

Recourse and Residential Mortgage Market: the Case of Nevada*

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Abstract

In 2009 the state of Nevada abolished deficiency judgments for purchase mortgage loans made after October 2009 and collateralized by primary single family homes. In this paper we test the effect of this law change on the residential mortgage market in Nevada. Using unique mortgage loan level application and performance data, we find strong evidence that lenders tightened their lending standards in response to the law change. Specifically, lenders reduced approval rates and loan sizes for affected mortgages by about 5 percent. Households, by contrast, did not increase their mortgage applications. Additionally, the deficiency law change did not appear to have affected mortgage default or house foreclosure outcomes. These results thus cast a cautionary note on policy recommendations that intend to use deficiency laws to curb mortgage defaults.

JEL Classifications: G21, K11, R20

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1 Introduction

In US, state laws govern residential mortgage defaults and house foreclosure process. In most states, mortgage loans are recourse loans, that is, lenders can apply the difference between mortgage balance and proceeds from foreclosure sales to debtors' other assets or earnings, a process also known as deficiency judgments. There are some exceptions, such as purchase money mortgages in California and 1-4 family residences in North Dakota.¹ Theory predicts that recourse should deter default since default puts debtors's other assets at risk (Ambrose, Buttimer, and Capone 1997, and Corbae and Quintin 2010). Empirically, however, the findings have been mixed. For instance, Clauretje (1987) finds that whether a state allows for deficiency judgments does not affect mortgage default rates significantly.² By contrast, Ghent and Kudlyak (2011) find lower default rates in recourse states, particularly for higher-priced homes whose owners are likely to have other financial resources that can be seized by mortgage lenders. Many policy discussions have also centered on this provision. The most prominent is the recommendation by Feldstein (2008) that turning nonrecourse mortgage loans into recourse loans maybe an effective way to solve the mortgage debt overhang problem and, thus, the current mortgage crisis.³

In this paper we show that the current debate on deficiency judgements as useful tools to curb mortgage defaults is incomplete and perhaps even misleading. The reason is because lenders and borrowers often respond to differences in regulations. With deficiency judgements, lenders may decide to lend to riskier borrowers, lend more, and/or lend at lower interest rates, and vice versa. Borrowers may decide not to apply for mortgages or apply for smaller mortgages. Analysis of the default behavior of approved mortgage loans is, thus, subject to selection bias. Put it simply, a finding that borrowers are not less likely to default in states with deficiency judgements may simply be because approved borrowers in those states are riskier.

To illustrate the point, we conduct a unique event study using proprietary mortgage loan level application and performance data. In 2009, Nevada, one of the states that experienced substantial price boom and subsequent crash during the recent housing cycle, passed a legislature that made significant changes to its deficiency judgment law. For homeowners who enter into a mortgage in conjunction with a purchase of a single family primary home after October 1, 2009, their mortgage lenders will not be able to pursue a deficiency judg-

¹Some states also limit deficiencies if a creditor proceeds through a non-judicial foreclosure. See Ghent and Kudlyak (2011) table 1 for a summary of different state recourse laws.

²The reason for the lack of effect of deficiency judgements on mortgage default is that there exists substantial costs associated with persuing deficiency judgments on foreclosures as documented in Capone (1996), Leland (2008), and Brueggeman and Fisher (2011). Additionally, they argue that debtors can file for bankruptcy and get rid of the unsecured deficiency debt.

³This suggestion has been controversial as summarized in Adam Levitin's blog at <http://www.creditslips.org/creditslips/2008/12/the-role-of-rec.html>.

ment if the house is taken in a foreclosure. We test whether lenders responded to the law change by altering their mortgage approval rates, approved mortgage loan sizes, and interest rates charged, and whether borrowers changed their mortgage applications by applying for more and larger loans. To facilitate the comparison with the aforementioned literature, we also test whether this new legislation had any effect on borrowers' default decision. Our identification comes from both time differences in the behavior of primary purchase loans for single homes as well as cross sectional differences between primary single home purchase and refinanced loans, primary single home purchase loans and purchase loans for investment single family properties, etc. This identification strategy has an advantage over those that rely on cross sectional differences in state laws to detect the effects of recourse loans because state laws are sticky and have changed little in recent years.

The paper has three main results. First, we uncover evidence that lenders tightened their lending standards by reducing approval rates and loan sizes for those affected borrowers. More specifically, the abolishment of deficiency judgments of single family purchase mortgage loans leads to a reduction of about 5 percent in both mortgage approval rates and mortgage sizes. Mortgage interest rates for approved loans, on the other hand, did not change in any statistically significant way. Second, we don't find any change in mortgage demand either in total amount or average loan size. Finally, borrowers' default behavior did not appear to have responded to the law change in any statistically significant way. What is more, we do not find any evidence that the change in recourse laws made borrowers' default behavior more sensitive to home equity. Our results thus suggest that mortgage deficiency judgments are not necessarily useful tools to reduce mortgage defaults as lenders have incentives to lend to riskier borrowers under deficiency judgments.

