Predatory Lending in a Rational World[1]

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[1]PRELIMINARY AND INCOMPLETE.

Abstract

Regulators express growing concern over "predatory lending," which we take to mean lending that reduces the expected utility of borrowers. We present a rational model of consumer credit in which such lending is possible and we identify the circumstances in which it arises with and without competition. Predatory lending is associated with imperfect competition, highly collateralized loans and poorly informed borrowers. Under most circumstances competition among lenders eliminates predatory lending.

"While Georgia's real estate foreclosure law has remained essentially the same since the 1880s, mortgage lending has changed dramatically during the past two decades...Leagues of homeowners are tapping into their equity to pay off credit cards, buy cars and take trips...One bump in the road - a job loss, a sick child, a divorce - could introduce homeowners to the harsh realities of Georgia's foreclosure law."

"Swift foreclosures dash American dream," *Atlanta Journal and Constitution*, January 30, 2005

"Any time you're looking at equity rather than ability to repay, you're approaching predatory lending." (Attorney Daniel J. Mulligan, whose law firm, Jenkins & Mulligan, San Francisco, is a member of the National Association of Consumer Advocates.)

"How unscrupulous lenders prey on the vulnerable," *San Francisco Chronicle*, July 15, 2001.

1 Introduction

Many states have new laws combating "predatory lending." This term has yet to acquire a precise definition, but judging from the content and discussion of the laws, it means lending that brings expected harm to borrowers. That is, harm is the lenders' expectation, rather than just a possibility. But this begs the question, how do such loans arise in the first place, when borrowing is voluntary? The answer turns on what borrowers know. If the borrower also expects harm, then the borrowing decision is irrational. If only the lender expects harm then the borrowing decision could be rational, but the borrower has to wonder why the lender chose to lend, and on those terms. This paper considers the rational basis for predatory lending - that is, if and when it arises in equilibrium.

Much of the concern surrounding predatory lending relates to circumstances under which a borrower's home is at risk in the event of default. House-purchase mortgages and home equity loans both fall within this category. Critics of banks' behavior in subprime lending markets suggest that borrowers underestimate their true probability of default and lose their homes in foreclosure; while lenders know the true odds but they recover enough in foreclosure that they lend anyhow. Because foreclosure brings costs to borrowers without offsetting benefits to lenders, this excess foreclosure threatens both wealth distribution and economic efficiency.

But for it to occur in equilibrium, it must be that, if some borrowers underestimate their foreclosure risk, there must be other borrowers receiving the same loan terms who overestimate their foreclosure risk, because otherwise the loan terms would prove to the underestimating borrowers that they should not take the loans. And furthermore, it must be optimal for the lender to offer the same terms to both types, rather then lend to the two types on different terms, or just to the good types. That is, predatory lending requires pooling of good and bad types.

A necessary condition, then, for predation is that lenders have extra, private information about borrowers' prospects. Considering that a few huge-volume lenders dominate consumer credit – for example, the top 10 mortgage lenders accounted for 61% of originations in 2003 (OFHEO, 2004) – this condition is likely to prevail. These lenders see not only a borrower's ex ante circumstances, but also both the ex ante circumstances and the ex post outcomes of thousands of similar borrowers, a potentially important advantage.

A simple model captures the important elements of the problem. On the borrowing side are homeowners who get private benefits from their homes, and who wish to borrow against them to capture additional benefits. On the lending side are creditors who can privately distinguish homeowners with good and bad prospects for repayment, and who foreclose if not fully repaid. Because liquidation is costly and does not capture the private benefits, it carries a deadweight cost. Lenders offer loan terms to borrowers, and we say that predatory lending occurs if homeowners accept terms that make them worse off. We identify the equilibria of two economies, one with a monopolistic lender, and one with multiple competing lenders.

With a monopolist lender, borrowers with low expected incomes are exposed to predatory lending when they have large equity stakes in their homes. These equilibria are robust to standard refinement concepts. Moreover, loans which are used to create additional collateral, such as home-improvement and house purchase loans, are particularly susceptible to predation. Introducing competition between lenders mitigates predatory lending. However, loans which are fully collateralized remain at risk when lending to borrowers with bad prospects is socially inefficient.

At the end of the paper, we analyze the effects of several prominent legislative interventions in the consumer credit market.

Related Literature

To the best of our knowledge, the only other academic paper to explicitly study predatory lending is a recent working paper by Hanson and Morgan [7]. They present a behavioral model in which some borrowers are "deluded" about their future income and overborrow for this reason. In contrast to the existing paper, borrowers are assumed unable to infer any useful information from the terms of the loan contract. Hanson and Morgan also attempt to empirically detect one specific form of predatory lending — namely payday lending — by examining whether borrowers without college degrees and/or uncertain income are disproportionately more likely to be delinquent in states which are more permissive of payday loans.

