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Recourse and residential mortgages: The case of Nevada

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ABSTRACT

The state of Nevada passed legislation in 2009 that abolished deficiency judgments for purchase mortgage loans made after October 1, 2009, and collateralized by primary single-family homes. In this paper, we study how this change in the law affected equilibrium mortgage lending. Using unique mortgage loan-level application data and a difference-in-differences approach that exploits the qualification criterion, we find that the law change led to a decline in equilibrium loan sizes of about 1 to 2 percent. There exists some evidence that mortgage approval rates also decreased for the affected loan applications. These results suggest that making the deficiency judgment law more default friendly in Nevada generated material cost on borrowers at the time of mortgage origination.

1. Introduction

In the United States, state laws govern residential mortgage defaults and house foreclosure processes. In most states, mortgage loans are recourse loans – that is, lenders can apply the difference between mortgage balance and proceeds from foreclosure sales to delinquent borrowers' other assets or earnings, a process also known as deficiency judgments.[1] Theory predicts that recourse should deter default since default puts delinquent borrowers' other assets at risk.[2] This prediction has prompted some discussion of using deficiency judgments to reduce mortgage defaults during the recent mortgage crisis.[3,4] Protections to defaulters in the form of no deficiency judgments, however, can impose substantial costs on lenders. If lenders try to recoup these costs by reducing approval rates or restricting loan sizes, laws intended to protect homeowners in distress may impose costs on all borrowers.

In this paper, we conduct a unique event study using proprietary mortgage loan-level application data to test whether changes in deficiency judgment laws affected mortgage loan approval rates or approved mortgage loan sizes. In 2009, Nevada passed legislation that made significant changes to its deficiency judgment law. For homeowners who entered into a mortgage in conjunction with the purchase of a single-family primary home after October 1, 2009, their mortgage lenders will not be able to pursue a deficiency judgment if the house is taken in a foreclosure. Our analysis is based on the difference-in-differences identification that exploits this qualification criteria: first-lien refinance loans for primary residences are not affected by the law change. Specifically, we assess the differential change in the approval rates as well as approved loan sizes of the treatment group (purchase loans) relative to the control group (refinance loans) around the new law implementation date. The identification assumption behind this comparison is that, in the absence of the legislative change, the approval rates and approved loan sizes in the control and treatment groups would follow similar patterns (up to a constant difference).

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[1] See Table 1 in Ghent and Kudlyak (2011) for a summary of different state recourse laws.

[2] See, for example, Ambrose et al. (1997), and Corbae and Quintin (2015).

[3] See Adam Levitin's blog post, "The Role of Recourse in Foreclosures," at http://www.creditslips.org/creditslips/2008/12/the-role-of-rec.html.

[4] The literature finds mixed evidence. For instance, Clauretie (1987) shows that whether a state allows for deficiency judgments does not affect mortgage default rates significantly, consistent with the observation that deficiency judgments are not carried out often in practice due to the high cost associated with pursuing them (Ambrose and Capone, 1996; Leland, 2008, and Brueggeman and Jeffrey, 2011). By contrast, Ghent and Kudlyak (2011) show that recourse affects default by lowering borrowers' default sensitivity to negative equity and home value.

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Our analysis shows that the law change is associated with a decline in approval rates of about 3 percent and in approved loan sizes of about 1 to 2 percent for the affected purchase loans. As a robustness check, we conduct additional experiments where we use first-lien purchase loans for primary residences from neighboring counties in other states as our alternative control group. Those states did not pass any significant legislative changes concerning foreclosure laws during our sample period. We continue to find that the equilibrium loan sizes declined for Nevada purchase loans after its law change. Finally, we conduct a placebo test using loans in counties that neighbor Nevada and that did not experience changes in deficiency judgment laws. There, we do not find any evidence of significant changes in approval rates or loan sizes for purchase loans after October 2009.

Our paper joins the large literature that analyzes the impact of various aspects of state laws on lending cost. For example, Meador (1982) analyzes the effect of state foreclosure laws on mortgage rates and finds that contract rates are generally higher in states where the law extends the length and expense of the foreclosure process. Clauretie and Thomas (1990) and Ciochetti (1997) document greater lender costs in states that require judicial foreclosure and statutory right of redemption. Lin and Michelle (2001) investigate the relationship between bankruptcy exemptions and the availability of credit for mortgage and home improvement loans. They find that applicants are more likely to be turned down for both types of loans when they live in states with unlimited rather than low homestead exemptions. Berkowitz and Hynes (1999), on the other hand, show that in the 1990s high homestead exemption levels did not tend to increase mortgage rates or increase the probability of being denied a mortgage. Pence (2006) examines the effect of foreclosure laws on the size of approved mortgage loans and finds that, everything else the same, lenders approve smaller loans in default-friendly states. To the best of our knowledge, our paper is the first to evaluate the effect of a legislation change in deficiency judgments. Our natural experiment provides variation in deficiency, which allows cleaner identification than the state-level variation in existing recourse laws. The previous literature has typically used the latter approach; however, state recourse laws change only infrequently.

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

2.1. The Nevada deficiency judgment law

Until recently, Nevada was a recourse state, since it allowed lenders to sue their borrowers to get a deficiency judgment within six months following foreclosure for all mortgage loans. The amount of the judgment, however, was limited to the lesser of the difference between the total debt and fair market value of the home, or the difference between the total debt and foreclosure sale price.[5] Before awarding a deficiency judgment, the court would hold a hearing to receive evidence from the lender and the borrowers concerning the fair market value of the property as of the date of the foreclosure sale. The lender must give the borrowers notice of the hearing 15 days prior to the hearing. The court would appoint an appraiser to appraise the property if the lender or borrowers made a request at least 10 days before the hearing date.[6]

The deficiency lawsuit is similar to a lawsuit to recover an unsecured debt, such as credit card debt. If the lender wins the case, the court will issue a judgment ordering the borrowers to pay off the deficiency. If the borrowers ignore this court order, the lender can use the deficiency judgment to place liens on other property that the borrowers own, garnish their wages, or freeze their bank accounts. In the Appendix, we provide information on the actual practice of deficiency judgment in Clark county, Nevada.[7,8] Based on our collected data, the fraction of foreclosed loans that ended up with a deficiency judgment has been declining over time, from 20 percent in 2000 to 0.12 percent in 2013.[9] The sharpest decline occurred in 2007, coinciding with the onset of the mortgage crisis. In contrast, the amount of awarded judgment as a fraction of mortgage outstanding has been increasing over time, with the median increasing from 9 percent in 2000 to 15 percent in 2013.

Since the mortgage crisis began in 2007, Nevada, like many other states, has begun to implement new laws to mitigate foreclosures. In 2009, eight laws were passed in Nevada alone. Table 1 summarizes the eight laws. As can be seen, almost all laws made foreclosures more cumbersome and costly by either imposing additional regulatory procedures or assigning more rights to owners or renters during a foreclosure. The only exception is Assembly Bill (AB) 140, which also increased owners' and tenants' responsibility to maintain the property during the foreclosure sale.

This paper concerns one of the most important new laws: AB 471. This bill 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 if the following four circumstances apply: the real property is a single-family house owned by the debtor, the debtor used the money loaned from the bank to buy the house, the house was owner occupied, and the loan was never refinanced. What this means is that, for many homeowners who enter into a mortgage in conjunction with a house purchased after October 1, 2009, their mortgage lender will not be able to pursue a deficiency judgment if the house is 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 remain subject to the prior law.[10]

Nevada passed no other laws in 2010 (the 26th Special Session). In the summer of 2011, to combat robo-signing, the Nevada legislature passed a set of pre-foreclosure rules that essentially require the big banks to prove their claim of title before the foreclosure can take place (AB 273, AB 284, AB 388, and Senate Bill (SB) 414). These changes made the judicial foreclosure process more attractive to banks, as they allowed them to sidestep the new robo-

[5] Nev. Rev. Stat. § 40.459.

[6] Nev. Rev. Stat. § 40.457.

