CFPB Office of Research Working Paper Series

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

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2017-02

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March 2017

Abstract

We study the effects of interest rate ceilings on the market for automobile loans. We find that loan contracting and the organization of the loan market adjust to facilitate loans to risky borrowers. When usury restrictions bind, automobile dealers finance a greater share of their customers' purchases, which allows them to price credit risk through the mark-up on the product sale rather than the loan interest rate. Despite having little effect on who receives credit, usury limits therefore have a substantial effect on who provides credit and on the terms of credit granted. Usury limits may harm defaulting borrowers, who face greater liabilities in default than they would if loan contracts were unconstrained.

JEL classification: D14 (Personal Finance), G2 (Financial Institutions and Services)

Keywords: Household finance, consumer credit, financial regulation, usury limit, loan contracting, credit rationing, seller finance, captive finance

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1 Introduction

Consumer protections play a fundamental role in credit markets by shaping information disclosure, underwriting, and the contracting environment (Posner and Hynes, 2002). In this paper we revisit an old debate about whether usury restrictions—limits on the maximum allowable interest rate—affect the terms and availability of credit. While legislative and case law developments substantially relaxed usury limits for bank lenders more than thirty years ago, the strong growth in non-bank lending to risky borrowers over the past two decades has made state usury limits relevant again, both in the payday loan market and in the automobile loan market that we consider in this study.

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, origination costs, and required capital returns. 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 propose and investigate an alternative view that applies to the large market for certain subprime automobile loans: vehicle sellers can 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.

The strategy of automobile dealers is simple. Vehicle loans are structured as installment contracts that require constant monthly payments for a fixed maturity (typically 3-6 years) and allow the lender to repossess the vehicle if the borrower defaults. Holding fixed the collateral, loan maturity, and principal amount, a lender is typically constrained to adjust the price of credit 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—marking up the sales price of the vehicle. When the usury limit binds, the integrated dealer-lender can subsidize a negative net present value loan with a higher-margin sale. Within the loan contract, this change amounts to increasing the stated loan amount (along with the sales price) rather than the interest rate, thereby achieving the desired monthly loan payment

while still complying with usury law. To give an example, a $9,000 loan at 30% interest has the same required monthly payment as a $10,650 loan at 20% interest over a four-year, fully amortizing term.

While dealers' contracting flexibility allows them to approximate an unconstrained loan, it does not completely eliminate the friction introduced by the usury limit. First, the constrained and unconstrained contracts are not identical. When a dealer raises the stated loan amount instead of the interest rate, the borrower's loan balance starts higher and remains higher until the end of the contract. Borrowers who prepay or default thus owe more to the lender when they terminate the contract. Second, risky borrowers may pay higher prices for credit, as their purchases depend upon financing from automobile sellers rather than a broader, and potentially more competitive, universe of third-party lenders. In an equilibrium with usury limits and dealer financing, therefore, few borrowers are completely excluded from the market, but dealers provide captive financing for a larger share of purchases and borrowers that receive dealer financing face different loan terms—lower interest rates, larger loan-to-value ratios, and possibly higher loan payments—than they would in the absence of usury limits.

Our analysis tests these predictions using novel data on vehicle sales and financing from Experian. The data cover 28 million new and used vehicle sales transactions between January 2011 and August 2013. Experian collects vehicle transaction information from administrative records at Departments of Motor Vehicles: the date of the sale, the vehicle type, the dealer's name and location, and the lienholder's name. Experian supplements each transaction record with an estimate of the vehicle's value provided by the National Automobile Dealers Association (NADA) Used Car Guide.[1] Experian also supplements the transaction records with information from the purchaser's credit record: the borrower's credit score and the loan amount, maturity, interest rate, and required payment. From the transaction-level database, Experian releases de-identified and aggregated information for statistical analysis. Our analysis, in particular, relies on the average transaction characteristics in each unique dealer-lender-month-credit score bin (20-point intervals) cell. In some portions of the anal-

[1]For new vehicles, this estimate is the manufacturer's suggested retail price (MSRP) and for used vehicles, this estimate is the average trade-in value given the vehicle's make, model, model year, and location.

ysis, we also use the Consumer Financial Protection Bureau's (CFPB) Consumer Credit Panel, a national sample of de-identified consumer credit records.

Usury limits matter for a significant portion of auto loan transactions. The majority of states limit interest rates, with ceilings ranging from 17 to 36 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). The strategy by which national credit card and mortgage lenders have typically avoided usury limits—chartering as a national bank exempt from state lending laws or locating in a state without usury limits such as South Dakota—proves infeasible for most auto loans.[2]

We begin by studying rationing, and then proceed to analyze the prevalence of dealer financing and the contract terms of dealer-financed loans. Our analysis relies primarily on the variation in usury limits across states, but we also examine within-state variation in borrower outcomes—over time, across borrowers, and across lenders—to address potential state-level omitted variables.

Our first finding is that borrowers still receive loans when usury limits bind, but that non-dealer loans are smaller than they would be if rates were unconstrained. We observe that risky borrowers comprise a similar share of borrowers, regardless of whether a state imposes an interest rate ceiling. This finding holds not only in the cross-section of states, but also in the time-series for Arkansas, which raised its usury limit from below 10% to 17% in the late-2000s. The share of auto loans granted to subprime borrowers in Arkansas tracks closely with peer states both leading up to, and following, the change in usury limit. The average size of non-dealer auto loans, however, increases by more than 5% in Arkansas relative to peer states during this period. This expansion of credit suggests that borrowers were rationed prior to the change; they accepted a smaller loan, perhaps with stronger collateral coverage (Barro, 1976; Assuncao et al., 2014), to qualify for credit at the constrained rate. The absence of complete rationing is somewhat surprising, however, since liquidity constraints prevent some automobile buyers from increasing their down payment (Adams et al., 2009; Attanasio et

[2]Specifically, the local dealer's involvement as a credit intermediary has led banks to follow the lending laws applicable in the dealer's state rather than their own jurisdiction.

al., 2008). We believe our subsequent findings regarding dealer financing help explain how constrained buyers continue to finance purchases without promising larger down payments or higher interest payments.

Our second finding is that the organization of the vehicle loan market differs quite dramatically when there is a usury limit. Integrated dealer-lenders provide a substantially higher share of loans to risky borrowers in states with usury limits. Among buyers with credit scores below 560 (roughly the bottom decile of buyers), for example, the proportion that receives dealer financing increases from 23% in states without a limit to nearly 36% in states with a limit. Notably, the likelihood of dealer financing is not uniformly higher in these states—dealer financing increases particularly for the riskiest subprime borrowers, for whom usury limits are most likely to bind. These findings are consistent with our hypothesis that dealers play an important role in facilitating loans for risky borrowers that cannot receive credit from outside lenders.

Our remaining findings relate to the contract terms of dealer-financed loans. We use a two-stage regression procedure to quantify the differences in loan terms where the usury ceiling is predicted to bind. In the first stage, we predict the likelihood that a borrower faces a binding usury ceiling, given the borrower's credit score and the level of the usury ceiling in his state. In the second stage, we regress a given feature of the borrower's loan contract, such as the interest rate, on the borrower's predicted probability of a binding usury limit. The identifying variation in our model comes from variation in the tightness of usury limits across states and among borrowers of different credit risk. 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 a given individual.

We find that usury limits reduce interest rates, but also lead to higher loan-to-value ratios on dealer-financed loans. Our estimates imply that a binding usury limit, on average, reduces the interest rate by six to eight percentage points, but raises the loan-to-value ratio by 40 to 60 percentage points. Jointly, these two changes actually raise the required monthly loan payment for a vehicle of similar value and a contract of similar maturity. That is, the increase in the loan amount more than offsets the decline in the interest rate, leading to a higher monthly payment.

We furthermore show that the elevated loan-to-value ratio that we observe is specific to dealer loans. Among non-dealer loans, a binding usury limit reduces the interest rate but does not raise the loan-to-value ratio or the loan payment. This contrast in findings between dealer and non-dealer loan contracts helps narrow, if not eliminate, the concern that variation in the identifying variation in usury limits is confounded with other demographic or policy differences across states. Had our findings on dealer loan contracts been driven by such state-level differences, we would have expected the risky borrowers served by third-party lenders to display elevated loan-to-value ratios as well.

Data limitations give rise to two important caveats. First, Experian does not measure vehicle down payments and sales prices, so we cannot directly test whether borrowers pay higher prices relative to collateral value when usury limits bind. Though the monthly loan payment rises, we cannot rule out the possibility of an offsetting decline in the down payment. We do note, however, that our estimated increase in the loan-to-value ratio is too large to be explained by the elimination of the down payment, which rarely exceeds 10% of the sales price (or 20% of the vehicle acquisition cost) among dealer-financed purchases. Second, Experian only observes the contract terms of loans that are reported to its credit bureau. Since many dealers do not report loans to the credit bureaus, we cannot be certain that our findings on loan contract terms generalize to the entire dealer financing market.

In light of our findings, how are automobile buyers ultimately affected by usury limits? When usury limits bind, some buyers accept less credit than they would prefer, while others, likely the most financially constrained buyers, make greater use of dealer financing. Despite receiving lower interest rates, these borrowers appear worse off in two ways. First, they face higher monthly payments, perhaps because the usury limit dampens competition from third-party lenders. Second, these customers face larger liabilities in default than they would in the absence of price restrictions. This difference is consequential, since a strikingly high share—more than 30%—of dealer-financed borrowers default.