In addition to the researches cited above, our paper is also related to two other strands of literature. The first is the literature that studies the impact of various aspects of state laws on lending cost. For example, Clauretje and Herzog (1990) and Ciochetti (1997) document greater lender costs in states that require judicial foreclosure and statutory right of redemption. Lin and White (2001) and Berkowitz and Hynes (1999) show that bankruptcy exemptions did and did not affect, respectively, whether a mortgage application was approved. Pence (2006) finds that lenders approve smaller loans in default-friendly states everything else the same. The second is the vast literature examining various aspects of mortgage borrowers' decision to default. Among the recent studies, Gerardi, Shapiro, and Willen (2007), Foote, Gerardi, and Willen (2008), and Demyanyk and van Hemert (2011) focus on negative equity as an important condition for defaults for mortgages originated in the state of Massachusetts. Bajari, Chu, and Park (2008), Bajari, Chu, Nekipelov, and Park (20013), Bhutta, Dokko, and Shan (2010), Guiso, Sapienza, and Zingales (forthcoming), and Elul, Souleles, Chomsisengphet, Glennon, and Hunt (2011) study both negative

home equity and illiquidity as two important drivers of the rise in mortgage defaults during the recent crisis.

The rest of the paper is organized as follows. Section 2 discusses the law change in Nevada and its potential impact on debtors and creditors. Section 3 presents our data source. Section 4 reports our empirical analysis and section 5 concludes.

2 The Nevada Deficiency Judgment Law and Its Impact

2.1 The Nevada Deficiency Judgment Law

The state of Nevada is a recourse state, it allows lenders to pursue deficiency judgments - the difference between the balance owed on a mortgage loan and what the lender sells the house for at auction - within six months of the auction. After the six months, lenders are barred from filing a law suit to collect the judgments.

In 2009, Nevada passed a legislature – Assembly Bill No. 471 – that made significant changes to Nevada’s deficiency judgment law. Under the new legislation, a financial institution holding a residential mortgage may not be awarded a deficiency judgment under the following circumstances: (1) the real property is a single-family house owned by the debtor; (2) the debtor used the money loaned from the bank to buy the house (as in a typical mortgage); (3) the house was owner-occupied; and (4) the loan was never refinanced. What this means is that, for many homeowners who enter into a mortgage in conjunction with a purchase after October 1, 2009, their mortgage lender will not be able to pursue a deficiency judgment should the house be taken in a foreclosure. Rather, upon foreclosure, the risk that the house has depreciated in value shifts back to the bank. Mortgages that do not satisfy these conditions continue to be subject to the prior law.⁴

2.2 The Impact of Deficiency Judgments on Mortgage Lending, Borrowing, and Default

If lenders are not allowed to collect on debtors’ other assets, they will be reluctant to foreclose on a house especially when foreclosure cost is high because there is no financial

⁴Aside from recourse, in Nevada, lenders may foreclosure on mortgages in default using either a judicial or non-judicial foreclosure process. The judicial process of foreclosure involves filing a lawsuit to obtain a court order to foreclosure and is used when no power of sale is present in the mortgage. The borrower has 12 months after the foreclosure sale to redeem the property. When a power of sale clause exists in a mortgage or deed of trust, the non-judicial process is used. Borrowers have no right of redemption under the power of sale.

gain from doing so. Furthermore, if lenders perceive default probabilities to rise as a result of the elimination of deficiency judgments, they will tighten their lending standards by lending to less risky borrowers, lending smaller amount of loans, or lending at higher mortgage rates. Borrowers, on the other hand, may decide to apply for mortgages or apply for larger loans if they do not risk their other assets in the event of being foreclosed.

The impact of the deficiency law on a borrower’s default behavior hinges crucially on the borrower’s non-housing asset. If the borrower has other assets that can be collected after house foreclosure, then the permission of deficiency judgments will deter the borrower from becoming seriously delinquent. The more assets the borrower has, the stronger the deterrence will be. Another important factor that affects the impact of the deficiency law on borrowers’ default behavior is the cost of collecting deficiency judgments. If the cost is high, then the effect is smaller. Finally, in a dynamic setting, future local house price movement, borrower’s income, and the cost of defaulting (less access to future credit) will all factor into borrowers’ decision. See Ghent and Kudlyak (2011) and Corbae and Quintin (2010) for more discussion.

Based on this theory, we seek to test several hypothesis. First, are lenders less willing to lend, lend a smaller amount, or lend at higher rates to primary single family purchase mortgage loans after October 2009? Second, do borrowers apply for more and/or larger primary single family purchase mortgage loans after October 2009? Finally, are single family primary mortgage loans made after October 2009 more likely to become delinquent than single family loans made earlier? Are lenders less likely to foreclose on a single family property with loans originated after October 2009 than other loans?

3 Data and Empirical Methodologies

3.1 Data and Data Sampling

We use two main data sets. The first, Home Mortgage Disclosure Act (HMDA), covers almost all mortgage applications as well as originations in US. It records each applicant’s final status (denied/approved/originated), purpose of borrowing (home purchase/refinancing/home improvement), occupancy type (primary residence/second or investment homes), loan amount, race, sex, income, as well as lender institution.⁵ HMDA is available through the Federal Financial Institutions Examination Council (FFIEC).