[7] Clark County is by far the most populous county in Nevada (it contains Las Vegas). Loans in Clark County account for more than 75 percent of total mortgages in Nevada between 2000 and 2013. We scraped the website of the Clark County District Court to obtain information on deficiency judgments contained in their case files. Information for the other counties were not easily accessible via the internet.

[8] We thank Yuan Yuan for her generous help in collecting this information.

[9] Quintin and Yuan (2015) find in their study of foreclosure sales in seven counties in Illinois between mid-2008 and mid-2012 that about 2 percent end up with a deficiency judgment. Over that period, our numbers are smaller. There are several possible reasons for this difference. First, our sample includes both liquidation and real-estate-owned mortgages. Using the liquidation sample, however, only raises the probability to about 0.3 percent. Second, deficiency judgment was no longer allowed against purchase mortgages for primary residences made after October 2009. Finally, households in Nevada might have fewer assets than households in Illinois, making deficiency judgment suits not appealing to lenders.

[10] Aside from recourse, in Nevada, lenders may foreclose on mortgages in default using either a judicial or nonjudicial foreclosure process. The judicial process of foreclosure involves filing a lawsuit to obtain a court order to seek 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 nonjudicial process is used. Borrowers have no right of redemption under the power of sale.

Table 1
Major Nevada Foreclosure Laws enacted in 2009. This paper focuses on Bill AB 471: the most significant in 2009. The source for the table comes from https://www.leg.state.nv.us/Session/75th2009/Bills/AB.

Bill #	Signed	Effective	Summary
AB 486	05/26	10/01	Adds a provision to the escrow law that an escrow agent or escrow agency may be required to pay restitution to a person who suffered an economic loss due to a violation of NRS or NAC 645A.
AB 471	05/28	10/01	Provided that the court may not award a deficiency judgment to the creditor or the beneficiary of the deed of trust if the purchase mortgage is secured by a single-family primary residence and made on or after October 1,2009.
AB 361	05/28	10/01	Provided that, under certain circumstances, a unit-owner's association may enter the grounds of a vacant unit or a unit in foreclosure to abate a public nuisance or maintain the exterior of the unit.
SB 128	05/28	07/01	Specifies certain reporting requirements during a foreclosure proceeding and imposes a time frame of 30 days for reporting a foreclosure sale to the county.
AB 149	05/29	07/01	Modifies existing foreclosure law and establishes a state Foreclosure Mediation Program. Foreclosure proceedings will be halted while borrowers are pursuing mediation.
AB 151	05/29	10/01	Requires mortgage loans to include the license number of the mortgage broker.
AB 152	05/29	07/01	Modifies definitions and established requirements for "loan modification consultants," such as licensing and certain fees for services relating to foreclosure.
AB 140	06/09	07/01 and 10/01	Establishes the rights and responsibilities of property owners and tenants during a foreclosure sale, including property maintenance. Imposes a $1,000 fine per day for failing to maintain the property.

signing law and to seek a deficiency judgment at the same time on properties not covered by AB 471.

As historical background, the wide adoption of restrictions on deficiency judgments by states occurred during another foreclosure crisis: the Great Depression. Before the Great Depression, there were few restrictions on deficiency judgments. In most states and territories, lenders were free to pursue all the remedies concurrently and successively. By the end of the Great Depression, almost all states had a "fair market value" provision, which prevented lenders from bidding far less than the market value of the property during a foreclosure sale. Many states went further and prohibited deficiency judgments altogether. Up until recently, virtually all of the restrictions on deficiency judgments dated from the foreclosure crisis of the Great Depression. See Ghent (2014) for a more detailed discussion of the historical origins of U.S. mortgage laws.

2.2. The impact of deficiency judgments on mortgage credit

If lenders are not allowed to collect on delinquent borrowers' other assets, they will be reluctant to foreclose on a house, especially when the foreclosure cost is high and the resale price is low, because there is no financial gain from doing so. Furthermore, if lenders perceive a rise in default probabilities as a result of the elimination of deficiency judgments, they will tighten their lending standards by lending to less risky borrowers, making smaller loans, or lending at higher mortgage rates. In other words, the supply of mortgage credit may be lower in defaulter-friendly states because lenders experience higher costs.

By contrast, no deficiency judgments provide borrowers with wealth insurance against negative shocks to house prices. If borrowers value this insurance, mortgage demand will be higher. Put it simply, borrowers may decide to apply for mortgages in the first place or to apply for larger loans since they do not risk losing their other assets in the event of foreclosure. Because of these offsetting effects on mortgage supply and demand, the net equilibrium effect of deficiency judgments on mortgage credit is, a priori, ambiguous.

3. Data

3.1. Data sampling

Our main data set is collected by the Home Mortgage Disclosure Act (HMDA), which covers almost all U.S. mortgage applications as well as originations. It records each applicant's final status (denied, approved, or originated), the purpose of borrowing (e.g., home purchase, refinancing, or home improvement), occupancy type (e.g., primary residence, second home, or investment home), loan amount, race, sex, income, and lenders' institutional categories.[11] The data are then merged with county-level monthly unemployment rates obtained from the Bureau of Labor Statistics and a monthly zip-code-level House Price Index (HPI) available from CoreLogic, Inc. When the zip-code-level HPI is not available due to low transaction volume, we substitute a county-level HPI. When the county-level HPI is not available either, we use the Nevada state HPI.

For our benchmark, we restrict the sample to first-lien purchase or refinance mortgage applications made in Nevada and collateralized by one- to four- unit primary residences six months before and six months after October 2009, when the new law became effective.[12] By construction, our treatment group consists of purchase loans while our control group consists of refinance loans that are not affected by the law change. We then delete those applications that were withdrawn without an approval decision or were closed for incompleteness. We also delete loans insured by the Federal Housing Administration (FHA) and the U.S. Department of Veterans Affairs (VA) from the sample because deficiency judgments are prohibited on FHA loans and strongly discouraged on VA loans. Finally, we drop mortgage loans for manufacturing housing as in

[11] Only lenders not doing business in a metropolitan statistical area (e.g., small community banks) are exempt from reporting to HMDA.

[12] HMDA does not distinguish single-family properties from two- to four- family properties.

Table 2
Sample construction. This table describes the construction of our benchmark sample using HMDA.
Notes: 1. There were no applications for multifamily dwellings during our sample period.
2. The variable names in the parentheses are those used by HMDA.
3. FSA/RHS stands for Farm Service Agency/Rural Housing Service, known as FmHA-insured (Farmers Home Administration) in 1998 and earlier collection years' guidance.

Selection criteria	Sample size
First lien loan applications made between 2009:04 and 2010:03 in Nevada	112,590
– Application withdrawn, closed for incompleteness, preapproval request denied, preapproval request approved but not accepted (action_type > =4)	15,914
– Home improvement loan (loan_purpose=2)	1,016
– Occupancy not applicable (occupancy=3)	257
– Non-single family property (property_type=2 or 3)	2,362
– Gross annual income of applicants less than or equal to zero or missing	8,445
– Loans guaranteed or insured by FHA, VA, FSA/RHS (loan_type=2,3,4)	35,763
– Not owner-occupied (occupancy=2)	12,449
Final sample	36,384

Ghent and Kudlyak (2011). Table 2 reports in details the steps we take to construct our benchmark sample Table A.1.

3.2. Background

The U.S. housing market went through a drastic cycle beginning in the late 1990s, with house prices growing significantly between 1996 and 2006 and then crashing in 2007 before recovering beginning in 2010. The cycle was particularly prominent in several states including Nevada. As can be seen in Table A.2 in the Appendix, this cycle was also reflected in changing mortgage applications in Nevada. In 2004 and 2005, total mortgage applications for first-lien, owner-occupied, one- to four- unit primary residences were more than 200,000 annually. They fell to the mid to low 100,000s in 2006 and 2007, and then to less than 100,000 starting in 2008. The fraction of applications that were conventional (i.e., not insured by FHA, VA, or FmHa), dropped sharply from over 90 percent before 2007 to about 50 percent between 2009 and 2011. Furthermore, the fraction of loans that were sold within the calendar year to institutions (especially government institutions such as Fannie Mae, Ginnie Mae, Freddie Mac, and Farmer Mac) increased steadily since the crisis began in 2007. Note that some of these loans would end up being securized by the government agencies, while others would stay on the balance sheets of their purchasers such as commercial banks, savings banks or savings associations, life insurance companies, and affiliate institutions. The private securitization market dried up after 2007.