A key assumption in our analysis is that, at least in some respects, the lender knows more about a borrower's future income than does the borrower himself. Much of our analysis is then concerned with what a rational borrower can infer about the lender's information from the loan contract offered. In a different context, Bénabou and Tirole [3] consider a similar model. Whereas our main concern is to understand under what circumstances a borrower can be made worse off by accepting a loan, Bénabou and Tirole are interested primarily in understanding when an increase in incentives will lead to a reduction in effort.

Hanson and Morgan asides, arguably the closest precursors to our paper belong to the extensive literature on competition for partially informed consumers. Prominent contributions include (but are certainly not limited to) Stigler [11], Salop and Stiglitz [9], Wilde and Schwartz [13], and Varian [12]. Subsequent papers, such as those of Beales *et al* [2] and Schwartz and Wilde [10], have sought to draw policy implications from these formal analyses. A recent article by Hynes and Posner [8] surveys a variety of issues related to the regulation of consumer finance, among which is the application of these models to the specific context of consumer loans. Ausubel [1] presents evidence that competition fails to eliminate profits in the credit card market, and sketches a model in which some borrowers are irrational and ignore the possibility that they will actually borrow using credit cards.

The key assumption in all these papers is that consumers are not fully and costlessly informed about the prices offered by all competing firms. This assumption can generate cases in which prices do not fall to a fully competitive level; but it clearly cannot generate circumstances in which a consumer's welfare is actually reduced by purchasing a good. In contrast, in our paper borrowers fully observe the interest rates offered to them; instead, it is their own future income process about which

they are imperfectly informed. On an abstract level this assumption is equivalent to borrowers not knowing their own preferences. In this regard, our paper clearly shares some common ground with recent papers on competition for behavioral consumers (see, e.g., Ausubel [1], or, more recently, Gabaix and Laibson [6]).

Paper Outline

The paper proceeds as follows. Section 2 presents the model. Section 3 analyzes the incidence of predatory lending under monopolistic lending conditions. Section 4 then explores the effect of increased competition on the possibility of predation. In Section 5 we extend our basic model to cover home-improvement loans, and show that (consistent with public concern) these are particularly prone to predation. For a variety of reasons consumer credit markets are highly regulated; Section 6 analyzes the impact of three high profile legislative interventions. Section 7 concludes. All proofs omitted in the main text are given in Appendix A.

2 Model and Definitions

As noted above, concern about predatory lending focuses on situations in which a borrower's home is repossessed upon default. We present a highly stylized model of home-equity loans — that is, loans in which a borrower uses an equity-stake in his home as collateral for a new loan, often for consumption purposes. Much of our analysis applies with little alteration to the other main case of interest, namely loans made for the purpose of the initial house purchase. As we will argue in Section 5, if anything we are biasing our analysis against generating predation by focusing on the consumption loans that do not create additional collateral.

Basic Setup

All agents are risk neutral and require an expected return of at least 0. Borrowers have no money but have the opportunity to spend L on a project that delivers a gross non-monetary benefit in one period of $L + S$. Examples include health care, children's education, weddings, travel, and just general consumption. In one period, each borrower will receive, independently of undertaking the project, stochastic in-

come of $y \in \{0, I\}$. In addition to the income, each borrower has collateral, which we will refer to as his house, which is worth H to the borrower and which sells for $H - X$, where $X < H$. The difference X represents the combination of the lender's costs of foreclosing on the house,[1] and the borrower's private benefits from his house, such as the adaptation of the rest of his life to living there.

Lenders have unlimited funds, so they will lend L if they expect repayment of at least L. Throughout, we restrict attention to debt contracts, which are defined by their face value F. We assume throughout that the high income realization I exceeds the face values of all equilibrium loan contracts, so that the lender is always repaid F when $y = I$. On the other hand, in the low income realization the borrower is forced to sell his house for $H - X$. (Equivalently, the lender seizes the house.) In this case, if $H - X \geq F$, the lender receives F and the borrower is left with $H - X - F$; while if instead $H - X < F$ then the lender receives $H - X$ and the borrower is left with 0.

Note that since in our setting the borrower only ever takes a loan from a single lender, it is irrelevant whether or not the loan is explicitly secured by the house. That is, even if the lender makes an unsecured loan, he ultimately still has the right to attach any wealth belonging to a borrower who has defaulted.

