Loan Contracting in the Presence of Usury Limits: Evidence from Auto Lending

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Abstract

We study the effects of usury limits on the market for auto loans and find little evidence of credit rationing. We show instead that loan contracting and the organization of the loan market adjust to facilitate loans to risky borrowers. When usury restrictions bind, auto dealers finance their customers' purchases and raise the vehicle sales price (and loan amount) relative to the value of the underlying collateral. By doing so, they arrange loans with similar monthly payments and compensate for credit risk through the mark-up on the product sale rather than the loan interest rate.

1 Introduction

Regulation shapes consumer credit markets in many ways, whether by governing the disclosure of loan terms, promoting fair access to credit, or even placing a ceiling on interest

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rates. In this paper, we explore how interventions of the latter type — usury restrictions — influence the market for auto loans. Usury restrictions are often motivated by the argument that lenders, if unchecked, will exercise market power and raise interest rates on risky borrowers beyond the level required to compensate for credit losses. Supporters of usury limits thus argue that lenders will respond to interest rate caps by extending credit at lower prices. Opponents counter that price ceilings will cause credit rationing, which reduces access to credit and harms precisely the risky borrowers that supporters of usury limits intend to help.

We find that neither of these theories accurately describes the impact of usury limits on the market for subprime auto loans. Instead, we find that auto dealers creatively contract around binding usury limits by financing their customers' purchases and pricing default risk through the mark-up on the vehicle sale rather than through the interest rate. In the resulting equilibrium, we find that few borrowers, if any, are rationed from the market, but that auto dealers provide captive financing for a larger share of auto purchases and borrowers face different loan terms—lower interest rates but larger loan-to-value ratios—than they would in the absence of usury limits.

The strategy pursued by auto dealers is simple. Auto loans are structured as installment contracts that require constant monthly payments for a fixed maturity (typically 3-5 years) and allow the lender to repossess the vehicle if the borrower defaults. Holding fixed the loan maturity and principal amount, a lender is typically constrained to adjust the monthly payment by changing the interest rate specified in the contract. For a lender that also serves as the vehicle seller, however, there is an additional degree of freedom. When a usury ceiling prevents upward adjustment of the interest rate, the integrated dealer-lender can design an installment contract with the desired monthly loan payment and similar risk profile by altering the loan amount. Without vertical integration this strategy would not be feasible, since increasing the loan amount requires the lender to provide more cash to the borrower at origination for no compensation (the monthly loan payment and collateral are unchanged.) The integrated dealer-lender, meanwhile, internalizes the benefit from selling the vehicle at

a larger mark-up, so can subsidize a negative net present value loan with a higher value sale. The dealer ultimately trades the same collateral for the same monthly payment, regardless of the contractually-specified loan amount and interest rate, so is indifferent between the interest rate-constrained and the interest rate-unconstrained contract.

Drawing on these insights, we test three hypotheses. First, do usury limits prevent risky borrowers from obtaining auto loans? Second, are auto dealers more likely to provide credit when usury limits are more binding? Third, in transactions where usury limits are more likely to bind, do borrowers will receive loan contracts with lower interest rates, but similar loan payments and larger loan amounts relative to the collateral value?

Our analysis uses detailed data on used automobile transactions compiled by Experian. The data pair information on vehicle transactions - vehicle type, estimated value, lienholder name, dealer name and location - with information from the purchaser's credit record - loan amount, payment and duration, in addition to credit score. The full sample covers approximately 28 million vehicle sales between January 2011 and August 2013.

Despite receiving relatively little attention in recent studies of consumer credit markets, usury limits matter for a significant proportion of auto loan transactions, both because usury ceilings are widespread and fairly stringent and because demand for auto loans is strong among subprime borrowers. More than one-third of states analyzed in this paper limit interest rates for auto loans in a practical sense, with an average ceiling ranging between 20 and 30 percent. Moreover, a thriving market for auto loans exists among subprime customers, which means that many borrowers do not qualify for interest rates beneath these ceilings. In the first half of 2014, 31%, or $70.7 billion, of auto loans went to consumers with credit scores below 640 (Equifax, 2014).

Although usury limits do indeed bind for many borrowers, we find little evidence that they prevent these borrowers from obtaining auto loans. Regardless of whether a state imposes a usury limit or not, the distribution of credit across borrowers is very similar.

In contrast, we find that the organization of the vehicle loan market changes quite dramat-

ically in the presence of usury limits. Integrated dealer-lenders provide a larger proportion of loans to subprime borrowers in states with usury limits. Notably, the likelihood of dealer financing is not uniformly higher in states with usury limits. Rather, it increases particularly for subprime borrowers, for whom usury limits are more likely to bind. These findings are consistent with our hypothesis that auto dealers can contract around binding usury limits for borrowers that cannot receive credit from outside lenders.

Finally, we examine loan contracting in a sample of dealer-financed loans covering roughly 30,000 vehicle sales by approximately 4,200 dealers. In a simple descriptive comparison of loans in the state with the most stringent usury limit (Arkansas) and in the largest state without a usury restriction (California), we show striking evidence that loan-to-value ratios adjust upward to price credit risk when interest rates are constrained. Meanwhile, monthly loan payments trend upward with credit risk but do not rise disparately in California, the unconstrained state.

To be more careful in identifying the specific impact of usury limits, we use regression analysis to control for heterogeneity in borrowers and vehicles. We use a two-stage regression procedure. First, we predict the likelihood that a borrower faces a binding usury ceiling, given the borrower's credit score, the usury ceiling in his state and the interaction of credit score and usury ceiling. Second, we use the first stage predictions in a regression model that quantifies the difference in loan terms where the usury ceiling is predicted to bind. The identifying variation in our model comes not from variation across borrowers but instead from state-level variation in the tightness of usury limits. This two-stage procedure allows us to avoid using an endogenous measure–the realized interest rate–when measuring the extent to which the usury ceiling binds. For cases in which the usury limit binds, one might worry that an unobservable characteristic accounts for both the borrower's high interest rate and for the difference in loan-to-value.

The results from this analysis show that usury limits reduce interest rates substantially, by an average of seven percentage points when the restriction binds with certainty. At the

same time, however, loan-to-value ratios are substantially higher when usury limits bind, consistent with the prediction that borrowers take out larger loans and pay higher prices relative to collateral value. For the bottom-line price of credit, the monthly loan payment, we find no difference due to binding usury restrictions.

Our paper contributes most directly to the literature on usury restrictions. Though our paper is the first to study the impact of usury restrictions on subprime auto lending, we build on a series of related papers (Adams et al. (2009); Einav et al. (2012);Einav et al. (2013)) that use data from a single auto dealer to explore the role of liquidity constraints in borrowing, the effect of credit scoring on firm profitability and the optimal design of loan contracts. This paper also relates to a larger literature on market participants' behavior under constraints, such as Attanasio et al. (2008) and Johnson and Li (2010). Attanasio et al. found, using auto loan data in the Consumer Expenditure Survey, consumers' responsiveness to different loan characteristics change with income. This matches the commonly held belief that high-income, unconstrained consumers shop on total price measures such as interest rate, while subprime consumers focus on periodic costs such as monthly payment and loan term. If consumers indeed focus on some loan outcomes more than others, this would more easily allow lenders to avoid usury limits. Similarly, Assunção et al. (2013) examines the impact of changes in expected return on assets via changes in repossession laws, and finds impacts both access to credit and terms offered. Additionally, examination of the impacts of usury cap restrictions on other loan characteristics mirrors the literature on attribute-based regulation, including Ito and Sallee (2014), which examines the impact of basing vehicle gas mileage standards on weight, and finds bunching near the limits occurring as a result. Finally, the ability of some subprime dealers to retain profits from both the financing of the vehicle as well as the overall sale price resembles many features of the captive auto financing. That industry features in a long line of literature, such as Barron et al. (2008), which examines the impact on credit standards resulting from the bundling of durable goods with financial products.

2 The Market for Vehicle Financing

Automobile dealers play an integral role in facilitating loans for their customers. Among "prime" customers, who have relatively strong credit histories and low risk of default, dealers often arrange financing for the customer at the time of the sale.[1] Although these dealers play a role in brokering and pricing loans, they rarely act as the lender and they serve few customers for whom interest rate restrictions bind.

Our analysis focuses on the segment of the auto dealer market that serves "subprime" customers, for whom default risk is high and for whom interest rate restrictions may bind. Many dealers in this segment of the market do not simply arrange loans, they actually finance their customers' purchases. In industry parlance, these locations are Buy Here Pay Here (BHPH) dealers, meaning that they sell the vehicle and also collect the recurring loan payments at the dealership.

BHPH dealers are typically independent from vehicle manufacturers and they sell used cars that are older and of lower value than the inventory carried by dealers serving prime customers.[2] Customers do not shop for a particular vehicle and then negotiate a purchase price contingent on financing. Instead, BHPH transactions usually begin with loan underwriting, as the salesperson reviews the customer's credit history, current income and major expenses, and specifies the maximum monthly loan payment for which the customer qualifies. The customer then examines the vehicles for which this payment qualifies them, and the negotiation proceeds from there to find an acceptable vehicle and agree upon the down payment and loan terms. An important aspect of this sales process, from the perspective of our analysis, is that it treats the purchase and financing as a bundle. The price of the vehicle and the loan are not presented and negotiated separately.

