Investor	0.004 (0.004)	0.010** (0.005)	-0.004 (0.005)	-0.012 (0.009)
Second-homeowner	-0.004 (0.010)	-0.020** (0.010)	-0.011 (0.008)	-0.016 (0.010)
Observations	43456	32469	39823	34051

Table 8: Default, Fraud and Bank Card Utilization

Probit models for the probability of a borrower having bank card utilization greater than or equal to 80% as of December 2008. Columns (1)–(3) include only borrowers who were not 60+ DPD in December 2008, whereas columns (4)–(6) include only borrowers who were 60+ DPD in December 2008 but did not terminate their mortgage on or before December 2008. Columns (3) and (6) restrict to borrowers who have multiple first-lien mortgages in Equifax four quarters after origination. Columns (2) and (5) report marginal effects for models (1) and (4), respectively. FICO at Origination is from the Black Knight McDash dataset. Source: Authors' calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
Fraud	-0.045* (0.027)	-0.009* (0.005)	-0.060** (0.027)	-0.330*** (0.055)	-0.120*** (0.020)	-0.337*** (0.057)
Investor	-0.075*** (0.017)	-0.015*** (0.003)	-0.147*** (0.029)	-0.173*** (0.063)	-0.063*** (0.023)	-0.161* (0.089)
Second-homeowner	0.031 (0.027)	0.006 (0.006)	-0.097** (0.040)	-0.145 (0.097)	-0.053 (0.035)	-0.167 (0.118)
Multiple First Liens	0.037*** (0.013)	0.008*** (0.003)		-0.030 (0.043)	-0.011 (0.015)	
Second Lien Indicator	0.091*** (0.012)	0.018*** (0.002)	0.035* (0.020)	0.054 (0.039)	0.019 (0.014)	0.045 (0.052)
Term is 15/20 years	-0.302*** (0.035)	-0.054*** (0.006)	-0.263*** (0.065)	-0.254 (0.255)	-0.091 (0.091)	-0.604 (0.486)
Term is 40 years	0.156*** (0.035)	0.034*** (0.008)	0.220*** (0.066)	0.031 (0.067)	0.011 (0.024)	-0.034 (0.094)
ARM	0.053*** (0.017)	0.011*** (0.004)	0.020 (0.030)	0.001 (0.050)	0.000 (0.018)	0.015 (0.067)
Orig. Int. Rate	0.168*** (0.008)	0.034*** (0.002)	0.173*** (0.016)	-0.001 (0.021)	-0.000 (0.008)	0.005 (0.032)
[660,700)	-0.444*** (0.014)	-0.145*** (0.005)	-0.361*** (0.031)	-0.195*** (0.045)	-0.072*** (0.017)	-0.078 (0.068)
[700,750)	-0.817*** (0.014)	-0.235*** (0.004)	-0.715*** (0.031)	-0.499*** (0.049)	-0.186*** (0.019)	-0.393*** (0.071)
[750,800)	-1.288*** (0.016)	-0.306*** (0.004)	-1.131*** (0.034)	-0.736*** (0.067)	-0.273*** (0.024)	-0.591*** (0.090)
≥800	-1.524*** (0.035)	-0.327*** (0.005)	-1.340*** (0.070)	-0.998*** (0.223)	-0.361*** (0.070)	-0.458* (0.276)
(200k,359650]	-0.011 (0.013)	-0.002 (0.003)	0.077*** (0.024)	-0.009 (0.046)	-0.003 (0.016)	0.104 (0.071)
(359650,417k]	-0.057** (0.026)	-0.012** (0.005)	0.037 (0.042)	0.012 (0.073)	0.004 (0.026)	0.091 (0.098)
(417k,700k]	-0.094*** (0.026)	-0.019*** (0.005)	0.041 (0.040)	-0.009 (0.073)	-0.003 (0.026)	0.091 (0.097)
>700k	-0.112** (0.044)	-0.022*** (0.008)	-0.042 (0.065)	0.282* (0.147)	0.098** (0.049)	0.327* (0.174)
(70,80]	0.096*** (0.019)	0.018*** (0.004)	0.077** (0.035)	-0.016 (0.092)	-0.006 (0.033)	-0.044 (0.125)
(80,90)	0.182*** (0.028)	0.036*** (0.005)	0.167*** (0.052)	0.004 (0.114)	0.001 (0.041)	0.026 (0.163)
≥90	0.235*** (0.026)	0.048*** (0.005)	0.152*** (0.051)	0.115 (0.107)	0.041 (0.039)	0.057 (0.155)
Interest-only Loan	0.128*** (0.020)	0.026*** (0.004)	0.168*** (0.031)	-0.086* (0.052)	-0.031* (0.018)	-0.112 (0.069)
Low Doc.	0.004 (0.011)	0.001 (0.002)	0.019 (0.021)	-0.090** (0.039)	-0.032** (0.014)	-0.109* (0.060)
Unknown Documentation Status	0.035* (0.018)	0.007* (0.004)	0.094*** (0.033)	-0.127 (0.083)	-0.045 (0.029)	-0.235** (0.119)
Correspondent Lender	0.018 (0.012)	0.004 (0.002)	-0.008 (0.024)	-0.058 (0.047)	-0.020 (0.017)	0.002 (0.075)
Brokered	0.015 (0.014)	0.003 (0.003)	0.027 (0.025)	0.021 (0.042)	0.007 (0.015)	-0.000 (0.058)
Updated LTV in [80, 90)	0.022 (0.017)	0.004 (0.003)	0.029 (0.032)	-0.167* (0.094)	-0.057* (0.032)	-0.109 (0.142)
Updated LTV in [90,100)	0.034* (0.020)	0.007* (0.004)	0.023 (0.037)	-0.294*** (0.095)	-0.102*** (0.032)	-0.312** (0.148)
Updated LTV in [100,120)	0.084*** (0.022)	0.017*** (0.004)	0.034 (0.042)	-0.308*** (0.098)	-0.107*** (0.033)	-0.276* (0.153)
Updated LTV ≥120	0.116*** (0.029)	0.024*** (0.006)	0.032 (0.054)	-0.389*** (0.111)	-0.136*** (0.038)	-0.350** (0.167)
1.4 ≤ Chg Unemp < 2.2	0.024 (0.015)	0.005 (0.003)	0.025 (0.032)	0.122* (0.069)	0.043* (0.025)	0.034 (0.113)