One other major development in the mortgage market around the time of our study is the introduction of the Home Affordable Refinance Program (HARP) by the U.S. Department of Treasury and the Federal Housing Finance Agency in March 2009. The program instructed government-sponsored enterprises (Fannie Mae and Freddie Mac) to provide credit guarantees on refinances of conforming mortgages, even in cases when the resulting loan-to-value ratios exceeded the usual eligibility threshold of 80 percent. HARP got off to a slow start, refinancing only about 300,000 loans nationwide during the first full year of the program, which coincides with the sample period of our study. However, there does appear to be a small pickup toward the end of the first year. Table A.3 reports the monthly refinancing volume by HARP. We will conduct analysis to address the potential impact of HARP on our analysis.

3.3. Descriptive

Turning to our sample, Table 3 reports summary statistics for the benchmark sample. We winsorize income and loan amount at 98th percentile by setting the income/loan amount above the 99th percentile to its 99th percentile value and the income/loan amount below the 1st percentile to its 1st percentile value. For the six months before and six months after October 1, 2009, there are a total of 36,384 applications for first-lien mortgages collateralized by one- to four- family primary residences with no government guarantees. The overall mortgage approval rate is 72 percent. Of these applications, 33 percent are for purchase and about 15 percent are affected by the change in deficiency judgments (i.e., purchase loan applications made after October 1, 2009). Roughly 27 percent of the applications are filed by women. About 78 percent of the applicants are white, 2 percent are black, 9 percent list a race other than white or black, and 11 percent do not report race. More than half of the applications have cosigners, suggesting that these applicants are likely married.

There exists significant income disparity among the applicants, with the average (nominal) income at application at $99,000 and the median income at $74,000. The average loan amount is

Table 3
Sample summary statistics. This table describes the data constructed in Table 2: all *Applications* including those that will be later rejected for conventional first-lien purchase or refinance loans for owner-occupied one- to four- unit primary residences submitted between April 2009 and March 2010. Notes:* indicates dummy variables.

Variable	Mean	Median	S.D.
Approval rate*	0.722	1	0.448
Purchase mortgage loans*	0.332	0	0.471
Purchase loans made after law change*	0.147	0	0.354
Gender: female*	0.274	0	0.446
Gender: unknown*	0.065	0	0.247
Race: black*	0.022	0	0.147
Race: nonwhite and nonblack*	0.091	0	0.288
Race: unknown*	0.114	0	0.317
With cosigner*	0.524	1	0.499
Income ($ thousands)	99	74	92
Loan amount ($ thousands)	209	180	123
Census tract % of population nonwhite and/or Hispanic or Latino	21	19	12
Census tract median family income ($thousands)	65	64	18
Census tract total population (thousands)	4.606	4.315	2.345
Regulatory agency:			
Office of the Comptroller of the Currency (OCC)*	0.551	1	0.497
Federal Reserve System (FRS)*	0.019	0	0.137
Federal Deposit Insurance Corporation (FDIC)*	0.025	0	0.155
Office of Thrift Supervision (OTS)*	0.087	0	0.281
National Credit Union Administration (NCUA)*	0.053	0	0.224
Dept. of Housing and Urban Development (HUD)*	0.205	0	0.404
Loans with private mortgage insurance (PMI)*	0.060	0	0.237
Lagged local unemployment rate (%)	12.099	12.400	1.608
Lagged net local house price growth rate (%)	−0.884	−0.712	1.783
Total number of observations	36,384		

Table 4
Sample summary statistics: purchase versus refinance loans. This table presents, by loan purpose (purchase versus refinance), the data constructed in Table 2: all *Applications* including those that will be later rejected for conventional first-lien purchase or refinance loans for owner-occupied one- to four- unit primary residence submitted between April 2009 and March 2010. The purchase loans are our treatment group while the refinance loans are our control group. Notes:* indicates dummy variables.

Variable	Treatment (Purchase loans)			Control (Refinance loans)		
	Mean	Median	S.D.	Mean	Median	S.D.
Approval rate*	0.817	1	0387	0.674	1	0.469
Gender: female*	0.294	0	0.456	0.264	0	0.441
Gender: unknown*	0.049	0	0.216	0.073	0	0.261
Race: black*	0.021	0	0.144	0.022	0	0.148
Race: nonwhite and nonblack*	0.137	0	0.344	0.068	0	0.251
Race: unknown*	0.096	0	0.295	0.122	0	0.323
With cosigner*	0.394	0	0.489	0.589	1	0.492
Income ($ thousands)	94	66	93	101	77	91
Loan amount ($ thousands)	193	159	125	217	191	121
Census tract % of population nonwhite and/or Hispanic or Latino	22	20	13	20	19	12
Census tract median family income ($000)	64	63	18	66	64	17
Census tract total population (thousands)	4.371	4.145	2.290	4.717	4.369	2.365
Regulatory agency:						
OCC*	0.396	0	0.489	0.628	1	0.483
FRS*	0.027	0	0.162	0.015	0	0.123
FDIC*	0.028	0	0.166	0.023	0	0.150
OTS*	0.079	0	0.270	0.090	0	0.287
NCUA*	0.047	0	0.211	0.056	0	0.230
HUD*	0.282	0	0.450	0.168	0	0.373
Loans with Private Mortgage Insurance (PMI)*	0.141	0	0.348	0.020	0	0.140
Lagged local unemployment rate (%)	12.315	12.500	1.505	11.990	12.100	1.647
Lagged net local house price growth rate (%)	−0.796	−0.439	1.824	−0.928	−0.712	1.761
Total number of observations	12,084			24,300		

$209,000, and the median is $180,000. On average, about 21 percent of the population are nonwhite and/or Hispanic or Latino in census tracts where the applications are filed. The average family income of these census tracts is $65,000, far below the average of the mortgage applicants, and the median is $64,000, also significantly below the median income of mortgage applicants. The average census tract population is about 4,600. Lenders of these mortgages mostly come from institutions that are regulated by the Office of the Comptroller of the Currency (OCC) (55 percent), followed by the Department of Housing and Urban Development (HUD) (21 percent), the Office of Thrift Supervision (OTS) (9 percent), National Credit Union Administration (NCUA) (5 percent), and the Federal Reserve (2 percent). About 6 percent of the loans have private mortgage insurance. Unemployment rates are high in all counties of Nevada for the sample period, with both the mean and the median over 12 percent. House prices declined for most of the state during that period at a monthly rate of 0.9 percent.

Table 4 reports the same summary statistics for the purchase loan (treatment group) and refinance loan applications (control group) separately. The most noticeable difference is that loan approval rates are much higher for purchase loans than for refinance loans, 82 percent versus 67 percent. Other than that, purchase loan applicants and refinance loan applicants appear similar with only a few exceptions. First, refinance applicants are more likely to have cosigners, 59 percent for refinance loans versus 39 percent for purchase loans. They also have slightly higher income and larger loans. Second, more of the refinance loan lenders are supervised by OCC, and fewer refinance loans have private mortgage insurance. Given that refinance loans were originated at times when house prices were high, it is likely that refinance loans have a much higher mortgage loan-to-value ratio. Unfortunately, we do not observe house value from the data.