Our work studies the same market, but addresses very different questions, as three recent papers on subprime automobile lending. Those papers use data from a single automobile dealer to examine the roles of liquidity constraints, adverse selection, and moral hazard in credit demand and repayment (Adams et al., 2009), as well as the dealer's responses in credit

scoring (Einav et al., 2013) and loan contract design (Einav et al., 2012). By contrast, we use data from many dealers to characterize the market-wide impact of usury restrictions on credit provision and contracting. Our analysis of contracting differs furthermore by examining the friction introduced by usury restrictions rather than imperfect information.

A large body of work examines the impact of usury limits and generally finds that credit supply declines where usury limits bind.[3] Our contribution is to show that seller financing can be used to avoid interest rate restrictions. The idea that seller financing creates pricing flexibility can be relevant outside the automobile market as well, for example among retailers that finance durable goods for financially constrained customers. Economists at the Federal Trade Commission, for example, have noted that rent-to-own retailers can manipulate cash prices to reduce stated interest rates (Lacko et al., 2000). Among studies of usury limits, only Peterson (1983) investigates this possibility, documenting a shift toward retail credit in Arkansas when compared to its more permissive peer states.[4] Our study builds on the FTC's conjecture and Peterson's study by providing comprehensive evidence that such practices presently occur within the automobile loan market, the largest segment of the subprime credit market.[5]

The ability of subprime dealers to earn profits from both the financing and sale of the vehicle resembles captive financing provided by automobile manufacturers and trade credit provided by suppliers to their customers. Our paper contributes to the academic literature on these topics by showing that regulatory frictions motivate seller financing, as do asymmetric

[3]Interest rate limits on consumer loans are associated with lower lending volumes (Greer, 1974; Ostas, 1976), greater rejection rates (Greer, 1975; Villegas, 1982; Rigbi, 2013), lower average credit losses (Goudzwaard, 1968; Johnson and Shay, 1970), lower loan-to-value ratios and shorter maturity in mortgage contracts (Ostas, 1976), and less homebuilding activity (Robins, 1974). Binding rate ceilings in the commercial loan market also reduce credit supply and economic activity (Benmelech and Moskowitz, 2010). Restrictions on credit card fees imposed by the 2009 Credit Card Accountability Responsibility and Disclosure Act, by contrast, reduced borrowing costs for risky borrowers without any offsetting changes to interest rates or credit limits (Agarwal et al., 2015). Usury limits may even *raise* credit prices for risky borrowers by providing a focal point for tacit collusion among lenders (Knittel and Stango, 2003).

[4]The evidence in the paper's Table I appears inconclusive regarding the cause of the shift, however, as even low-risk and high-income borrowers favor retail credit in Arkansas, despite being less likely to be constrained by the usury limit.

[5]For comparison, in 2012 lenders originated approximately $90 billion in auto loans to consumers with credit scores below 620 (Federal Reserve Bank of New York, Household Debt and Credit Quarterly Report, https://www.newyorkfed.org/microeconomics/databank.html), compared to $49 billion in payday loans (Hecht, 2014).

information in the credit market and market power in the product market.[6]

The rest of the paper proceeds as follows. Section 2 provides background on vehicle financing. Sections 3 and 4 introduce the data and report our findings. Section 5 concludes with a discussion of welfare and policy implications.

2 Customer Financing by Automobile Dealers

Automobile dealers play an integral role in facilitating loans for their customers. Our analysis focuses on the segment of the 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, as is common in the "prime" market, 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 sell used cars that are older and of lower value than the inventory carried by dealers serving prime customers.[7] An important aspect of this sales process, from the perspective of our analysis, is that it treats the purchase and financing as a bundle. 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

[6]Research on captive finance and trade credit highlights various explanations for seller financing. Those reasons include sellers' differential information (Stroebel, 2016; Petersen and Rajan, 1997), their advantage in loan collection and collateral liquidation (Mian and Smith, 1992; Petersen and Rajan, 1997), their control over collateral value (Murfin and Pratt, 2015), their desire to price discriminate and exploit market power in the goods market (Brennan et al., 1988; Barron et al., 2008), and their implicit equity stake in the customer (Petersen and Rajan, 1997). Without testing a particular motivation for seller financing, Benmelech et al. (2016) document the importance of captive finance to automobile sales and the imperfect substitution between captive and third-party credit during the 2007-2009 financial crisis. Our finding that vehicle sales and lending become integrated in response to usury restrictions is reminiscent of the finding in Breza and Liberman (2017) that firms internalize procurement when faced with restrictions on trade credit contracts.

[7]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.

from there to find an acceptable vehicle and agree upon the down payment and loan terms.

2.1 Loan Contracting with Dealer Financing

To clarify the way in which dealer financing changes loan contracting, we offer a stylized example of the vehicle sales and financing process. Panels A and B of Figure 1 summarize the cash flows among the customer, dealer, and lender in transactions with and without dealer financing.

Panel A characterizes a transaction without dealer financing. The customer and dealer agree to a sales contract in which the dealer exchanges the vehicle for a given price (P), to be funded at the closing through a down payment (D) from the customer and a payment (L, equal to the loan amount) from the lender to the dealer. The customer and lender, in turn, agree to a loan contract specifying the loan amount, 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—calculated as a function of the loan amount, the monthly payment, and the loan maturity—must not exceed the usury limit.

Panel B summarizes the cash flows in a dealer-financed purchase. The important difference relative to third-party financing is that the loan amount, L, never changes hands. This difference provides the dealer-lender more contracting flexibility. When a usury restriction limits the interest rate, the stated loan amount can be adjusted upward to get the desired loan payment. For example, a 48-month amortizing loan with a constant payment of $324 per month can be specified as a $9,000 loan at 30% interest or a $10,650 loan at 20% interest. Whether there is a usury limit at 20% or not, the dealer can exchange the same collateral for the same down payment and promised loan payments. The sales contract can likewise be adjusted to increase the stated sales price, so that there remains a fair exchange of value in the sale (P = D + L). This strategy is only feasible with integration of sales and lending.[8]

While the required loan payment can be replicated by raising the loan amount rather

[8]In principle, side payments from the dealer to the lender would be another way to induce lenders to originate negative-net present value loan contracts. Our understanding is that such side payments made on a loan-by-loan basis would either be illegal or would be treated as reducing the loan amount for the purpose of computing the borrower's contractual interest rate under usury law.

than the interest rate, the constrained and unconstrained contracts are not identical. A loan with a higher loan amount and lower interest rate will have a larger principal balance throughout the life of the loan. Table 1 illustrates this point by summarizing the payment schedules of the two sample loans discussed above. One year after origination, the repayment amount on the 30% loan is $7,633, which is nearly 15% lower than the $8,720 repayment amount on the 20% loan. Borrowers that anticipate early termination of the contract, either through refinancing or default, would therefore prefer the unconstrained contract with the higher interest rate and lower loan amount. The difference in repayment amount decreases over time, but can be large early in the contract, when many BHPH borrowers default. Industry sources report a typical default rate of approximately 31 percent, with the highest frequency of default occurring in the fifth month after origination (NIA, 2014).

3 Data Sources

Our main data source is Experian's AutoCount® database, which contains de-identified information on automobile purchases, merged with consumer credit information to be used for statistical purposes. Experian identifies purchases using vehicle registration information from state Departments of Motor Vehicles. This information includes the date and location of the transaction, the type of vehicle (make, model, model year, and whether new or used), and the names of the buyer, automobile dealer, and lienholder. Experian supplements each record with an estimate of the vehicle's value from the NADA Used Car Guide—for new vehicles, the value is the MSRP and for used vehicles, the value is the average trade-in value conditional on the make, model, model year, and location of sale. Experian further supplements each record with credit information collected by its credit bureau, specifically the buyer's credit score at the time of the transaction, as well as any loan information reported by the lender at origination—the interest rate, loan maturity, monthly payment, and loan amount. The de-identified database does not include the sales price or the loan down payment. Our sample covers the time period of January 2011 through August 2013.

A pertinent feature of the AutoCount data is aggregation. While the underlying records are at the transaction level, Experian only releases aggregated statistics—the count of trans-

actions and the average transaction characteristics—for specified transaction groupings. 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.

Another pertinent feature of the AutoCount data is that Experian only observes contract terms for lenders that report to its credit bureau. While the Experian data are, to our knowledge, the most comprehensive source of information on dealer-financed loans, many BHPH dealers choose not to report their loans to the credit bureaus.[9] Accordingly, an important caveat to our analysis of loan contract terms is that we do not observe the entire market, and the sample that we do observe may not be representative.

We also use the CFPB's Consumer Credit Panel (CCP), a longitudinal sample of approximately 5 million de-identified credit records that is nationally representative of the credit records maintained by one of the national credit reporting agencies. The data used to estimate auto transactions relative to the general population comes from December 2012, while the analysis of loan characteristics relies on loans reported by auto finance companies (excluding dealer-lenders) and appearing on credit reports as of March 2014.

We compiled information on 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). For use as control variables, we merged information on median household income, the poverty rate, and the unemployment rate at the zip code level from the 2011 5-year American Community Survey.

[9] In this regard, BHPH lenders are similar to other alternative credit providers such as payday lenders, automobile title lenders, and pawnshops.

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. Most commonly, the state imposes a single maximum interest rate applicable to all auto loans. In other cases, the state sets a maximum interest rate that increases with the age of the vehicle financed or decreases with the initial loan amount. For example, Pennsylvania, imposes a maximum interest rate of 18% per year on vehicles less than 2 years old and 21% per year on vehicles more than two years old. In Indiana, 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 $2,000 and $4,000, and 15% per year on the portion above $4,000, with a minimum cap of 25%. The usury ceiling 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.[10]

For each loan in AutoCount, we code the applicable usury ceiling based on the auto dealer's location and the initial loan amount. Our sample does not include a measure of vehicle age. 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. Figure 2 shows the geographic distribution of the average interest rate limit in the sample. States in the western United States are less likely to impose a usury ceiling. Within the Midwest and East, the usury limits are fairly well dispersed geographically.