[1] Relatively few customers — less than 20% of those who finance purchases — arrange financing directly with a lender prior to negotiating the final sale of the vehicle. Much more commonly, the dealer arranges financing for the customer at the time of the sale. Davis (2012) estimates roughly 80 percent of consumers who finance a vehicle purchase use this "indirect" method in which the dealer serves as an intermediary.

[2] In principle, our insights apply to vehicle financing of all types, including financing of new car purchases. Usury restrictions, however, have little practical impact for the vast majority of customers that buy new cars, which have higher values.

Our study evaluates the role of usury restrictions in encouraging dealer financing. We acknowledge, however, that there are other market frictions that may encourage dealer financing among subprime buyers. Dealers may, for example, gather useful information about borrower credit risk during the sales process, giving them an underwriting advantage over outside lenders. Dealers may also have an advantage in recovering value from defaulted loans since they can avoid transactions costs and liquidate collateral through their own dealership. Our analysis does not examine these motivations for dealer financing.

2.1 Loan Contracting with Arm's Length Financing

To clarify the way in which dealer financing changes loan contracting, we offer a stylized model of the vehicle sales and financing process. Figure 1 summarizes the cash flows among the dealer, customer and lender.

The customer and dealer agree to a sales contract in which the dealer exchanges the vehicle for a price (P), to be funded at the closing through a down payment (D) from the borrower and a payment (L) from the lender to the dealer. The borrower and lender, in turn, agree to a loan contract specifying the loan amount (L, transferred to the dealer on the borrower's behalf), the schedule of promised loan payments to be paid by the borrower, and the collateral that the lender can repossess and liquidate in the event of default. The loan's interest rate or finance charge is calculated in accordance with state law, r = f(L, PMT). If the loan amount and recurring loan payment imply an interest rate above the usury limit ($r > r_{usury}$), the transaction is not feasible. An important constraint is that the cash transferred to the dealer (L) is recorded as the loan amount and the lender cannot arbitrarily mark up the loan amount in the contract to conform with the usury restriction.

The zero profit constraint for the lender is that the discounted value of expected loan cash flows (loan payments and collateral liquidation) equal or exceed its payment of L to the dealer. If the breakeven interest rate exceeds the usury rate, the only way to facilitate a transaction is for the lender to reduce the risk of default, for example by increasing the down

payment (and reducing L relative to the collateral value), which lessens moral hazard-related default and allows for a lower breakeven interest rate.

2.2 Loan Contracting with Dealer Financing

Figure 2 summarizes the cash flows and contracting for a purchase using dealer financing. Dealer financing expands the set of feasible loan contracts in the presence of usury limits. The reason is that the payment L on the borrower's behalf from the lender to the dealer never changes hands, so does not constrain the stated loan amount in the contract with the borrower. When a usury restriction limits r, the loan amount L can be adjusted upward to get the desired loan payment. For example, a 36-month amortizing loan with a constant payment of $382 per month can be specified as a $9,000 loan at 30% interest or a $10,280 loan at 20% interest. Whether there is a usury limit at 20% or not, in the end the dealer can exchange the same collateral for the same down payment and promised loan payments. The sales contract likewise can be adjusted to increase the stated sales price P, so that there remains a fair exchange of value in the sale (P = D + L).

While the loan payment can be replicated by raising the loan amount rather than the interest rate, the two loan contracts will differ slightly. A loan with a higher loan amount and lower interest rate will amortize more slowly, so borrowers that repay early owe a larger repayment amount. For borrowers that make all promised loan payments, then, the cash flows are identical and the borrower is indifferent between the two contracts. Borrowers that anticipate prepaying the contract, however, will prefer the "unconstrained" contract with higher interest rate and lower loan amount. As a practical matter, the cash flow differences are fairly small. Returning to the sample loan discussed above, Table 1 shows the slower amortization of principal in the 20% interest loan. After one year, the repayment amount on the 20% loan is $7,507, roughly 10% higher than the repayment amount of $6,833 on the 30% loan and after two years the repayment amounts only differ by $200.

Though it is tempting to say that moral hazard is greater for borrowers with larger loan

amounts, this is not the case. Moral hazard depends on the present value of loan payments relative to the value of the collateral. If the present value of the loan payments is higher relative to the collateral at a given point in time, then there will be more moral hazard-related default.

The provision of credit through dealers thus nearly eliminates any distortion introduced by usury restrictions. One additional consideration is the market power of dealers. If there are similar competition among dealers as among outside lenders, dealer financing is a good substitute for outside financing. On the other hand, if the dealer market is uncompetitive, then eliminating competition from outside lenders and forcing the financing to run through the dealer may increase the price of credit for consumers.

3 Data Sources and Sample Description

3.1 Data Sources

Our main data source is Experian's AutoCount® database, which combines information on automobile purchases with household credit records. Experian assembles the data in three steps. First, they compile publicly available records of automobile transactions from Departments of Motor Vehicles (DMVs) in 46 states.[3] The DMV records cover all transactions and, for most states, include: the buyer's name and address; the vehicle make, model, model year and new/used status; the auto dealer's name and address; and the lienholder's name. Next, Experian attaches to each transaction the buyer's credit score and the transaction's financing terms.[4] The loan information, which Experian's credit bureau division collects directly from auto lenders, includes: the loan amount and duration, which are reported directly, as well as the loan interest rate (simple amortizing interest rate) and monthly payment, which are both computed assuming constant installment payments and full amortization of principal.

[3]States excluded are Delaware, Oklahoma, Rhode Island, and Wyoming.

[4]After merging DMV transactions with credit records, Experian omits the borrower's identifying information from AutoCount.

Because lenders report loan terms at will, the loan information is not comprehensive; as we discuss further in Section 4.4.1, some transactions have no loan information and others have partial information. From the borrower's credit history, Experian calculates a credit score, ScoreX, to measure default risk. In the third and final step, Experian incorporates an estimate of the vehicle's value, given the make, model and model year. For used vehicles the estimated value is based on actual transaction prices of vehicles reported to be in average condition. Of the key terms of the vehicle sale and financing transactions, the most important items omitted from AutoCount are the sales price and loan down payment.

A pertinent feature of the AutoCount data is aggregation. While the records underlying AutoCount are at the transaction level, Experian only releases aggregated statistics - the count of transactions and the average transaction characteristics - for specified transaction groupings. In practice, this constraint forces relatively minimal aggregation, as Experian allows for grouping into very fine categories. The observations underlying our analysis of loan contracts are at the level of dealer-lender-month-credit score bin (20 point intervals). For each "cell" we observe the number of transactions and the average of each variable (e.g. average interest rate, loan amount, vehicle value, etc.) within the cell.

We supplement the AutoCount data with information on state usury limits. We compiled the usury limits directly from state laws and statutes, cross-checking our list of relevant laws with those reported in the National Consumer Law Center publication The Cost of Credit (2009).

4 Examining the Impact of Usury Limits on the Market for Auto Loans

4.1 Description of Usury Limits Across States

Twenty nine states impose an interest rate ceiling on auto loans. The restrictions follow one of three structures. Most commonly, states impose a single maximum interest rate applicable to all auto loans; twelve states fall into this category.[5] Another group of states impose a maximum interest rate that varies with the age of the vehicle financed. The ceiling is always increasing in the age of the vehicle and typically varies by 2 to 5 percentage points depending on the vehicle age. For example, Pennsylvania allows for interest rates of up to 18% per year on vehicles less than 2 years old and 21% per year on vehicles more than two years old. The remaining states impose a maximum rate that decreases with the initial loan amount, typically with some floor, as in Indiana where the maximum interest charge is 36% per year on the portion of the balance up to $2,000, 21% per year on the portion between $2,00 and $4,000, and 15% per year on the portion above $4,000, with a minimum cap of 25%.

Table 2 summarizes the interest rate caps applicable in each state. The usury rate averages 21.5% per year when evaluated at the minimum usury ceiling within each state, and 25.5% per year when evaluated at the maximum usury ceiling in each state. Figure 3 shows the geographic distribution of usury restrictions. States in the western United States are less likely to impose a usury ceiling. Within the Midwest and East, however, the usury limits are fairly well dispersed geographically. The states with the tightest restrictions, for example, include Nebraska in the Midwest, Arkansas and Tennessee in the South, and Maine, Massachusetts, Rhode Island and Vermont in the Northeast.

For each loan in the AutoCount we code the applicable usury ceiling based on the auto

[5]While most states with rate limits base them on simple amortizing interest, some (e.g., Texas, Florida) instead allow for a maximum finance charge per year based on the original amount financed. What is stated as a 15% limit on finance charge per year equates to a substantially higher limit on the allowable interest rate. In these cases we show the equivalent simple interest rate for a 3 year loan, and use the equivalent rate given term at the observation level in estimation .

dealer's location and the initial loan amount. The AutoCount data used in this paper does not include a measure of vehicle age. In states where the usury rate varies by vehicle age, we apply the rate for older vehicles (4 years or older), which are typical of purchases by subprime buyers, with some recoding based on patterns indicating a particular dealer observed another statutory rate limit.