4. Results

Fig. 1 charts the time trend in average approval rates and loan sizes for purchase and refinance loans, respectively, for the time period between January 2008 and December 2011. The approval rates for purchase loans are fairly stable until the end of 2010 when they begin to inch up. For approval rates for refinance loans, there is a sharp decline in the middle of 2008 followed by a sharp rise in early 2009, coinciding with the introduction of HARP, which was introduced by the government in March 2009. After that, the approval rates have been stable with a slight upward trend. The loan sizes for purchase and refinance loans have generally tracked each other during this period, with purchase loans slightly larger than refinance loans before 2009 and then slightly smaller than refinance loans after 2009. It is worth noting that for the six months before the law change (i.e., April 2009 to October 2009), there do not appear to be significant differential changes in the approval rates or approved loan sizes between the treatment (purchase loans) and control groups (refinance loans). This observation yields support to the validity of our identification assumption, that is, in the absence of the legislative change, the approval rates and approved loan sizes in the control and treatment groups would follow similar patterns (up to a constant difference).

Fig. 2 charts the raw data for average mortgage loan approval rates and approved mortgage loan sizes as deviations from their respective October 2009 levels. The left panel indicates that approval rates for purchase loans fluctuate much more than loan approval rates for refinance loans. Additionally, while average mortgage loan approval rates do not appear to exhibit any trend for purchase loans during the time period, they seem to increase slightly for refinance loans. In terms of approved mortgage loan sizes, leading to October 2009 when the new law takes effect, average loan sizes decline for both purchase loans and refinanced loans. More so for purchase loans. Though both loan sizes begin

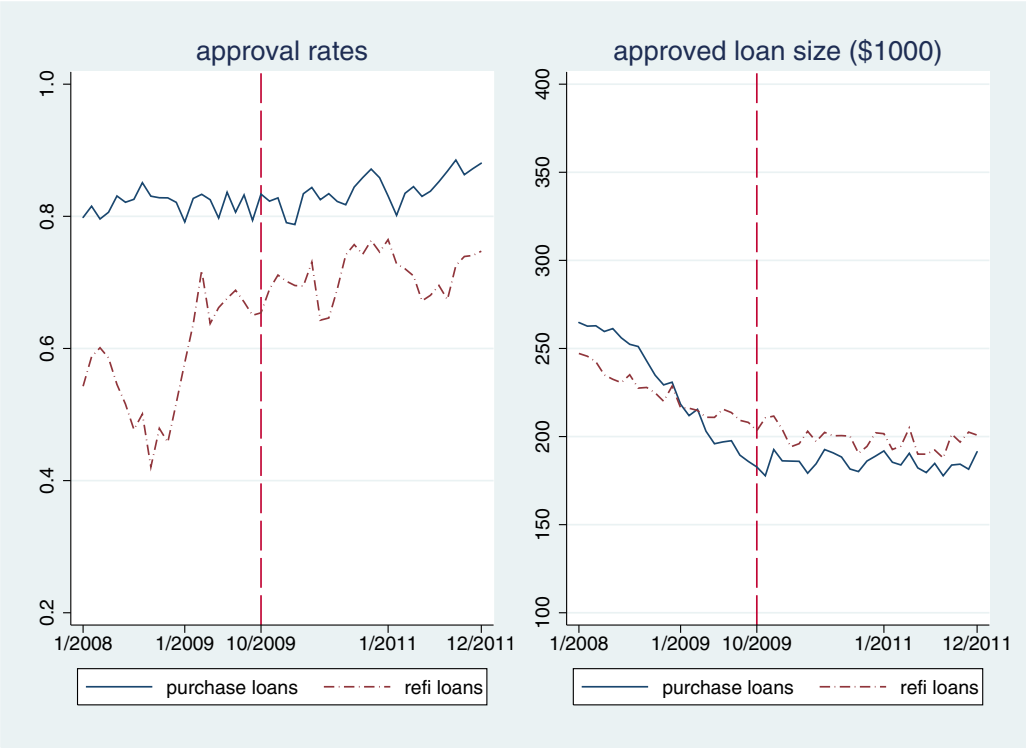

Fig. 1. Average approval rates and average loan sizes for approved mortgages (Source: HMDA. We restrict mortgages to first-lien conventional loans that are for one- to four-family primary residences.).

to recover after the law change, the recovery comes a bit earlier for refinance loans than for purchase loans.

4.1. Empirical methodology

We analyze the response in mortgage loan approval rates and approved loan sizes using a difference-in-differences methodology. The treatment group corresponds to purchase loans that are subject to the law change, and the control group corresponds to refinance loans that are not affected by the law change. The pre-treatment period is from 2009:04 to 2009:09 (six months), and the post-treatment period is from 2009:10 to 2010:03 (six months).

We study the average monthly response to the law change using the following specification,

$$Y_t = \alpha Z_t + \beta X_t + \varepsilon_t, \quad (1)$$

where Y_t is the variable of interest (approval rates or approved loan sizes); Z_t is the key interaction variable previously discussed, purchased loans made after October 2009; and X_t is a vector of control variables, including gender, race, and income of the applicant, whether the applicant has a cosigner for the mortgage, census tract minority population, census tract median family income and total population, and dummies for the various regulatory agencies for the lender. We further control for county and month fixed effects and separate linear time trends for each county. Finally, we cluster standard errors at the county level.

The coefficient α measures the effect of the change in the deficiency law. As mentioned in the introduction, the identification of this coefficient is based on the qualification criteria associated with the legislative change: the new law applies to single-family first-lien mortgages made after October 2009, and it applies to purchase mortgages only. Specifically, when Nevada eliminated deficiency judgment for first-lien purchase mortgages made for single-family homes after October 2009, to study its effect we could simply subtract loan approval rates and approved loan sizes after October 2009 from their respective levels before October 2009. However, contemporaneous changes in credit market conditions may have affected the approval rates and approved loan sizes for these purchase loans. To help control for these changing economic conditions, we use the refinance loans that are not affected by the legislative change as our control group as these loans are exposed to similar credit market conditions. We can then compare the difference in approval rates and approved loan sizes for refinance loans before and after October 2009 with the same difference for purchase loans. The difference in these two differences would therefore serve as an estimate of the effect of the elimination of deficiency judgment for purchase loans in Nevada.

We use ordinary least squares (OLS) when the dependent variable y_t is continuous as is the case with approved mortgage loan sizes and probit regression when the dependent variable is binary as is the case with mortgage approval rates.

4.2. Main results

We report our regression results in Table 5. According to our analyses, the key variable, one- to four- family purchase loans made after October 2009, contributes negatively and is statistically significant to lenders' approval rates as well as mortgage loan sizes upon approval. In particular, a one- to four- family mortgage purchase loan made after October 2009 has an approval rate that is 2.56 percentage points lower than that of a similar loan made earlier or a single-family refinance loan, that is, it is 3.16 percent ((2.56/81)*100) less likely to be approved. The approved loan size is $2,500 less, or 1.30 percent ((2.5/193)*100) smaller than loans not affected by the change in the law. The change in equilibrium loan sizes is smaller than the 4 to 6 percent decline in loan sizes in states with default-friendly foreclosure laws found in Pence (2006).