Our main analysis relies on cross-sectional variation in state usury limits, which were static during the time period covered in our AutoCount sample. Arkansas, however, did change its limit in the late-2000s, and we analyze this period in the CCP data. Prior to the change in law, Arkansas' usury limit was set at the lower of 17% or 5 percentage points above the Federal Reserve discount rate. The resulting limit hovered around 10% between 2006 and 2008, and then fell to a low of 5.5% by the beginning of 2009. In response to this decline, Congress incorporated text into a federal spending bill that, as of June 24, 2009,

[10] Appendix Table A1 summarizes the interest rate caps applicable in each state.

overrode the Arkansas regulation and raised the state's maximum allowable interest rate to 17%. Arkansas voters subsequently made this change permanent by amending the state's law and raising the usury limit to 17% as of January 2011.

4.2 Do Usury Restrictions Cause Rationing?

We begin our analysis by investigating whether usury restrictions cause rationing of automobile loans. We first consider complete rationing of the type described by Stiglitz and Weiss (1981), whereby borrowers fail to receive a loan of any size. We then consider partial rationing, whereby rationed borrowers still get credit, but receive smaller loans than they prefer at the available interest rate.

If binding usury restrictions cause complete rationing, then 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 usury ceilings to the analogous distribution in states without usury ceilings. Using the entire AutoCount sample, which includes 28 million financed automobile purchases, we calculate the fraction of financed purchases that go to customers in each 20-point credit score bin c. That is, we divide the number of financed purchases in each credit score bin ($FinancedPurchases_c$) by the total number of purchases across all credit score bins ($TotalPurchases$). Figure 3 plots the distribution of this variable within two subsamples, states that impose a usury limit and states that do not. The distributions are quite similar, with a slight leftward shift for states with usury limits, indicating that high-risk borrowers receive a slightly *greater* share of auto loans. This evidence is counter to the credit rationing hypothesis, as low credit score borrowers do not comprise a smaller fraction of loans in states with usury limits.

Our findings are similar when we analyze the fraction of the population in each credit score bin that receives an automobile loan. We divide the same numerator as above, $FinancedPurchases_c$, by the estimated population of individuals in credit score bin c, $TotalPopulation_c$, as measured in the CCP data. The resulting fraction measures the probability of receiving an auto loan in each credit score grouping. Figure 4 plots this fraction by credit score grouping and by usury status. Across all credit score groupings, the data show

higher rates of borrowing in states with usury limits. These differences are fairly constant across credit score groupings, so that after removing a fixed effect for states with usury limits, we find little evidence that high-risk borrowers are rationed in states with rate limits.

As further tests of rationing that exploit within-state variation in usury limits, we examine changes in provision and size of automobile loans following Arkansas' relaxation of its usury limit in 2009. Using the CCP data, we measure the proportion of auto finance loans granted granted by third-party, or non-dealer, lenders to subprime borrowers (credit score below 650) in each month.[11] We then carry out a differences-in-differences analysis to evaluate whether the relaxation of usury limits expanded credit access in Arkansas relative to neighboring states Missouri, Oklahoma, Louisiana, Mississippi and Tennessee. If the relaxation of the usury limit in June 2009 expanded credit access for previously rationed borrowers, then we would expect the fraction of subprime loans or the size of subprime loans to increase in Arkansas relative to peer states.

Figures 5 and 6, respectively, plot the proportion of loans and the average size of auto loans granted to subprime borrowers in Arkansas and in neighboring states. In these figures, the raw data are smoothed using a quadratic local polynomial regression. The initial change in the Arkansas usury law, along with the later permanent change, are marked with vertical red lines. The proportion of loans granted to subprime borrowers in Arkansas tracks closely with peer states between 2006 and 2014. The average size of subprime loans, on the other hand, increases in Arkansas relative to peer states following its relaxation of the usury limit. Between late-2009 and 2012, the average loan size in Arkansas increases by $1,000, or roughly 5%, relative to peer states.

We formalize this analysis using a differences-in-differences regression. We estimate the model:

$$LoanAmount_{ist} = \alpha + \beta Post_t + \gamma Post_t \times Arkansas_s + \boldsymbol{\delta}_s + \boldsymbol{\theta}' \boldsymbol{X}_{it} + \mu r_t + \varepsilon_{ist}, \quad (1)$$

where *LoanAmount* is the dollar value of an automobile loan to individual i in state s at origination time t. *Post* is an indicator for whether the transaction took place after June

[11] The CCP data do not have the information needed to specifically identify dealer loans, so we are unable to examine the provision of dealer loans in this analysis.

2009 (the month in which the usury limit was raised) and *Arkansas* is an indicator for whether the individual resides in Arkansas. The sample includes all CCP borrowers with credit scores below 650 who reside in Arkansas or a neighboring state and received loans from auto finance companies. The model includes a control for the Federal Reserve discount rate at the time of the transaction, r. The model also includes, within the vector X, fixed effects for the borrower's credit score grouping (20-point bins) and the median income, unemployment rate, and poverty rate in the borrower's zip code. We estimate the model using ordinary least squares, with observations clustered by state in calculating standard errors.

The coefficient of interest is γ, which measures the change in the average loan amount in Arkansas relative to peer states following the June 2009 relaxation of the usury limit. The model's estimate for γ is \$567, with a standard error of \$199. The expansion of subprime automobile lending in Arkansas displayed in Figure 6 is thus strongly statistically significant.

In summary, our analysis of usury limits and credit rationing reveals that risky borrowers continue to receive automobile loans when usury limits bind. However, when usury limits are tight, borrowers receive smaller loans from third-party lenders. These results indicate rationing in the size of credit, with buyers adjusting by either raising their down payment or purchasing lower priced vehicles. Another alternative for buyers who would otherwise be rationed is to use dealer financing, as we explore in the next two sections.

4.3 Do Usury Restrictions Increase the Prevalence of Dealer Financing?

Using the full AutoCount sample of 28 million financed purchases, we test whether dealer financing becomes more prevalent in states with usury limits. We measure dealer financing based on the vehicle registration information that Experian collects from the Departments of Motor Vehicles. This information is quite comprehensive, since it relies on registration records and the borrower's credit score alone, rather than the automobile loan information reported to Experian's credit bureau. We classify a purchase as dealer financed if the names of the automobile dealer and lender match or if the lender is known by Experian or the CFPB to be under common ownership with the dealer. Since our analysis pertains to credit

provision by dealers rather than manufacturers, we do not classify as dealer financed the instances in which a manufacturer's "captive finance" division provides the loan.

The data extract we obtain from AutoCount is at the dealer-lender-month-credit score bin level. For each dealer-month, we measure the proportion of transactions in each 20-point credit score bin that are financed by the dealer itself.[12] We then estimate the following regression equation:

$$DealerFinanceShare_{cist} = \alpha + \beta Limit_s + \boldsymbol{\gamma}_c + \boldsymbol{\eta}_t + \varepsilon_{icst}, \tag{2}$$

where each observation pertains to customers within a given credit score grouping c who made a financed vehicle purchase from dealer i in state s and month t. The indicator variable $Limit_s$ takes the value of one if state s imposes an interest rate limit for auto loans, and zero otherwise. The vectors $\boldsymbol{\gamma}$ and $\boldsymbol{\eta}$ are fixed effects for the credit score bin and the month, respectively. To understand whether the marginal effect of a usury limit changes with borrower risk, we extend the model by interacting *Limit* with indicators for the borrower's credit score range. We estimate the model using ordinary least squares, with observations clustered by state in calculating standard errors.

Our predictions are two-fold: 1) a larger share of transactions will use dealer financing in states with usury limits, so that the estimated coefficient on *Limit* will be positive; and 2) within states that restrict interest rates, the marginal increase in dealer financing will be largest among risky borrowers for whom the usury limit is more likely to bind. That is, when *Limit* is interacted with indicators for the borrower's credit score range, we should find the largest interaction coefficient for borrowers with the lowest credit scores.

The regression estimates are displayed in Table 2. Overall, the share of transactions with dealer financing is approximately 2.9 percentage points (p-value < 0.05) higher in states that impose usury limits compared to states that do not. The second model allows for differential effects by credit risk. Its estimates show that the usury limit raises the prevalence of dealer financing by the largest amount for low-score buyers. Relative to similar buyers in states

[12] If the dealer made five financed sales within the credit score range 500-520 and financed two of them, the share of dealer financing would be 0.4 for that observation. The complement of this variable measures the share of financed transactions using outside lenders. Non-financed transactions are excluded.

without a cap, buyers in the 550 to 650 score range are 4.8 percentage points (p-value $<$ 0.05) more likely to obtain dealer financing when they reside in a state with a usury limit. Buyers in the riskiest grouping, with a credit score between 300 and 550, display an even larger shift toward dealer financing when faced with a usury limit. The estimated increase is 14.2 percentage points (p-value $<$ 0.05). For comparison, 23% of buyers in that credit score grouping receive dealer financing in states without usury limits. In proportion to this baseline rate, the 14.2-percentage point change is more than a 60% increase. In the final model, we add controls for state fixed effects to absorb differences in the prevalence of dealer financing that are common across borrowers of all credit scores in each state. We find that the estimated effects of the usury limit are nearly unchanged by the state fixed effects, which confirms that the pattern we document—increasing dealer financing among riskier borrowers—holds in the cross-section of borrowers within usury-limiting states.