4.2 Do Usury Restrictions Cause Rationing?

We begin by investigating whether usury restrictions prevent risky borrowers from obtaining auto loans. As a starting point, we confirm that the usury limits do indeed bind for many borrowers. Figure 4 plots the frequency of loans by interest rate bin for subprime borrowers in states without usury restrictions. A substantial share of those loans carry interest rates between 21% and 25%, which would exceed the maximum usury ceiling in more than a dozen states.

If binding usury restrictions cause credit rationing, we should observe a smaller fraction of loans granted to risky borrowers in states that restrict interest rates. To test this hypothesis, we compare the distribution of credit scores among customers receiving auto loans in states with and without usury caps.

Using the entire AutoCount sample, which includes 28 million financed automobile purchases, we compute the fraction of financed purchases that go to customers in each 20-point credit score bin. Figure 5 displays these probability density functions within two subsamples, states that impose a usury limit and states that do not. The distributions are similar, though in states with usury limits the distribution is shifted slightly to the left. Counter to the credit rationing hypothesis, low credit score borrowers do not comprise a smaller fraction of loans in states with usury limits. Why are the distributions not identical? As shown in Figure 6, the distribution of credit scores in the overall population (roughly estimated using an unweighted sample of consumers in December 2012 from the CFPB Consumer Credit Panel) is also shifted slightly to the left in states that impose usury limits. So, the distri-

bution of auto loans mirrors the distribution of credit scores, suggesting little, if any, credit supply constraint due to usury limits.

We conclude that there is little credit rationing due to usury restrictions. Many risky borrowers that we would expect to be rationed continue to receive credit. In the next two sections we explore how the lending market adjusts to facilitate loans for these borrowers.

4.3 Do Usury Restrictions Increase the Prevalence of Dealer Financing?

We next explore whether the organization of the auto loan market changes to facilitate loans for risky borrowers. Our conjecture is that usury restrictions constrain outside lenders, but that dealers can nevertheless provide credit to risky borrowers when interest rate restrictions bind. Using the full AutoCount sample of 28 million financed purchases (as in the analysis of credit rationing), we test whether dealer financing becomes more prevalent among borrowers for whom usury restrictions are likely to bind. Collapsing by dealer-month grouping, we measure the proportion of transactions financed by the dealer (as opposed to an outside lender).[6] We then estimate the following regression equation:

$$1\{ShareDealerFinancing_{icst} = BHPH\} = \alpha + \beta Cap_s + \gamma_c + \eta_t + \varepsilon_{icst}$$

The dependent variable in this model is the proportion of dealer-financed transactions (the complement being the share financed by an outside lender) at dealer i in state s and month t, for customers within credit score grouping c. The variable Cap_s indicates whether there is a usury limit in the state: it takes the value of one if state s imposes an interest rate limit for auto loans, and zero otherwise. The vectors γ_c and η_t, are fixed effects for credit score bin and month, respectively. We estimate the model using ordinary least squares, with observations

[6] If the dealer made five financed sales within the credit score range 500-550 and financed two of them, the Share of Dealer Financing would be 0.4 for that dealer-month-credit score range. The complement of this variable measures the share of financed transactions using outside lenders. Non-financed transactions are excluded.

clustered by state in calculating Huber-White robust standard errors. Our predictions are two-fold: 1) among the set of risky borrowers, a larger share of transactions will use dealer financing in states with usury limits—the estimated coefficient on Cap will be positive; and 2) within states that restrict interest rates the share of dealer financing will increase with credit risk—when interacted with credit score, the coefficient on the Cap will decrease with the credit score.

The regression estimates are displayed in Table 3. Overall, the share of transactions using dealer financing is approximately 3.12 percentage points (p-value 0.11) higher in states that impose usury limits compared to states that do not. Allowing for differential effects by credit risk, we see that dealer financing increases quite dramatically for the vast majority of subprime borrowers (those with credit scores of 660 or below). Relative to buyers with credit scores above 760 (the excluded group), borrowers in the 600 to 660 score range are 11.9 percentage points (p-value < 0.01) more likely to obtain dealer financing in states with usury limits. Furthermore, as credit scores decline, the prevalence of dealer financing increases even more. In states with usury limits, buyers with credit scores in the ranges 480-540 and 540-600 are 18.8 percentage points (p-value < 0.10) and 17.6 percentage points (p-value < 0.05) more likely to use dealer financing. The very riskiest borrowers, with scores below 480, display no difference in prevalence of dealer financing across states, though these cells include very few borrowers. As shown in the third column, the pattern of increased dealer financing for subprime customers in states with usury limits is robust to the inclusion of state fixed effects. It is important to note that we control for credit score flexibly in these models, so the increased prevalence of dealer-financed loans in states with usury limits is not driven by the greater proportion of low credit score borrowers in these areas.

4.4 Do Usury Restrictions Change Loan Contracting in Dealer-Financed Transactions?

The final portion of our analysis examines contract terms among dealer-financed loans. We conjecture that dealers serve risky borrowers by contracting around binding usury limits — accounting for credit risk by adjusting the sales price and loan amount rather than the interest rate. Our predictions are that interest rates will be lower, loan-to-value ratios will be higher and loan payments will be unchanged due to binding usury restrictions. One alternative hypothesis is that interest rate restrictions prevent dealers and lenders from exerting market power. The prediction in this case is that usury restrictions reduce interest rates and loan payments. Another alternative hypothesis is that firms avoid rationing credit to risky customers by requiring larger down payments or, equivalently, extending a smaller loans relative to the value of the collateral. The prediction in this case is that loan-to-value ratios will be lower when usury restrictions bind.

4.4.1 Sample Description: Dealer-financed Loans

This analysis focuses on a subset of the AutoCount database: loans made by so-called Buy Here Pay Here dealers that provide financing in addition to selling cars.[7] AutoCount's coverage of loan terms among dealer-financed loans is not complete for two reasons. First, lenders report loan terms at will, so loan information is not available for lenders that choose not to report loans to Experian's credit bureau. Many smaller dealerships choose not to report to Experian, so most of the loans come from midsize and larger BHPH dealership networks. Second, Experian's data reported to Experian on the characteristics of a given loan are sometimes incomplete, leaving the credit bureau unable to determine the full set of characteristics of the loan.

[7]Experian identifies transactions where the dealer and lender are owned by the same overall company. When we could positively identify cases where the original data identifies a known Buy Here Pay Here lender as another type of lender we included these loans as appropriate. An example here is a firm that has a fully owned captive finance subsidiary with a different name than the dealership.

As noted in Section 3, Experian only releases aggregated statistics on loan contracts. The observations underlying our analysis are at the level of dealer-lender-month-credit score bin (20 point intervals). For each "cell" we observe the number of transactions and the average of each variable (e.g. average interest rate, loan amount, vehicle value, etc.) within the cell. We exclude loans that are missing information on any dimension (interest rate, payment, loan amount, loan term and collateral value). Overall, the sample for our analysis includes 28,155 observations, covering 39,547 transactions. An observation in the data thus reflects 1.4 underlying transactions on average. The modal observation covers a single transaction. Summary statistics for transactions with loan characteristics appear as Table 5. Geographically, the loan contracts are concentrated in Texas and California.

4.4.2 Graphical Evidence for Dealer-financed Loans in Arkansas and California

Before proceeding with more formal statistical analysis, we begin by describing the patterns in loan contracting within two states: California, the largest state without a usury ceiling and Arkansas, the state with the most stringent usury limit.[8]

Figure 7 plots average interest rates against credit score for dealer-financed loans in California and Arkansas. Within California, interest rates rise as credit scores decline, with quite rapid increase as credit scores fall from 700 to the mid-500s. Meanwhile, the average interest rate in Arkansas is quite flat in the same credit score range, consistent with the fact that many borrowers face a binding usury restriction that prevents upward rate adjustments. The pattern in loan-to-value ratio is roughly the opposite, as loans in California display a nearly constant loan-to-value ratio of 1.4 and loans in Arkansas show an increasing loan-to-value ratio as credit scores decline. The average loan-to-value ratio is similar in both states at the credit score of 700, where average interest rates are also similar. Strikingly, the loan-to-value ratios diverge in precisely the same credit score range as interest rates,

[8]Strictly speaking, California imposes a usury restriction for auto loans. Practically speaking, however, this constraint does not bind, as the interest rate limit of 20% only applies to loans with original principal balance below 2,500. Very few auto loans have such a small principal amount at origination.

with loan-to-value rising as opposed to interest rates in Arkansas and interest rates rising rather than loan-to-value in California. These figures confirm our main hypothesis about loan contracting: where interest rates are constrained, loan amounts will change instead to account for credit risk. Meanwhile loan payments track each other quite closely in Arkansas and California after subtracting a state-level mean. [9] Despite the disparate increase in loan interest rates in California, the loan payment shows no such disparity with Arkansas.

