Consumer Credit Regulation and Lender Market Power*

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Abstract

We investigate the welfare consequences of consumer credit regulation in a dynamic, heterogeneous-agent model with an explicit role for lenders' market power. We incorporate a decentralized credit market with search and incomplete information frictions in an off-the-shelf Eaton-Gersowitz model of consumer credit and default. Lenders post credit offers and borrowers can apply to multiple lenders, however some borrowers are informed and direct their applications toward the lowest offers while others are uninformed and apply randomly. Equilibrium features price dispersion — controlling for a borrower's default risk, there exists both high- and low-cost lending. Importantly, the distribution of loan prices and the extent of lenders' market power is disciplined by borrowers' outside options. We calibrate the model to match characteristics of the unsecured consumer credit market, including high-cost options such as payday loans. We use the calibrated model to evaluate interest rate caps. In a model with a competitive financial market, caps can only harm borrower welfare. In contrast, with lender market power interest rate caps can raise borrower welfare by reducing markups, but that requires households have some degree of financial illiteracy (lack of information about interest rates).

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1 Introduction

Alternative financial institutions (AFIs) provide high-cost loans for households in the US. The most notable are payday lenders that offer short-term loans at extremely high interest rates (with an average around 350 percent annualized). These rates have been cited frequently as justification for regulatory actions, such as interest rate ceilings or loan-size limits, aimed at curbing the activities of AFIs that are often deemed as harmful to borrowers. These regulations are ubiquitous; a quarter of states ban payday lending or other AFIs completely while others impose tight regulations. In this paper, we explore the aggregate and distributional welfare implications of these credit regulations.

In a competitive model of unsecured credit and default-based pricing (such as those used in Chatterjee, Corbae, and Rios-Rull (2008) or Athreya, Tam, and Young (2012), restricting loan contracts cannot help consumers because they simply shrink budget sets; either the household is unaffected by the cap, because their optimal borrowing choice leads to small enough default risk, or they are forced to reduce borrowing and therefore current consumption. As a result, no welfare gains are available.[1] If we want to understand the argument for interest rate caps, we must therefore extend the model to allow for the possibility that loan terms are set inefficiently.

In this paper, we do so by departing from the assumption of perfect competition in order to allow lenders to posses market power. We incorporate search and information frictions following Lester (2011) and Bethune, Choi, and Wright (2020) into the workhorse model of unsecured credit and bankruptcy. Lenders post credit offers with commitment and borrowers search for the best offers. Some households direct their search (we call these households informed) and others do not (uninformed). In equilibrium, two types of intermediaries emerge, low and high cost; only uninformed households use the high cost market, while both types use the low cost market. We interpret this model as capturing not only market power but also a stylized form of financial illiteracy. The equilibrium is constrained inefficient since there is over-entry of high-cost lenders that exploit their market power. A planner who only has the instrument of a blunt interest-rate ceiling may use it to indirectly tax high-cost lenders, but potentially at the risk of distorting other

[1] If the risk-free rate is endogenous, reduced borrowing leads to higher capital and therefore can potentially deliver welfare gains through higher wages. However Chatterjee et al. (2008) show that the effect of bankruptcy regulations on the risk-free rate is small, and therefore this channel is unlikely to deliver significant gains.

low-cost markets.[2]

We calibrate the model to match features of both the traditional unsecured credit market (credit card lenders) and the market for AFIs (payday lenders). Introducing lender market power helps overcome a challenge in calibrating standard, competitive models: to generate interest rates high enough to be affected by regulatory ceilings, the default rate must be counterfactually high. In turn, the level of debt and borrowing must also be counterfactually low, as agents are unwilling to pay very high rates to borrow (or if they are willing to pay those rates, wealth accumulation will be too small). The only way for these models to generate the empirical regularities in credit markets is to somehow exogenously impose the need to use the high-cost lender. We show our model can generate interest rate spreads between high- and low-cost lenders in line with the data while remaining consistent with default rates, levels of borrowing, and participation in the high-cost AFI market. To do so, our model only requires that 4 percent of households are uninformed.

Our primary experiment is to study the aggregate and distributional effects of interest rate ceilings. We find that interest rate ceilings are welfare-improving. Despite the fact that there are only 4 percent of uninformed agents in the calibration, restricting high-cost lenders' rent-seeking behavior implies ceilings as low as a 25 percent annual percentage rate (APR) increase aggregate welfare, with gains on average around 0.03 percent of annual consumption. Furthermore, the optimal ceiling is Pareto-improving over the calibrated equilibrium, improving the poorest and lowest wealth households welfare by 0.32 percent of annual consumption. The reason blunt interest rate ceilings are effective tools in the model relies on two aspects of the calibrated economy. The first is that there is little overlap in the interest rates charged between the low- and high-cost markets, consistent with empirical evidence.[3] The second is that while there are potentially both positive and negative spillover effects, we find quantitatively large positive spillovers resulting from improved market composition – even *informed* borrowers gain from limiting the high-cost market because they anticipate using it in the future.

[2]Saldain (2023) explores an alternative option that households borrow excessively due to self-control problems and finds that borrowing constraints are already tight enough, due to the high default rates, that households do not benefit from further regulation.

[3]For further discussion, see Section 4. The largest interest rate in the low-cost market is 34 percent while the smallest in the high-cost market is 100 percent, roughly consistent with empirical evidence on credit card and payday lender APRs.

In sum, if all lenders *ex-ante* compete in price to attract borrowers, then interest rate ceilings only harm welfare. However, if even a few borrowers are uninformed and, as a result, some lenders can post terms to extract their rent, then interest ceilings can lead to meaningful welfare gains.

Our model captures two features of public discourse over the need to regulate unsecured debt markets. First, interest rates are set using monopoly power, which is a common thread in political discussions of lending markets (and notably applies not only to AFIs but also large credit card lenders like Bank of America, CitiBank, and Chase). Second, households are "financially unsophisticated" in a stylized sense; the uninformed households lack knowledge about the options that are available in the credit market, and even the low-cost market exploits these households to some degree.

2 Environment

Time is discrete and infinite. There is a large measure of ex-ante identical lenders and a unit measure of ex-ante identical households that interact in a frictional market for defaultable, unsecured debt. Lenders are risk-neutral and can borrow at an exogenous rate of return $r > 0$. To lend in any period, they must enter the credit market at a fixed cost $\kappa > 0$. Upon entry, they post terms of trade, with commitment, that lists the price of the loan q and the amount borrowed $a' < 0$, contingent on the observed state of the borrower, to be specified.

Households discount the future at rate $\beta \in (0, 1)$ and have preferences over consumption within a period, $u(c)$, with $u'(c) > 0$, $u''(c) < 0$, and $\lim_{c\to 0} u'(c) = \infty$. They receive a stochastic endowment, y, whose process is given by a Markov transition matrix $\Pi(y'|y)$ and is i.i.d across households. Households can save and borrow using one-period, non-contingent debt. At the beginning of the period, a borrower can default on any outstanding debt. Upon default, debt is cleared, the defaulter spends a period in financial autarky and incurs a one-time utility penalty, $\lambda^i > 0$, that is randomly drawn, i.i.d. through time, from a distribution $G(\lambda)$. A household's financial choice is denoted $k \in \{S, D\}$, to represent solvency and default, respectively.

Saving is frictionless and earns a risk-free return r. In order to borrow, a household must search for a lender in the credit market. When searching, borrowers can be either informed (I)

or uninformed (U) about the set of credit offers posted. Being informed means they observe $h \in [2, ..., \infty)$ draws from the distribution of offers before choosing where to direct their search. We focus on the limiting case $h \to \infty$ in which informed borrowers observe every offer and direct their search to the one yielding the highest expected utility. Uninformed households draw only $h = 1$ offer and so are effectively random searchers. All households have rational expectations about the equilibrium distribution of posted offers. A household's financial information state is stochastic and follows a Markov process given by π_{ij} for $i, j \in \{I, U\}$. Households learn their information type simultaneously with their period endowment. Notice, the process is independent across borrowers or any other household state variables, so any equilibrium relationship between wealth and a household's financial information will be endogenous. The complete state of a household is given by $\mathbf{s} \equiv (a, y, k, j)$ which implies lenders post terms of trade $(q(\mathbf{s}), a'(\mathbf{s}))$.

We introduce two assumptions that serve to limit the ability of lenders to extract rents from uninformed borrowers. The first is that a household's information state is private information, while beginning of period wealth, current income, and financial status are observable and common knowledge to all agents. This assumption will generate informational rents to borrowers and induce a screening problem that potentially limits lenders' ability to compete ex-ante for informed borrowers. How severe the information problem is depends on how many uninformed borrowers arrive in a given low-cost market, which is endogenous as it depends on the entry decisions of lenders and the past borrowing decisions of households. Second, we assume that all borrowers have the ability to initiate bargaining conditional on matching with a lender at a given posted terms of trade. In equilibrium, a lender would never post terms that generate a lower borrower surplus than the bargaining protocol. Hence, the ability to bargain directly limits the amount of rents lenders can extract from the uninformed. How much the lender can extract is then a function of the bargaining weight, and we discipline this value in the calibration.

As is standard in the competitive search literature, a submarket consists of all lenders and borrowers posting and directing their search to the same terms of trade. Within a submarket, borrowers and lenders are paired bilaterally according to a matching function. Let n represent the ratio of the measure of lenders to the measure of borrowers. Then, $\alpha(n)$ is the probability that a borrower gets matched to a lender and $\alpha(n)/n$ is the probability that a lender gets matched to a borrower. We assume that $\alpha(n)$ is continuous and $\alpha(0) = 0$, $\alpha'(n) > 0$, and $\lim_{n \to \infty} \alpha(n) = 1$.

Unmatched borrowers are only allowed to save during the current period (although in general the optimal choice is to set $a' = 0$ so that they are simply paying off their existing balance). We focus on symmetric strategies for borrowers. Additionally, for simplicity we assume that borrowers only draw offers from submarkets indexed to their type (that is, lenders can commit to not lending to any agent who "does not belong" in a given submarket).

3 Equilibrium

We guess and later verify that the equilibrium set of active submarkets will consist of two submarkets for each solvent household with observable state (a, y).[4] In one submarket, lenders will post terms of trade to cater to uninformed searchers and, therefore, effectively post the bargaining solution. We label this submarket “high cost". In the other submarket, lenders will cater to the informed agents and post terms of trade competitively (to maximize informed borrowers' expected surplus). However, their ability to compete for informed agents will be limited by the presence of uninformed – but lucky – agents that randomly draw the competitive terms of trade. The presence of these uninformed borrowers induces a screening problem. We label this submarket “low cost".