4.4 Do Usury Restrictions Affect Loan Contracting?

The final portion of our analysis examines the loan contracts of borrowers for whom usury restrictions are expected to bind. Our conjecture is that dealers serve these borrowers by contracting around the usury limit—accounting for credit risk by adjusting the sales price and loan amount rather than the interest rate. Under this view, a binding usury limit will cause dealers to reduce interest rates but raise loan-to-value ratios.

Our analysis focuses on subprime loans (below a credit score of 650) for which AutoCount provides complete information on the interest rate, loan amount, maturity, collateral value, and monthly payment. We observe aggregated statistics—the number of transactions and the average of each variable—in each dealer-lender-month-credit score bin (20 point intervals) "cell." The full sample of dealer-financed loans includes 28,155 observations, covering 39,547 transactions. Within this sample, an important measurement issue remains. A cell with multiple loans will appear unconstrained by the usury limit if one loan has a low interest rate while the other transactions occur at the limit. To avoid systematically undercounting loans that are constrained by a usury limit, we further restrict our analysis to single-loan cells, which leaves us with a final sample size of 16,143 observations and transactions.

Summary statistics for the sample appear in Table 3. The average customer has a credit

score of 548 and purchases a vehicle with estimated trade-in value of $7,030. The average loan contract has an annualized interest rate of almost 20%, a maturity of roughly 3.5 years, and an initial principal balances that is 1.7 times as large as the trade-in value. This loan-to-value ratio is high because the denominator measures the vehicle's trade-in value, which is typically lower than its price in a retail sale.[13] Comparing transactions in states with and without usury limits, we observe substantially shorter loan contracts, higher loan-to-value ratios, and lower estimated collateral value for transactions in states with usury limits. Our analysis below attempts to identify whether these differences emerge due to the binding usury limit.

Before examining dealer loan contracts, we first confirm that usury limits are likely binding for many of the risky borrowers that seek dealer financing. Figure 7 plots the frequency of loans in each 1 percentage point interest rate bin for dealer-financed loans 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.

4.4.1 Analysis of Dealer Loan Contracts

A natural starting place for our regression analysis would be to estimate a model such as:

$$Y_{icst} = \alpha + \beta BindingLimit_{icst} + \mathbf{\Gamma}' \boldsymbol{X}_{it} + \varepsilon_{icst}. \tag{3}$$

The dependent variable is the loan characteristic of interest (e.g., the interest rate or loan-to-value ratio) for loan i, originated in month t to a borrower of credit score c and state of residence s. The variable *BindingLimit* is an indicator for whether the loan's interest rate is equal to the state-prescribed maximum rate. The problem with this model is that the *BindingLimit* indicator is a direct function of the interest rate and an indirect function of the other contract terms, so an ordinary least squares estimate for β is likely to be biased. To address this problem, we use a Two Stage Least Squares (2SLS) approach.

[13]The retail price is higher in part due to repairs and reconditioning performed by the dealer prior to re-sale. BHPH dealers spend, on average, an additional 15 to 20% (relative to their acquisition cost) to recondition the vehicle (NIA, 2014).

In the first stage, we estimate the likelihood that the usury restriction binds, conditional on the borrower's credit score and the applicable usury restriction:

$$BindingLimit_{icst} = \alpha + \gamma_0 Limit_s + \gamma_1 LimitLevel_{is} + \gamma_2 LimitLevel_{is}^2 + \boldsymbol{\theta}' Limit_s \times \boldsymbol{\lambda}_c + \boldsymbol{\Psi}' \boldsymbol{X}_{icst} + \nu_{icst}, \tag{4}$$

in which *Limit* is an indicator for whether the state imposes a usury restriction and *LimitLevel* is the level the usury restriction applicable to a loan of i's size.[14] We include a quadratic term for *LimitLevel* to allow for a non-linear relationship with the incidence of a binding limit. By interacting *Limit* with each 20-point credit score bin ($\boldsymbol{\gamma}$), we also allow the predicted tightness of the usury restriction to vary for borrowers of different credit risk.

In the second stage, we regress the loan characteristic of interest on $\widehat{BindingLimit}$, the likelihood of a binding restriction predicted in the first stage:

$$Y_{icst} = \alpha + \beta \widehat{BindingLimit}_{icst} + \boldsymbol{\Gamma}' \boldsymbol{X}_{icst} + \varepsilon_{icst}. \tag{5}$$

The identifying variation in $\widehat{BindingLimit}$ includes cross-state variation—differences in the existence and level of the usury restriction across states—as well as within-state variation for borrowers in different credit score groupings and with different loan sizes. The vector X contains control variables included in both stages of the regression analysis: in each model we include fixed effects for each 20-point credit score and for each origination month and, in some models, we include controls for the median income, unemployment rate, and poverty rate in the borrower's zip code. The exclusion restriction requires that, after conditioning on other covariates such as the credit score, a state's statutory limit on interest rates is unrelated to loan terms except through the restriction that it imposes on the contractual interest rate. This assumption would be violated if, for example, a state's other economic policies were correlated with its usury restriction and with conditions in the automobile financing market. In Section 4.4.2 below, we use the sample of non-dealer loans to investigate this issue.

[14] We set the *LimitLevel* variable to the maximum rate allowable by state law or to zero in states without a limit.

Table 4 displays our regression estimates for dealer loan contracts. We find that a binding usury limit reduces the interest rate but also raises the loan-to-value ratio and shortens the maturity. In the baseline model, which includes controls for the borrower's credit score and the origination date, the interest rate is 6.46 percentage points lower (p-value < 0.05), on average, when the usury restriction binds for certain. When we control for the estimated value of the vehicle purchased, the estimated estimated effect is -7.99 percentage points (p-value < 0.05). The further controls for economic conditions in the borrower's zip code do not meaningfully change this estimate. The estimated decline of 6.5 to 8 percentage points is sizable, as it would imply a 20 to 30% proportional decline for a borrower that might otherwise pay a 30% interest rate in an uncapped state. For the loan-to-value ratio, the baseline model indicates an increase of 59.6 percentage points (p-value < 0.01) when the usury restriction binds. After conditioning on the vehicle value, this estimate declines to 39.2 percentage points, but remains strongly significant. The final specification, which includes controls for local economic conditions, shows an increase in loan-to-value ratio of 47.1 percentage points when the usury limit binds. As a proportion of the 1.71 average loan-to-value ratio of dealer-financed loans (see Table 3), this 40 to 60 percentage point increase in the loan-to-value ratio represents a 25 to 35% increase, which is similar to the proportional decline in the interest rate.

The third set of results shows that the loan maturity also declines when the usury limit binds, by nearly 19.9 months (p-value < 0.05) in the baseline model and by roughly 10 months (p-value < 0.05) after conditioning on the vehicle value and local economic conditions. A 10-month decline is roughly 20% of the average loan maturity among uncapped loans. It is possible that dealers shorten loan maturity as a means of reducing default risk; shorter loans are exposed to less cumulative default risk and they also amortize more quickly, leaving the lender with stronger collateral coverage throughout the life of the loan.

The final pair of regressions examine the natural logarithm of the estimated vehicle value. In these specifications we do not observe a statistically significant difference in the vehicle value when the usury limit binds. The estimated coefficient is large, however, so we cannot rule out the possibility of a substantial change. The point estimates imply that dealers sell vehicles of lower value to customers for whom the usury limit binds. This change may

reflect the dealer's attempt to reduce the risk of default; holding fixed the customer's down payment, a reduction in the vehicle value sold would improve the lender's collateral coverage.

In further analysis reported in Table 5, we find that a binding usury limit actually raises the required monthly loan payment for a vehicle of a given value and a loan contract of a given maturity. We apply the same 2SLS model as above. In the first specification, which does not include a control for vehicle value, we estimate a positive but statistically insignificant increase of $34 per month when the usury limit binds for certain. After controlling for the estimated value of the vehicle purchased, we estimate that the loan payment increases by $113 per month ($p$-value < 0.01) when the usury limit binds for certain. When we add controls for economic conditions, we estimate that a binding usury limit raised the monthly payment by $120 per month. A portion of the increase in monthly loan payment pertains to the more rapid principal amortization on shorter loans. After accounting for differences in the loan maturity, we estimate that the loan payment is $87 per month higher when the usury limit binds.[15]

Our findings are consistent with the hypothesis that the usury limit induces dealers to price credit risk through the sales price mark-up and raise the loan amount relative to collateral value when they cannot raise the interest rate. It is striking that the monthly loan payment increases rather than decreases when the usury limit binds. This increase may reflect weakening in competition, as the usury limit prevents third-party lenders from offering similar loan contracts as dealer-lenders. Risky borrowers that are constrained to shop for credit only at dealers may end up paying higher prices. An important caveat to this discussion is that we do not observe the vehicle down payment (or sales price) within AutoCount, so we cannot rule out the possibility that borrowers make smaller down payments in exchange for larger loan payments. In principle, the increase in the loan-to-value ratio might also be explained by a reduction in down payment rather than an increase in the stated loan amount (and sales price). However, the size of the increase in the loan-to-value ratio that we observe makes this possibility unlikely. Dealer financed purchases have an average down payment of roughly 10% of the purchase price (NIA (2014)), or 20% of the dealer's vehicle acquisition cost. So, even if the down payment were reduced to zero when the usury

[15]We include fixed effects for loans in each one-year maturity range.

limit binds, the change in the loan-to-value ratio would fall substantially short of the 40 to 60 percentage point increase that we estimate.