The order of events is as follows. The lender makes a take-it-or-leave-it offer to lend to the borrower at a face value F, and the borrower either borrows L on those terms, spending it on the project, or does not borrow. When there are multiple lenders, they make simultaneous take-it-or-leave-it offers (see Section 4).

Information Structure

As discussed, a key element of our model is that lenders are better informed about the income prospects of borrowers than are borrowers themselves. Formally, while a borrower thinks there is a probability p that he will receive income $y = I$, each lender receives an informative signal $\sigma \in \{g, b\}$. If the lender observes signal $\sigma = b$ (respectively, $\sigma = g$), the borrower's actual probability of income $y = I$ is p_b (respectively, p_g).

[1] One estimate puts the cost of foreclosure at just less than \$60,000 for loans that go through the full formal process: see Crews and Green [5].

Comments

1. One possible way in which the probabilities p, p_b and p_g are related is as follows. A fraction θ of borrowers are type G; for these borrowers, there is a probability π_G that $y = I$. The remaining fraction $1 - \theta$ are type B, and have probability $\pi_B < \pi_G$ of income $y = I$. Conditional on this public information, the probability that a borrower collects $y = I$ is $p \equiv \theta\pi_G + (1 - \theta)\,\pi_B$. The signals received by lenders are (possibly noisy) indicators of a borrower's type. So conditional on both the public information and the lender's signal $\sigma \in \{g, b\}$, the probability that a borrower gets $y = I$ is $p_\sigma = \Pr(\pi = \pi_G|\sigma)\,\pi_G + \Pr(\pi = \pi_B|\sigma)\,\pi_B$.[2]

2. Formally, the informational advantage of lenders over borrowers can be equally interpreted either as:

   (a) Standard private information. That is, evaluating the probability of high and low (disposable) income realizations is only possible if the borrower possesses data of the income realizations of a sizeable number of borrowers with similar observable characteristics. A lender is likely to have much better access to this information than a borrower.

   (b) Bounded rationality. Even if both the borrower and lender have exactly the same information about the income realizations of comparable borrowers, a lender may be much better at drawing the correct inferences from this information than a borrower.

3. Many plausible scenarios are consistent with this formal framework, some more consistent with bounded rationality and some more consistent with standard asymmetric information. Examples include:

   (a) The borrowers work in one of several sectors. These sectors will be differentially affected by macroeconomic shocks. For instance, the steel industry may be more affected by exchange rate fluctuations than the food industry. Lenders understand these correlations, but borrowers do not.

[2] For example, in the specific case in which $\Pr(\pi = \pi_G|\sigma = g) = \Pr(\pi = \pi_B|\sigma = b) = 1 - \varepsilon$, then

$$\begin{aligned} p_g &= \frac{\theta(1-\varepsilon)\,\pi_G + (1-\theta)\,\varepsilon\pi_B}{\theta(1-\varepsilon) + (1-\theta)\,\varepsilon} \\ p_b &= \frac{\theta\varepsilon\pi_G + (1-\theta)(1-\varepsilon)\,\pi_B}{\theta\varepsilon + (1-\theta)(1-\varepsilon)}. \end{aligned}$$

(b) Borrowers belong to different demographic groups. Similar to above, different groups may be differentially affected by macroeconomic shocks.

(c) The income that matters in our model is disposable income, i.e., total income net of essential expenditures. Borrowers from different demographic and/or geographic groups may have different probabilities of experiencing a rise in essential expenditure. For example, the probability of large health expenditures may be much greater for 70-year old men than for 65-year old men.

If the lender observes $\sigma = g$ then we say that the borrower has good prospects, and we refer interchangeably to lending after signal g and lending to good prospects. Analogously, after $\sigma = b$ the borrower has bad prospects, and lending after signal b is equivalent to lending to bad prospects.

Predatory Lending Defined

Our question for the model is whether predatory lending arises in equilibrium. This requires a working definition. The essence of predatory lending is expected harm: a predatory loan reduces the lender's expectation of the borrower's utility. Thus, we say that an equilibrium features *predation of bad prospects* (respectively, *good prospects*) if, conditional on the lender observing signal b (respectively, signal g), a borrower is made worse off in expectation by accepting the lender's offer. To reiterate, the expectation here is conditional on the lender's information σ.

Another question for the model is whether predatory lending causes harm to society, rather than just the borrower. To address this question, we refer to lending that causes net harm to society as *socially inefficient*, as opposed to socially efficient, and if lending after observing σ is socially inefficient we say that an equilibrium in which such loans are accepted features *strong predation* after signal σ. Note that such loans would have to be harmful to the borrower since the *lender* would not be losing expected value conditional on his own information. Predation that is not strong we call *weak*.