We proceed by first defining the trade surplus of lenders and borrowers, and then characterize the terms of trade in the high- and low-cost submarkets. A lender's expected surplus from trade with a solvent household of type $(a, y, j \in \{I, U\})$ at credit terms (q, a') is

$$\mathcal{S}^{\mathcal{L}}\left(q, a'; a, y, j\right) = -\left[\frac{1 - \mathbb{E}_{y', j'|y, j}\left[d\left(a', y', j'\right)\right]}{1 + r} - q\right] a'. \tag{1}$$

For each unit of debt, $-a' > 0$, lenders expect to be repaid $1 - \mathbb{E}_{y', j'|y, j}\left[d\left(a', y', j'\right)\right]$ in the following period, discounted to the present by $1/\left(1 + r\right)$, where $d\left(a', y', j'\right) \in \{0, 1\}$ represents the default decision of the borrower contingent on their state at the beginning of the following period. The term inside the square brackets, then, represents expected profits per unit lent.

[4] Notice that lenders can perfectly discriminate borrowers based on their observable state, (a, y) and solvency status, which implies that, out of equilibrium, if a borrower of type $(\hat{a}, \hat{y})$ searches in submarket (a, y), then lenders can commit to refuse trade.

The solvent borrower's surplus, conditional on trade (q, a') in either submarket, is given by

$$\mathcal{S}^{\mathcal{B}}\left(q, a'; a, y, j\right) \equiv \ u\left(c\right) + \beta \mathbb{E}_{y', j' | y, j} v\left(a', y', j'\right) - v^{s,n}\left(a, y, j\right) \quad (2)$$
$$s.t. \quad c = a + y - qa'.$$

In (2), the borrower's surplus is the difference in their lifetime utility of borrowing $-a'$ at price q, and the lifetime utility of their outside option of saving, $v^{s,n}(a, y, j)$, given by

$$v^{s,n}\left(a, y\right) = \max_{c, a' \geq 0} \left\{ u(c) + \beta \mathbb{E}_{y', j' | y, j} v\left(a', y', j'\right) \right\} \quad (3)$$
$$s.t. \quad c = a + y - \frac{1}{1+r} a',$$

where $v\left(a', y', j'\right)$ represents the lifetime value of a solvent household at the beginning of a period.

If a borrower opts to bargain, the terms of trade are determined by the Kalai (1977) proportional bargaining solution.[5] Let $\theta \in [0, 1]$ represent the borrower's share of the surplus (or bargaining power). The terms are given as the solution to

$$\bar{\mathcal{S}}^{\mathcal{B}}(a, y, j) = \max_{q, a'} \ \mathcal{S}^{b}\left(q, a'; a, y, j\right) \quad (4)$$
$$s.t. \ \ (1-\theta)\mathcal{S}^{\mathcal{B}}\left(q, a'; a, y, j\right) = \theta u'\left(a + y - qa'\right) \mathcal{S}^{\mathcal{L}}\left(q, a'; a, y, j\right). \quad (5)$$

The borrower's surplus from bargaining, $\bar{\mathcal{S}}^{\mathcal{B}}\left(a, y, j\right)$, represents their outside option in any credit meeting. It is determined by the share θ of the maximized total surplus of the match. We now turn to determining the terms of trade in the high- and low-cost submarkets.

High-cost submarket Let $q_{Uh}\left(a, y\right)$ and $a'_{Uh}\left(a, y\right)$ represent the posted terms of trade in the high-cost submarket for uninformed, solvent borrowers of type (a, y) and let $n_h\left(a, y\right)$ represent the market tightness.[6] Suppressing the dependence on (a, y), $\left\{q_{Uh}, a'_{Uh}, n_h\right\}$ are given as the

[5]Relative to more well known Nash (1950) bargaining solution, the Kalai (1977) solution imposes monotonicity. This will be a useful feature when we consider the effects of interest rate ceilings since it implies that a binding constraint on the total surplus will weakly reduce the surplus of borrowers and lenders. The strength of how it affects each party is determined by θ.

[6]We assume that high-cost lenders post the same terms for informed consumers, $q_{Ih} = q_{Uh}$ and $a'_{Ih} = a'_{Uh}$, and verify that the expected borrower surplus of informed agents searching searching in the high-cost submarket at these terms of trade is always lower compared to their expected surplus in the low-cost submarket.

solution to

$$\max_{q,a'} \mathcal{S}^{\mathcal{L}}\left(q,a';a,y,U\right) \tag{6}$$

$$s.t.\;\; \mathcal{S}^{\mathcal{B}}\left(q,a';a,y,U\right) \geq \bar{\mathcal{S}}^{\mathcal{B}}\left(a,y,U\right), \tag{7}$$

plus the free-entry condition

$$\frac{\alpha\left(n_h\right)}{n_h}\mathcal{S}^{\mathcal{L}}\left(q_{Uh},a'_{Uh};a,y,U\right) \leq \kappa \qquad (\text{``="} \text{ if } n_h > 0). \tag{8}$$

In (6)-(7), the terms of trade are set by maximizing the lender's surplus, subject to the participation constraint of borrowers that they achieve at least their surplus from bargaining. The high-cost lender extracts as much as possible from uninformed borrowers, giving them their outside option from bargaining. Given $\left(q_{Uh},a'_{Uh}\right)$, the free-entry condition (8) pins down the market tightness. The left side is equal to the lender's expected surplus – the probability of matching with a borrower times their surplus – while the right side is the cost of entry. We define an uninformed borrower's expected surplus in the high-cost submarket as

$$v^{s,h}\left(a,y,U\right) = \alpha\left(n_h\right)S^{\mathcal{B}}\left(q_{Uh},a'_{Uh},U\right). \tag{9}$$

Low-cost submarket The terms of trade and tightness in the low-cost submarket $\left(\{q_{j\ell},a'_{j\ell}\}_{j\in\{I,U\}},n_\ell\right)$ for type (a,y) are given as the solution to

$$\max_{\{q_{j\ell},a'_{j\ell}\}_{j\in\{I,U\}},n_\ell} \alpha(n_\ell)\mathcal{S}^{\mathcal{B}}(q_{I\ell},a'_{I\ell};a,y,I), \tag{10}$$

$$s.t.\;\; \mathcal{S}^{\mathcal{B}}\left(q_{j\ell},a'_{j\ell};a,y,j\right) \geq \bar{\mathcal{S}}^{\mathcal{B}}\left(a,y,j\right) \quad \text{for } j\in\{I,U\} \tag{11}$$

$$\mathcal{S}^{\mathcal{B}}\left(q_{j\ell},a'_{j\ell};a,y,j\right) \geq \mathcal{S}^{\mathcal{B}}\left(q_{-j\ell},a'_{-j\ell};a,y,j\right) \quad \text{for } j\in\{I,U\} \tag{12}$$

$$\frac{\alpha(n_\ell)}{n_\ell}\sum_{j\in\{I,U\}}\frac{\Gamma(a,y,j)}{\Gamma(a,y,I)+\Gamma(a,y,U)}\mathcal{S}^{\mathcal{L}}(q_{j\ell},a'_{j\ell};a,y,j) = \kappa. \tag{13}$$

The solution maximizes informed borrowers' expected trade surplus subject to participation constraints (11), incentive-compatibility constraints (12), and the free-entry condition (13), where $\Gamma\left(a,y,j\right)$ is the equilibrium measure of agents in state (a,y) for $j\in\{I,U\}$. Low-cost lenders post direct revelation mechanisms to compete for informed borrowers, but that competition is limited by presence of some uninformed agents that can potentially misreport their type and trade at the terms for informed agents. Lenders therefore attempt screen uninformed borrowers, but binding incentive compatibility constraints limit competition for informed agents. Finally, the free-entry condition (13) weights the expected lender surplus of trading with informed and uninformed borrowers of type (a, y) according to the equilibrium distribution.

It is helpful to understand why the lender cares about the information state of the borrower. Unlike some models of unsecured lending with asymmetric information where the private information involves the utility cost of default (e.g., Athreya et al., 2012), our lenders do not observe borrowers' current information state, which has no direct effect on the relative values of solvency and default since the terms are set after borrowers have already exploited their information in the current period. However, since a borrower's information state is persistent, their current state is informative about their future information which does determine the relative value of default. Informed agents – that are more likely to be informed tomorrow – are generally less likely to default because the terms at which they borrow in the future are more favorable (they get better qs so they can roll over debt more easily). The lender today would benefit from identifying the uninformed and exploiting their relatively-poor continuation value. This screening, in turn, limits the ability of the lender to extract the surplus of the uninformed who turn up in the low-cost market because they must be willing to select the appropriate contract.

Given (n_ℓ, n_h) we can define the ex-ante probability that household (a, y) trades in submarket $i = \{\ell, h\}$, as $\alpha_i \equiv \alpha_i(a, y) \in [0, 1]$. Let $N_h \equiv N_h(a, y)$ and $N_l \equiv N_l(a, y)$ denote the equilibrium measures of lenders posting the high- and low-cost terms of trade, respectively, for households in state (a, y). Then,

$$\alpha_\ell = \begin{cases} \alpha(n_\ell) & \text{if } j = I \\ \frac{N_\ell}{N_l + N_h}\alpha(n_\ell) & \text{if } j = U \end{cases} \qquad \alpha_h = \begin{cases} 0 & \text{if } j = I \\ \frac{N_h}{N_\ell + N_h}\alpha(n_h) & \text{if } j = U \end{cases} \tag{14}$$

In (14), the ex-ante probability of trading in the low-cost submarket for an informed household is simply the probability of matching $\alpha(n_\ell)$. The ex-ante probability for an uninformed household depends on the endogenous market composition of low- and high-cost lenders, N_ℓ / N, where

$N = N_h + N_\ell$. Likewise, the probability of entering the high-cost submarket for an informed household is zero while for an uninformed household it is the probability of matching $\alpha(n_h)$ times the probability of drawing a high-cost offer N_h/N.

At the beginning of the period, a household starts with assets and income (a, y) and chooses either to default or stay solvent. Their lifetime utility at the beginning of the period is given by

$$v(a,y,j) = \max\left\{v^s(a,y,j), v^d(a,y,j)\right\}, \tag{15}$$

where the value of remaining solvent is

$$v^s(a,y,j) = \alpha_h v^{s,h}(a,y,j) + \alpha_\ell v^{s,l}(a,y,j) + (1 - \alpha_h - \alpha_\ell) v^{s,n}(a,y,j). \tag{16}$$

With probability α_h they enter and trade in the high-cost submarket, with probability α_l they enter and trade in the low-cost submarket, and with probability $1 - \alpha_h - \alpha_l$, they are excluded from borrowing in the period because they have failed to match. The value of defaulting is given by

$$v^d(a,y,j) = u(y) - \lambda + \beta \mathbb{E}_{y',j'|y,j}\left[v\left(0, y', j'\right)\right]. \tag{17}$$

Defaulters spend a period in financial autarky, consume their endowment y, incur the utility cost of defaulting of λ, and start next period with zero net assets.[7] Finally, we can characterize the measures of lenders that enter the high- and low-cost submarkets (N_ℓ, N_h). Using the definition of tightness in submarket $i \in \{l, h\}$ and (14),

$$n_\ell(a,y) = \frac{N_\ell(a,y)}{\Gamma(a,y,I) + \frac{N_\ell(a,y)}{N_\ell(a,y)+N_h(a,y)}\Gamma(a,y,U)} \text{ and} \tag{18}$$

$$n_h(a,y) = \frac{N_h(a,y)}{\frac{N_h(a,y)}{N_\ell(a,y)+N_h(a,y)}\Gamma(a,y,U)}. \tag{19}$$

Given (n_ℓ, n_h, Γ), we can solve (18)-(19) for (N_h, N_l) for each (a, y).