4.4.2 Contrasting Dealer and Non-Dealer Loan Contracts

We have characterized the changes in dealer loan contracts as being *caused* by usury limits. An important issue to consider is whether the differences in usury limits that we study are confounded with other economic, demographic or policy differences across states. As an example, if demand for collateralized loans were higher in states that limit interest rates—borrowers might be rationed in unsecured credit and shift toward secured loans—then we might observe higher loan-to-value ratios even if dealer credit supply were unaffected by the usury limit. We use the sample of non-dealer loans to explore this issue, as our predictions about credit supply are specific to dealer loan contracts, whereas differences in credit demand ought to be manifest in the loan contracts of all subprime borrowers, including those that use third-party financing.

We apply a similar 2SLS identification strategy as above, expanding the sample to include both third-party and dealer loans. In the second stage, we estimate the model:

$$Y_{icst} = \alpha + \beta \widehat{Bind}_{icst} + \theta \widehat{Bind}_{icst} \times DealerLoan_i + \nu DealerLoan_i + \Gamma' X_{icst} + \varepsilon_{icst}, \quad (6)$$

where $DealerLoan$ takes the value of one for dealer loans and zero for non-dealer loans. In the first stage regression, we also expand the set of instruments to include the interaction of $DealerLoan$ with each of Equation 4's instrumental variables.

The regression estimates are displayed in Table 6. Third-party lenders continue to serve risky borrowers and provide lower interest rates as dictated by usury limits. When the usury limit is predicted to bind, the interest rate declines for both dealer and non-dealer loans, by an average of 3.49 percentage points (p-value$<$0.05). The estimate for the interaction coefficient θ is also negative, indicating a more substantial, but statistically insignificant, interest rate reductions for dealer loans at the constraint. In the other contract terms—the loan-to-value ratio and the loan maturity—dealer and non-dealer loans display different responses to a binding usury limit. Non-dealer loans show no differences in loan-to-value

ratio or loan maturity when the interest rate is constrained; for both outcomes, the estimate for β is small in magnitude and statistically insignificant. The interaction coefficient θ, on the other hand, is sizable and statistically significant for both outcomes. Those estimates indicate the same increase in the loan-to-value ratio and shortening of loan maturity that we documented previously for dealer loans at the usury constraint. The contrasting responses of dealer and non-dealer loans strengthens the interpretation of our prior findings. The increase in loan-to-value ratio on usury-constrained loans truly is specific to credit supplied by dealers, as we hypothesize, rather than symptomatic of all subprime loans in states with usury limits.

5 Conclusions

We study the effects of interest rate limits on the supply of automobile loans. We find that usury restrictions change the organization of the lending market by shifting subprime borrowers away from third-party lenders and toward automobile dealers that finance their customers' purchases. We propose that this shift in financing occurs because dealers have more flexibility in pricing credit risk. Dealers can raise the vehicle sales price (and stated loan amount) in lieu of the interest rate when they are serving a borrower for whom the usury limit binds. Our analysis of dealer loan contracts provides evidence in support of this hypothesis. Vehicle buyers for whom usury limits are expected to bind receive dealer loans with lower interest rates but higher loan-to-value ratios. These borrowers ultimately face larger monthly loan payments for a vehicle of a given value, as the increase in the loan-to-value ratio more than offsets the decrease in the interest rate.

How are borrowers ultimately affected by usury limits? While the traditional argument against usury limits is that they cause rationing, our analysis suggest that usury limits can be costly even when borrowers are not rationed. By encouraging dealers to price risk through the loan amount rather than the interest rate, usury limits cause risky borrowers to face larger liabilities upon prepayment or default. By preventing competition from third-party lenders, usury limits may also increase the rents of dealer-lenders at the expense of risky borrowers. Our study does not provide conclusive evidence on this issue, though the

increase in monthly loan payments that we observe is consistent with this possibility. As we describe below, usury limits may also work in opposition to the goals of truth-in-lending and fair credit laws.

Truth-in-lending laws mandate full and clear disclosure of the cost of credit as an annualized interest rate. These disclosures reduce borrowing costs for some individuals (Stango and Zinman, 2011), perhaps by making it easier to shop among offers and identify the cheapest source of credit from a menu of loan contracts that vary in maturity and repayment schedule. A binding usury limit interferes with this process by preventing price discrimination in the interest rate and encouraging price discrimination in other dimensions. Consumers with less sophistication or less time to search may have difficulty identifying the best deal when they can no longer negotiate the cost of the loan separately from the cost of the vehicle.

Fair credit laws prohibit disparate loan pricing by race, gender, age and origin. When credit risk is priced through the product mark-up, however, enforcement becomes more difficult, as regulators can no longer compare interest rates to judge whether dealers have treated borrowers fairly. Previous research on the automobile market indicates that there is scope for such discrimination in product pricing.[16] An important question for future research is whether dealer-financed borrowers, for whom credit risk may not be priced in the interest rate, receive appropriate protection under fair lending laws.

[16] Auto dealers and repair shops offer different prices depending on the customer's race and gender. Ayres and Siegelman (1995) find that dealers quote minority and female buyers higher initial prices for the same vehicle and Busse et al. (2013) finds that repair shops quote higher prices to women. Zettelmeyer et al. (2006) finds that minority buyers pay slightly higher prices for vehicles, but the differences are largely explained by other observable traits. Goldberg (1996) finds no significant differences in average vehicle purchase prices by race and gender, but she does find larger price dispersion among minority buyers.

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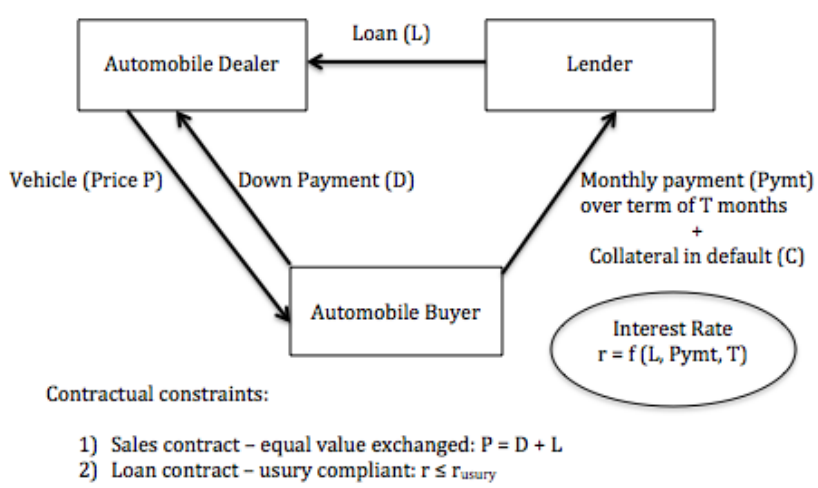
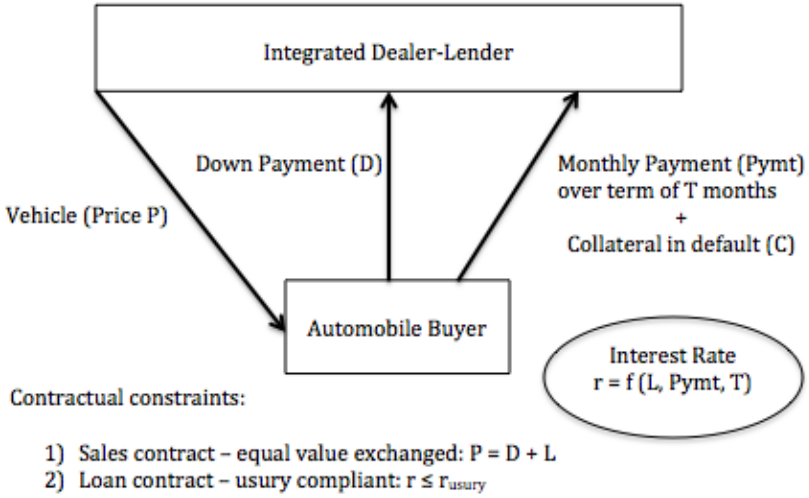


(a) Without Dealer Financing



(b) With Dealer Financing

Figure 1: Sales and Loan Contracting With and Without Dealer Financing. The figures above characterize the cash flows and contractual constraints of financed automobile purchases. Panel A describes a transaction with third-party (i.e., non-dealer) financing and Panel B describes a transaction with dealer financing.