Predation of bad prospects involves borrowers suffering from defaulting more than they expect, and predation of good prospects involves borrowers suffering from repaying their loans more than they expect. Since the former is a much better fit for publicly-voiced concerns about predation we will focus on it, though we will also point out where the latter occurs.

3 Monopoly Lending

In this section we identify and characterize the pure-strategy perfect Bayesian equilibria of the monopolist-lender economy. For this purpose we need first to establish the relevant boundaries: the boundary between social efficiency and inefficiency, and for each agent, the boundary between entering the loan and staying put. We derive these boundaries, use them to identify necessary conditions for efficiency and predation, and then solve for the equilibria.

Social Efficiency of Lending

A loan delivers surplus S to the borrower in both the income and no-income states, and also destroys X in the no-income state. As such, lending after signal σ is strictly socially efficient if and only if $S > (1 - p_\sigma)X$. For use below, likewise note that uninformed lending would be strictly socially efficient if and only if $S > (1 - p)\,X$.

If lenders and borrowers had the same information we would never see socially inefficient loans, because someone's expectations must be negative. But when borrowers base expectations on less information, this logic no longer applies; the borrower's expectations for himself will not be negative, but that does not stop the lender's expectations for the borrower from going negative.

Borrowers' Break-even Face Values and their Properties

Consider first a borrower who in equilibrium does not learn the lender's signal about him. If he does not accept a loan then he keeps his house for sure, and gets income I if the income state obtains. Thus, his reservation utility is $H + pI$. If he *does* accept a loan of L with face value F, then he obtains a non-monetary utility of $L + S$. Of course, he must also repay the loan. If his income is high he can afford to make the payment F, and so keeps his house: his total payoff is $L + S + H + I - F$. On the other hand, if his income is low he cannot afford to make the payment F, and so loses his house: his total payoff is $L + S + \max\{0, H - X - F\}$. We denote the highest face value acceptable to a borrower who does not learn the lender's signal by F^D, which is defined implicitly by the indifference equation

$$L + S + p(H + I - F^D) + (1 - p)\max\left\{0, H - X - F^D\right\} = H + pI. \qquad (1)$$

Solving,[3]

$$F^D = \begin{cases} \frac{L+S-(1-p)H}{p} & \text{if } H-(L+S) < pX \\ L+S-(1-p)X & \text{otherwise} \end{cases} . \tag{2}$$

As we have stressed, the borrower does not directly observe the lender's signal σ. However, he may learn the signal in equilibrium. In this case, the highest face value he is prepared to pay on the loan depends on the signal. We denote these reservation face values by F_b^D and F_g^D; algebraically they take the same form as expression (2), with p simply replaced by p_b and p_g respectively.

The relative values of F_g^D, F^D and F_b^D are central to predatory lending because they determine whether it is good or bad prospects who might accept a welfare-reducing loan. If $F_g^D > F^D > F_b^D$ then a face value $F \in (F_b^D, F^D]$ would be acceptable to a borrower who does not know the lender's signal (since $F \leq F^D$) but reduces the welfare of bad prospects (since $F > F_b^D$). Likewise, good types may suffer if $F_g^D < F < F_b^D$. So these relative values are crucial to predation, and straightforward manipulation of equation (2) implies that they turn on the sign of $H-(L+S)$:

Lemma 1 *$F_g^D > F^D > F_b^D$ if $H > L+S$, $F_g^D = F^D = F_b^D$ if $H = L+S$, and $F_b^D > F^D > F_g^D$ if $H < L+S$.*

So better prospects have the higher tolerance for promised repayments when their collateral is worth more than the loan's payoff, and worse prospects have the higher tolerance when it is worth less. This is a natural consequence of the better prospects having the lower chance of losing the collateral, and the worse prospects having the lower chance of making the repayment.

Lenders' Break-even Face Values and their Properties

If the lender makes a loan with face value F then in the high income state he gets F and in the low income state he gets $H-X$ if $H-X < F$ and F otherwise. Thus, if we let F^C be the lowest face value acceptable to the creditor when lending is unconditional on the signal, then F^C solves[4]

$$pF^C + (1-p)\min\left\{F^C, H-X\right\} = L. \tag{3}$$

[3]Note that the condition $H-(L+S) < pX$ is equivalent to $H-X < F$ when $F = \frac{L+S-(1-p)H}{p}$. Also, F^D can alternatively be written as $F^D = \max\left\{\frac{L+S-(1-p)H}{p}, L+S-(1-p)X\right\}$.

[4]Recall that we have normalized the net interest rate to 0.