[7] Default is therefore to be interpreted as Chapter 7 bankruptcy, in which all unsecured debt is eliminated and lenders are prohibited from garnishing any future labor income.

4 Calibration

We set a time period in the model to be one month. We adopt a matching function of the form $\alpha(n) = \frac{n}{(1+n^{v})^{\frac{1}{v}}}$. A first group of parameters is calibrated to values commonly used in the literature. The monthly risk-free rate is $r = \frac{0.01}{12}$. We choose the persistence and standard deviation of the endowment process to match those used in the bankruptcy literature $\rho_y = 0.95$ and $\sigma_y = 0.10$. The relative risk aversion parameter σ is set to 2. We assume the default cost distribution $G(\lambda)$ is given by a Gumbel distribution with scale parameter μ and shape parameter ω. We set $\omega = 500$.[8] The remaining parameters are jointly calibrated within the model. These parameters are the discount factor β, the entry cost of the lender κ, the scale parameter μ, the elasticity of the matching function v, the share of the surplus that the borrower gets when bargaining with a lender θ, and the probabilities that govern the information process π_{II} and π_{UU}.

We calibrate the model to match the features of the unsecured credit market broadly defined to include both conventional lending (e.g., credit cards) and high-cost lending. We target two sets of moments. First, a set of moments that are common targets in the unsecured credit literature: (i) the fraction of households with negative net worth, 12.5 percent, (ii) the average interest rate on credit cards, 12 percent, which we interpret as the average interest rate for low-cost lenders in the model, (iii) the ratio of aggregate unsecured debt over aggregate income, 1.23, and (iv) the annual fraction of households that file for bankruptcy, 1.2 percent.

Second, we target moments related to high-cost borrowing. We approximate high-cost borrowing using data on the payday lending industry, which represents the largest share of high-cost borrowing. We obtain statistics from the Survey of Consumer Finances (SCF) and the Consumer Financial Protection Bureau (CFPB) such as CFPB (2013).[9] From these sources, we target (i) the average effective interest rate paid in payday borrowing, 339 percent, (ii) the fraction of households in a given year that took out a payday loan, 3.4 percent, and (iii) the fraction of borrowing sequences in payday lending that last longer than a month, 45 percent, where borrowing se-

[8] A large value of ω implies that the randomness in λ plays little role in determining default but the household problem is convex, making computation easier. As $\omega \to \infty$ the optimal choice function approaches the maximum.

[9] Several waves of the SCF ask survey respondents if they have taken a payday loan in the previous 12 months. CFPB (2013) provide aggregate data on interest rates and borrowing sequences (consecutive loans) from a nationwide but undisclosed payday lender.

quences are defined as loans in consecutive periods. Targeting the effective high-cost interest rate disciplines the share of the surplus that high-cost lenders can extract from borrowers. Targeting the extensive margin of high-cost borrowing disciplines the steady state fraction of uninformed households while targeting the fraction of long high-cost borrowing sequences disciplines the persistence of the uninformed state.

Table 1: Parameter calibration

Parameter	Value	Description
		External
ρ_y	0.95	Persistence income shock
σ_y	0.1	Standard deviation income shock
r	$\frac{0.01}{12}$	Risk-free interest rate
ω	500	Scale parameter Gumbel dist.
		Jointly determined
β	0.991	Discount factor
κ	0.00007	Entry cost lenders
λ	0.012	Stigma cost of default
θ	0.010	Borrower's share of surplus
v	28.39	Slope matching function
π_{II}	0.97	Prob. informed when informed
π_{UU}	0.41	Prob. uninformed when uninformed

We report the jointly calibrated parameters in Table 1 and the empirical moments and model counterparts in Table 2. The model is able to match not only standard moments used in the unsecured credit literature, but also captures features of the high-cost lending sector that are a challenge for competitive, default-based pricing models. The challenge of the standard model is that to generate high interest rates in the high-cost market, the model must impose counterfactually-high default rates. Introducing lender market power allows us to break the tight connection between default and interest rates. For example, the average interest rate across high-cost submarkets in the model is 304 percent, compared to the average payday interest rate in the data of 339 percent, while the default rate in the model of 1.3 percent remains in line with the data value of 1.20 percent. The calibration achieves this combination by setting the bargaining power of borrowers to a very low value ($\theta = 0.01$).[10]

[10]The borrower's share of the surplus θ has to be positive, as the choice of new debt a'_h is indeterminate at the lower bound of $\theta = 0$. At the lower bound, any a'_h yields the same surplus to the borrower.

Our model is consistent with evidence that operating costs are higher for payday lenders, as noted in Flannery and Samolyk (2005). To see why, note that lenders have the same fixed entry cost across submarkets κ, but the model endogenously generates a different expected fixed cost per loan. High-cost lenders face a lower probability of trade compared to low-cost lenders and therefore frequently pay costs but receive no revenue.[11]

Our model is also consistent with the fact that a relatively small fraction of total unsecured credit is borrowed from high-cost lenders. In the data, the fraction of households that borrowed from AFI lenders in the previous year ranges from 3.4 percent to 7.8 percent, depending on how expansively AFI borrowing is defined.[12] The fraction of households borrowing from a payday lender is 3.4 percent, while in the model it is 3.8 percent. To generate this number, the calibration imposes a low probability of an informed agent becoming uninformed, $\pi_{IU} = 0.03$, while having a moderate persistence of the uninformed state, $\pi_{UU} = 0.41$.

Table 2: Targeted moments: data and model

Moment	Data	Model	Source
Fraction NW<0 (%)	12.50	14.44	Athreya et al. (2012)
Default rate (annualized, %)	1.20	1.30	Athreya et al. (2012)
Debt-to-income ratio (%)	1.23	1.31	Sanchez (2018)
Mean Interest Rate Low-cost (annualized, %)	12.07	10.98	Athreya et al. (2012)
Mean Interest Rate High-cost (annualized, %)	339	304	CFPB (2012)
Fraction High-cost (prev. 12m, %)	3.4	3.8	SCF (2016)
Fraction of Long Borrowing Sequences - High-cost	0.45	0.33	CFPB (2012)

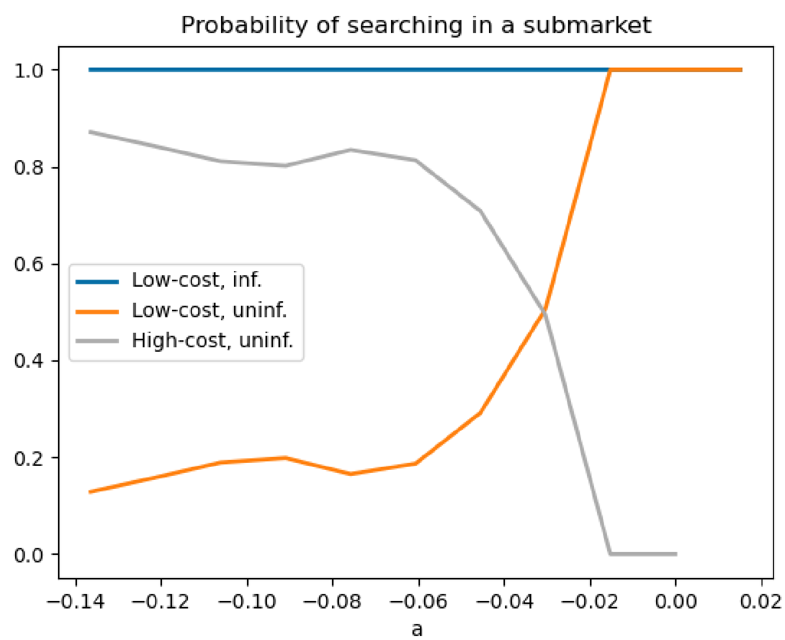
Finally, our model is also consistent with (untargeted) cross-sectional features of high-cost borrowing across the wealth distribution. In Figure 1, we show the probability of searching in a submarket $k \in \{\ell, h\}$, $\frac{N_k}{N}$, for the median income borrower, plotted by wealth. Informed borrowers always search for credit in the low-cost submarket regardless of wealth, as the blue line shows. For uninformed households, the probability of searching in the high-cost market (illustrated as the gray line) tends to decrease in wealth, a. At higher levels of wealth, high-cost lenders find it too costly to enter, $N_h(a, y) = 0$, since the borrower's surplus is too low to justify the high expected fixed cost. As a result, wealthy uninformed borrowers only trade in the low-

[11] In the data, one reason AFIs are expensive because they operate brick-and-mortar storefronts that have long hours and need to be located near public transit.

[12] The upper bound includes AFIs such as pawn shops, which are technically secured debts. Around 85 percent of pawned items are reclaimed by the borrower.

cost submarket. However at lower wealth levels, high-cost lenders become more prevalent and crowd out low-cost options. Borrower surplus increases as wealth falls since their outside option forces them to deleverage to zero net worth. Knowing this fact, high-cost lenders are induced to enter at higher rates leading to a higher probability of uninformed, low-wealth borrowers trading with a high-cost lender. This endogenous result in the model is consistent with evidence from the Survey of Consumer Finances (2016) where payday borrowing is more common at lower levels of net worth.

Figure 1

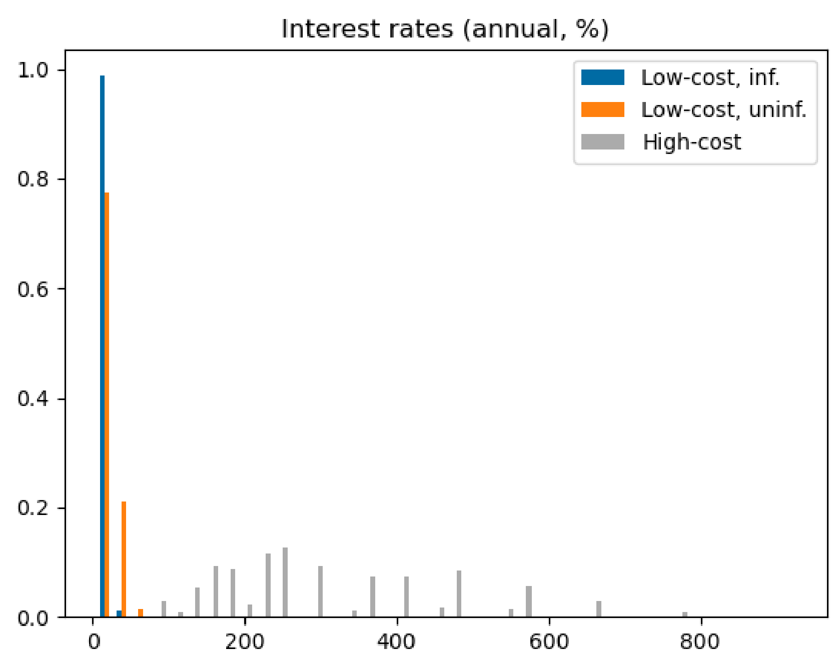


Matching these facts is important for our policy exercises. Welfare gains from regulating interest rates are generally larger if lenders have more market power, so a model that assigns all the spread to market power will overstate those gains (admittedly our market power parameter hits the lower bound, so it is not clear we could actually overstate these gains, but the general point holds anyway). Similarly, a model that generates an excessively-large high-cost market will also overstate the gains, since more uninformed agents will be stuck borrowing at very high rates, and one that gets the distribution of borrowers by wealth wrong will skew the welfare gains since it will miss on the distribution of marginal utility.