In terms of the other control variables, for approval rates, everything else the same, a purchase mortgage loan is about 16 percentage points more likely to be approved. This result arises because

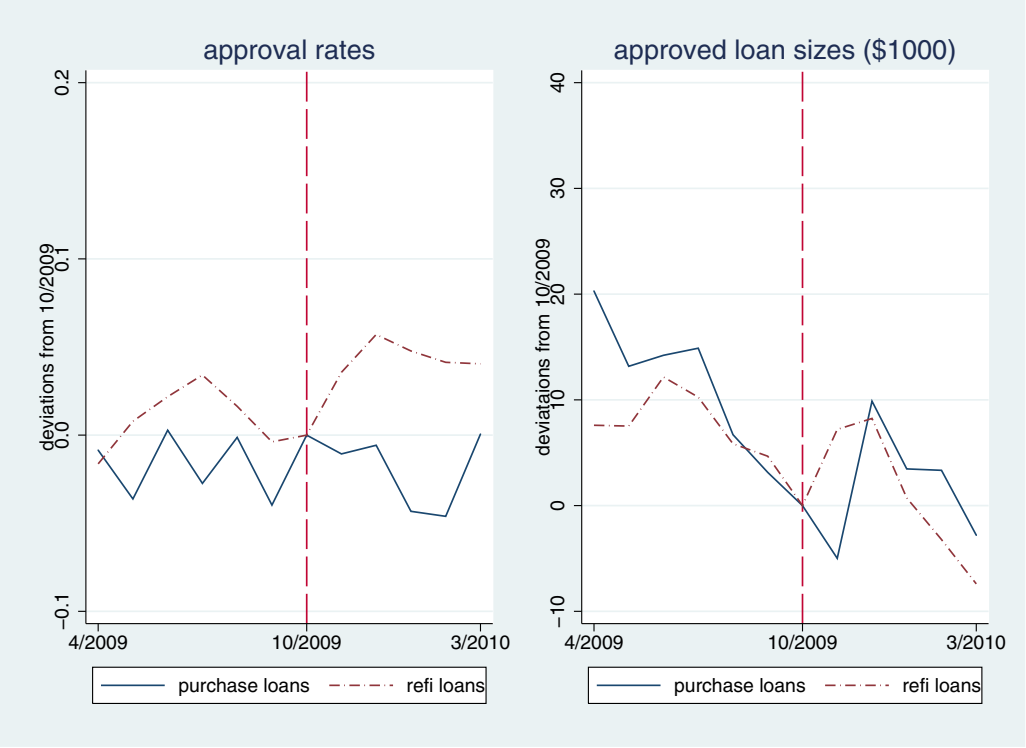

Fig. 2. Deviations in average approval rates and average loan sizes for approved mortgages from their respective Oct. 2009 Levels (Source: HMDA. We restrict mortgages to first-lien conventional loans that are for one- to four- family primary residences.).

Table 5
Mortgage lending: approval rates and approved loan sizes – benchmark (HMDA). This table presents estimates from regressions that track mortgage approval rates and approved loan sizes around the law change (April 2009 to March 2010). The dependent variable for the approval rate takes the value of 1 if the loan is approved and 0 otherwise. The approved loan sizes are in thousand dollars. * indicates statistical significance at 10 percent level, ** at 5 percent, and *** at 1 percent.

Dependent variable	Mortgage approval rates (Probit, Marginal effect)		Approved loan sizes (OLS)	
Independent variable	Marginal coeff.	S.E.	Coefficient	S.E.
Purchase loans made after reform	−0.0256***	0.0077	−2.5262*	1.0208
Purchase loan	0.1580***	0.0040	−2.8066*	1.9102
Income at origination ($ thousands)	4.71e-05***	1.76e-05	0.7303***	0.0177
Loan amount ($ thousands)	−7.73e-04***	1.06e-05		
Have cosigner	5.37-02***	1.80-03	6.4798***	1.3430
Race: black	−0.0872***	0.0069	5.8633***	1.0228
Race: other than white and black	−0.0432***	0.0029	4.9496***	1.0773
Race: unknown	−0.0632***	0.0067	8.1649***	2.4679
Gender: female	−0.0152***	0.0055	−8.6664***	1.9792
Gender: unknown	0.0140	0.0105	−5.7641***	1.7734
Census tract % of population nonwhite	−0.0036***	0.0003	−1.2153***	0.1150
Census tract population	0.0039***	0.0009	0.5904	0.6925
Census tract median family income	0.0023***	0.0002	1.0125***	0.1606
Lender supervisor: OCC	0.0079	0.0119	1.6865	2.3351
Lender supervisor: FRS	0.1025***	0.0207	4.8361	4.3473
Lender supervisor: OTS	−0.0165	0.0122	20.2405***	3.0311
Lender supervisor: NUCA	0.1260	0.0164	−9.3316***	3.5456
Lender supervisor: HUD	0.0290**	0.0130	8.7436***	2.9464
Loans with PMI	0.0929***	0.0396	26.4033***	2.9909
Lagged monthly unemployment rate	0.0146	0.0148	−3.7960**	1.7515
Lagged HPI growth rate	0.2624	0.2212	−25.3170	60.3821
Number of fixed effects included				
Linear county time trends	17		17	
County fixed effects	17		17	
Monthly fixed effects	12		12	
Pseudo R-squared	0.0750		0.4769	
Number of observations	36,384		26,269	

loans made earlier during housing booms are likely of lower standards and are thus less likely to be approved for refinance, especially after house prices declined and lenders subsequently tightened their lending standards. As expected, a high income increases the probability of being approved, while a large loan amount reduces the probability of being approved. Specifically, a $1,000 increase in income raises the approval rate by about 0.47 basis points, while a $1,000 increase in loan amount reduces the approval rate by about 7.7 basis points. Having a cosigner increases the loan approval rate by a substantial 5 percentage points. Being a minority, black or nonblack as well as not reporting race leads to lower loan approval rates than being white. Specifically, being a nonhispanic white leads to a loan approval rate that is between 4 to 6 percentage points higher. This number is slightly smaller than the findings in Munnell et al. (1996). In their 1989 study of mortgage lending in the Boston area, Munnell et al. (1996) find that there is a 6 percentage point difference in the approval rate of white applicants and minority applicants. Being female also leads to lower loan approval rates. Living in census tracts with more nonwhite and nonhispanic minorities also lowers the loan approval rates.[13] Living in more populated census tracts or census tracts with higher median family income, by contrast, raises mortgage approval rates. Finally, compared with commercial banks that are supervised by the FDIC, lenders supervised by the Federal Reserve and HUD are more likely to approve mortgage loans. Loans with private mortgage insurances are also more likely approved.

In terms of loan sizes, interestingly, purchase loans are on average $2,800 smaller, reflecting perhaps reduced house prices. Applicants with higher incomes borrow more; a $1,000 increase in income corresponds to a $730 increase in loan sizes. Having loan cosigners implies a loan that is $6,400 larger. While being a nonwhite minority implies larger loan sizes, being a female implies smaller mortgage sizes. Additionally, living in areas with higher minority population leads to smaller mortgage loans, while living in areas with higher median family income means larger loans. Compared to loans from lending institutions that are supervised by the FDIC, those supervised by OTS and HUD and those with private mortgage insurances are all larger, while those extended by institutions supervised by NUCA are smaller. Finally, high local unemployment rates lead to smaller loan sizes.

4.3. Robustness analyses

4.3.1. The potential impact of HARP

As discussed earlier, HARP was introduced in March 2009. Its slow start and eventual pick up toward the end of the first year potentially biased our results because it artificially raised the approval rates of refinance loans (Table A.3). To qualify for HARP refinance before 2011, a loan has to satisfy the following requirements: Fannie Mae or Freddie Mac must own or guarantee the loans, the current loan-to-value ratio must be greater than 80 percent but less than 125 percent, and the borrower must be current on his or her mortgage with no late payment over the last six months and no more than one late payment over the last 12 months. Unfortunately, we do not observe any information concerning the loan or the borrower prior to the loan application. However, we do observe whether the loan is sold to government agencies such as Fannie Mae, Ginnie Mae, Freddie Mac, and Farmer Mac as well as nongovernment entities such as commercial banks, savings banks or savings associations, life insurance companies, and affiliate institutions within the calendar year of the application. We thus explore the heterogeneity in loan approval rates and approved loan sizes based on this information. There are, however, important caveats with this approach. Additional loans are sold after the calendar year. As a matter of fact, during the time period of our study, most of the loans would end up being purchased by Fannie Mae or Freddie Mac.[14] Those refinance loans being recorded as purchased earlier by Fannie Mae and Freddie Mac may not necessarily correspond to HARP loans. As a matter of fact, many purchase loans are also invested by Fannie Mae and Freddie Mac within the calendar year of their origination.