2.2 ≤ Chg Unemp < 3.4	0.030*	0.006*	0.005	0.074	0.026	-0.079
	(0.017)	(0.003)	(0.036)	(0.074)	(0.026)	(0.120)
3.4 ≤ Chg Unemp < 20	0.079***	0.016***	0.058	0.145*	0.051*	-0.062
	(0.021)	(0.004)	(0.042)	(0.083)	(0.029)	(0.133)
FHA/VA	0.208***	0.045***	0.216***	0.275***	0.098***	0.313
	(0.016)	(0.004)	(0.055)	(0.067)	(0.023)	(0.215)
Portfolio	0.064***	0.013***	-0.010	-0.025	-0.009	0.046
	(0.019)	(0.004)	(0.038)	(0.065)	(0.023)	(0.097)
Private Securitized	0.084***	0.017***	0.058**	0.044	0.016	0.027
	(0.016)	(0.003)	(0.028)	(0.053)	(0.019)	(0.074)
Constant	-1.715***		-2.068***	-0.678		0.911**
	(0.115)		(0.271)	(0.730)		(0.461)
Observations	118501	118501	30270	6248	6248	2869

Table 9: Comparison of Merged Sample and Black Knight McDash Dataset

Compares summary statistics for our merged credit-bureau-mortgage sample, with the overall McDash dataset for 2005–2007 originations. The McDash sample applies all first-lien restrictions that are present in the CRISM sample. FICO at Origination is from the Black Knight McDash dataset. Source: Authors’ calculations of Black Knight McDash, Federal Reserve Bank of New York Consumer Credit Panel/Equifax, CRISM: Equifax Credit Risks Insight Servicing and Black Knight McDash data, CoreLogic Solutions, and Bureau of Labor Statistics.