5 Interest Rate Dispersion

In this section, we characterize the rich dispersion in interest rates generated by our model. The distribution of interest rates from the model is shown in Figure 2 and summarized in Table 3. Annualized interest rates for unsecured credit range from 6 to 923 percent. Low-cost lenders post rates on the lower end —- between 6 and 66 percent — while high-cost lenders post rates on the higher end —- between 90 and 923 percent. From the distribution alone, we can already see that a blunt instrument, such as an interest rate cap, can be effective in targeting the central inefficiency of the credit market because it can be set to affect only the high-cost market, at least directly.

Figure 2: Relative frequency of interest rates, by submarket



Within the low-cost submarket, the rates paid by informed consumers —- up to 38 percent — match reasonably well the observed terms on credit cards. According to the Survey of Consumer Finances (2016), the maximum interest rate on credit cards reported by households was 36 percent. The additional spread in low-cost submarkets borne by uninformed consumers — the rates between 36 and 66 percent — can be interpreted as additional financial costs, such as late fees, that are documented in Grodzicki and Koulayev (2021).

Table 3: Interest rates across submarkets and information state

	Average	Std. dev.	Min.	Max.
Low-cost submarket	11.0	6.0	6.0	66.0
- Informed	10.8	5.6	6.0	38.0
- Uninformed	26.1	12.7	6.6	66.0
High-cost submarket	303.9	154.2	90.9	923.6

In Table 3 we can also see that, in the low-cost submarket, uninformed consumers pay higher interest rates compared to informed consumers, for a given (a, y). Low-cost lenders screen uninformed borrowers by offering them lower debt levels at higher interest rates. Uninformed borrowers have a stronger incentive to borrow less compared to the informed, as they are more likely to remain uninformed than an informed borrower is to become one and carrying less debt reduces their likelihood of meeting a payday lender next period and having to roll over their debt at a high interest rate. Although smaller loans carry less risk of default, the interest rate paid by an uninformed consumer is still higher. Through higher interest rates, lenders are able to extract surplus from uninformed consumers even in the low-cost submarket. However, low-cost lenders cannot extract as much surplus as high-cost lenders, since contracts have to satisfy incentive compatibility constraints and these are binding for the uninformed.

In Table 4, we decompose average interest rates into three components due to: i) default risk, ii) the fixed cost of entry, and iii) market power. For this decomposition, we compute two counterfactual interest rates to assess the importance of each of the factors. First, we consider an interest rate that accounts for default risk alone, as it would in a competitive model:

$$q^D\left(a', y, j\right) = \frac{E\left[1 - d\left(a', y', j'\right)\right]}{1 + r},$$

where d is the default rate in the next period. Second, we compute the interest rate that accounts for the fixed cost of entry κ:

$$q^{FC}\left(a', y, j\right) = -\frac{\kappa}{a'}.$$

We measure the contribution of market power as the difference between the equilibrium interest rate in our model and the interest rates that correspond to default risk plus fixed costs. The decomposition is shown in Table 4.

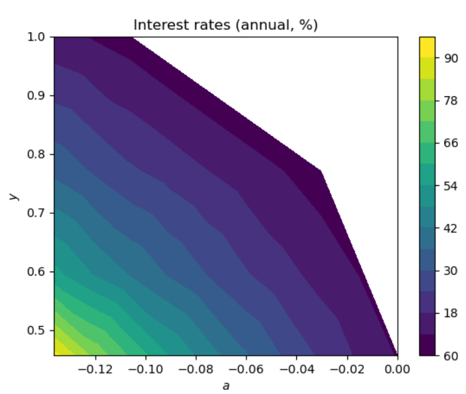
Table 4: Decomposition of average interest rates by submarket and information state

	Low-cost, inf.	Low-cost, uninf.	High-cost, uninf.
Equilibrium rate	10.8	26.0	303.9
Default risk only	10.1	5.5	8.3
Fixed cost only	1.3	6.6	1.3
Market power effect	-0.6	13.9	294.3

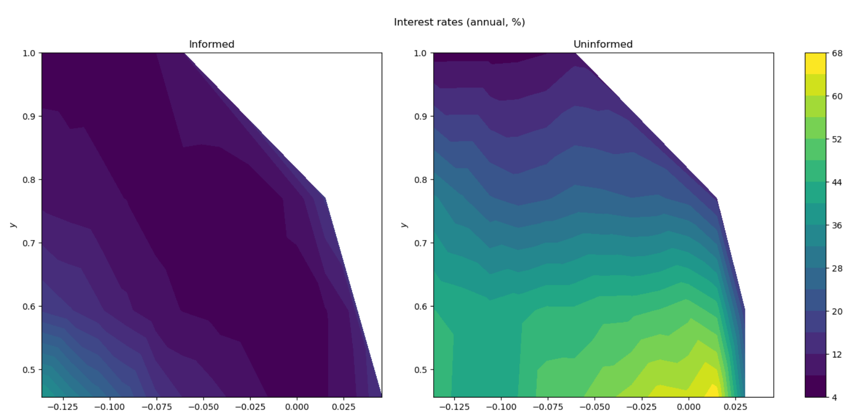
We find that most of the interest rates in the high-cost market are due to market power. Lenders have virtually all of the bargaining power and default rates are relatively low. In a frictionless model, the risk of default and the fixed entry cost would justify an average interest rate of 9.6 percent, compared to the effective interest rate of 303.9 percent. The large spread is therefore an indicator of substantial distortions relative to the competitive benchmark.

The composition of interest rates in the low-cost submarket is very different depending on the information state of the consumer. Uninformed consumers subsidize informed consumers. Informed consumers pay an average interest rate of 10.8 percent, which is not enough to cover the risk of default and the fixed cost (the break-even rate is 11.4 percent). Uninformed consumers pay on average 26 percent. More than half of their rates are driven by market power, as an interest rate of 12.1 percent would be enough to cover the risk of default and fixed costs.

Figure 3: Interest rates, low- and high-cost submarkets



High-cost



Low-cost

Interest rates also vary throughout the wealth and income distribution, as shown in Figure 3.

In high-cost markets, interest rates are higher in submarkets for lower income and lower wealth (more debt). For those states, borrower surplus is higher and lenders can increase interest rates to extract more surplus. This variation holds in the low-cost submarkets as well, but in this case it is due to higher default risk. For the uninformed, their rates are higher for lower income.

6 The effects of interest rate ceilings

In this section, we investigate the effects of interest rate ceilings. In particular, we focus on interest rate ceilings that are noncontingent – they apply to all submarkets uniformly. These ceilings are one of the most common policies used by states to regulate high-cost lending, and they do not require any particular knowledge on the part of the regulator. In terms of the model, an interest rate ceiling $\bar{r}$ corresponds to a price floor $\bar{q} = \frac{1}{1+\bar{r}}$ for $q_i\left(a'; a, y, j\right)$.

In our model, an interest rate ceiling restricts the division of surplus within a match. Directly-affected submarkets that would have equilibrium interest rates above the ceiling may continue to operate at lower rates after the ceiling is imposed or may shut down, depending on whether the total surplus remains positive at the ceiling or not. Furthermore, general equilibrium spillover effects imply that interest ceilings can alter the terms of trade and credit availability across other, not directly-affected submarkets. Our goal is to characterize how interest rate ceilings alter the entire composition of the unsecured credit market and consumer welfare.

Normative effects Figure 4 illustrates our primary results. We show the consumption-equivalent aggregate welfare gain (loss if negative) from introducing progressively tighter interest rate ceilings into the model.

We find an optimal interest rate ceiling of 26 percent (annualized), which yields an aggregate welfare gain of 0.03 percent. Gains are heterogeneous across the wealth and income distributions, as shown in Figure 5. For example, low-income, low-wealth households will gain up to 0.32 percent from imposing the optimal ceiling. Importantly, the policy is *Pareto-improving*; no households lose from the optimal interest rate ceiling. Despite the blunt nature of the instrument, no one would oppose introducing it.

To get a grasp on the source of welfare gains from the interest rate ceiling policy, we decom-

Figure 4: Aggregate welfare gain of interest rate caps

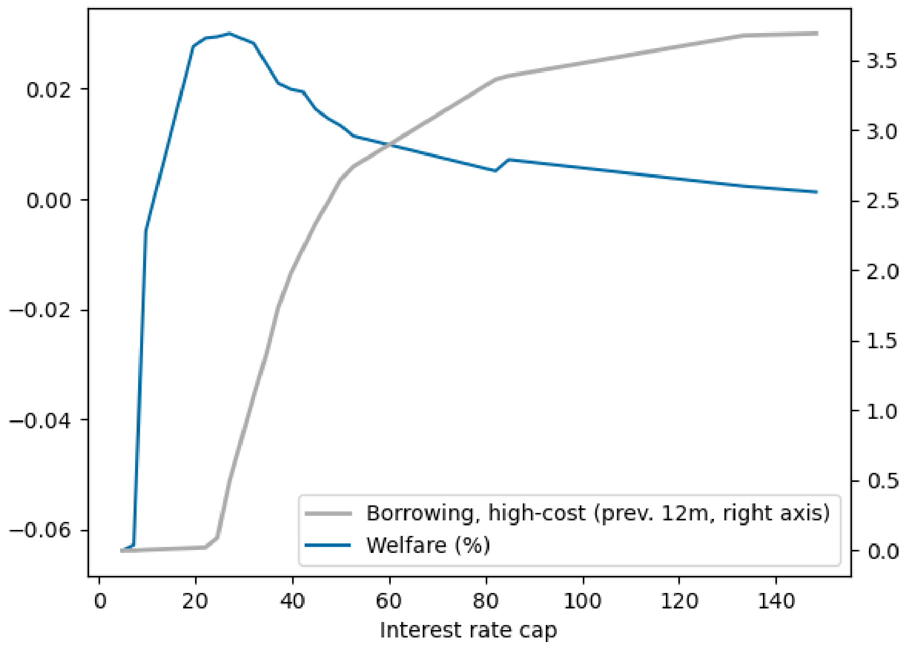
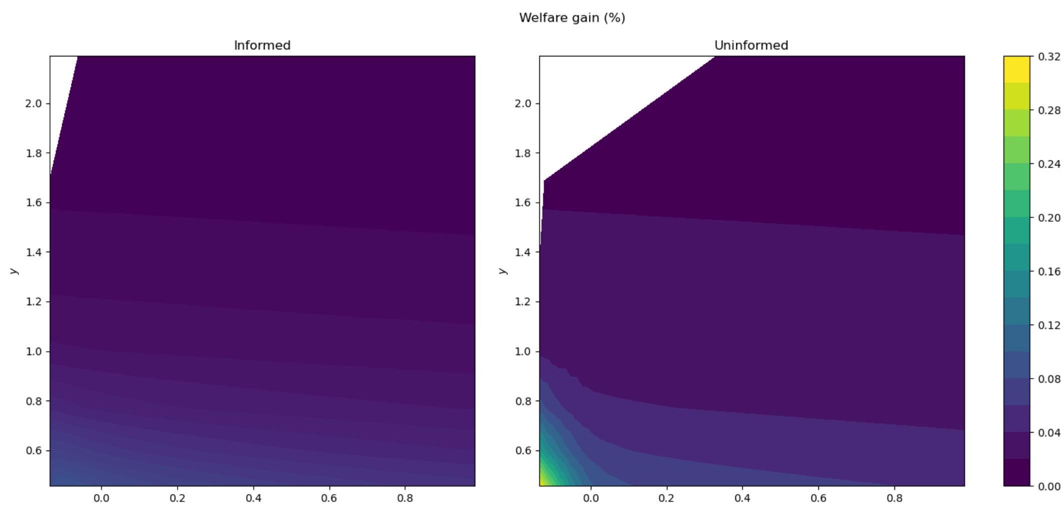