The second, LPS Applied Analytics, Inc., provides information from homeowners’ mortgage applications concerning their financial situation, characteristics of the property, terms of the mortgage contract, and information about securitization, plus updates on whether

⁵Only lenders who do not do business in any metropolitan statistical area are not required to report (e.g., small community banks) to HMDA.

homeowners paid in full or defaulted, whether lenders started foreclosure and whether the home was sold in foreclosure. LPS covers some two-thirds of installment-type loans in the residential mortgage servicing market for the post-2005 period that we are analyzing. LPS is a proprietary data set purchased by the Federal Reserve System.

Both data are then merged with county level monthly unemployment rates obtained from the Bureau of Labor Statistics and monthly zip code level house price index available from CoreLogic, another proprietary data purchased by the Federal Reserve System. When zip code house price index is not available due to low transaction volume for the calculation of repeated index, we substitute with county level house price index and when county level house price index is not available either, we use Nevada state house price index.

We use HMDA to examine lenders' mortgage loan approval decision and mortgage loan size decision and to detect whether there is any changes in mortgage applications for the affected mortgages after the implementation of the new deficiency judgment law. As our benchmark, we restrict the sample to first lien mortgages made in Nevada for one-to-four family properties around October 2009 – six months before and after, as well as one year before and after.⁶ We delete those applications that are withdrawn without an approval decision or closed for incompleteness. We also drop all loans insured by Federal Housing Administration (FHA), Veterans Administration (VA), or Farmers Home Administration (FmHa) because deficiency judgments are prohibited on FHA loans and strongly discouraged on VA and FmHa loans. We also drop mortgage loans with private mortgage insurance as in Ghent and Kudlyak (2011) and loans for manufacturing housing.

We use LPS to analyze lenders' interest rate decision conditional on mortgage loan approval, borrowers' default behavior, and lenders' foreclosure decision. We focus on first lien mortgages for single family properties made in Nevada around October 2009 and follow the performance of these loans till the end of 2012. As with the HMDA data, we delete from the sample loans insured by the government including FHA, VA, and FmHa and loans with private mortgage insurance.

3.2 Empirical Methodologies

We use various regression techniques to study the impact of the deficiency law change in Nevada on lenders as well as borrowers' behavior. As mentioned earlier, mortgage loan application approval decision and mortgage loan size come from HMDA. For the hypothesis regarding borrowers' mortgage application decision, we aggregate the data to the county level and by purpose of the loan – whether the loan is for purchase or refinance. we measure borrowers' default behavior by becoming for the first time 60 days or more delinquent, and 90 days or more delinquent as reported by LPS. The measurement of foreclosure

⁶HMDA does not distinguish between single family properties and two-to-four family properties.

decision comes from the same source. Note that foreclosure is a legal process in which a lender attempts to recover the balance of a loan from a borrower who has stopped making payments to the lender by forcing the sale of the asset used as the collateral for the loan. We thus treat foreclosure as a lender’s decision rather than a borrower’s. Mortgage interest rate at origination also comes from LPS.

Our identification comes from the interaction of two terms, whether the loan is a purchase loan for single family homes and whether the loan is made after October 2009. Given the rich information contained in the data, we will conduct robustness analysis using other information such as primary versus investment purchase loans as identification.

A generic regression in our analysis takes the following form,

$$(1) \quad y_{it} = \alpha Z_{it} + \beta X_{it} + \varepsilon_{it},$$

where y_{it} is the variable of interest, Z_{it} is the key interaction variable discussed above, and X_{it} is a vector of control variables. For the HMDA data, X_{it} includes the gender of the applicant, race, income, whether the applicant has a cosigner, whether he comes from an area with 30 percent or more minorities, whether the lender is a commercial bank or its subsidiary, independent mortgage bank, thrift, or credit union. It also includes county unemployment rates and zip code house price growth rates. When we aggregate the data to test for trend in mortgage application, we can no longer control for any mortgage loan level or applicant level information. Thus, X_{it} will only include county unemployment rates and zip code house price growth rates. For the LPS data, X_{it} includes borrowers’ credit score at origination and mortgage loan contract information such as mortgage loan age, loan-to-value ratio at origination, whether the loan has full documentation, of fixed interest rate, current interest rate, and whether the loan is sold to private investors.⁷ For tests on mortgage lending and mortgage default, we further control for county fixed effects, monthly time fixed effects, and separate linear time trends for each county. The tests on mortgage demand, due to limited sample size after aggregation, include county fixed effects, a linear time trend and its square. Finally, we cluster standard errors at the loan level.

We use ordinary least square regressions (OLS) when the dependent variable y_{it} is continuous and Probit regression when the dependent variable is binary. When testing for mortgage loan size, we use Tobit analysis because the data are censored in the sense that rejected loans effectively have zero loan amount. As an alternative, we also use Heckman’s test to control for selection bias (Heckman 1976 and 1979). Unfortunately, LPS does not include any rejected loans, we thus use OLS for our interest rate analysis.

⁷We observe no subprime loans, and very few interest only and balloon mortgage loans during our sample period.