4.4.3 Regression Analysis of Dealer-financed Loan Contracts

Our goal with the regression analysis is to understand how binding usury restrictions change the key terms in dealer-financed loan contracts. A natural starting place is to estimate some version of

$$Y_{it} = \beta_0 + \beta_1 Bind_{it} + \Gamma' X_{it} + \varepsilon_{it}$$

The dependent variable is either the interest rate, loan-to-value or monthly payment of individual i in month t and $Bind$ is an indicator for whether the interest rate is equal to the state-prescribed maximum rate. Estimating this specification with OLS, however, would produce biased estimates of the impact of rate limits. When examining the interest rate as the dependent variable, for example, the $Bind$ indicator is clearly not exogenous since it is a function of the interest rate. For other outcomes, such as the loan-to-value, the problem is less stark but still evident since omitted characteristics that influence loan-to-value (for example the down payment) are likely correlated with the realized interest rate and, in turn, the $Bind$ indicator. To address this problem we evaluate the impact of binding interest rate limits in a two-stage procedure. First, we estimate the likelihood that the usury restriction binds, conditional on the borrower's credit score and the state's usury restriction. We then use the predicted probability of facing a binding restriction as an independent variable in explaining contract terms such as the interest rate, loan payment and loan-to-value ratio.

[9] Incomes and prices are higher in California, as is the value of vehicles purchased, even conditional on credit score. Subtracting a state-level mean payment is one way to adjust for generally higher prices in California than in Arkansas.

The two regression equations in this Two Stage Least Squares (2SLS) approach include a first stage of

$$Bind_{ist} = \alpha + \lambda' Usury_{is} + \Psi' X_{ist} + \nu_{ist}$$

and a second stage of

$$Y_{ist} = \alpha + \beta \widehat{Bind}_{ist} + \Gamma' X_{ist} + \varepsilon_{ist}$$

The vector X contains control variables included in both stages of the regression analysis: indicators for each 20-point credit score and linear controls for the value of the vehicle and the duration of the loan. The vector $Usury$ contains the variables included in the first-stage regression but excluded from the second-stage. Those variables are: an indicator for whether the state imposes a usury restriction (Cap), a quadratic in the level of the usury restriction ($CapLevel$ and $CapLevel^2$) and the interaction between Cap and each 20-point credit score bin. The $CapLevel$ variable takes the value of zero if the state does not limit the allowable interest rate, and otherwise equals the maximum rate allowable by state law. Accordingly, all variables in $Usury$ take the value of zero in a state without usury restrictions, and loans in those states have an estimated probability of receiving a capped interest rate of close to zero. The identifying variation in $\widehat{Bind}_{ist}$ includes cross-state variation in usury restrictions, within-state variation in usury restrictions (within states in which the interest rate limit varies across loans of different size) and within-state variation in the impact of usury restrictions (across individuals in different credit score groupings). The exclusion restriction here requires that the statutory limit on interest rates impact loan characteristic outcomes of interest, including the interest rate itself, through no mechanism other than their impact on whether the loan hit some rate ceiling, after conditioning on other covariates such as the credit score.

4.4.4 Regression Results

We first discuss the results from the first-stage analysis of whether a loan faces a binding interest rate restriction. Figure 10 shows the distribution of the predicted value of *Bind* from the first stage regression. The mass of the distribution lies between 0 and 0.5.

Tables 6 through 9 display second-stage regression results for interest rates, loan-to-value ratios and loan payments. The estimates indicate that usury limits are effective in reducing interest rates. Controlling for borrower credit score, interest rates are estimated to be 5.7 percentage points lower (p-value < 0.05) when the usury restriction binds for certain. After adding a control for vehicle value, the estimated effect of a binding restriction is somewhat larger, at -7.0 percentage points (p-value < 0.05). In the final specification, which includes controls for amount financed and loan term as well, the estimated effect remains roughly the same at -7.1 percentage points (p-value < 0.05). This result, along with the strong weak instruments statistic, reassures us that our specification is successfully picking up the variation of interest, and matches the intuition provided by the figures plotting interest rate against credit score in Arkansas and California.

Table 7 displays analogous results for loan-to-value ratios. While interest rates decline when usury restrictions bind, loan-to-value ratios rise. In the first specification, with controls for credit score alone, the loan-to-value ratio increases by 0.59 (p-value < 0.01) when the usury restriction binds for certain. After including a control for the vehicle value as well, the estimated effect remains large, positive and statistically significant at 0.44. These regression estimates again parallel our findings in comparing loans in Arkansas and California—as usury restrictions bind, borrowers receive lower interest rates but also take out larger loans relative to collateral value. These findings are consistent with our hypothesis that lenders price credit risk through the sales price mark-up, raising loan amounts relative to collateral value when they cannot raise interest rates. Down payments are not measured in the AutoCount data, so are an omitted variable in these models. It is worth noting that the average BHPH transaction includes a down payment of roughly 10%. Even if the down payment were

reduced to zero in states with usury restrictions, the magnitude of the change in loan-to-value would not be large enough to explain our findings. It must be that price mark-ups are changing as well. Furthermore, the likely adjustment by lenders to a binding usury restriction would be to reduce credit risk by requiring a larger down payment. We find the opposite pattern - for riskier borrowers, where the usury restriction is more likely to bind, we actually find *higher* loan-to-value ratios on average.

This assumption of higher leverage making up for lower interest rates assumes a relatively low default rate. Given the generally poor credit characteristics of borrowers in the BHPH space, to achieve this requires minimizing default risk to the extent possible. The higher loan leverage increases the moral hazard risk faced by the lender, without the ability to make up for that risk through higher interest rates. In order to maintain a desired monthly cash flow and return on interest and collateral, as well as mitigate increased hazard we would expect to see a decline in loan length associated with an increased likelihood of receiving a loan with a capped interest rate. Indeed, Table 8 shows a decrease of 18 months in loan length (p-value$<$0.05) associated with receiving a bounded interest rate, while adding other deal characteristics brings the coefficient down somewhere in the range of 9-14 months.

Holding fixed the collateral, loan duration and amortization schedule, the bottom line price for a financed vehicle purchase is the monthly loan payment. Our analysis of loan payments, presented in Table 9, finds no difference due to binding usury restrictions. In the first specification, with controls for credit score, the coefficient on $\widehat{Bind}$ implies a \$56 lower monthly payment due to binding usury restriction. However, this coefficient is not statistically significant. After controlling for vehicle value, the coefficient also changes signs, implying a \$48 higher monthly payment for similar collateral when the usury restriction binds for certain. This estimate is remains imprecise and statistically insignificant.

Overall, these regression results provide confirmation of our hypotheses regarding loan contracting. Usury restrictions result in lower interest rates, but higher loan-to-value ratios. While the imprecision of our estimates for loan payments prevents us from drawing strong

conclusions, we find no evidence that loan payments change due to usury restrictions.

4.4.5 Do Usury Limits Hinder Competition in the Lending Market?

By forcing loans to be originated by dealers rather than outside lenders, usury restrictions may reduce competition among lenders and increase price mark-ups. We extend our analysis of loan contracting to explore whether the impact of usury limits depends on local competition among auto dealers. To do so, we measure the Herfindahl index (HHI) among used car dealers in each zip code. We then interact the predicted binding variable with HHI to see if the effects of binding usury limits on loan payments, for example, depend on dealer market competition.

ANALYSIS TO BE DONE...

5 Conclusion

We study the effects of usury restrictions on the market for auto loans. We find little evidence that usury limits cause credit rationing. Instead, our analysis shows that the most substantial effect of usury restrictions is on the organization of the lending market. We find that usury restrictions shift market share away from outside lenders and toward automobile dealers, which can creatively contract around interest rate limits. When usury restrictions bind, automobile dealers finance their customers' purchases and raise the vehicle sales price (and loan amount) relative to the value of the underlying collateral. By doing so, they arrange loans with similar monthly payments and compensate for credit risk through the mark-up on the product sale rather than through the loan interest rate. Thus, borrowers ultimately face similar loan payments even when the usury ceiling reduces the interest rate that they obtain.

Usury restrictions may, through their impact on loan contracting, work in opposition to the goals of truth-in-lending provisions. Prior research suggests that many consumers have

difficulty inferring the cost of credit (implied annual interest rate) from other terms of the loan contract, and in turn have difficulty identifying the cheapest source of credit from a menu of loan contracts (Stango and Zinman, 2011). Enforcement of truth-in-lending laws that mandate disclosure of annual percentage rates (APRs), leads to lower borrowing costs for such individuals (Stango and Zinman, 2011). In this context, binding usury restrictions prevent price discrimination through interest rates, even where APR disclosure is mandated. Given the substantial heterogeneity in vehicle quality and uncertainty about value, it may be difficult for consumers to identify the best deal among offers differentiated in the price mark-up as opposed to offers differentiated separately in the price mark-up and the price of credit, which is much more homogenous. While a sophisticated consumer can adjust for vehicle quality and compare the loan payments across transactions, customers with less sophistication and less time or bandwidth to search may be harmed because the usury restriction prevents them from identifying and negotiating the cost of the loan separately from the cost of the vehicle.