Figure 5: Welfare gain of a 26% interest rate ceiling



pose the welfare gains using two partial equilibrium experiments. First, we compute the welfare gains of an economy with the terms of trade (interest rates and borrowing levels) of an economy with an interest rate ceiling, but keeping fixed the tightness of each submarket from the unregulated economy. This allows us to measure to what extent the gains from the optimal ceiling are being driven by changes in terms of trade and not due to changes in the probability of matching with high- and low-cost lending. In our second experiment, we do the opposite and compute the welfare gains of an economy with the tightness of the economy with a ceiling, but fixing the interest rates and borrowing levels to the ones from the unregulated economy. The results are presented in Figure 6.

Our results support the idea that the welfare gains from tighter interest rate ceilings are driven by general equilibrium effects through the relative tightness of the submarkets, and not through changes in the terms of trade. As the high-cost submarket faces tighter interest rate ceilings, lenders exit, and uninformed consumers are then more likely to match with low-cost lenders. The terms of trade of informed consumers, the majority of the population in the model, deteriorate with a tighter interest rate ceiling, as shown in Figure 7. Here, we show the interest rate schedules in the low-cost submarket for informed and uninformed consumers with median income in the left and right panel, respectively. Interest rate schedules for the informed shift upward as the ceiling is tightened. For the uninformed, the schedules shift upward for ceilings above 50 percent but decline with tighter ceilings.

Positive effects The interest rate ceilings we investigate are binding for high-cost lenders.[13] Figure 8 shows the equilibrium interest rate and the tightness in the high-cost submarket. In each panel, the lines illustrate the interest rate and tightness as a function of the incoming wealth of the borrower, keeping income fixed at the median income of the borrowers. Each line within a plot represents a different interest rate ceiling. If the cap is not restrictive enough to close down the market, the high-cost lender simply sets the price at the cap. As a result, borrowers that match with high-cost lenders face better prices (left panel). Among high-cost submarkets that are still active, profits conditional on trade are decreasing with a tighter interest rate cap, so

[13]In principle, even ceilings that do not bind could affect welfare by changing the outside option of borrowers and lenders in the bargain. Such ceilings would be very high and the effects are likely to be very small because lenders are extracting essentially all the surplus.

Figure 6: Welfare decomposition: terms of trade vs tightness

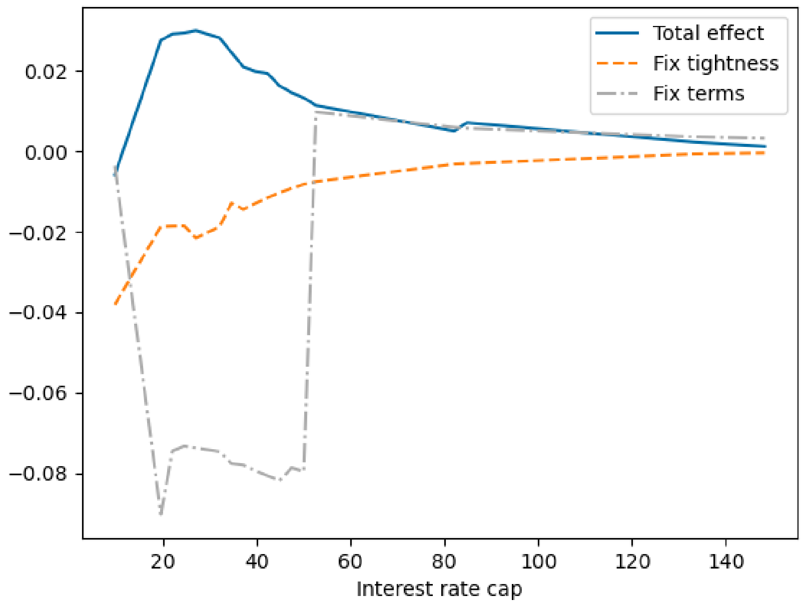
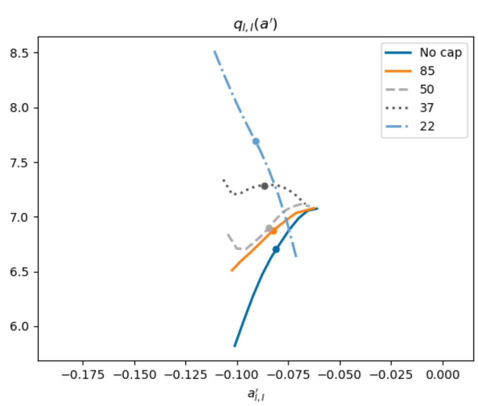
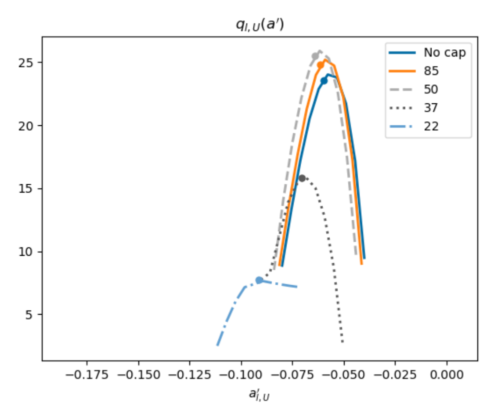


Figure 7: Interest rate schedules in the low-cost submarket



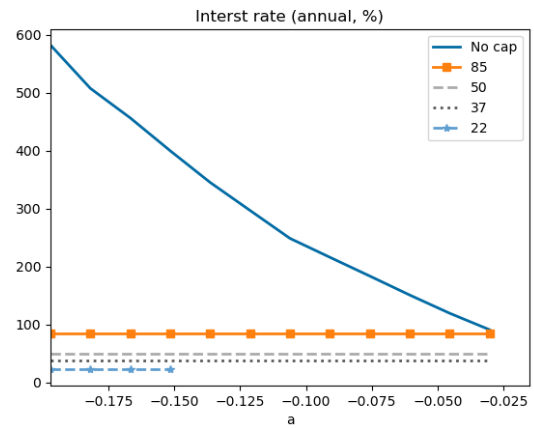
(a) Informed



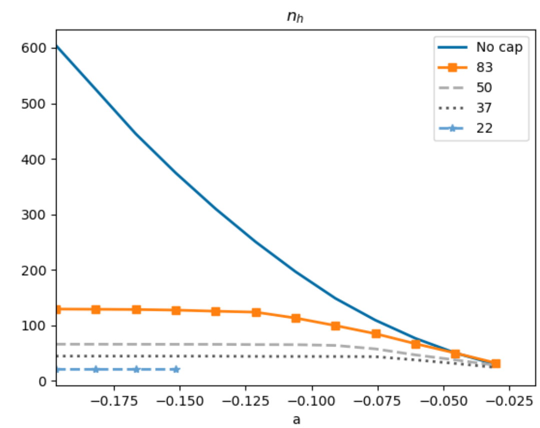
(b) Uninformed

lenders exit and the tightness of the submarket goes down (right panel).

Figure 8: Interest rates and tightness in the high-cost submarket, per interest rate cap



(a) Interest rate



(b) Tightness

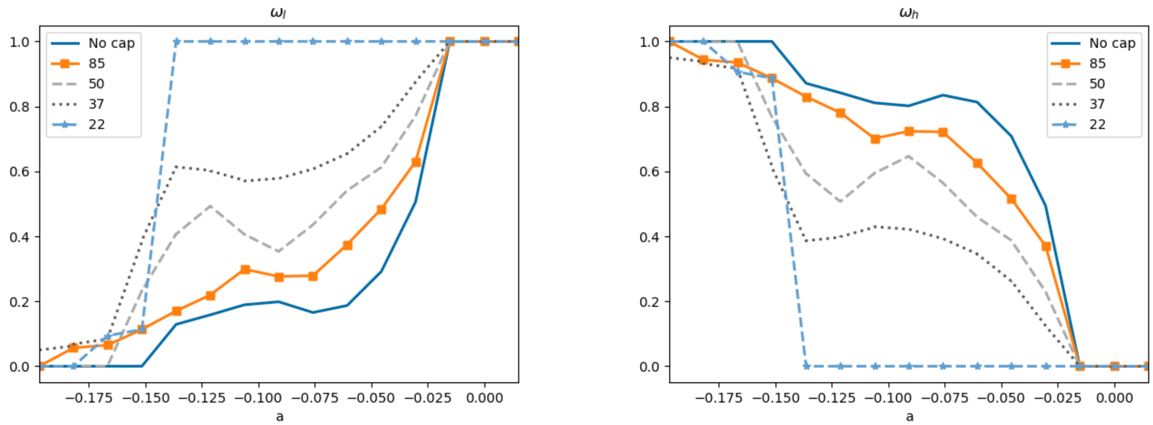
The reduced entry by high-cost lenders spills over to the *ex ante* probability of matching with a low-cost lender. To illustrate how caps alter the composition of the credit market we plot the relative number of lenders in submarket k over the total lenders across submarkets (ω_k) in Figure 9. With the cap, there are more low-cost lenders relative to high-cost lenders, so there is a higher chance of randomly meeting a low-cost lender when uninformed. This increase benefits borrowers as they will be matched more frequently with low-cost markets, and it is important to note that, since information states can change, this increase also benefits informed borrowers. Consumption smoothing improves due to increased access to lower interest rates.[14]

In terms of prices and borrowing in the low-cost submarket, theory suggests that interest rate caps can increase or decrease them. Indeed, we find quantitatively that equilibrium interest rates and borrowing can increase or decrease in the low-cost submarket depending on an agent's information state, wealth, and income. Figure 10 shows average interest rates and the fraction of households borrowing for high and low submarkets, and the information state; in Figure 12 we show debt-to-income ratios and default rates.