Table A.4 in the Appendix provides the summary statistics for approved loans that are sold within the calendar year and approved loans that are not sold. There are only three noticeable differences between the two types of loans. First, more of the refinance loans are sold within the calendar year. Second, many more loans sold within the calendar year come from lenders supervised by HUD. Third, none of the loans sold have private mortgage insurance while 24 percent of the loans not sold have private mortgage insurance. These differences are not surprising given that 68 percent of the entities that bought in the secondary market are government agencies (Fannie Mae, Freddie Mac, Ginnie Mae, and Farmer Mac), and, hence, no private mortgage insurance is required. Of the loans purchased by government agencies, 70 percent are refinance loans, while of those sold to nongovernment agencies, only 57 percent are refinance loans. This suggests some impact by government loan modification program that came into effect in March 2009. We do not report separately the summary statistics for these two types of loans, purchased by government versus purchased by nongovernment agencies, as they remain similar in all other aspects.

We report our regression results in Table 6. When we restrict our sample to loans sold within the calendar year, it remains that the purchase loans are $1,400 smaller after the law change; this is slightly more than half of the decline in loan size we found in the benchmark sample. The change in the deficiency law does not impact purchase loans if we study only loans sold to government agencies within the calendar year. When we examine loans not sold within the calendar year, we find that the change in the law reduces the mortgage approval rates by almost 8 percentage points; this is three times as large as the 2.5 percentage point drop we find in the benchmark. In terms of equilibrium loan sizes, the decline is $4,000, about $1,500 larger than the benchmark. Finally, we delete from our benchmark sample conforming refinance loans (loan amount less than $417,000) that are sold to Fannie Mae or Freddie Mac, assuming that all these loans are HARP loans. In row 8 of Table 6, we observe that the elimination of deficiency judgment led to a 3.9 percentage point decrease in mortgage approval rates, higher than the 2.56 percent we obtained using the bench-

[13] These findings pertain to the literature on discrimination in mortgage lending. Ladd (1998) reviews earlier studies that provide evidence of disparate treatment of minorities in terms of loan denial rates, loan default rates, and the possibility of geographic redlining. Ross and John (2002) also discuss mortgage-lending discrimination and weakness in the fair-lending enforcement system. Additionally, Apgar and Calder (2005) document the new form of discrimination in the increase in high-cost, inappropriate, or predatory mortgage loans in low-income and minority neighborhoods during the housing booms of the late 1990s to early 2000s.

[14] Indeed, we investigate a matched HMDA-LPS dataset. This dataset is proprietary and jointly owned by several Federal Reserve Banks. The match is conducted based on the following rules: origination date and action date are within five days of each other; origination amount must be within $500; property zip code must match; lien types if populated must match; loan purpose types if populated must match; and occupancy types if populated must match. Applying the same criteria we used to construct the benchmark sample, the matched data yield 12,540 observations, less than half of those in the baseline. According to the matched data, at origination, 18 percent of the loans are invested by Fannie Mae or Freddie Mac, 19 percent are privately securitized, and 63 percent are portfolio loans. By month six after origination, 93 percent of the loans are invested by Fannie Mae or Freddie Mac, 2 percent are securitized by private entities, and 4 percent remain on banks' portfolios. Note that these numbers do not correspond well with those reported by HMDA indicating perhaps HMDA captures ex-ante loan agreements (i.e., lenders already know that the loans are earmarked for sale when making the loans).

Table 6
Robustness analyses. This table presents the estimated coefficient of the interaction variable: purchase loans made after October 2009 under different settings. The regression specification follows that in the benchmark as specified in Table 5.
Notes: 1. Loans sold within the calendar year refer to originated loans being subsequently sold to secondary market entities including Fannie Mae, Ginnie Mae, Freddie Mac, Farmer Mac, commercial banks, savings banks or savings associations, and life insurance companies. Some of the loans sold will stay on the purchasing institution's balance sheets, and others will be securitized. Loans sold to government agencies are loans sold to Fannie Mae, Ginnie Mae, Freddie Mac, and Farmer Mac.
2. Conforming loans are loans with balances below $417,000.
3. For the alternative control group, we use counties on both sides of the Nevada border for the whole sample. Loan applications and approved loans on the other side of the Nevada border serve as the control group. See the main text for a list of counties included in this analysis.
4. For the alternative sample, we use counties along the border of Nevada but exclude Nevada and assume that those counties had a similar law change in October 2009 for purchase loans.
5. * Statistical significance for the estimate at 10 percent level, ** at 5 percent level, and *** at 1 percent level.

Dependent variable	Mortgage approval rates			Approved loan size		
	Coefficient	S.E.	Obs.	Coefficient	S.E.	Obs.
Benchmark	−0.0256***	0.0077	36,384	−2.5262*	1.0208	26,269
Heterogeneity						
Loans sold within the year				−1.3663*	0.7643	18,512
Loans sold to gov. agencies				−2.2004	3.5265	12,498
Loans not sold within the year	−0.0794***	0.0057	17,872	−4.0624*	2.4412	7,757
Excluding conventional refi. loans sold to Fannie Mae and Freddie Mac	−0.0391***	0.0070	31,560	0.0561	2.5139	21,445
Robustness Analyses						
Propensity Score Matching	−0.0267***	0.0072	36,384	−2.6316***	0.6432	26,269
Alternative control group						
OLS	0.0010	0.0118	27,836	−4.0364*	2.3682	23,129
PSM technique	−0.0003	0.0111	27,836	−4.3746*	2.5125	23,129
Alternative sample						
OLS	−0.0156	0.0133	59,623	−3.0570	2.0043	45,647
Propensity Score Matching	−0.0289	0.0165	59,623	−1.8143	2.2311	45,647

mark sample. The average approved loan sizes, however, are no longer significantly impacted by the legislative change. These results indicate that the law change appears to have a much smaller effect on loans sold in the secondary market, especially to government agencies. This may be because the sold loans are either of higher quality or enjoy some form of government support and, thus, less likely to default and benefit from the law change.

4.3.2. Robustness analyses

We conduct several robustness analyses in this subsection. First, we use an alternative propensity score matching technique for the estimation. This technique attempts to reduce bias stemming from the fact that the policy experiment is nonrandom (i.e., the law change applies to purchase loans only and purchase and refinance loans may be fundamentally different). Then we use an alternative control group to address the concern that, perhaps instead of the treatment group, it is our choice of control group in the benchmark that is responsible for the results. This also relates to the concern of the potential impact of HARP in driving our baseline results. Finally, we conduct a placebo test using other states that did not have such a change in deficiency judgment laws. The results for these analyses are reported in Table 6.

Propensity score matching. What PSM does is to first run a probit or logit regression over the entire sample explaining which observations are treated, using as control variables only the loan-specific variables given in Table 5, except for loan amount. A propensity score is then constructed based on the regression. Using the computed score for each observation as a weight, we run the second stage regressions explaining mortgage approval rates and approved mortgage loan sizes following the specification given in Table 5. This technique has been widely used in the literature including in, among many others, Agarwal and Qian (2014) and Elul (2016). As can be seen in Table 6, the results are not much different from the benchmark analysis. This is not surprising given the similarity between applicants for purchase loans and applicants for refinance loans reported in Table 4.

Alternative control group. To deal with the concern that the reduction in loan approval rates and approved mortgage loan sizes are driven by refinance loans, we construct a new sample. In the sample, we include all first-lien purchase mortgages made in counties on both sides of the border of Nevada. These counties include Mohave in Arizona; Alpine, Inyo, Lassen, Mono, Nevada, Placer, San Bernardino and Sierra in California; Cassia, Owyhee, and Twin Falls in Idaho; Harney, Lake, and Malheur in Oregon; Carson City, Clark, Douglas, Elko, Esmeralda, Humboldt, Lincoln, Lyon, Mineral, Nye, Washoe, and White Pine in Nevada; and Beaver, Box Elder, Iron, Juab, Millard, Tooele, and Washington in Utah. There were no changes in deficiency or foreclosure-related laws during the sample period for these states other than Nevada.