Solving explicitly,[5]

$$F^C = \begin{cases} \frac{L-(1-p)(H-X)}{p} & \text{if } H-X<L \\ L & \text{otherwise} \end{cases} \tag{4}$$

Likewise, let F_b^C and F_g^C denote the lowest face values acceptable after observing signals b and g respectively; algebraically they take the same form as expression (4), with p simply replaced by p_b and p_g respectively.

It is immediate that $F_b^C > F^C > F_g^C$ when $H - X < L$, i.e. the loan is undercollateralized, and $F_b^C = F^C = F_g^C$ otherwise. Thus, any loan that is profitable to make after a bad signal is also profitable after a good signal, while the reverse need not be true.

Relation between Lenders' and Borrowers' Break-even Face Values

How do these break-even conditions relate to efficiency and predation? Efficiency is simple. Bearing in mind that the lenders' break-even face values are lower bounds and the borrowers' break-even face values are upper bounds, it is straightforward that if lending is socially inefficient then the lenders' and borrowers' break-even face values, conditional on the same information, must not overlap. In fact, this is not only sufficient but necessary:

Lemma 2 *$F^C > F^D$ if and only if $S < (1-p)X$, and $F_\sigma^C > F_\sigma^D$ if and only if $S < (1-p_\sigma)X$.*

How do they relate to predation? As we discussed in the introduction, predation can only arise in a pooling equilibrium with lending. In turn, a pooling equilibrium with lending can clearly only arise if $F_b^C \leq F^D$, as follows. On the one hand, the borrower would clearly not accept an offer $F > F^D$ unless he learns the lender's information, which he does not in a pooling equilibrium. On the other hand, if a pooling equilibrium were to feature $F < F_b^C$ the lender would be losing money after seeing the bad signal, and would prefer not to lend.

With the functional forms of F_b^C and F^D we can identify the subset of the parameter space where this holds. Clearly a necessary condition for $F_b^C \leq F^D$ is $F^C \leq F^D$,

[5] Equivalently, $F^C = \max\left\{L, \frac{L-(1-p)(H-X)}{p}\right\}$.

which is simply the condition that uninformed lending be socially efficient, i.e. $X \leq S/(1-p)$. If a loan of L can be fully collateralized, i.e. $H \geq L + X$, then $F_b^C = F^C$ and so this condition is also sufficient. If a loan of L *cannot* be fully collateralized, i.e. $H < L + X$, and therefore the creditor must collect more than L in the income state to offset his loss in the no-income state, then $F_b^C = (L - (1-p_b)(H-X))/p_b$ and $F^D = (L + S - (1-p)H)/p$.[6] Note that as H decreases, F_b^C increases at the rate $(1-p_b)/p_b$ whereas F^D increases at the slower rate $(1-p)/p$. This is because the debtor with bad prospects exchanges too little income-state payoff for a unit of no-income-state payoff, valuing the former at $p > p_b$ and the latter at $(1-p) < (1-p_b)$. The lender trades these states at the right price. Since F_b^C increases with X, this implies that the range of X satisfying $F_b^C \leq F^D$ shrinks as H decreases. Formally, we have:

Lemma 3 *$F_b^C \leq F^D$ if and only if*

$$X \leq \bar{X} \equiv \min\left\{\frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)}, \frac{S}{1-p}\right\}.$$

For predation after signal σ to be *strong* we need the additional condition that $F_\sigma^D < F_\sigma^C$. So if $F_\sigma^D < F_\sigma^C \leq F$ then strong predation after signal σ is possible, but if $F_\sigma^C \leq F_\sigma^D \leq F$ then only weak predation is possible.

We now have what we need to find the equilibria.

Pooling Equilibria with Lending

Given our assumptions about the borrower's rationality, predatory lending can only arise in our model if , in equilibrium, the borrower fails to learn the lender's information about him. That is, predation is inherently a pooling equilibrium phenomenon. Moreover, borrowers with good and bad prospects cannot simultaneously be victims of predatory lending.

In this subsection we analyze the incidence of pooling equilibria with lending, and then inspect these equilibria for predation. In the subsection following we address the incidence of separating and no-lending equilibria.

[6] Observe that when $X \leq S/(1-p)$ then $H - (L+S) < pX$ whenever $H - L < X$.

The complete set of pooling equilibria with lending turns out to correspond precisely to the restriction $X \leq \bar{X}$. By Lemma 3, the necessity of this restriction is straightforward; to reiterate, any pooling equilibrium with lending needs $F_b^C \leq F^D$ because if $F > F^D$ then borrowers would not accept, and the lender would not offer $F < F_b^C$ after observing $\sigma = b$.