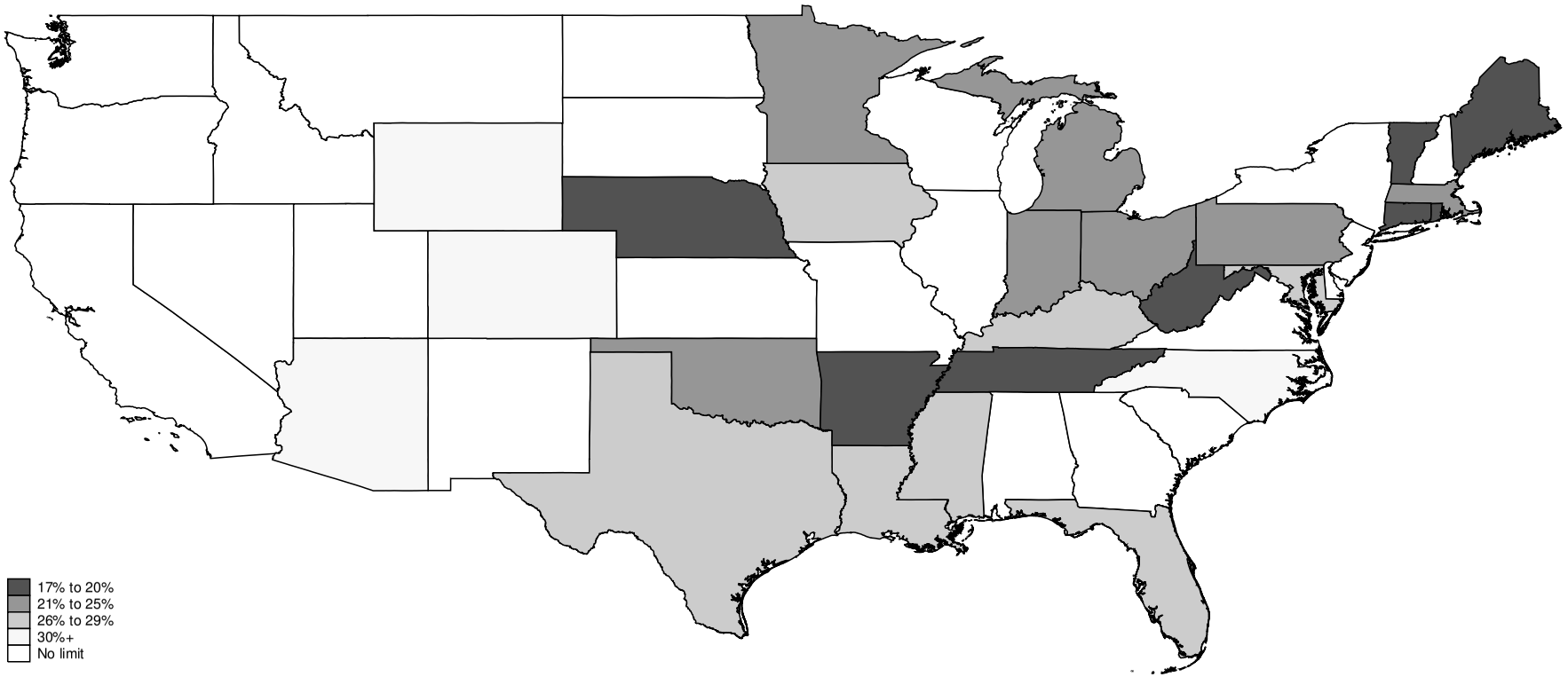


Figure 2: Geographic Variation of Usury Limits. This map displays the maximum interest rate applicable to automobile loans in each state. States without a usury limit are unshaded. The shading darkens as the maximum interest rate declines, as indicated by the legend on the left-hand side of the figure. For states in which the usury limit varies with the age of the vehicle, we display the usury limit applicable to a vehicle that is four years old. For states in which the usury limit varies with the size of the loan, we compute the state's average limit using the state's financed purchases reported in AutoCount.

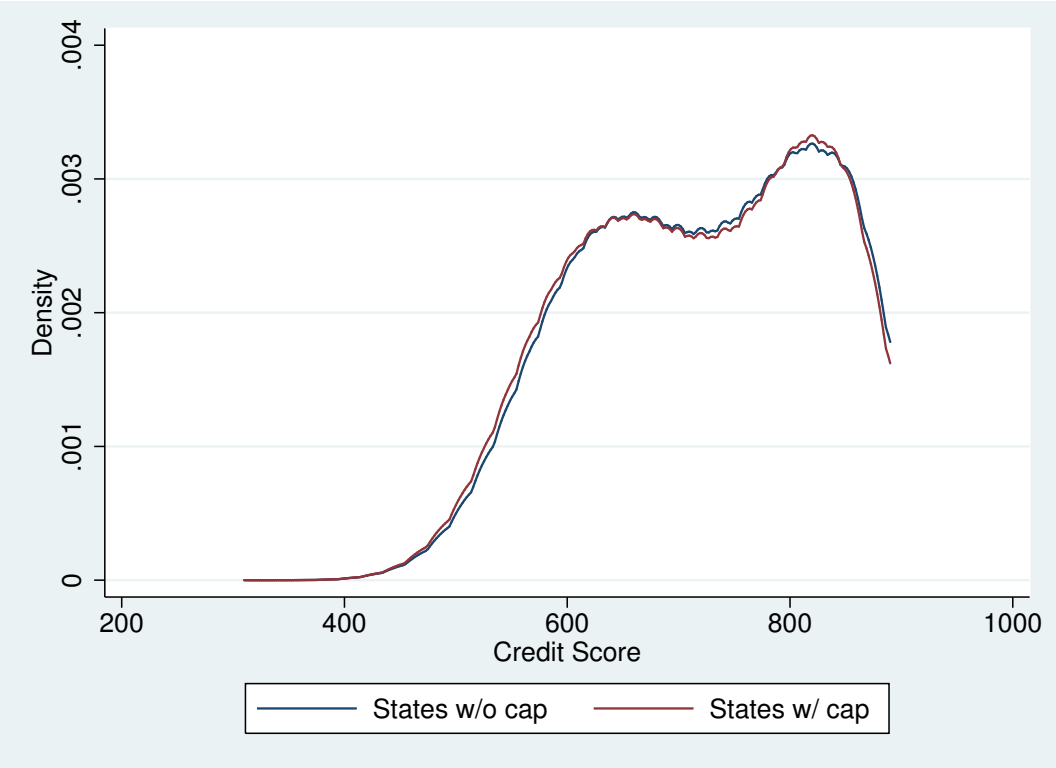


Figure 3: Distribution of Credit Scores for Individuals with Auto Loans. Using the sample of financed purchases in AutoCount, we compute the kernel density of borrowers by credit score. The red line reports the density for states with a usury limit ("cap") and the blue line reports the density for states without a usury limit.

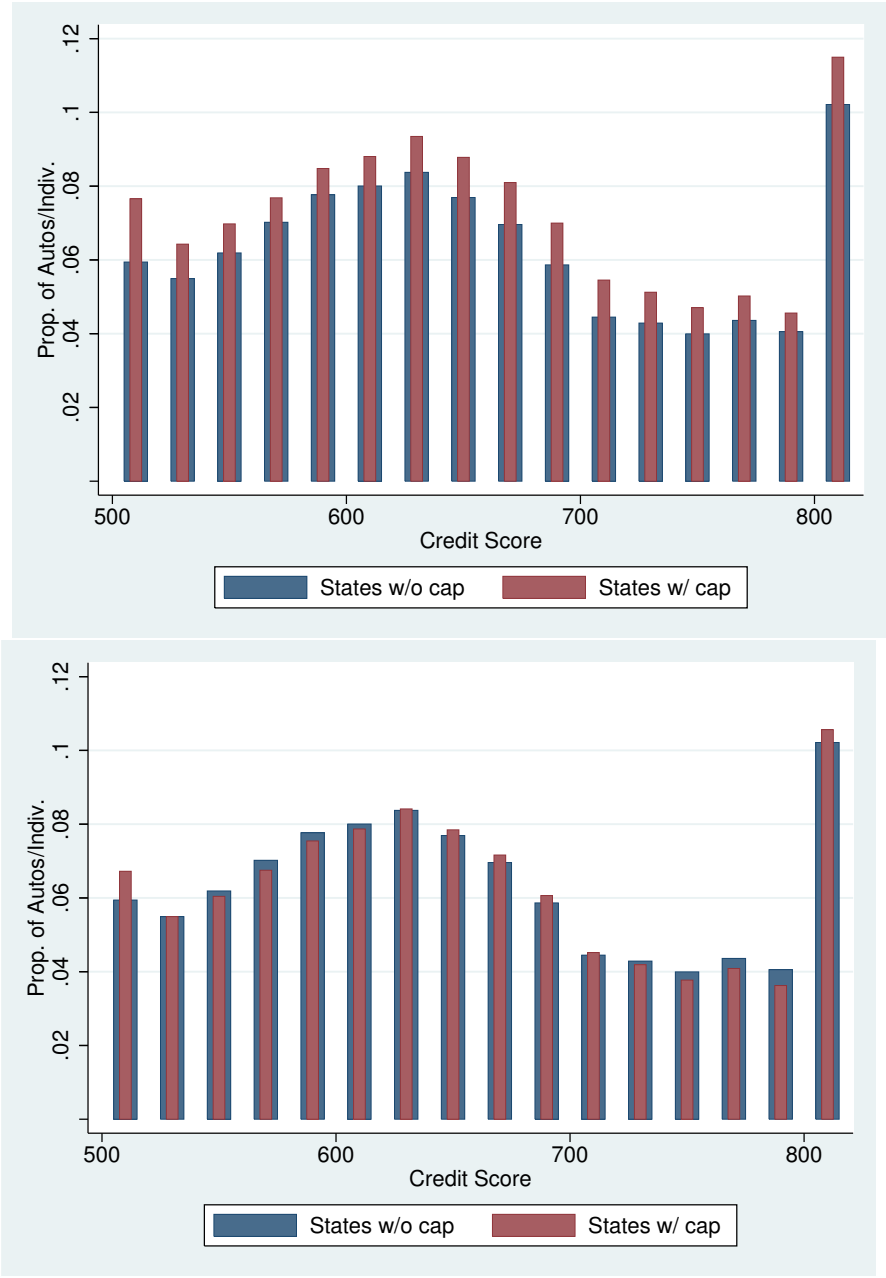


Figure 4: Fraction of Population with an Automobile Loan, by Credit Score and Presence of Usury Limit. The figures above plot the estimated fraction of adults in each 20-point credit score bin that have an automobile loan. We construct these estimates for each credit score bin by dividing the number of individuals with an auto loan (calculated in AutoCount) by the number of individuals with a credit score (calculated in CFPB Consumer Credit Panel). The red bars pertain to individuals in states with usury limit ("cap") and the blue bars pertain to individuals in states without a usury limit. The top figure reports the raw estimates and the bottom figure reports the estimates net of a fixed effect common to all credit score bins in states with a usury limit.