4 Empirical Analysis

Our empirical analysis consists of three parts. First, we investigate how lenders respond to the deficiency law change in terms of mortgage loan approval rates, loan sizes, and interest rates. Then we examine whether borrowers respond to the law change with regard to loan applications. Finally, we study the relationship between changes in deficiency judgments and mortgage default and house foreclosure.

4.1 Mortgage Lending

We use three measures for lending standards, mortgage approval rates, approved mortgage loan sizes, and interest rates of approved mortgage loans. As discussed earlier, we use HMDA data for the analysis on approval rates and mortgage loan sizes and LPS data for the test on mortgage interest rates.

4.1.1 Descriptive Statistics

Table 1 reports summary statistics for the HMDA sample. For the six months before and after October 2009, there are in total 27,889 mortgages originated for one-to-four family primary residence with no government guarantee or private insurance. Of the 27,889 applications, 72 percent are for refinance. About 9 percent of the applications are affected by the change in deficiency judgments. The overall mortgage approval rate is 66 percent. About 70 percent of the applications are filed by male. Close to 80 percent of the applicants are white and a little over 2 percent are black. Over half of the applications have cosigners. There exists substantial income disparity among the applicants with the average (nominal) income at application at \$106,000 and the median income at \$73,000. The average loan amount is \$222,000 and the median is \$183,000. About 3 percent of the applicants live in areas with over 30 percent of the residents are minorities. The majority of the applications are filed at commercial banks (65 percent), followed by independent mortgage banks (19 percent), thrifts (9 percent), and credit unions (5 percent). Unemployment rates are high in all counties of Nevada with both mean and median at over 12 percent. House prices declined for most of the state during that period.

Table 2 reports summary statistics for the LPS sample. Between April 2009 and April 2010 excluding October 2009, 10,987 mortgage loans are made for first lien single family primary mortgages without government guarantees or private insurance. Note that this number is somewhat smaller than the 18,406 approved mortgage loans calculated from HMDA. This is because we delete from LPS sample mortgages with private insurance and 2-to-4 family mortgages while such information is not available in HMDA. Including these

two categories add a little over 1,000 observations to the sample. The remaining difference comes from the imperfect coverage of LPS data of the Nevada market.

Of the 10,987 mortgages, 45 percent are for refinance. This number is substantially lower than the 72 percent at application indicating that mortgage approval rates are lower for refinance mortgages during that period. About 5 percent of the mortgages are affected by the law change. The mean interest rate at origination is 4.98 percent and the median is 4.88 percent and almost all of the mortgages are fixed-rate mortgages (over 98 percent). The mean credit score at origination is 717 and the median is 771.⁸ About 41 percent of the mortgages have full documentation. A mere 2 percent are jumbo mortgages, 18 percent are sold to private investors. Finally, the unemployment rates are about 12.3 percent on average and almost all areas experience recent monthly house price decline of about 1 basis point on average.

4.1.2 Results

Approval and Loan Size. We conduct two analysis using HMDA. The first is a Probit analysis where the dependent variable takes the value of 1 if the loan is approved and zero otherwise. The second is a Tobit analysis where the dependent variable is the actual loan amount for approved loans and zero for rejected loans. We report the regression results in Table 3. The key variable, one-to-four family purchase loans made after October 2009, contributes negatively and statistically significantly to lenders' approval rate as well as mortgage loan size upon approval. In particular, a one-to-four family mortgage purchase loan made after October 2009 has an approval rate that is 3.71 percentage points lower than that of a similar loan made earlier or a single family refinance loan, or 5.62 percent less likely to be approved and the loan size is \$10,447, or 4.71 percent smaller after approval than loans not affected.

In terms of the other control variables, for approval rates everything else the same, a refinance mortgage loan has an approval rate that is 19 percent points lower. This result is likely due to the fact that loans made earlier during housing booms are of lower standards and are thus less likely to be approved for refinance once lenders tighten their lending standards after the crisis. As expected, higher income increases the probability of being approved while higher loan amount reduces the probability of being approved. Specifically, a \$1000 increase in income raises the approval rate by about 2 basis points while a \$1000 increase in loan amount reduces the approval rate by about 3 basis points. Living in minority areas substantially lowers the approval rates. Non-white, female, and applicants without cosigners all have much lower mortgage approval rates. Lending institutions also affect loan approval rates. In particular, compared with specialized mortgage banks, commercial

⁸The credit score system used by LPS ranges from 300 to 850.

banks are less likely to approve mortgages while credit unions are more likely to approve.

In terms of loan size of approved mortgages, refinance loans are on average \$66,000 smaller. Applicants with higher income borrow more with a \$1000 increase in income corresponding to about \$317 increase in loan size. Borrowers living in minority areas get smaller loans, as do non-white, female applicants, or applicants without cosigners. Compared with mortgage banks, commercial banks approve smaller loans while thrifts and credit unions giving out larger loans. Higher local unemployment rates reduce loan sizes. Higher local house price growth rates, interestingly, also reduces loan sizes.

Interest Rate To further investigate whether lenders lend at higher interest rates to borrowers affected by the change in the deficiency law, we run an ordinary least squares regression (OLS) using LPS for loans made between April 2009 and April 2010 excluding October 2009. The results are reported in Table 4.