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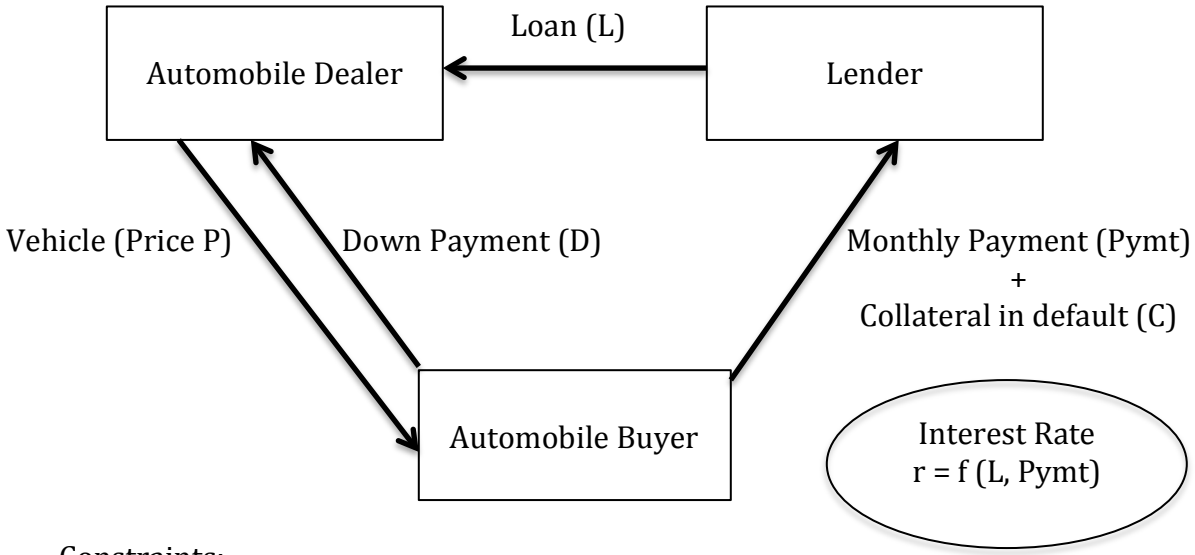
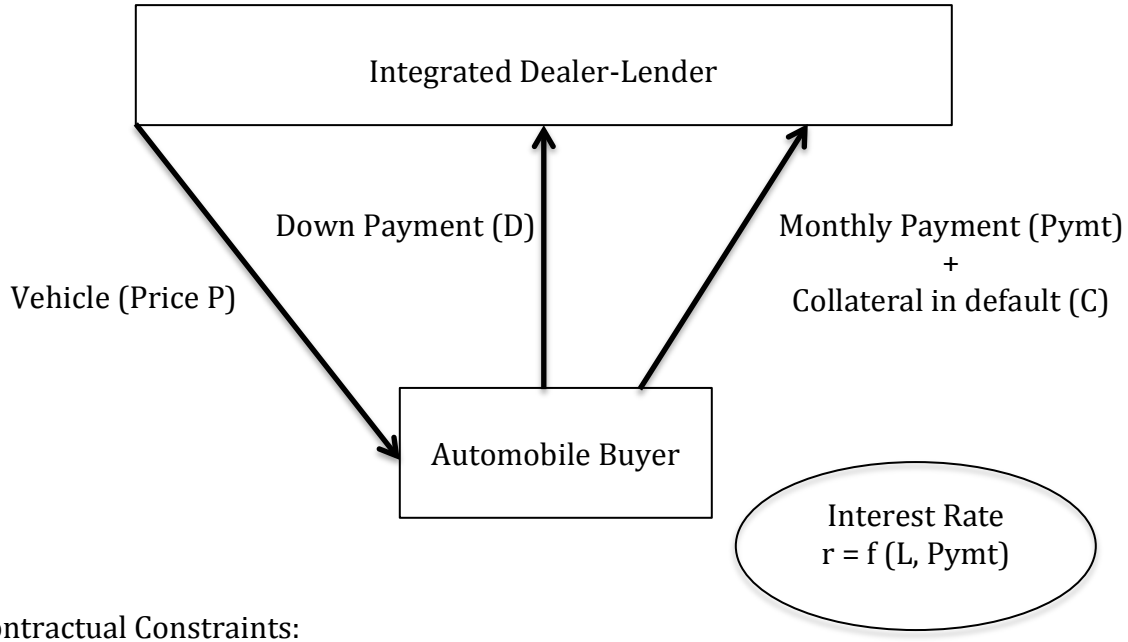


Constraints:

1) Sales contract – equal value exchanged: $P = D + L$
2) Usury limit: $r \leq r_{usury}$
3) Lender zero profit: $L \leq PV(Pymt, C)$

Figure 1: Sale and Loan Contracting with Arm's Length Financing



Contractual Constraints:

1) Sales contract – equal value exchanged: $P = D + L$
2) Usury limit: $r = f(L, Pymt) < r_{usury}$