As in the benchmark, we restrict our sample to nonmanufacturing housing loans not insured by the FHA or VA. In this new sample, our treatment group remains the same as before (purchase loans made in Nevada) but the control group consists now of purchase loans made in those other counties. In Table A.5, we report the summary statistics of this new sample. Comparing Table A.5 with Table 4, we see that purchase loans made in states that border Nevada (the new control group) are more similar to the purchase loans made in Nevada (the treatment group) than refinance loans made in Nevada during the same period in several aspects. They have more similar loan approval rates, fraction of borrowers with cosigners, fraction of loans coming from lenders under the supervision of the OCC, and fraction of loans having private mortgage insurance. However, loan amounts are less similar. The census tracts are also less alike in all three dimensions: median family income, total population, and minority population. In terms of regression results, according to Table 6, we no longer have any statistically significant results with respect to loan ap-

proval rates using either the whole sample or the PSM matched sample. However, we continue to observe that mortgage loan sizes are smaller in Nevada after the law change by about $4,000, or 2 (4/208*100) percent.

Alternative sample. Finally, we conduct a placebo test using purchase as well as refinance mortgage applications made in the counties that border Nevada. We pretend that there is a similar change in deficiency judgments in October 2009 that affects only purchase mortgage loans and test whether that impacted loan approval rates and loan sizes for purchase loans.

We report the summary statistics of the new sample in Table A.6. Compared to the benchmark sample, we have far more refinance loans than purchase loans, and the two types of loans seem to be more similar than they are in the benchmark sample. For example, although the approval rates for refinance loans on average are still smaller than those for purchase loans, the differences are smaller than those in the benchmark sample. The differences in loan amounts between purchase loans and refinance loans are also smaller in this alternative sample than those in the benchmark sample. We report the regression results in the last two rows of Table 6, and it appears that the pretended law change does not affect the approval rates nor the approved loan sizes of purchase loans any differently than they affect those of refinance loans.

4.3.3. Discussion

Our benchmark as well as robustness analyses suggest that changes in the deficiency judgments reduced loan sizes of approved mortgages and this result is robust to alternative construction of the control group or estimation technique. Although the benchmark analysis also indicates that loan approval rates also declined after the law change for the purchase loans, this result is less robust to alternative construction of the control group.

Several factors may contribute to the result of reduced equilibrium loan sizes. Lenders may respond to the higher costs introduced by the new deficiency judgments by reducing the supply of credit. For example, lenders may have tightened their lending standards by asking for more down payment or charging higher interest rates. The smaller loan sizes may also reflect declining house prices if the zip code house price index included in the analysis is not an adequate proxy for individual property values. It is also possible that households applying after the law change are more prudent despite the fact that the new law has made foreclosure less costly.

Although it is not possible to give our result a clean interpretation, it is clear that the mortgage market reached a different equilibrium for purchase loans after the law change, that is, borrowers take out smaller loans. Although this is an indication of the higher cost of borrowing, this result doesn't necessarily imply that borrowers are worse off as they now enjoy greater insurance provided by the new law.

5. Concluding remarks

This paper studies whether the change in deficiency judgments that affected only purchase mortgages made on single-family primary residences after October 2009 in the state of Nevada had any effect on equilibrium mortgage approval rates and loan sizes. In doing so, the paper makes a contribution to several strands of literature that seek to understand the relationship between real estate laws and lending cost.

Given that the law change in Nevada does not affect refinance loans, using a difference-in-differences identification, the paper finds evidence that approved mortgage sizes are smaller for purchase loans after the law change. There is also evidence that approval rates have also declined for purchase mortgages after the law change. We find the negative effect on loan sizes after the law change is robust to alternative choice of control group: purchase loans made in counties that border Nevada that did not experience any changes in deficiency judgment laws. However, the results on approval rates are not robust to this alternative sample construction.

Overall, the results in this paper seem to corroborate the existing evidence in the literature, that is, borrowers in states with default-friendly laws face a reduced supply of mortgage credit. The paper, however, does not address the issue that perhaps even at this price, borrowers in those states may still benefit from the increased insurance provided by generous foreclosure laws. Such a welfare analysis requires more structural approach, which we leave to future research.

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Appendix

We collect information on deficiency judgment cases for Clark County, Nevada.[15] We first obtain a list of lender names from HMDA for the years 2000 to 2011. In total, we have 460 lenders, including prominent names such as Bank of America, Bank One, Chase Manhattan Bank, Citibank, Countrywide Home Loans, GMAC Bank, Merrill Lynch Credit Corporation, and Wells Fargo. There are also many local smaller lenders. We built a Python web scraper that automates the following procedure to collect data from the court website. The web scraper is publicly available on GitHub at https://github.com/floswald/scraper. The search proceeds as follows:

1. Go to the Clark County court records at https://lvjcpa.clarkcountynv.gov/Anonymous/default.aspx.
2. Select "District Civil/Criminal Records."
3. On the next page, select "party" from the "Search By:" dropdown menu. In the box with "Party Information:," select "Business" under "*Business Name" and enter the lender names that we obtained from HMDA as described above. In the box with "Case Status," choose "All" for "Date Filed:" and search for cases filed after 2000 but before 2014. Click "search."
4. In the resulting page, pick all cases that have "Breach of Contract" under " Type/Status."
5. For each breach of contract click the case number to access the court files.
6. Check whether the court ruling is one of "DEFAULT JUDGMENT," "DFLT JDGMT," "DFLT JMNT," "JUDGMENT PLUS INTEREST," "DEFAULT JUDGMENT PLUS INTEREST," "DEFAULT JUDG + INT," "DEFAULT JUDGMT + INT," "JUDGMENT PLUS LEGAL INTEREST," "DEFAULT JMNT + INTEREST," "DFLT JMNT+LEGAL," "DFLT JDGMT+INTEREST." Information on amount awarded, attorney cost, and so on are collected from this page.
7. The resulting data set is available upon request from the authors.

[15] We thank Yuan Yuan for generously providing us with the information and technique for collecting this information.

Table A.1
Deficiency Judgments in Clark County, Nevada (2000 - 2013). The sample for loans in foreclosure sales comes from LPS Applied Analytics. It includes mortgages that are real-estate owned, in liquidation, or in foreclosure sales. The sample for loans with deficiency judgments is collected from the county court as described in the Appendix.
Notes. 1. The numbers inside the parentheses in column 4 are the percentage of loans in foreclosure that ended up in deficiency judgment court (column 4/column 2).
2. The numbers inside the parentheses in column 5 are awarded deficiency judgments as shares of mortgage outstanding (column 5/column 3).

Year	Loans in foreclosure sales		Loans with deficiency judgments	
	Number	Median balance ($)	Number	Median awarded judgments ($)
2000	881	111,477	174 (20%)	10,471 (9.4%)
2001	651	114,788	132 (20%)	9,649 (8.4%)
2002	700	118,679	96 (14%)	10,853 (9.1%)
2003	663	115,828	99 (15%)	9,491 (8.2%)
2004	586	104,729	91 (5%)	10,034 (9.6%)
2005	1330	169,782	72 (3%)	12,577 (7.4%)
2006	3891	237,125	111 (0.62%)	13,444 (5.7%)
2007	13670	251,674	83 (0.09%)	15,602 (6.2%)
2008	35680	241,692	32 (0.13%)	20,145 (8.3%)
2009	51831	235,015	69 (0.18%)	17,854 (7.6%)
2010	37167	220,986	67 (0.12%)	32,016 (14.5%)
2011	23694	219,907	28 (0.11%)	42,867 (19.5%)
2012	12332	208,913	13 (0.10%)	16,111 (7.7%)
2013	5915	203,341	6 (0.12%)	26,369 (14.7%)

Table A.2
Mortgage loan applications and originations in Nevada (2004–2014). This table reports all applications of first-lien purchase or refinance mortgages for owner-occupied one- to four- family units in Nevada from 2004 to 2014 according to HMDA.
Notes. 1. The numbers in the parentheses in column 6 are the percentage of total approved loans that are sold to Fannie Mae, Ginnie Mae, Freddie Mac, and Farmer Mac. The difference of the two numbers is the percentage of loans sold to commercial banks, savings bank or savings association, life insurance company, affiliate institution, and other types of purchasers.