Moving from left to right along the x-axis represents higher interest rate caps or, equivalently, lower price floors. Interest rate caps reduce the average interest rate and participation in high-

[14]In the appendix, we report a similar plot but with the probability of searching and meeting a high- or low-cost lender α_k (see Figure 18). The changes are practically identical, which confirms that spillovers to the low-cost submarket from regulation occur through changes in ω_k.

Figure 9: Probability of searching in a submarket for uninformed consumers, per interest rate cap



(a) Low-cost submarket

(b) High-cost submarket

cost submarkets. Caps reduce the incentive of lenders to enter and post extractive terms of trade. Some high-cost markets still exist and lend at the cap, but others are destroyed. These effects spill over to the low-cost submarket. In the low-cost market, the extensive margin of borrowing increases as interest rates ceilings get tighter, for informed and uninformed households. Average interest rates increase for informed agents, while uninformed agents pay on average lower; the higher interest rates for the informed is the congestion effect of more uninformed reducing the probability of matching, which is small because there are not many uninformed borrowers.

Along the intensive margin of borrowing, informed and uninformed consumers are borrowing more in the low-cost submarkets as the interest rate ceilings become tighter, as shown in the left panel of Figure 12. High-cost borrowing increases to a ceiling of 75 percent and decreases at tighter ceilings. Overall, more borrowing increases the default rate of the economy as shown in the right panel.

However, when the interest rate ceiling is too tight — below 22 percent — tighter ceilings collapse the credit market as borrowing and average interest rates decrease to the point that there is no borrowing at all. Default rates are too high and entry too costly to justify any lending. Note that this rate is above some rates charged in the unregulated equilibrium, unlike what would happen in a competitive lending environment.

We can decompose the path of interest rates for each interest rate ceiling ceiling as above. We

Figure 10: Interest rates and borrowing

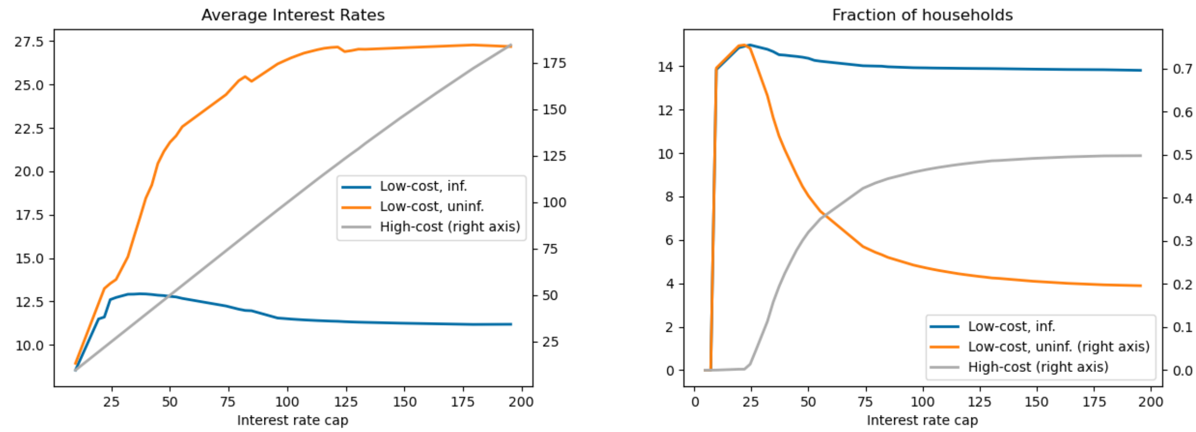
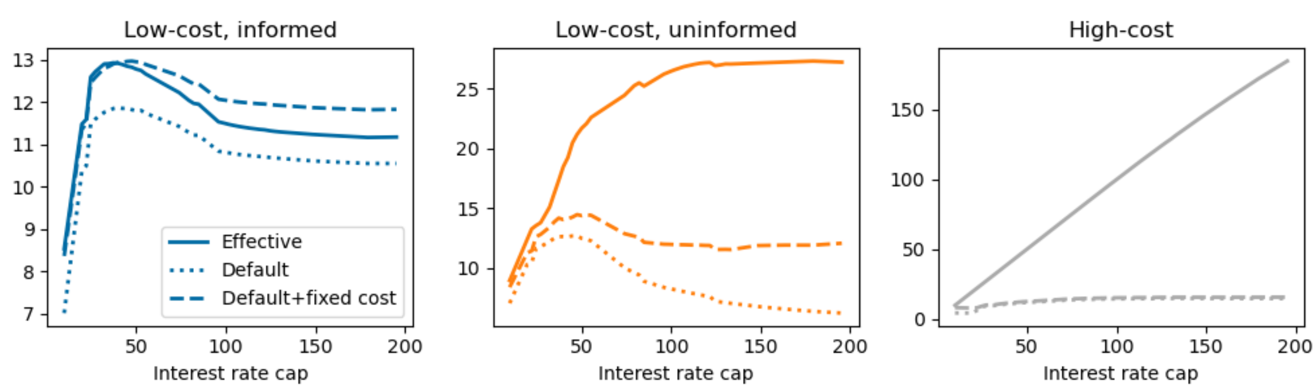
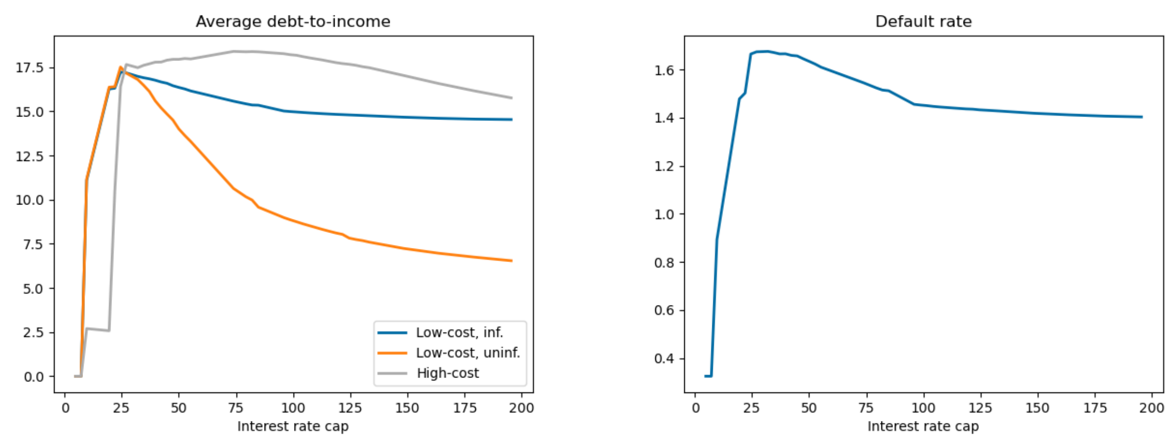


Figure 11: Average interest rates by interest rate ceiling



show the average interest rates together with the interest rate implied by the default risk and the fixed costs in Figure 11. We interpret the distance between effective interest rates and the interest rate that includes default risk and fixed cost as the effect of market power. The increase in rates for informed agents is driven by larger loans, which carry a higher default risk but also a lower cross-subsidization that they get from uninformed consumers. The lower rates for uninformed consumers are driven by lower market power despite the fact that the risk of default is increasing due to larger loans.

Figure 12: Debt-to-income and default rate



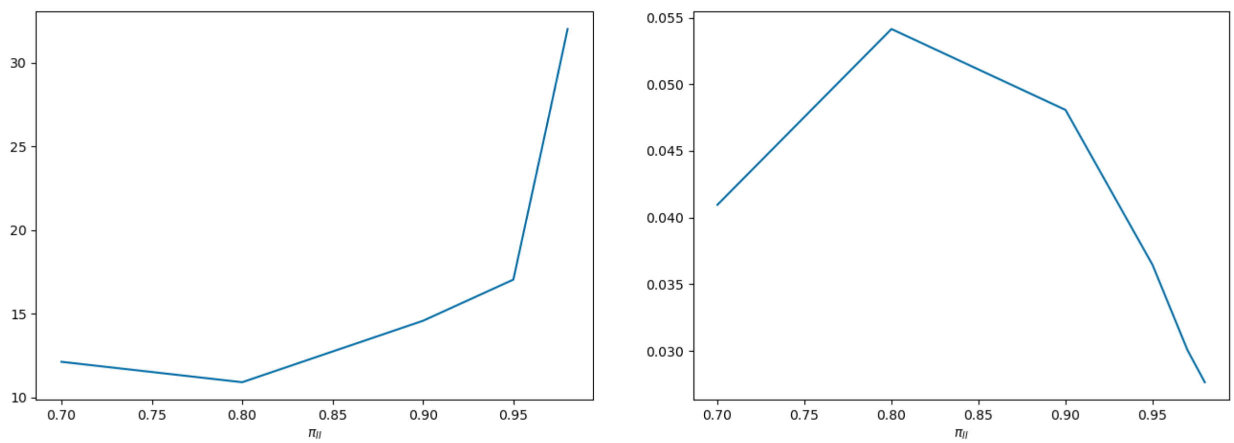
Sensitivity to $\pi_{I,I}$ We compute the model for different values of the probability of remaining informed $\pi_{I,I}$. We choose this parameter as it is identified by the extensive margin of borrowing and plays an important role in welfare; regulations that only directly help the currently uninformed may not be Pareto-improving if information states are too persistent, as the benefits are expected to arrive too far in the future. In particular, if information states are essentially permanent, then only indirect effects (which are negative) will affect the informed.

With this in mind, we recalibrate $\pi_{I,I}$ to match the range of borrowing in payday across US states. Payday borrowing varies substantially between states, as shown in Figure 19, ranging from 0.20 percent of households in Vermont to 6 percent in Mississippi.[15] These statistics are calculated using the Unbanked/Underbanked supplement of the Current Population Survey. Due to the high rate of non-responses in the CPS supplement, we choose $\pi_{I,I}$ such that payday

[15]These figures exclude states like California where payday lending is banned outright.

borrowing can be as high as 12 percent. As shown in Figure 20, higher payday borrowing is not necessarily associated with tighter interest rate ceilings, which would reduce borrowing, as in our model above.