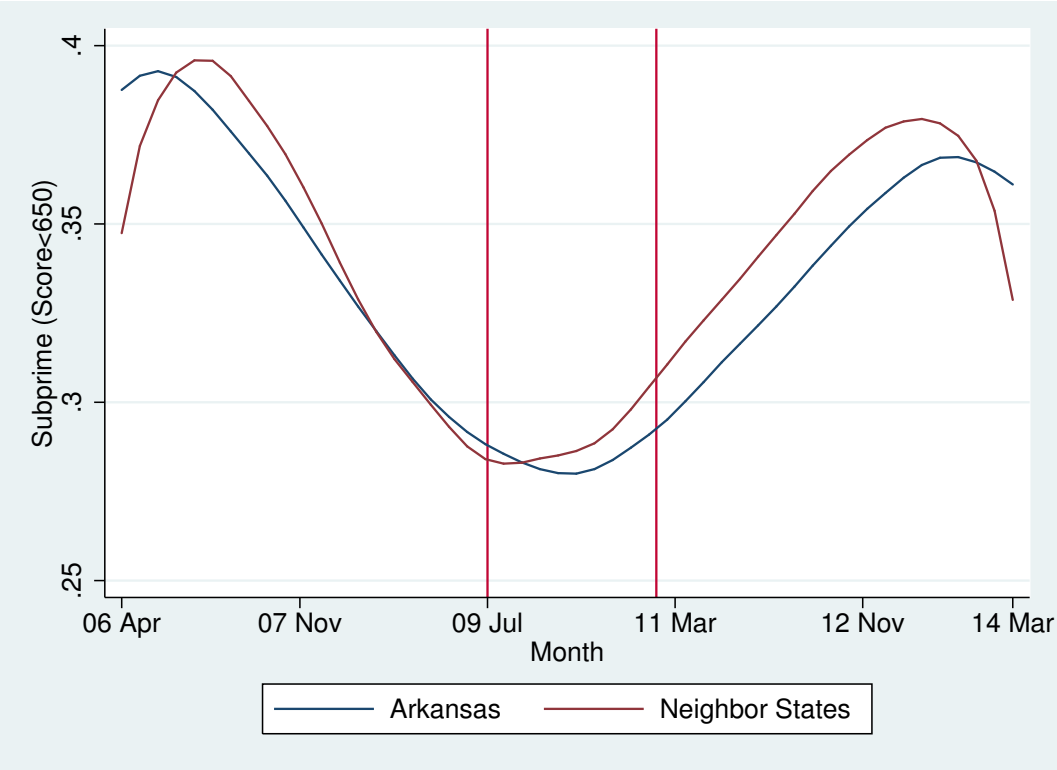


Figure 5: Proportion of Automobile Loans Made to Subprime Consumers. The plots above show the proportion of automobile loans that were made to consumers with credit scores below 650 in Arkansas (blue line) and its neighboring states (blue line). The x-axis reports the loan orignation date, which ranges from April 2006 to March 2014. The vertical lines at June 24, 2009 and January 1, 2011 pertain to the dates on which Arkansas temporarily relaxed, and then permanently fixed, its usury limit at 17%. Prior to the initial change, the usurly limit had been below 10% for multiple years. The sample includes all loans originated by automobile finance companies (dealer loans excluded) in the CFPB Consumer Credit Panel. The raw data are smoothed using a quadratic local polynomial regression.

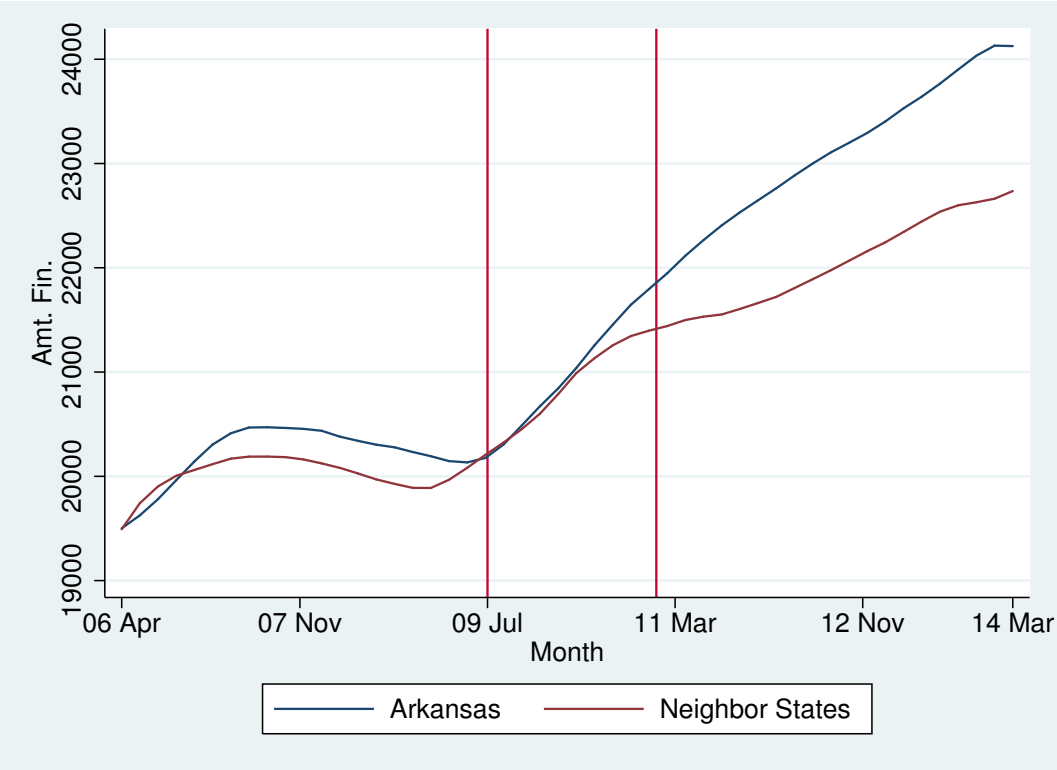


Figure 6: Amount Financed, Automobile Loans to Subprime Consumers. The plots above show the average amount financed for automobile loans to consumers with credit scores below 650 in Arkansas (blue line) and its neighboring states (blue line). The x-axis reports the loan orignation date, which ranges from April 2006 to March 2014. The vertical lines at June 24, 2009 and January 1, 2011 pertain to the dates on which Arkansas temporarily relaxed, and then permanently fixed, its usury limit at 17%. Prior to the initial change, the usurly limit had been below 10% for multiple years. The sample includes all loans originated by automobile finance companies (dealer loans excluded) in the CFPB Consumer Credit Panel. The raw data are smoothed using a quadratic local polynomial regression.

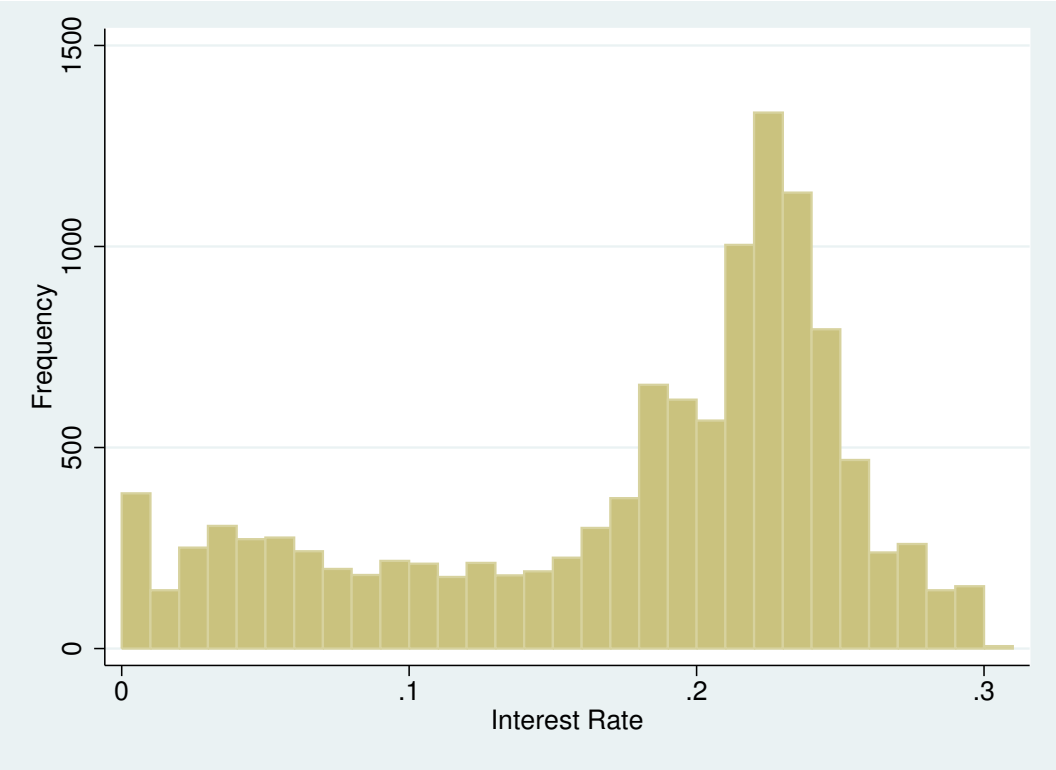


Figure 7: Histogram of Dealer-financed Loans in States without Usury Limits. Using the AutoCount data, we construct the histogram of interest rates on dealer-financed loans in states without usury limits.