Figure 2: Sale and Loan Contracting with Dealer Financing

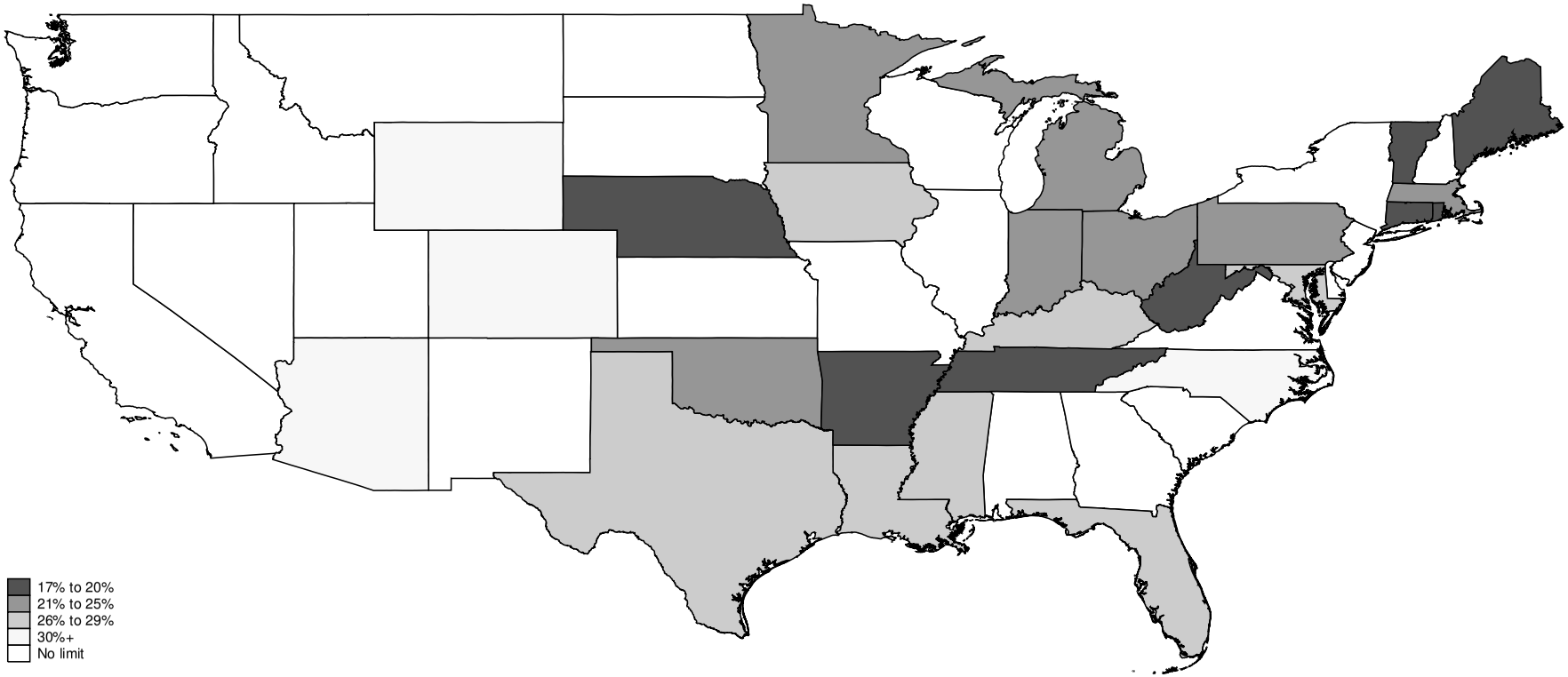


Figure 3: Geographic Distribution of Usury Limits

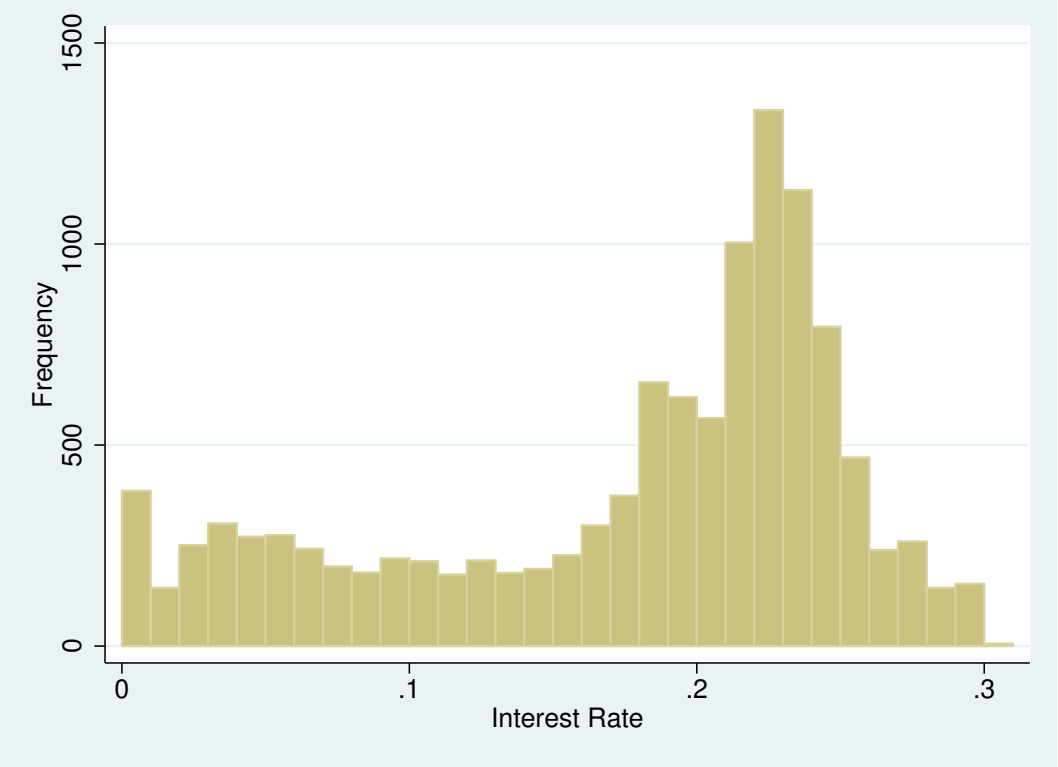


Figure 4: Histogram of Dealer-financed Loans in States without Usury Limits

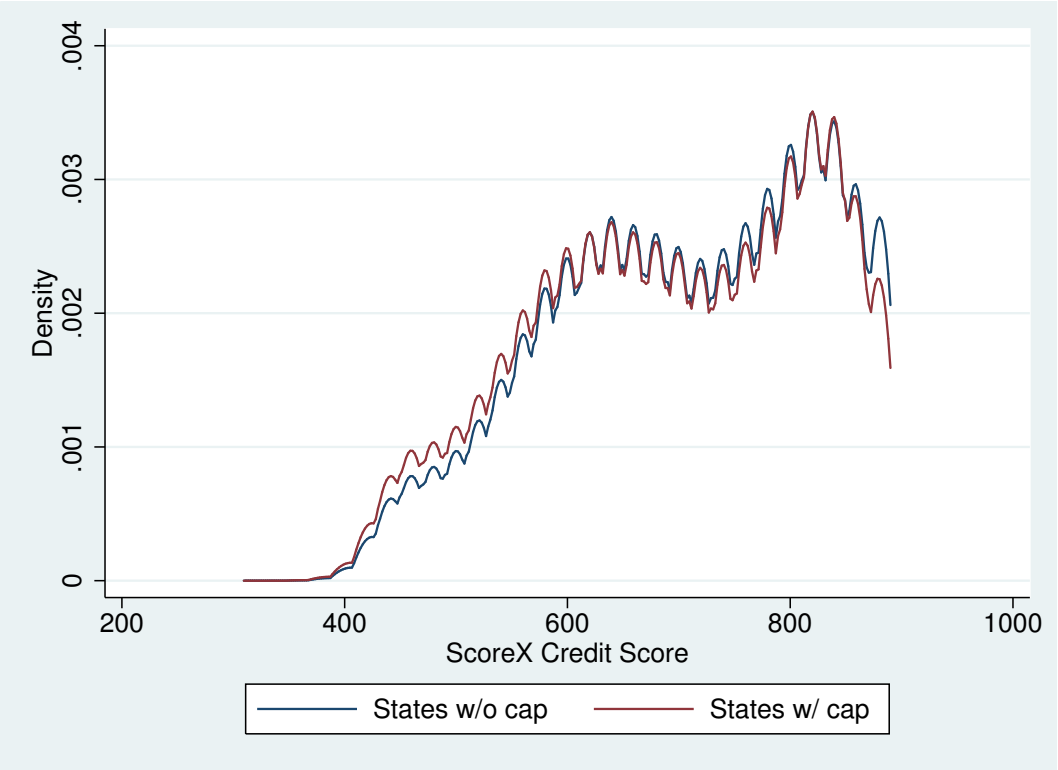


Figure 5: Kernel Density of Credit Scores for Borrowers with Auto Loans, by Usury Cap Presence

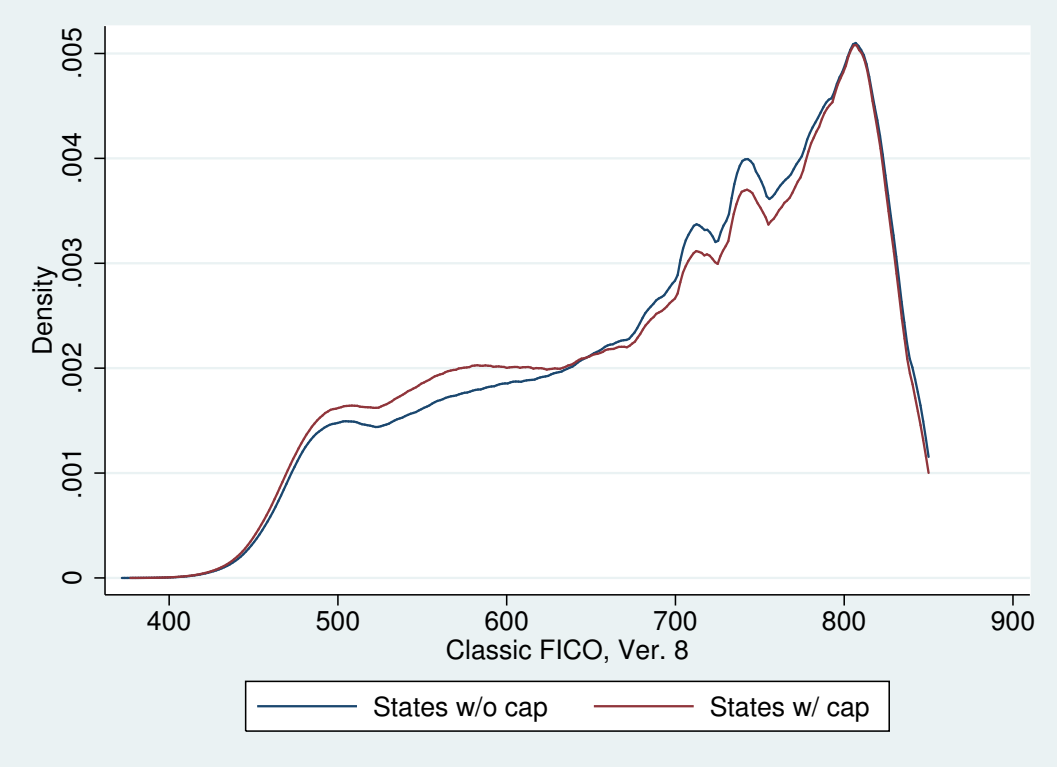


Figure 6: Kernel Density of Credit Scores for Population, by Usury Cap Presence

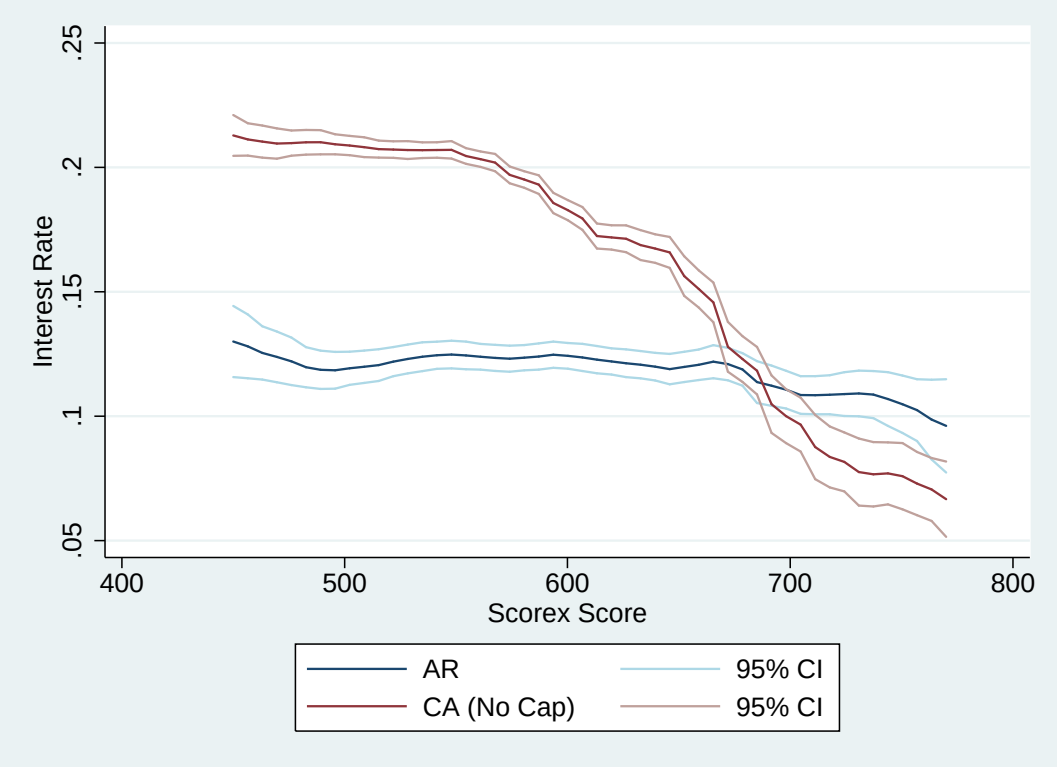


Figure 7: Local Regression of Interest Rate on Credit Scores, AR(Cap) v. CA(No Cap)