According to our analysis, interest rates on first lien single family primary purchase mortgage loans made after October 2009 are not statistically different from those made after October 2009 or first lien single family primary refinance mortgage loans. This could stem from our earlier results that the approved first lien single family purchase loans are already of relatively higher quality and relatively smaller size after October 2009.

For the other control variables, mortgage rates for refinance loans are, on average, about 11 basis points lower. An increase of 10 percentage points in mortgage loan-to-value ratio raises the interest rate by about 3 basis points. An increase of 10 in credit score, on the other hand, reduces the interest rate by about 2 basis points. Loans sold to private investors and loans with adjustable-rate mortgages all have lower interest rates but jumbo mortgages have higher interest rates. Finally, areas with high local unemployment rates also face higher mortgage interest rates.

4.1.3 Robustness Analysis

Approval Rate and Mortgage Loan Size To test the robustness of our results on mortgage loan approval rate and mortgage loan size, we conduct four additional analysis. First, we use Heckman model to adjust for selection bias. Then we extend our sample to include made between October 2008 and October 2010 excluding October 2009, exactly one year before and one year after the deficiency law change. As another exercise we include investment single family property loans as part of the control group for the primary single property purchase loans that are affected by the law change. Finally, we conduct two placebo tests, one assuming the law change occurred in April 2008 and the other assuming the law change occurred in April 2011. The results are reported in Table 5.

The Heckman model generates a much bigger effect on approval rates, a 10 percent re-

duction in approval rates, but the effect on loan size is roughly unchanged from the benchmark. Extending the benchmark sample to include loans made one year before October 2009 and one year after, on the other hand, produce much larger effects on both approval rates and approved mortgage loan sizes. Particularly, the approval rates are reduced by close to 9 percentage points and the loan size is reduced by about \$24,000. Including investment property loans does not change the benchmark results by nearly as much. Tests using the two placebo dates generate very different results from the benchmark. For both fake dates, the effects on both mortgage approval rates and mortgage loan sizes are statistically significant but have positive signs. All these experiments thus confirm that after the change in deficiency judgement law, lenders tightened their lending standards in terms of loan approval rates and loan size for affected borrowers.

Mortgage Interest Rate For mortgage interest rates, we conduct three robustness tests, extending the sample by including loans made one year before and one year after the deficiency law change, including investment properties, and including multifamily properties, respectively. The results are presented in Table 6.

Compared with the results on mortgage approval rates and mortgage loan sizes, the results on mortgage interest rates turn out to be less robust. Lenders actually reduce interest rates for affected mortgages in the longer sample regression and the regression including investment properties. These results are plausible because, as pointed out earlier, the new purchase loans made after October 2009 are of higher quality and smaller sizes.

4.2 Mortgage Application

In this subsection, we test mortgage applicant’s behavior. Theory predicts that those that are affected by the change in the deficiency law should increase their demand for mortgages after the law change. Using the constructed HMDA sample, we calculate by month, county, and loan type (purchase versus refinance), the total number and value of mortgages made for one-to-four family houses. We then regress the number/amount on the key variable identifying loans that are affected by the law change, whether the loans are refinanced loans, average income of the MSA, the fraction of MSAs that have over 30 percent minorities, lagged average local unemployment rates, lagged average local house price growth rates, a time trend and its square, and, finally, county dummies.⁹ We keep loans made between April 2009 and April 2010 excluding October 2009. The regression results are reported in Table 8.

As can be seen, there does not appear to exist a structural break for loan applications for one-to-four primary purchase mortgage loans after October 2009 in terms of

⁹We chose not to have separate time dummies given the much smaller sample size.

total number and dollar amount of mortgage applications and the average size of mortgage applications. Regarding other control variables, refi loans explain a large fraction of total loan demand. County dummies (not reported) that capture applicant as well as local characteristics beyond those already included in the regressions also play important roles

Robustness Analysis We conduct two additional robustness tests, expanding sample periods to one year before and after the law change and include loans for investment properties. According to the results reported in Table 8, we do not detect any trend break in demand for single family primary purchase mortgages after October 2009.

4.3 Mortgage Default and House Foreclosure

This subsection seeks to test whether single family purchase mortgage borrowers that borrowed after October 2009 are more likely to default and whether lenders are less willing to foreclose on these borrowers. The control groups are single family purchase loans made before October 2009 and single family refinance loans made during the whole sample period. We define defaults to be the first time that the loan becomes 60 days delinquent or 90 days delinquent, respectively. The foreclosure decision is defined as entering foreclosure process.

4.3.1 Descriptive Statistics

We use LPS for the default and foreclosure analysis. In particular, we focus on mortgage loans originated six months before and six months after the change in the deficiency judgment laws in October 2009 which spans April 2009 to April 2010 excluding October 2009. During this period, 10,987 mortgage loans were originated for owner-occupied primary home mortgages without mortgage insurance and by private mortgage lenders.