For sufficiency it is enough to show that $F_b^C \leq F^D$ implies at least one pooling equilibrium. Consider the case $H > L + S$, under which (by Lemma 1) $F_b^D < F^D < F_g^D$; so there exists an F such that $F^D \geq F \geq F_b^D$ and $F \geq F_b^C$. If borrowers believe that the creditor offers F after either signal *and* they believe sufficiently strongly that any out-of-equilibrium offer higher than F implies $\sigma = b$, then the creditor is best off offering F and the borrowers accept.[7] Parallel arguments apply for $H \leq L + S$. Thus, we have:

Proposition 1 *A pooling equilibrium with lending at face value F exists if and only if $F \in [\max\left\{F_b^C, \min\left\{F_b^D, F_g^D\right\}\right\}, F^D]$. This range is non-empty precisely when $X \leq \bar{X}$.*

It can be easily verified that all of the equilibrium outcomes identified by the above proposition satisfy the intuitive criterion of Cho and Kreps [4]. Moreover, the pooling equilibrium outcome that involves the highest F, $F = F^D$, is the unique perfect sequential equilibrium outcome.[8]

Do the pooling equilibria of Proposition 1 entail predation, and if so, of what form? By definition, predation of bad prospects — weak or strong — requires $F > F_b^D$. We also know from the proposition above that, in the space of pooling equilibria, $F > F_b^D$ requires $F^D > F_b^D$, which corresponds to $H > L + S$.[9] Thus, we have a corollary to Proposition 1:

Corollary 1 *An equilibrium with predation of bad prospects exists if and only if $X \leq \bar{X}$ and $H > L + S$.*

[7] Conversely, there is no pooling equilibrium in which with $F < F_b^D$. For in this case, the creditor could deviate and offer $\tilde{F} \in \left(F, F_b^D\right)$. The borrower will accept such an offer *regardless* of his out-of-equilibrium beliefs. Consequently, $\tilde{F}$ represents a profitable deviation for the creditor.

[8] A proof is available from the authors.

[9] Conversely, if $H > L + S$ then $F_b^D < F^D < F_g^D$, and so provided $X \geq \bar{X}$ there exists a pooling equilibrium with $F > F_b^D$.

Is this strong predation that hurts society's wealth, or is it weak predation that redistributes the borrower's wealth to the lender? From Lemma 2, this depends on whether F_b^C is greater or less, respectively, than F_b^D, or equivalently, whether X is greater or less than $S/(1-p_b)$:

Corollary 2 *An equilibrium with strong predation of bad types exists if and only if $S/(1-p_b) < X \leq \bar{X}$ and $H > L+S$. An equilibrium with weak predation of bad prospects exists if and only if $X \leq \bar{X}$, $X \leq S/(1-p_b)$ and $H > L+S$.*

We can see already that if $H > L+S$ and lending to bad prospects is strictly socially efficient, then no *other* type of equilibrium exists. Observe that in any separating equilibrium at most one of the offers is accepted — since if both were accepted, there would be no reason for the lender ever to propose the lower of the face values. However, nor is there an equilibrium in which lending occurs after just one of the signal realizations: since lending to bad prospects is strictly socially efficient, $F_g^C \leq F_b^C < F_b^D$, and so the offer $\tilde{F} = F_b^D - \varepsilon$ is strictly preferred to not lending.[10] Finally, for the same reason no-lending cannot be an equilibrium either. Formally,

Corollary 3 *If $X \leq \bar{X}$, $X < S/(1-p_b)$ and $H > L+S$ then the only equilibria are pooling equilibria where the lender's offer is $F \in [F_b^D, F^D]$. Of these, all except $F = F_b^D$ feature weak predation of bad prospects.*

When $H > L+S$ and lending to bad prospects is socially inefficient, other equilibria may exist (see below). However, every pooling equilibrium necessarily entails strong predation of bad prospects:

Corollary 4 *If $X \leq \bar{X}$, $X > S/(1-p_b)$ and $H > L+S$ then every pooling equilibrium features strong predation of bad prospects.*

Turning now to the case in which $H < L+S$, any predation must be at the expense of borrowers with good prospects. As noted above, most of the public concern about predatory lending appears to relate to borrowers who, in our language, have bad

[10] Since $F_b^D < F_g^D$ when $H > L+S$, the borrower will accept the offer $\tilde{F} < F_b^D$ regardless of his beliefs.

prospects. While this focus may in large part reflect egalitarian criteria, it is also consistent with economic efficiency considerations. Specifically, strong predation only ever affects bad prospects, and never good prospects. To see this, simply observe that if a loan to good prospects is socially inefficient then so is a loan to bad prospects, and so no pooling equilibrium can exist.[11]

We collect these observations regarding the predation of good prospects into the following corollary, along with the analogous uniqueness result to Corollary 3 (the proof of which is given in the appendix):

Corollary 5

1. *An equilibrium with predation of good prospects exists if and only if* $X \leq \bar{X}$ *and* $H < L + S$.