Figure 13: Optimal interest rate cap and welfare gains across $\pi_{I,I}$



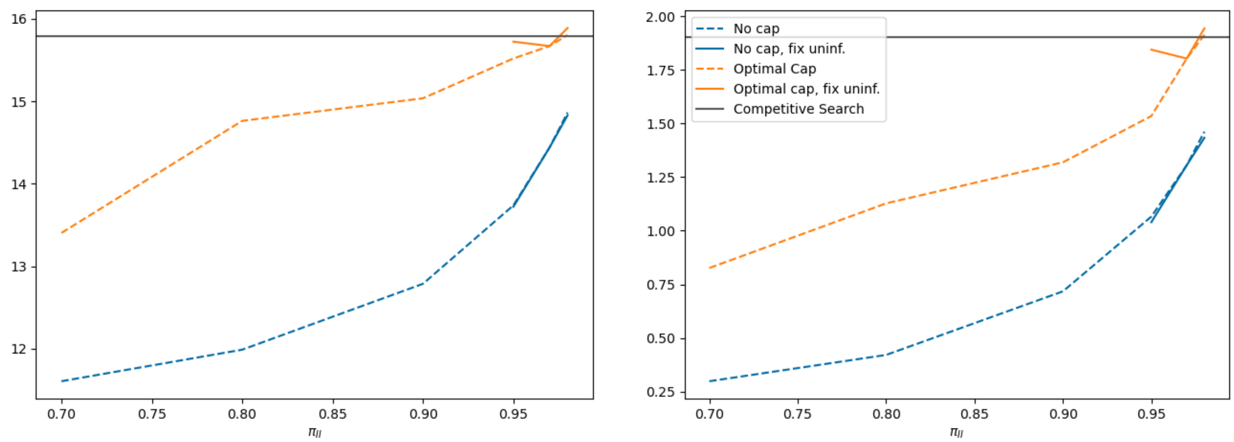
(a) Optimal interest rate cap

(b) Welfare gain from optimal cap (%)

For every $\pi_{I,I}$, we compute the unregulated equilibrium and an economy with the optimal cap, and we calculate the welfare gains from optimal regulation. These curves are shown in Figure 14. Economies with lower $\pi_{I,I}$ still benefit from an interest rate ceiling (right panel), and the optimal ceiling is decreasing (left panel). However, aggregate borrowing in both the extensive and intensive margins are further away from the competitive search outcome (an economy with only informed consumers). In our baseline calibration, the optimal ceiling virtually implements the allocations of the competitive search model.

Finally, we perform an additional exercise. As we lower $\pi_{I,I}$, we simultaneously adjust $\pi_{U,U}$ so that the fraction of uninformed households in the invariant distribution remains constant. The results are shown in the solid blue and orange lines in Figure 14. When the fraction of uninformed consumers is constant, the outcomes in the optimal cap economy are closer to the outcomes from the competitive search model even though the unregulated economy shows a collapse in borrowing as above.

Figure 14: Extensive and intensive margin of borrowing across models



(a) Fraction of households borrowing (%)

(b) Debt-to-income ratio (%)

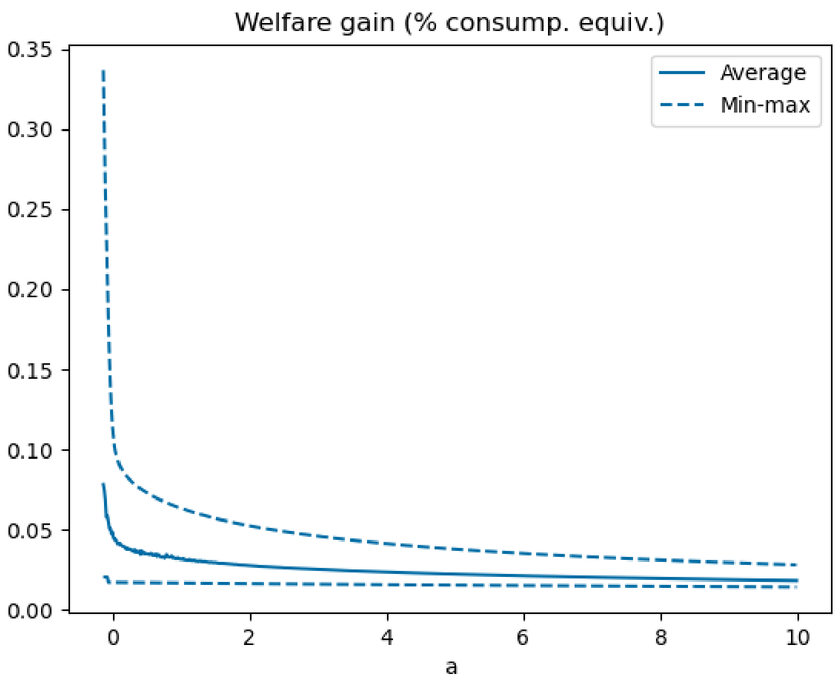
7 The Value of Information

In this section, we perform three additional experiments with our model. First, we consider an economy where all households are informed. Second, we ask what a single uninformed agent would pay to become informed, holding the equilibrium fixed. Third, we consider an economy as in the baseline, but where the information state is observed by the lenders in addition to wealth and income. The goal of these experiments is to shed light on the value of information in the model, and therefore the role it plays in our welfare results above.

All households are informed In this experiment, we assume that all households are informed, which turns our model into a standard directed search model. We calculate the welfare gains relative to our benchmark economy; we interpret this change as the gains associated with either improved financial literacy or improved dissemination of facts about credit markets. This particular allocation is of interest because it is generally the best that a planner could implement without being able to affect search technologies.

On average, households gain 0.032 percent of their consumption in an economy where all households are informed compared to our baseline model, only a small amount larger than the 0.03 percent welfare gain from the optimal interest rate ceiling. This result indicates that the interest rate ceiling is close to implementing the welfare gains from the competitive search model, suggesting that interest rate ceilings are not only welfare-improving but that they are quite powerful. In addition, since implementing the fully-optimal policy would be complicated and involve a substantial amount of individual information about borrowers, it is helpful to understand the gains from simple, easy to administer policies; that a blunt interest rate cap can capture nearly all the gains available is a result that is of practical value to policymakers.

Figure 15: Welfare gains (%) when all households are informed



One uninformed borrower becomes informed In this experiment, we ask households how much they value becoming informed while keeping the equilibrium constant. This experiment can be thought of as the value of a financial literacy program that is not big enough to change the equilibrium. We show the results in Figure 16.[16]

The value of being immediately informed for the average uninformed consumer is 0.04 percent of lifetime consumption. This gain is represented by the blue dashed line in Figure 16. The welfare gain decreases with wealth, as shown by the full blue line in the same plot. The welfare gain is due to better terms in the low-cost submarket; by directing their search, they can find

[16]Note that this change is ultimately transitory, since the agent may become uninformed again in the future.

substantially lower interest rates. Since households with higher wealth are less likely to borrow, they gain less from this exercise.

Lenders observe the information state In our last experiment we make the information state public, so that lenders can observe current income, wealth, and whether a consumer is informed or not. In this world, low-cost submarkets cease to exist for uninformed consumers, which generates a welfare loss for them as they pay higher rates. Furthermore, informed consumers no longer receive subsidized interest rates, because the low-cost lenders no longer serve uninformed consumers. The latter is a welfare loss for informed households. There is also a welfare gain for informed households stemming from less congestion in the low-cost market.

The average effect of these forces is a negative welfare effect of making the information state public information, albeit a small one (-0.004 percent on average). Because lenders are relatively effective at screening uninformed agents in the low-cost market (only 1.3 percent of borrowers in the low-cost market are uninformed), the subsidy to the informed agents is relatively small, leading to a small gain; combined with the small number of uninformed agents overall, the result is a small welfare loss on average. However, not all costs are small: consumers at the bottom of the wealth distribution lose a significant amount of welfare, up to 0.02 percent of their consumption, because their interest rates will rise substantially and they face the bad options of rolling over at high rates or paying the debt off immediately, both of which would involve substantial reductions in consumption, or paying the default cost. But because these households are not particularly numerous, the average effect is small.

Note that this result is qualitatively different from that in Athreya et al. (2012), Sanchez (2017), and Chatterjee, Corbae, Dempsey, and Rios-Rull (2023), where better information in unsecured credit markets leads to large welfare gains. In competitive models, adverse selection can be very strong (for example, in Athreya et al. (2012) the credit market under asymmetric information is about one third as large as it is with symmetric information, and there exist equilibria in that model where the unsecured credit market unravels completely), whereas here it is relatively weak. This result could arise from a number of differences – the degree of market power, the nature of the hidden information, or the calibrated amount of hidden information.

Figure 16: Welfare gains of uninformed households

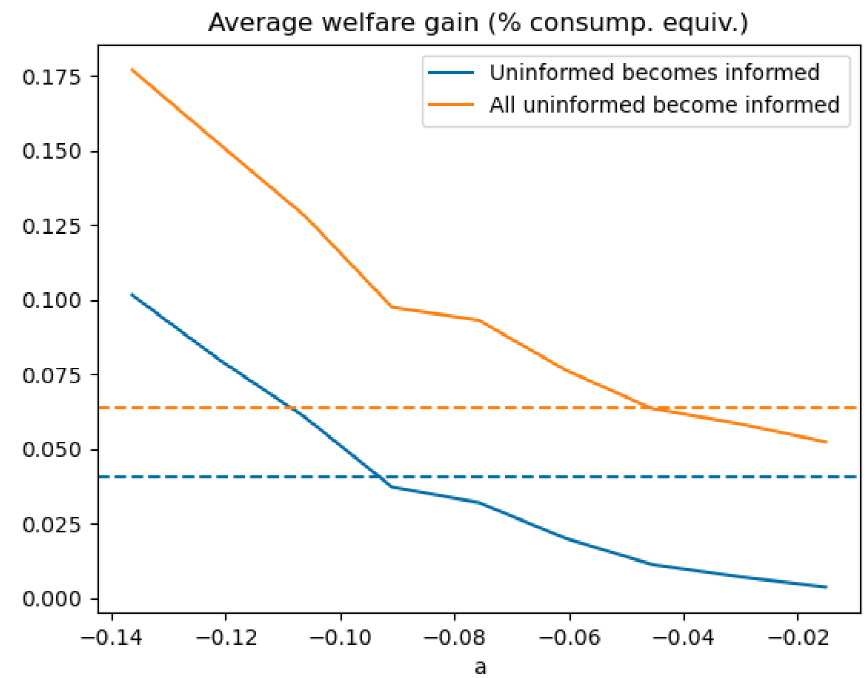
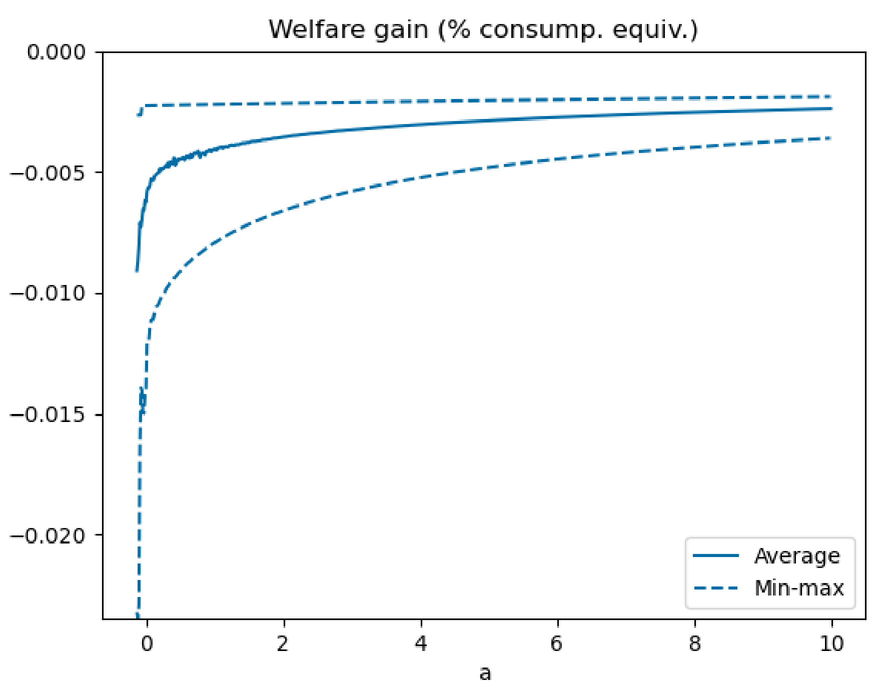