We follow these mortgage loans from the time of their origination to the first time the loan becomes 60 day, 90 day delinquent, enters into foreclosure, or reaches the end of the sample period December 2012. Table 9 reports the summary statistics for 60+ delinquency sample. In total, we have 343,120 observations. The monthly 60 day delinquency rate is 0.08 percent. The average loan age is 21 months and the median is 24 months. The mean mortgage loan-to-value ratio at origination is 68 percent with a median of 65 percent. The average credit score is 760, on the high end of the credit score range of 300 and 850. The monthly unemployment rate averages 13 percent while the monthly net house price growth rate averages about 0.55 percent with large variances. The sample statistics for the 90 days delinquency and foreclosure sample are very similar except that the 90 day delinquency rate averages 0.04 percent monthly for the 90+ day delinquency sample and the foreclosure rate is 0.02 percent monthly for the foreclosure start sample.

4.3.2 Results

As discussed in the empirical methodologies, we run Probit regressions with the dependent variable being the binary variable that takes the value of 1 if the loan becomes delinquent or being foreclosed by the lender and 0 otherwise. We cluster standard errors at the loan level. Table 10 reports our regression results including marginal effects of each explanatory variable and its associated standard error.

The variable of interest, single family mortgage loans made after October 2009, is not statistically significant in any of the three regressions. During that period, refinance loans are more likely to become delinquent. The older the mortgage loan is, the more likely it becomes 60 days, 90 days delinquent or enters into foreclosure though the speed of the increase declines. As expected, mortgage loans with high mortgage loan-to-value ratios at origination are more likely to become delinquent or being foreclosed. Current interest rate as well as adjustable-rate-mortgage loans also contribute positively to default and foreclosure probabilities. By contrast, having high credit scores at origination reduces default as well as foreclosure probability. County, time fixed effects and separate county linear time trends are included in all three regressions.

4.3.3 Robustness Analysis

We conduct four additional analysis to test the robustness of our benchmark results. Specifically, we study loans that were made one year before and one year after the change in deficiency law; we look at subsamples where the appraised house value is above the median and where current mortgage loan-to-value ratio is above 90, respectively; and we include in the benchmark sample refinance loans for primary homes. The results on the key variable, primary purchase loans for single family homes made after October 2009 are reported in Table 11. As can be seen, none of the estimates are statistically significant for any of the default and foreclosure definition.

5 Conclusions and Discussions

In October 2009, Nevada disallowed deficiency judgments on single family purchase mortgages made after October 2009. We test in this paper whether this law change had a measurable effect on the residential mortgage market in Nevada. In particular, we investigate whether mortgage lending, borrowing as well mortgage default and foreclosure responded to the law change. In doing so, the paper makes contribution to several strands of literature that seek to understand the relationship between real estate laws and borrower and lender behavior.

In contrast to some of the existing studies, we do not find any significant change in affected borrowers' mortgage default or lenders' foreclosure decisions. However, we find strong evidence that lenders tightened their lending standards substantially both in terms of loan approval rate and loan size though not on mortgage interest rates. It further reveals that there are no changes in mortgage applications from households.

The paper thus casts a cautionary note on using deficiency judgments as deterrence for mortgage default or mortgage foreclosure as deficiency judgments encourage lenders to lend to riskier borrowers. Further policy research requires more structural analysis which we pursue in a separate project.¹⁰

¹⁰See "Consumer Bankruptcy and Mortgage Default" by Wenli Li, Costas Meghir, and Florian Oswald.

Table 1. Sample Summary Statistics – HMDA

variable	mean	median	standard deviation
approval rate*	0.6594	0	0.4739
refinanced mortgage loans*	0.7159	1	0.4510
loans affected by law changes*	0.0878	0	0.2831
female*	0.2733	0	0.4456
gender unknown*	0.0682	0	0.2520
race: black*	0.0229	0	0.1495
race: non-white and non-black*	0.0886	0	0.2842
race: unknown*	0.1157	0	0.3199
no cosigner*	0.4711	0	0.4992
income (\$ thousands)	106.4254	73.0000	191.4229
loan amount (\$ thousands)	222.0114	183.0000	200.2909
living in area with 30% or more minorities*	0.0262	0	0.1596
lender: commercial bank and their subsidiaries*	0.6463	1	0.4781
lender: independent mortgage banks*	0.1911	0	0.3932
lender: thrifts*	0.0906	0	0.2870
lender: credit unions*	0.0527	0	0.2234
lagged local unemployment rate (%)	12.0379	12.1000	1.5494
lagged net local house price growth rate	-0.0032	-0.0098	0.1195
Total number of observations	27,889		

Note. Mortgage loans for owner-occupied primary housing originated between April 2009 and April 2010 excluding October 2009 from non-government agencies.

*indicates dummy variables.

Table 2. Sample Summary Statistics – LPS

variable	mean	median	standard deviation
refinance mortgage loans*	0.4493	0	0.4974
loans affected by the law change*	0.0473	0	0.2122
current interest rate	4.9805	4.8750	0.4506
mortgage loan-to-value ratio at origination	66.4874	70.0000	22.0924
credit score at origination	717	771	182
full document*	0.4059	0	0.4910
jumbo loan*	0.0198	0	0.1392
loan sold to private investor*	0.1844	0	0.3878
adjustable-rate mortgage*	0.0179	0	0.1328
lagged local unemployment rate	12.3008	12.6000	1.7558
lagged gross local real house price growth rate	-0.0007	-0.0046	0.1171
Total number of mortgage loans	10,987		

Note. Purchase or refinance loans for owner-occupied single family housing originated between April 2009 and April 2010 excluding October 2009. These loans are not government guaranteed. * indicates dummy variables.