Year	Total applications	% of purchase loans	% approved loan	% conventional loans	% approved loans sold within the calendar year
2004	213,271	41.4	78.6	96.6	68.7 (17.9)
2005	216,770	43.1	76.5	98.4	73.6 (12.9)
2006	175,343	43.1	72.3	98.5	68.9 (11.0)
2007	129,395	36.9	64.1	95.7	64.8 (17.8)
2008	80,743	52.4	65.5	64.7	75.6 (30.1)
2009	75,562	56.9	74.5	50.7	82.1 (32.6)
2010	57,565	59.8	78.5	50.5	82.5 (30.4)
2011	47,823	62.3	80.3	52.5	80.0 (30.7)
2012	77,829	38.8	81.0	69.7	84.2 (44.9)
2013	71,881	42.9	82.7	70.4	82.4 (46.6)
2014	59,979	57.8	81.1	61.5	81.2 (44.8)

Table A.3
HARP refinance volume. This table reports the number of loans in thousands refinanced through HARP by Fannie Mae and Freddie Mac. The data source is Foreclosure Prevention and Refinance Report, Third Quarter 2010, http://www.fhfa.gov/AboutUs/Reports/ReportDocuments/20103Q_FPR_508.pdf. Eligibility requirements prior to December 2011: Fannie Mae or Freddie Mac must own or guarantee the loan; the current loan-to-value ratio is greater than 80 percent but less than 125 percent; and the borrower must be current on his or her mortgage with no late payments over the last 6 months and no more than one late payment over the last 12 months.

Month	Loans modified under HARP (thousands)
April 2009	2
May 2009	6
June 2009	23
July 2009	31
August 2009	32
September 2009	24
October 2009	18
November 2009	21
December 2009	34
January 2010	32
February 2010	35
March 2010	35
April 2010	30

Table A.4
Summary statistics: approved loans sold within the calendar years versus loans not sold. This table reports summary statistics of approved purchase mortgages or refinance conventional first-lien mortgages for one- to four- family primary residences by their investment status within the calendar year of the approval date.*indicates dummy variables.

Variable	Approved loans sold			Approved loans not sold		
	Mean	Median	S.D.	Mean	Median	S.D.
Purchase loans*	0.344	0	0.489	0.452	0	0.500
Gender: female*	0.265	0	0.441	0.275	0	0.447
Gender: unknown*	0.052	0	0.223	0.082	0	0.274
Race: black*	0.086	0	0.281	0.019	0	0.289
Race: nonwhite and nonblack*	0.093	0	0.290	0.092	0	0.289
Race: unknown*	0.052	0	0.223	0.134	0	0.340
With cosigner*	0.552	1	0.497	0.498	0	0.500
Income ($ thousands)	92	72	77	114	78	115
Loan amount ($ thousands)	192	172	96	224	183	152
Census tract % of population nonwhite and/or Hispanic or Latino	19	18	11	21	19	12
Census tract median family income ($thousands)	66	64	17	66	64	19
Census tract total population (thousands)	4.648	4.302	2.365	4.537	4.328	4.887
Regulatory agency:						
OCC*	0.561	1	0.496	0.468	0	0.500
FRS*	0.025	0	0.156	0.014	0	0.107
FDIC*	0.021	0	0.145	0.030	0	0.171
OTS*	0.072	0	0.256	0.099	0	0.298
NCUA*	0.061	0	0.240	0.061	0	0.239
HUD*	0.260	0	0.438	0.093	0	0.290
Loans with PMI*	0	0	0	0.235	0	0.424
Lagged local unemployment rate (%)	12.089	12.400	1.624	12.123	12.400	1.566
Lagged net local house price growth rate (%)	−0.835	−0.564	0.017	−0.910	−0.712	0.018
Total number of observations	18,512			7,750		

Table A.5
Summary statistics: using purchase loans from neighboring states as controls. This table reports the summary statistics of the alternative sample where we use purchase loans from neighboring counties as the control group. See the text for the list of the county names. *indicates dummy variables.

Variable	Nevada purchase loans			Other purchase loans		
	Mean	Median	S.D.	Mean	Median	S.D.
Approval rate*	0.817	1	0.387	0.844	1	0.365
Gender: female*	0.295	0	0.456	0.264	0	0.441
Gender: unknown*	0.049	0	0.216	0.052	0	0.222
Race: black*	0.021	0	0.144	0.014	0	0.115
Race: nonwhite and non-black*	0.138	0	0.344	0.151	0	0.358
Race: unknown*	0.096	0	0.295	0.116	0	0.321
With cosigner*	0.393	0	0.488	0.451	1	0.498
Income ($ thousands)	94	66	93	91	70	77
Loan amount ($ thousands)	199	155	159	234	207	145
Census tract % of population nonwhite and/or Hispanic or Latino	22	20	13	33	22	25
Census tract median family income ($thousands)	64	63	18	58	56	21
Census tract total population (thousands)	4.368	4.145	2.291	8.009	6.496	4.887
Regulatory agency:						
OCC*	0.397	0	0.489	0.330	1	0.470
FRS*	0.027	0	0.162	0.012	0	0.107
FDIC*	0.028	0	0.166	0.050	0	0.217
OTS*	0.079	0	0.270	0.079	0	0.270
NCUA*	0.046	0	0.211	0.033	0	0.178
HUD*	0.282	0	0.450	0.364	0	0.481
Loans with PMI*	0.141	0	0.348	0.133	0	0.339
Lagged local unemployment rate (%)	12.327	12.500	1.491	12.037	12.000	2.108
Lagged net local house price growth rate (%)	−1.418	−1.279	1.022	−0.418	−0.232	1.079
Total number of observations	12,004			15,832		

Table A.6
Robustness analysis 2: using purchase and refinance loans from neighboring states. This table reports the summary statistics for the sample used in the placebo analysis where the data contain all applications including those that will be later rejected for conventional first-lien purchase or refinance loans for owner-occupied one- to four- unit primary residences submitted between April 2009 and March 2010 in counties neighboring Nevada. See the main text of for the list of the county names. We test whether loans made in these counties exhibit similar patterns as those in the benchmark sample. *indicates dummy variables..

Variable	Purchase loans			Refinance Loans		
	Mean	Median	S.D.	Mean	Median	S.D.
Approval rate*	0.844	1	0.365	0.745	1	0.435
Gender: female*	0.264	0	0.441	0.220	0	0.414
Gender: unknown*	0.052	0	0.222	0.076	0	0.265
Race: black*	0.014	0	0.115	0.014	0	0.119
Race: nonwhite and non-black*	0.151	0	0.358	0.059	0	0.236
Race: unknown*	0.116	0	0.321	0.154	0	0.361
With cosigner*	0.451	1	0.498	0.637	1	0.481
Income ($ thousands)	91	70	77	96	79	71
Loan amount ($ thousands)	234	207	145	236	218	124
Census tract % of population nonwhite and/or Hispanic or Latino	33	22	25	24	15	20
Census tract median family income ($thousands)	58	56	21	60	57	20
Census tract total population (thousands)	8.009	6.496	4.887	7.069	6.090	3.966
Regulatory agency:						
OCC*	0.330	1	0.470	0.511	1	0.500
FRS*	0.012	0	0.107	0.015	0	0.122
FDIC*	0.050	0	0.217	0.061	0	0.238
OTS*	0.079	0	0.270	0.108	0	0.311
NCUA*	0.033	0	0.178	0.056	0	0.229
HUD*	0.364	0	0.481	0.227	0	0.419
Loans with PMI*	0.133	0	0.339	0.022	0	0.148
Lagged local unemployment rate (%)	12.037	12.000	2.108	11.408	2.291	2.291
Lagged net local house price growth rate	−0.418	−0.232	1.079	−0.500	−0.480	1.127
Total number of observations	14,597			45,036		

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