	McDash			CRISM		
	Owner-occupant	Investor	Second-homeowner	Owner-occupant	Investor	Second-homeowner
Sample Size (Loans)	4,555,472	531,997	205,434	127,677	16,381	5,741
Share Borrowers	86.1%	10.1%	3.9%	85.2%	10.9%	3.8%
Share of Orig. Dollars	87.9%	7.9%	4.1%	87.4%	8.5%	4.1%
Share of Dec. 2008 Defaults	90.1%	8.0%	1.9%	88.7%	9.0%	2.3%
Bubble State	19.7%	19.1%	29.2%	18.3%	16.2%	29.3%
FICO at Orig.	702.3	722.2	741.9	705.4	720.3	741.3
FICO <660	27.4%	15.7%	7.2%	25.9%	17.5%	7.3%
FICO [660,700)	18.0%	17.2%	13.4%	17.7%	16.3%	13.8%
FICO [700,750)	24.2%	27.6%	27.8%	24.8%	26.4%	27.4%
FICO [750,800)	25.5%	33.1%	41.0%	26.9%	33.6%	41.5%
FICO ≥800	4.8%	6.3%	10.6%	4.8%	6.2%	10.0%
LTV at Orig.	81.5	78.0	75.5	81.8	78.9	75.4
LTV ≤70	14.3%	20.9%	22.5%	13.7%	19.4%	22.9%
LTV (70,80]	47.5%	49.8%	57.8%	47.9%	48.6%	56.4%
LTV (80,90)	6.7%	9.2%	9.2%	6.3%	8.0%	9.7%
LTV ≥90	31.5%	20.0%	10.6%	32.0%	24.0%	11.0%
Chg. HPI: Orig-Dec. 2008	-12.6%	-11.7%	-14.0%	-12.0%	-10.7%	-13.8%
Interest Rate at Orig.	6.45	6.58	6.32	6.4	6.57	6.28
Broker originated	20.2%	12.9%	14.2%	18.6%	10.4%	14.1%
ARM	25.3%	22.0%	27.6%	22.6%	14.6%	27.9%
IO	15.2%	12.2%	19.9%	13.6%	8.5%	19.7%
Jumbo	8.8%	2.9%	10.0%	9.4%	2.4%	10.5%
Loan amt. ≤200k	59.0%	72.1%	56.7%	58.0%	72.0%	55.9%
Loan amt. (200k,359650]	27.6%	22.0%	28.6%	27.9%	22.5%	28.9%
Loan amt. (359650,417k]	5.1%	3.1%	5.1%	5.1%	3.2%	5.1%
Loan amt. (417k,700k]	6.6%	2.3%	7.2%	7.2%	2.0%	7.5%
Loan amt. >700k	1.7%	0.5%	2.4%	1.9%	0.4%	2.6%
FHA/VA	11.8%	14.1%	0.0%	12.9%	19.3%	0.0%
GSE	54.7%	55.8%	70.0%	55.1%	58.5%	70.7%
Portfolio	8.8%	5.9%	10.3%	9.7%	3.9%	10.0%
Private Securitized	24.7%	24.2%	19.7%	22.3%	18.3%	19.2%
Default by Dec. 2008	11.7%	8.9%	5.4%	10.0%	7.9%	5.7%
LTV Dec. 2008	95.7%	90.6%	90.7%	95.2%	90.4%	90.5%
LTV Dec. 2008 <80	21.9%	30.0%	30.6%	22.2%	29.7%	30.4%
LTV Dec. 2008 [80, 90)	20.0%	23.8%	23.5%	20.6%	24.0%	23.6%
LTV Dec. 2008 [90,100)	18.8%	17.7%	17.5%	19.0%	17.8%	17.7%
LTV Dec. 2008 [100,120)	26.9%	19.5%	17.3%	26.8%	20.4%	17.1%
LTV Dec. 2008 ≥120	12.4%	8.8%	11.0%	11.5%	8.1%	11.1%