Table 1: Comparing Sample Loans with Same Payment, Different Rate-Loan Amount Combination

Terms:	Higher Rate, Lower Loan Amount L = $9,000, r = 30%, T = 48 mths			Lower Rate, Higher Loan Amount L = $10,650, r = 20%, T = 48 mths		
Payment:	$324 per mth			$324 per mth		
Period	Principal	Interest	Remaining Principal Balance	Principal	Interest	Remaining Principal Balance
1	$99	$225	$8,901	$147	$177	$10,502
-						
12	$130	$194	$7,633	$176	$148	$8,720
-						
24	$175	$149	$5,796	$214	$110	$6,367
-						
36	$235	$89	$3,324	$261	$63	$3,498
-						
48	$316	$8	$0	$319	$5	$0

Note: This table shows the interest payments and principal amortization of two fully amorizing loans that differ in their interest rate and loan amount but are identical in their total monthly payment.

Table 2: Usury Limits and the Prevalence of Dealer Financing for Risky Borrowers

	Dependent Variable: Proportion of Financed Purchases with Dealer Financing (%)		
Limit (indicator)	2.9**		
	(1.2)		
Limit × Score 300 − 550		14.2**	13.2**
		(6.3)	(6.4)
Limit × Score 550 − 650		4.8**	4.0**
		(1.8)	(1.7)
Limit × Score 650 − 750		0.8**	0.3
		(0.4)	(0.3)
Limit × Score 750 − 900		0.1	
		(0.1)	
Control Variables			
Year-month FEs	Yes	Yes	Yes
Credit score FEs	Yes	Yes	Yes
State FEs	No	No	Yes
R^2	0.30	0.31	0.33
Observations	27,901,678	27,901,678	27,901,678

Note: This table reports estimation results from regressions of the proportion of financed vehicle purchases with dealer financing on an indicator for whether the transactions occur in a state with a usury limit (*Limit*). We observe the share of dealer-financed transactions for buyers in each 20-point credit score bin, at each dealer and in each month, so the unit of observation is the dealer-month-credit score bin (20-point intervals). All models include, as control variables, fixed effects for each year-month and for each 20-point credit score bin. The models reported in the second and third columns identify the marginal effect of *Limit* separately for buyers in each of four credit score ranges (where *Score* 300 − 500, for example, is an indicator for whether the buyer's credit score falls between 300 and 550). The third model also includes fixed effects for the state in which the dealer is located. In the row "Observations," we report the total number of vehicle purchases underlying the sample. We cluster observations by state in computing the standard errors, which are reported in parentheses.
** p <0.05

Table 3: Average Characteristics of Dealer Loans

	Mean (Standard Deviation)		
	States Without Usury Limit	States With Usury Limit	All States
Credit Score	552	546	548
	(55)	(57)	(56)
Interest Rate (%)	19.8	19.7	19.7
	(6)	(6)	(6)
Monthly Payment ($)	366	365	365
	(114)	(116)	(115)
Maturity (months)	47	38	41
	(17)	(13)	(15)
Loan-to-Value Ratio	1.63	1.75	1.71
	(0.46)	(0.51)	(0.50)
Estimated Vehicle Trade-in Value ($)	8,293 (5,457)	6,393 (3,834)	7,030 (4,534)
Observations	5,408	10,735	16,143

Note: This table reports summary statistics of the dealer-financed automobile loans that we analyze in Tables 4 and 5. We report averages and standard deviations (in parentheses) for the credit scores of the borrowers and the terms of their loans. In the first and second columns, the samples are restricted to borrowers in states without usury limits and states with usury limits, respectively. In the third column, the sample includes borrowers in all states.

Table 4: Impact of a Binding Usury Limit on Loans Made By Automobile Dealers

	Dependent variable:		
	Interest Rate (%)		
Pr(Binding Limit)	-6.46**	-7.99**	-7.89**
	(3.29)	(3.47)	(3.38)
Value ($ 1,000s)		-0.33***	-0.36***
		(0.07)	(0.07)
	Loan-to-Value Ratio (%)		
Pr(Binding Limit)	59.6***	39.2***	47.1***
	(14.50)	(9.70)	(12.20)
Value ($ 1,000s)		-4.6***	-4.5***
		(0.40)	(0.50)
	Loan Maturity (Months)		
Pr(Binding Limit)	-19.9**	-10.5**	-9.7**
	(8.47)	(4.99)	(4.62)
Value ($ 1,000s)		1.99***	1.97***
		(0.18)	(0.16)
	Log of Estimated Vehicle Value		
Pr(Binding Limit)	-0.44	-	-0.30
	(0.31)	-	(0.21)
Control Variables			
Year-month FEs	Yes	Yes	Yes
Credit score FEs	Yes	Yes	Yes
Zip code controls	No	No	Yes
Observations	16,143	16,143	16,048

Note: This table reports estimates from regressions of various loan terms on the probability of a binding usury limit ($Pr(BindingLimit)$) within the sample of dealer-financed loans. The estimates come from two-stage least squares models in which we first predict the probability of a binding usury limit and then regress the loan characteristic on this estimated probability. The identifying variation comes from differences in the presence and level of usury limits across states and among borrowers, as described in Section 4.4.1. Each model includes, as control variables, fixed effects for each year-month and for each 20-point credit score bin. In the models reported in the second column, we add a control for the estimated trade-in value of the vehicle purchased. In the models reported in the third column, we add controls for the median household income, poverty rate, and unemployment rate in the borrower's zip code in 2011 (from the American Community Survey). We cluster observations by state in computing the standard errors, which we report in parentheses.
** p <0.05, *** p <0.01

Table 5: The Impact of a Binding Usury Limit on the Monthly Payment of Dealer Loans

	Dependent variable: Required Monthly Loan Payment ($)			
Pr(Binding Limit)	34.1	112.9***	119.9***	87.0***
	(46.4)	(35.5)	(37.8)	(28.3)
Value ($ 1,000s)		17.1***	17.0***	18.9***
		(1.6)	(1.7)	(1.7)
Control Variables				
Year-month FEs	Yes	Yes	Yes	Yes
Credit score FEs	Yes	Yes	Yes	Yes
Zip code controls	No	No	Yes	No
Loan maturity FEs	No	No	No	Yes
Observations	16,143	16,143	16,048	16,143

Note: This table reports estimates from regressions of the required monthly loan payment on the probability of a binding usury limit ($Pr(BindingLimit)$) within the sample of dealer-financed loans. The estimates come from two-stage least squares models in which we first predict the probability of a binding usury limit and then regress the required monthly loan payment on this estimated probability. The identifying variation comes from differences in the presence and level of usury limits across states and among borrowers, as described in Section 4.4.1. Each model includes, as control variables, fixed effects for each year-month and for each 20-point credit score bin. In the model reported in the second column, we add a control for the estimated trade-in value of the vehicle purchased. In the model reported in the third column, we add controls for the median household income, poverty rate, and unemployment rate in the borrower's zip code in 2011 (from the American Community Survey). In the model reported in the fourth column, we include fixed effects for loans in each one-year bin of loan maturity. We cluster observations by state in computing the standard errors, which we report in parentheses.
*** p <0.01

Table 6: Comparing the Impacts of a Binding Usury Limit on Dealer and Non-Dealer Loans

	Dependent variable:		
	Interest Rate (%)	Loan-to-Value Ratio (%)	Loan Maturity (Months)
Pr(Binding Limit)	-2.9**	-1.0	3.0
	(1.2)	(4.8)	(2.8)
Pr(Binding Limit) × Dealer Loan	-5.5	49.3***	-15.6**
	(3.7)	(11.7)	(6.2)
Dealer Loan	-0.7	8.8***	-7.6***
	(0.5)	(3.4)	(1.9)
Value	-0.4***	-2.6***	1.7***
	(0.03)	(0.2)	(0.1)
Control Variables			
Year-month FEs	Yes	Yes	Yes
Credit score FEs	Yes	Yes	Yes
Zip code controls	Yes	Yes	Yes
Observations	578,974	578,974	578,974

Note: This table reports estimates from regressions of various loan terms on the probability of a binding usury limit ($Pr(BindingLimit)$). The sample includes both dealer-financed and non-dealer loans. The estimates come from two-stage least squares models in which we first predict the probability of a binding usury limit and then regress the loan characteristic on this estimated probability and its interaction with an indicator for dealer-financed loans ($DealerLoan$). The identifying variation comes from differences in the presence and level of usury limits across states and among borrowers, as described in Sections 4.4.1 and 4.4.2. Each model includes, as control variables, fixed effects for each year-month and for each 20-point credit score bin. Each model also includes controls for the estimated trade-in value of the vehicle purchased and the median household income, poverty rate, and unemployment rate in the borrower's zip code in 2011 (from the American Community Survey). We cluster observations by state in computing the standard errors, which we report in parentheses.
** p <0.05, *** p <0.01

Table A1: Maximum Interest Rate for Auto Loans, by State

State	Limit range (%)	Varies by?	State	Limit range (%)	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	21		PA	18 - 21	Vehicle age
ID	None		RI	18	
IL	None		SC	None	
IN	25 - 36	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: This table reports the maximum interest rates for automobile loans in each state. In states for which the maximum interest rate depends on the age of the vehicle financed or the loan amount, we report the minium and maximum limit that may apply. While most states establish a limit using simple amortizing interest, some states (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. "None" includes both states without any rate limits, and those with limits beyond the maximum rate found within the AutoCount data for that state.