Figure 17: Welfare gains (%) when information state is observed



8 Conclusion

We study the positive and normative effects of interest rate ceilings in environments in which lenders possess market power. We find that annual interest rate ceilings as low as 30 percent can increase borrower welfare in the presence of uninformed agents whose surplus can be extracted more completely by lenders. Even if only a small fraction of agents are uninformed (4 percent in the calibrated model) the gains from imposing interest rate ceilings outweigh the costs for all agents.

Our model complements the findings in Saldain (2023) regarding the welfare effects of credit market regulations. In that paper, households with self-control problems could also benefit from interest rate ceilings, but do not because their default incentives already lead to very tight borrowing constraints. It could be fruitful to combine the two models, especially if the preferences of the borrowers are not observable.[17]

We have explored alternative models. In particular, we considered a market structure in which all households could obtain two draws from the distribution of lenders; the resulting equilibrium again has two types of lenders, low and high cost, where high cost lenders are used exclusively by those who failed to match in the low cost market. These lenders are labeled 'high-cost' because they exploit the limited outside options of the borrowers who failed to obtain a low-cost match. While this model delivered interesting results on the spillovers of market power due to regulation in the high-cost market, the spreads were an order of magnitude too small and interest rate ceilings ended up reducing welfare as in the competitive model.[18]

Our model does not feature dynamic information updating on the part of lenders. Credit scoring is a mechanism through which markets provide information on relevant and unobserved state variables, such as propensities to default. Chatterjee et al. (2023) show that dynamic scoring has important effects on the provision of competitive credit. Given that payday lenders typically do not report to the main three credit bureaus (Equifax, TransUnion, and Experian), but rather rely on their own information agency (Teletrack), it would be an interesting extension to consider

[17]See also Raveendranathan and Stefanidis (2023), who study the role of restricting the ability of lenders to increase debt limits to households with self-control problems.

[18]Details of these experiments are available upon request. We explored also an extension of our model to allow for random searchers to get multiple offers, but solving for the equilibrium structure was difficult; we intend to revisit that model in future research.

the role of scores in our model and the welfare gains/losses associated with better tracking of past activity and the sharing of information.[19]

Our model also does not feature delinquency (informal default; see Athreya, Sanchez, Tam, and Young (2018)). While the default rates on payday loans is high, it is more likely due to failure to repay than formal bankruptcy. In Athreya et al. (2018), after a borrower skips a payment the lenders optimally reset the value of the outstanding debt, taking into account how likely the borrower is to pay in the future versus continuing to be delinquent or filing for bankruptcy. High "penalty" rates for delinquent debt could easily run afoul of the ceilings, which could lead to welfare gains through reduced interest rates but could also encourage delinquencies and lender exit. Whether this extension changes our answers regarding the welfare gains from simple caps is left for future work.

[19] Accounts that get sold to debt collectors or result in court judgements do appear on credit reports.

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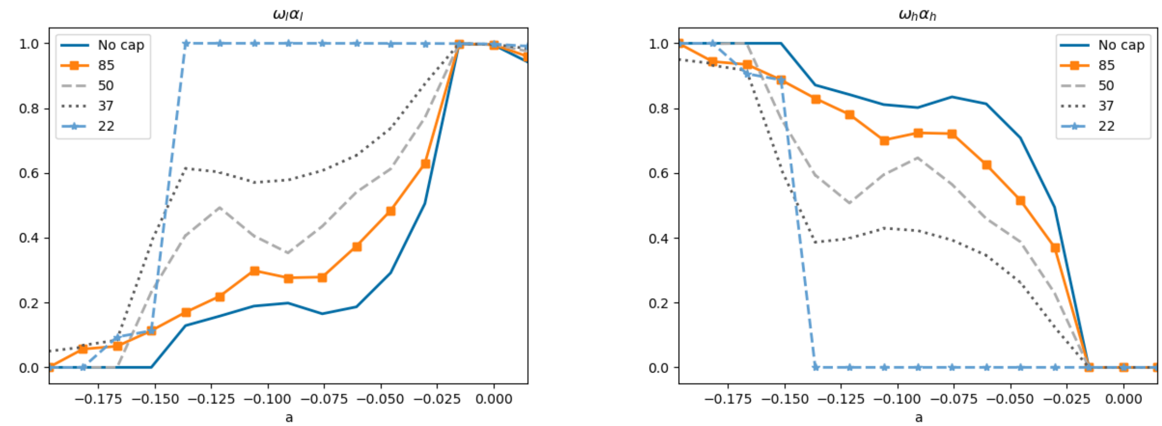
A Figures

Figure 18: Probability of searching and meeting a lender for uninformed consumers, per interest rate cap and submarket



(a) Low-cost submarket (b) High-cost submarket

Figure 19: Fraction of households borrowing from AFS and payday lenders

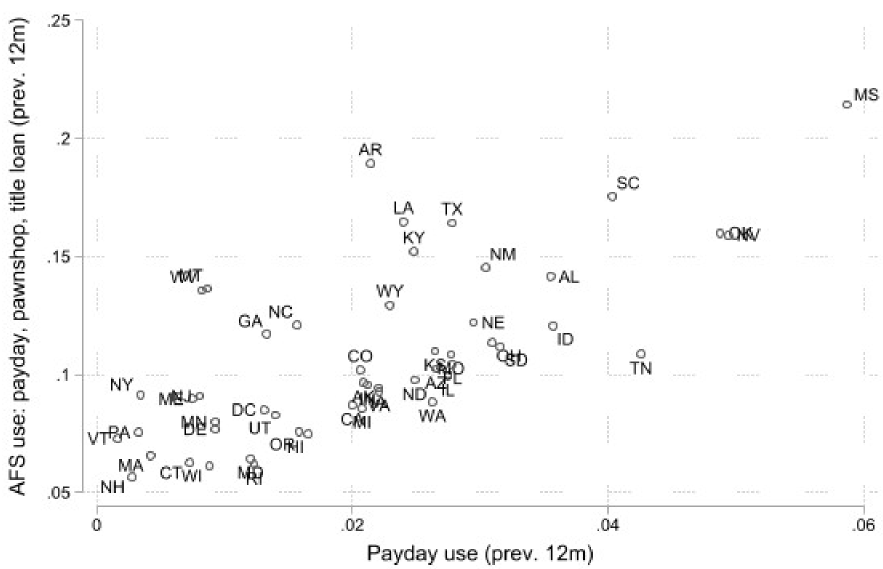
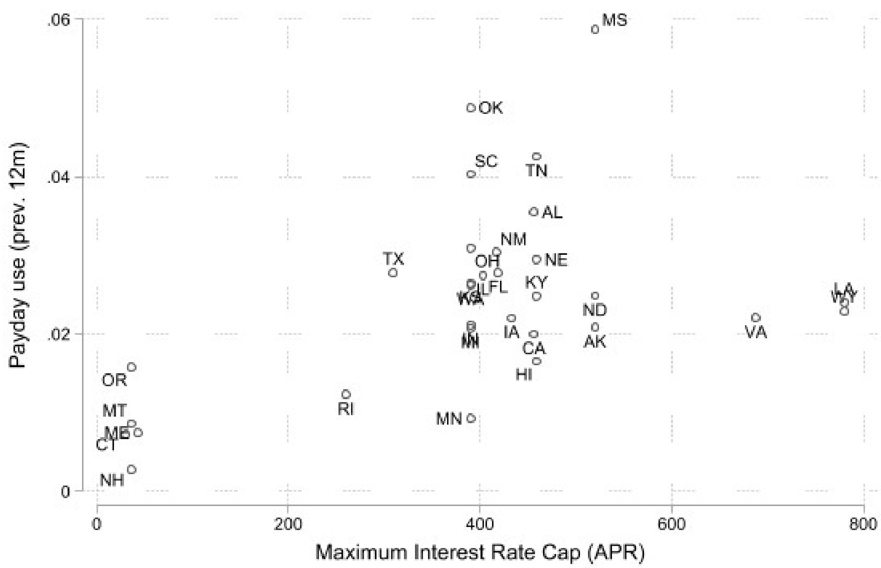


Figure 20: Fraction of households borrowing from payday lenders and interest rate cap



B Solution

We assume a matching function of the form $\alpha(n) = \frac{n}{(1+n^v)^{\frac{1}{v}}}$, and proceed as follows:

0. Guess $v^0(a,y,j), d^0(a,y,j), \Gamma^0(a,y,j)$. We use as a guess the solution from the model without private information.

1. Solve $v^{s,n}(a,y)$.

2. Solve $v^{s,l}(a,y)$ using local optimizer FFSQP.

3. Solve $v^{s,h}(a,y)$ using local optimizer FFSQP. Compute n_h using (8).

4. Compute α_l, α_h solving equations (14), (18) and (19).

$$\alpha_l = \alpha(n_l)\frac{\Gamma(a,y,I)n_l}{\Gamma(a,y,U)(n_h - n_l)} \tag{20}$$

$$\alpha_h = \alpha(n_h)\frac{n_h\Gamma(a,y,U) - n_l[\Gamma(a,y,I) + \Gamma(a,y,U)]}{\Gamma(a,y,U)(n_h - n_l)} \tag{21}$$

   Need $\frac{n_h}{n_l} > \frac{\Gamma(a,y,I)+\Gamma(a,y,U)}{\Gamma(a,y,U)}$ for positive α_l,α_h.

5. Compute $v^s(a,y), v^d(a,y)$. Update $v^1(a,y), d^1(a,y), \Gamma^1(a,y,j)$

6. If $v^0(a,y), d^0(a,y), \Gamma^0(a,y,j)$ close enough to updated values, finish; otherwise, update guess in step 0.