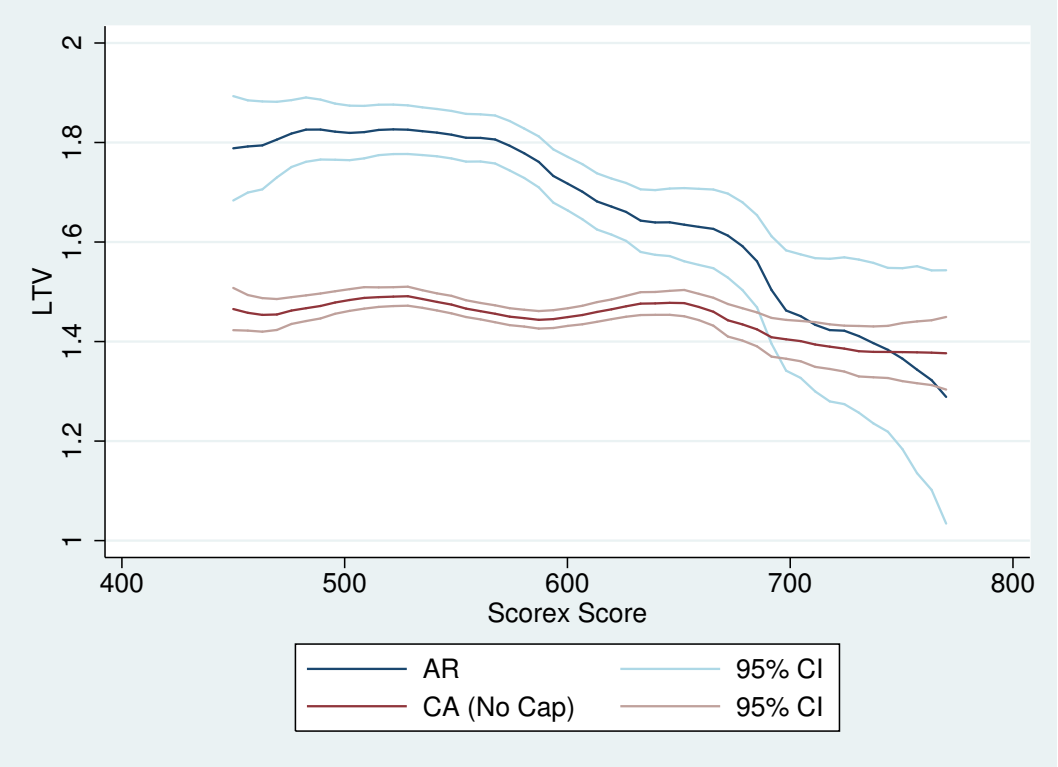


Figure 8: Local Regression of Loan-to-value on Credit Scores, AR(Cap) v. CA(No Cap)

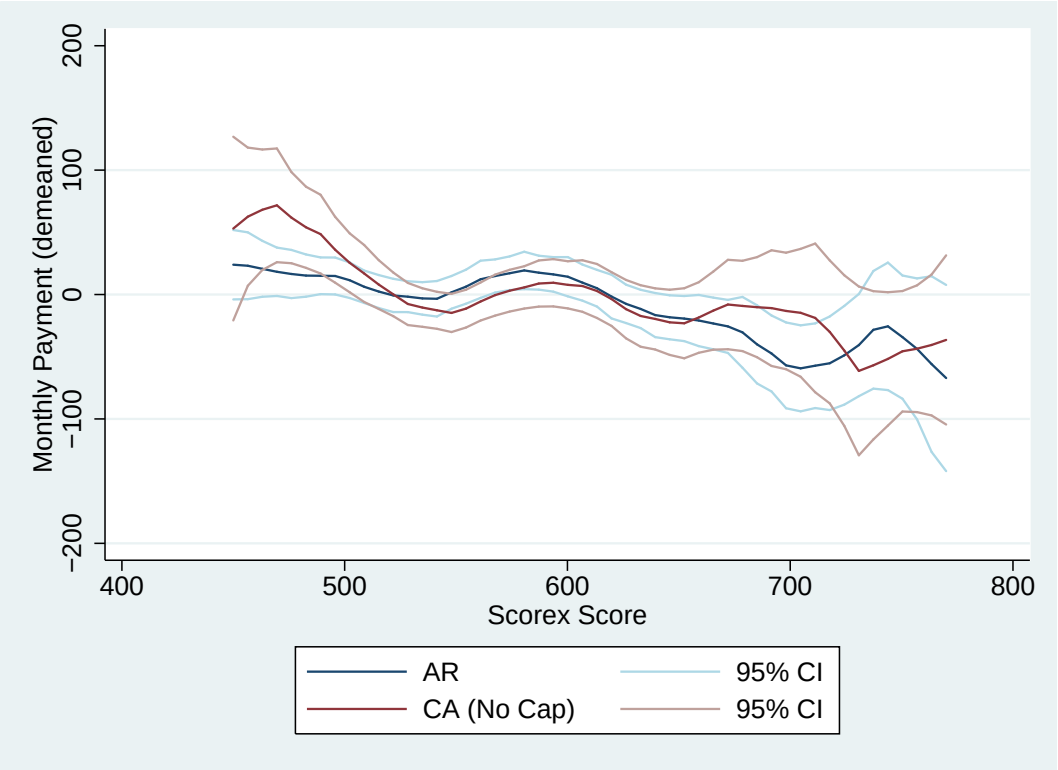


Figure 9: Local Regression of Demeaned Monthly Payment on Credit Scores, AR(Cap) v. CA(No Cap)

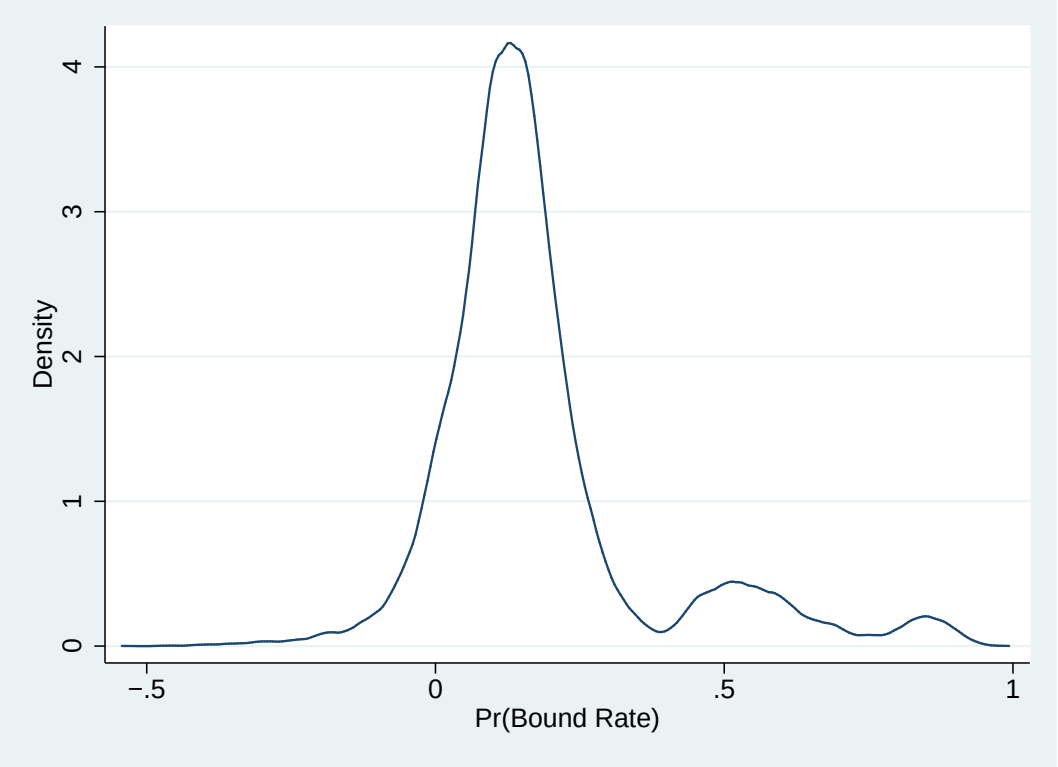


Figure 10: Kernel Density Estimate of Pr(Bounded Interest Rate) from IV First Stage