2. *When it occurs, predation against good prospects is always weak.*

3. *When* $X \leq \bar{X}$, $H < L + S$ *and* $X < \frac{(p_g - p_b)(H-L) + p_b S}{p_g(1-p_b)}$, *all equilibria are pooling equilibria. Of these, all except* $F = F_g^D$ *feature weak predation of good prospects.*

Figure 1 shows how the three forms of predation divide the parameter space. Collateral value H is on the horizontal axis, and private value X on the vertical. To interpret the graph, recall that when H is high and loans can be fully collateralized, the requirement $X \leq \bar{X}$ coincides with the social efficiency condition $X \leq \frac{S}{1-p}$. On the other hand, when H is lower then predation can only occur when the social loss associated with liquidation is also lower. The condition $X \leq \bar{X}$ is represented by the lower envelope of the two bold lines.

The dashed horizontal line separates the region where lending to bad prospects is socially efficient (below) from the region where it is socially inefficient (above). Thus, under the lower envelope of the bold lines we see the three regions: weak predation of good types to the left of $H = L + S$, and predation of bad types to the right, strong above $S/(1 - p_b)$ and weak below.

The figure summarizes our results so far. Predatory lending requires sufficiently low private values, and predation of bad prospects also requires high collateralization. As collateralization decreases, repayment shifts toward the income state, thereby shifting

[11] Formally, if a loan to good prospects is socially inefficient, then $F_g^C > F_g^D$, which implies $F_b^C \geq F^C > F^D$.