Table 3. Mortgage Lending: Approval Rates and Loan Size – Benchmark (HMDA)

variable	Mortgage Approval (Probit, Marginal Effect)		Mortgage loan size (Tobit)	
	marginal effs	s.e.	coefficient	s.e.
purchase loans made after reform	-0.0371***	0.0135	-10.4465***	3.2977
refinance loan	-0.1897***	0.0062	-66.0726***	3.4139
income at origination (\$ thousands)	1.60e-04***	2.67e-05	0.3172***	0.0112
loan amount (\$ thousands)	-2.87e-04***	2.24e-05		
MSA with over 30% minorities	-0.2496***	0.0061	-132.3559***	6.7045
being black	-0.1089***	0.0051	-45.7309***	2.4109
being non-white and non-black	-0.0681***	0.0047	-25.8185***	2.2543
race unknown	-0.0796***	0.0034	-25.5976***	3.2223
female	-0.0173	0.0154	-18.6823***	4.6003
gender unknown	0.0402***	0.0086	28.5598***	3.7594
no cosigner	-0.0594***	0.0037	-36.0006***	1.9352
lender: commercial bank	-0.0245***	0.0057	-8.9606***	1.9501
lender: thrift	-0.0115	0.0109	18.7221***	2.6794
lender: credit union	0.1258***	0.0153	15.3800***	3.2681
lagged monthly unemployment rate	0.0358	0.0306	-15.9427***	5.8650
lagged hpi growth rate	-0.0068	0.0197	-31.2756***	7.8177
linear county time trends	yes		yes	
county fixed effects	yes		yes	
time fixed effects	yes		yes	
Pseudo R-square	0.1325		0.0206	
number of observations	27,889		27,889	

Note. * indicates statistical significance at 10 percent level, ** at 5 percent level, and *** at 1 percent level.

Table 4. Mortgage Lending: Interest Rate – Benchmark (LPS)

variable	interest rate at origination	
	coefficient	s.e.
purchase loan made after reform	-0.0398	0.0260
refinance loan	-0.1072***	0.0099
loan-to-value ratio at origination	0.0027***	0.0002
credit score at origination	-0.0018***	0.0001
full document	0.0108	0.0103
private investor	-0.0527***	0.0132
jumbo mortgage	0.4600***	0.0631
adjustable rate mortgage	-0.8055***	0.0402
lagged monthly unemployment rate	0.0573***	0.0150
lagged real hpi growth rate	0.0321	0.0352
linear county time trend	yes	
county fixed effects	yes	
time fixed effects	yes	
R-squared	0.1934	
number of observations	10,987	

Note. * indicates statistical significance at 10 percent level, ** at 5 percent level, and *** at 1 percent level.

Table 5. Mortgage Lending: Approval Rates and Loan Size – Robustness Analysis (HMDA)

	loan approval rate		loan size (\$)	
	coefficient	s.d.	coefficient	s.d.
Heckman Model	-0.1012***	0.0422	-10.8093**	5.8480
loans originated: October 2008 – October 2010	-0.0870***	0.0044	-24.1974***	3.7385
include investment loans	-0.0566***	0.0115	-10.1488***	3.0577
placebo law change date: April 2008	0.1062***	0.0052	52.4968***	4.4692
placebo law change date: April 2011	0.0687***	0.0097	63.4501***	0.5970

Note. * indicates statistical significance at 10 percent level, ** at 5 percent level, and *** at 1 percent level.

Table 6. Mortgage Lending: Interest Rate – Robustness Analysis (Static LPS)

Sample	mortgage rate (%)	
	coefficient	s.d.
loans originated: October 2008 – October 2010	-0.0684*	0.0353
include investment properties	-0.1270***	0.0250
include multifamily properties	-0.0328	0.0255

Note. * indicates statistical significance at 10 percent level, ** at 5 percent level, and *** at 1 percent level.

Table 7. Mortgage Applications – Benchmark (HMDA)

variable	# loan applications		loan amount (\$1000)		average loan size	
	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.
purchase loans after reform	55.864	33.233	13107.88	7695.07	2.362	14.147
refinance loans	113.409***	23.249	27813.71***	5384.87	16.489	9.900
average income of the MSA	-0.046	0.079	-13.396	18.339	-0.0130	0.034
MSA with over 30% minorities	-264.198	102.698	-72401.97	98737.78	-175.848	181.527
lagged unemployment rate	5.730	14.640	1239.245	3390.79	6.749	6.234
lagged house price growth rate	-24.282	102.698	-2485.247	23786.91	-6.064	43.731
time trend	0.215	38.936	-1644.464	9018.21	-23.437	16.580
time trend squared	-0.373	0.923	-41.618	213.859	0.521	0.393
county dummies included	yes		yes		yes	
Adjusted R-squared	0.669		0.648		0.373	
number of observations	295		295		295	

Note. * indicates statistical significance at 10 percent level, ** at 5 percent level, and *** at 1 percent level.