Table 1: Loan Payment Schedules with Equal Payments, Different Interest Rate-Loan Amount Combination

	Loan 1: $9,000, 30% APR, 36 months				Loan 2: $10,280, 20% APR, 36 months			
Period	Monthly Payment	Principal	Interest	End-of-period Principal Balance	Monthly Payment	Principal	Interest	End-of-period Principal Balance
1	$382	$157	$225	$8,843	$382	$211	$171	$10,070
-								
12	$382	$206	$176	$6,833	$382	$253	$129	$7,507
-								
24	$382	$277	$105	$3,919	$382	$308	$74	$4,124
-								
36	$382	$373	$9	$0	$382	$376	$6	$0

Note:

Table 2: Maximum Interest Rate for Auto Loans, by State

State	Limit (%)	Varies by?	State	Limit	Varies by?
AK	24 - 36	Loan amount	MT	None	
AL	None		NC	30.60 - 47	Vehicle age
AR	17		ND	None	
AZ	24 - 36	Loan amount	NE	18	
CA	None		NH	None	
CO	21 - 36	Loan amount	NJ	None	
CT	17 - 19	Vehicle age	NM	None	
DC	23.50 - 28.33	Vehicle age	NV	None	
DE	None		NY	None	
FL	29	Vehicle age	OH	25	
GA	None		OK	21	
HI	24		OR	None	
IA	24 - 27	Vehicle age	PA	18 - 21	Vehicle age
ID	None		RI	18	
IL	None		SC	None	
IN	21	Loan amount	SD	None	
KS	None		TN	20	
KY	23 - 26.50	Vehicle age	TX	18 - 26	Vehicle age
LA	21 - 27	Loan amount	UT	None	
MA	21		VA	None	
MD	22 - 27	Vehicle age	VT	20	
ME	18		WA	None	
MI	25		WI	None	
MN	19.75 - 23.25	Vehicle age	WV	18	
MO	None		WY	21 - 36	Loan amount
MS	21 - 28.75	Vehicle age			

Note: "None" includes both states without any rate limits, and those with limits beyond the maximum rate found within the data for that state

Table 3: Does Prevalence of Dealer Financing Loans Vary with Usury Restrictions?

	Dependent variable: Proportion of Financed Purchases with Dealer Financing		
	(1)	(2)	(3)
Cap	0.0312	-0.0300***	
	(0.0195)	(0.0107)	
Cap * Scorex 300 - 420		-0.0695	-0.0582
		(0.109)	(0.0994)
Cap * Scorex 420 - 480		-0.0224	-0.00491
		(0.0644)	(0.0647)
Cap * Scorex 480 - 540		0.188*	0.188*
		(0.107)	(0.102)
Cap * Scorex 540 - 600		0.176**	0.157**
		(0.0697)	(0.0607)
Cap * Scorex 600 - 660		0.119***	0.0962***
		(0.0401)	(0.0326)
Cap * Scorex 660 - 760		0.0202	0.0154
		(0.0143)	(0.0188)
Cap * Scorex 760 + (Excluded)			
Constant	-0.0491***	-0.0154***	-0.0267*
	(0.0156)	(0.00488)	(0.0141)
Time Effects	Yes	Yes	Yes
Credit Score	Yes	Yes	Yes
StateEffects	No	No	Yes
Adj. R-sq.	0.510	0.513	0.525
Obs.	840,287	840,287	840,287

Note: State-level clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01

Table 4: Count of Loans by State, by Presence of Rate Cap

Rate Cap Exists			**No Rate Cap**		
State	*Loan Ct.*	*Pct.*	*State*	*Loan Ct.*	*Pct.*
TX	16,544	59.56 %	CA*	6,152	52.26 %
FL	2,216	7.98 %	IL	706	6.00 %
IN	1,413	5.09 %	AL	632	5.37 %
OH	1,396	5.03 %	MO	592	5.03 %
AR	1,184	4.26 %	GA*	460	3.91 %
PA	1,177	4.24 %	NM	438	3.72 %
TN	866	3.12 %	SC	414	3.52 %
IA	656	2.36 %	VA	394	3.35 %
LA	379	1.36 %	NV	342	2.91 %
NC	353	1.27 %	KS	322	2.74 %
Other	1,591	5.73 %	Other	1,320	11.21 %
Total	**27,775**	**70.23 %**	**Total**	**11,772**	**29.77 %**

Note: CA and GA laws require caps on some loans as a function of loan amount.

Table 5: Summary Loan Characteristics, by Presence of Interest Rate Cap in State of Sale

Variable	No Rate Cap	Rate Cap	Total
Credit Score	588.02	572.65	577.23
	(85.95)	(79.19)	(81.56)
Interest Rate	0.18	0.19	0.19
	(0.09)	(0.07)	(0.08)
Monthly Payment	405.27	402.31	403.19
	(294.61)	(132.06)	(195.15)
Term	46.92	39.92	42.00
	(16.99)	(12.80)	(14.53)
Amt. Fin.	$ 13,211.01	$ 11,971.53	$ 12,340.49
	($ 7,194.90)	($ 5,607.01)	($ 6,148.93)
LTV	1.56	1.67	1.64
	(0.44)	(0.44)	(0.44)
Vehicle Value (KBB)	9,510.39	7,739.72	8,266.80
	(6,321.69)	(4,393.51)	(5,109.54)
Obs.	9,417	18,738	28,155

Table 6: The Impact of Binding Usury Restrictions on Loan APR

Variable	(1) IV	(2) IV	(3) IV
Pr(Binding = 1)	-0.0571**	-0.0704**	-0.0709**
	(0.0282)	(0.0322)	(0.0314)
Vehicle Value (KBB)		-0.00265***	-0.00346***
		(0.000441)	(0.000844)
Amt. Financed ('000s)			0.000997
			(0.000742)
Term			-0.000129
			(0.000272)
Constant	0.227***	0.252***	0.255***
	(0.00344)	(0.00627)	(0.0117)
Time Effects	Yes	Yes	Yes
Credit Score	Yes	Yes	Yes
Credit x Cap	No	No	No
Observations	28,152	28,152	28,149
K-P F-statistic	3.333	3.627	3.914
Num. Deg. of Freedom	29	29	29
Denom. Deg. of Freedom	3736	3736	3736
Partial R-sq.	0.109	0.101	0.106

Note: Instruments incl. rate cap presence, level, and quadratic; credit tier; and cap and credit score interaction. Dealer-state clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01

Table 7: Regression Output for LTV Ratio

Variable	(1) IV	(2) IV
Pr(Binding = 1)	0.594***	0.442***
	(0.138)	(0.135)
Vehicle Value (KBB, '000s)		-0.0329***
		(0.00217)
Constant	1.324***	1.636***
	(0.0216)	(0.0290)
Time Effects	Yes	Yes
Credit Score	Yes	Yes
Credit x Cap	No	No
Observations	28,152	28,152
K-P F-statistic	3.333	3.627
Num. Deg. of Freedom	29	29
Denom. Deg. of Freedom	3,736	3,736
Partial R-sq.	0.109	0.101

Note: Instruments incl. rate cap presence, level, and quadratic; credit tier; and cap and credit score interaction. Dealer-state clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01

Table 8: Regression Output for Loan Length

Variable	(1) IV	(2) IV	(3) IV
Pr(Binding = 1)	-18.02**	-9.060	-14.34***
	(7.469)	(5.781)	(5.041)
Cap Size			
Vehicle Value (KBB)		1.645***	
		(0.121)	
Amt. Financed ('000s)			1.559***
			(0.0825)
Constant	58.19***	42.56***	38.97***
	(0.864)	(0.994)	(1.186)
Time Effects	Yes	Yes	Yes
Credit Score	Yes	Yes	Yes
Credit x Cap	No	No	No
Observations	28149	28149	28149
K-P F-statistic	3.333	3.626	3.820
Num. Deg. of Freedom	29	29	29
Denom. Deg. of Freedom	3736	3736	3736
Partial R-sq.	0.109	0.101	0.108

Note: Instruments incl. rate cap presence, level, and quadratic; credit tier; and cap and credit score interaction. Dealer-state clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01

Table 9: Regression Output for Loan Monthly Payment

Variable	(1) IV	(2) IV
Pr(Binding = 1)	-56.84	48.82
	(133.3)	(91.72)
Vehicle Value (KBB, '000s)		20.69***
		(2.554)
Constant	357.4***	161.2***
	(14.38)	(16.80)
Time Effects	Yes	Yes
Credit Score	Yes	Yes
Credit x Cap	No	No
Observations	28,152	28,152
K-P F-statistic	3.333	3.627
Num. Deg. of Freedom	29	29
Denom. Deg. of Freedom	3736	3736
Partial R-sq.	0.109	0.101

Note: Instruments incl. rate cap presence, level, and quadratic; credit tier; and cap and credit score interaction. Dealer-state clustered standard errors in parentheses, * p<0.10, ** p<0.05, *** p<0.01