Table 8. Mortgage Applications – Robustness Analysis (HMDA)

sample	# loan applications		loan amount (\$1000)		average loan size	
	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.
application: 200810 – 201010	19.358	22.187	4481.328	5140.752	3.605	9.066
include investment properties	33.356	27.348	7709.468	6304.198	3.186	13.261

Note. * indicates statistical significance at 10 percent level, ** at 5 percent level, and *** at 1 percent level.

Table 9. Sample Summary Statistics (Dynamic LPS)

variable	mean	median	standard deviation
60 days mortgage delinquency sample			
60 day mortgage delinquency rate	0.00082	0	0.0286
age of the loan (months)	20.5853	24	11.6763
ltv ratio at origination	67.8904	65.44	18.0439
refi mortgage*	0.6356	1	0.4813
loans affected by the law change*	0.0550	0	0.3289
current interest rate	4.9543	4.8750	0.4645
credit score at origination	760	773	44
full document*	0.5251	1	0.4994
jumbo loan*	0.0184	0	0.1344
loan sold to private investor*	0.0232	0	0.1505
adjustable-rate mortgage*	0.0170	0	0.1293
lagged local unemployment rate	12.8822	13.1000	1.7929
lagged local house price growth rate	0.0050	-0.0044	0.1392
Total number of mortgage loans	10,987		
Total number of observations	343,120		

Note. Purchase loans for owner-occupied housing originated between April 2009 and April 2010 excluding October 2009 and followed until the loan first becomes 60 days delinquent or the end of the sample period, December 2012. These loans are not government guaranteed and with no private mortgage insurance.

* indicates dummy variables.

Table 10. Mortgage Default and Foreclosure Start – Benchmark
(loans originated between 200904 to 201004)

variable	60 days delinquent		90 days delinquent		Foreclosure start	
	marginal effs	s.e.	marginal effs	s.e.	marginal effs	s.e.
purchase loans > reform	3.47e-05	7.34e-05	2.35e-06	4.56e-06	6.05e-07	2.73e-06
refi loans	1.12e-04***	4.09e-05	6.01e-06***	3.82e-06	3.21e-06***	3.06e-06
loan age (months)	3.01e-05***	1.17e-05	1.36e-06***	9.00e-07	7.79e-07***	7.49e-07
loan age squared	-3.94e-07***	1.80e-07	-1.51e-07***	1.13e-08	-1.07e-08***	1.06e-08
ltv ratio at origination	5.77e-06***	1.91e-06	3.34e-07***	2.05e-07	1.97e-07***	1.66e-07
credit score at origination	-1.86e-06***	6.01e-07	-6.81e-08***	4.04e-08	-2.61e-08***	2.34e-08
current interest rate	8.87e-05***	3.41e-05	4.49e-06***	2.96e-06	1.84e-06***	1.83e-06
full document	5.12e-05**	2.73e-05	2.21e-06*	1.74e-06	6.96e-07	9.05e-07
private investor	3.90e-05	6.34e-05	-1.82e-06	2.00e-06	-7.00e-07	1.20e-06
jumbo mortgage	-1.04e-04	4.30e-05				
adjustable rate mortgage	3.13e-04***	2.25e-04	2.54e-05***	2.16e-05	2.19e-05***	2.30e-05
lagged unemp. rate	2.13e-05	2.55e-05	5.81e-07	1.44e-07	-1.64e-07	7.12e-07
lagged hpi growth rate	6.76e-06	5.81e-05	2.05e-07	3.25e-06	5.39e-07	2.10e-06
county fixed effects	yes		yes		yes	
time fixed effects	yes		yes		yes	
county time trends	yes		yes		yes	
Pseudo R-squared	0.1133		0.1405		0.1636	
number of observations	343,120		344,836		344,890	

Note. * indicates statistical significance at 10 percent level, ** at 5 percent level, and *** at 1 percent level. Dummies for interest only and balloon loans predict 90 days delinquency perfectly and are not included in the regression. The dummy for jumbo loans predicts foreclosure probability perfectly and are not included in the 90 days delinquency and the foreclosure regressions.

Table 11. Mortgage Default and Foreclosure Start - Robustness Analysis

sample	60 days delinquent		90 days delinquent		Foreclosure start	
	marginal effs	s.e.	marginal effs	s.e.	marginal effs	s.e.
appl: Oct. 2008 - Oct. 2010	-8.3-e05	3.64e-04	-6.65e-06	7.97e-05	-3.57e-06	2.90e-05
house value above mean	9.73e-05	2.23e-04	-3.80e-07	6.00e-06	2.49e-06	3.35e-06
mortgage ltv above 100	3.76e-04	4.73e-04	-3.13e-05	7.51e-06	-6.96e-06	2.97e-05
+ investment loans	1.89e-05	6.43e-05	1.46e-05	3.66e-05	1.22e-07	2.46e-06

Note. * indicates statistical significance at 10 percent level, ** at 5 percent level, and *** at 1 percent level.

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