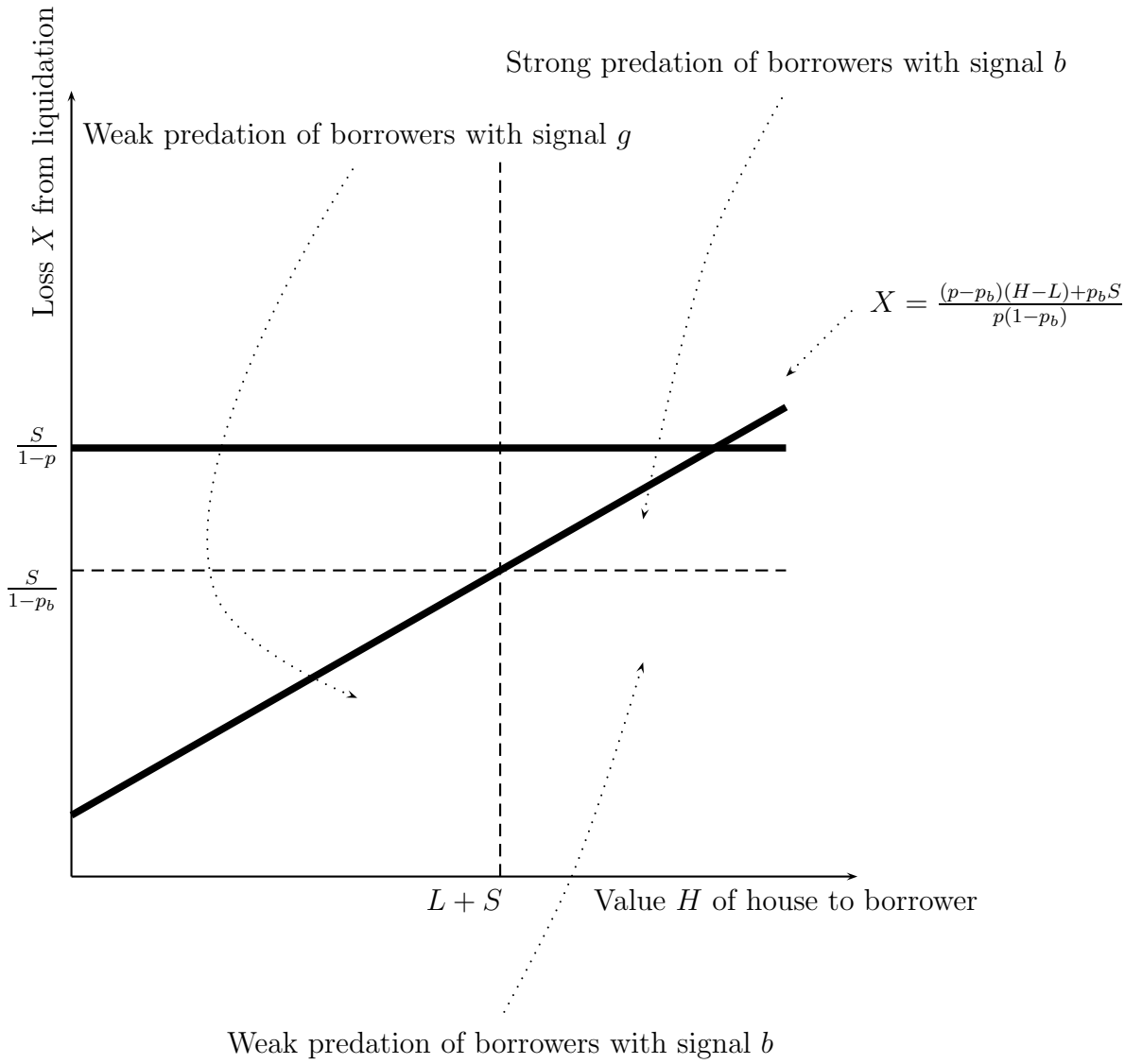

Figure 1: Pooling equilibrium under monopolistic lending

the harm to good prospects. Socially destructive predation of bad prospects is possible if collateralization and private values are high enough; everybody could be better off in this situation if lenders could commit not to lend after $\sigma = b$, but without a commitment device, their incentives not to lend are too weak when collateral is high.

To summarize, we find pooling equilibria that admit predation of all types, depending on collateral and private values. Next we consider the other possible types of equilibria: those with lending only to good prospects, and those with no lending at all.

Other Equilibria

We have already established that the portion of the parameter space where $H > L+S$ and $X < S/(1-p_b)$ allows only pooling equilibria with lending. In this subsection we consider what else can happen in the rest of the parameter space.

Equilibria without lending are not particularly interesting, but for completeness it is worth mentioning that they are possible when lending after signal b is socially inefficient. In such equilibria the borrowers reject the equilibrium offers, and interpret any deviations as coming from a lender who has observed the signal σ such that $F^D_\sigma < F^D$, and so reject these deviations also. However, provided that lending after signal $\sigma = g$ is socially efficient, these equilibria are not very robust. In particular, under a slight perturbation of our model to one in which there is a small cost γ of making an offer, the no-lending equilibrium would fail the intuitive criterion.[12]

Of more interest are equilibria with lending to only good prospects. If $H > L+S$ but lending after $\sigma = b$ is socially *in*efficient, though lending after $\sigma = g$ is still socially efficient, then separating is possible:

Proposition 2 *If $H > L+S$ and lending after the good signal is socially efficient but lending after the bad signal is socially inefficient, i.e. $\frac{S}{1-p_b} < X \leq \frac{S}{1-p_g}$, then there exist separating equilibria in which the lender offers $F_g \in [\max\left\{F^D_b, F^C_g\right\}, \min\{F^D_g, F^C_b\}]$*

[12] A proof is available from the authors upon request. For a rough intuition, take the case where $H > L+S$ and consider an offer by the lender after signal g of $\tilde{F} = F^D_b - \delta$, where δ is small. The signal g lender could argue: "Borrower, you should infer from this that I observed $\sigma = g$, since if I had instead observed $\sigma = b$ I will lose money on this loan, and so would have no incentive to try to convince you that I instead observed $\sigma = g$." Provided the borrower finds this speech convincing, he will accept the offer $\tilde{F}$, giving the lender positive profits. A similar argument applies in the case $H < L+S$.

after observing $\sigma = g$, and $F_b \neq F_g$ such that $F_b > F_b^D$ after observing $\sigma = b$; and in which the borrower accepts F_g but rejects F_b. There are no other separating equilibria in which lending occurs.

In these equilibria, all the positive-NPV loans are made, and all the negative-NPV loans are not, an appealing outcome. However, it is worth noting that with the exception of the equilibrium with $F_g = \min\{F_g^D, F_b^C\}$, the separating equilibrium of Proposition 2 are not at all robust. Specifically, consider a separating equilibrium with $F_g < \min\{F_g^D, F_b^C\}$. To support this equilibrium, the borrower must interpret an out-of-equilibrium offer $\tilde{F} \in \left(F_g, \min\{F_g^D, F_b^C\}\right)$ as coming from a lender who has observed $\sigma = b$. However, since $\tilde{F} < F_b^C$, this means the borrower believes a lender is offering a loss-making loan. This is clearly a problematic assumption to make. More precisely, under the small offer-cost perturbation of the model discussed above, no separating equilibrium with $F_g < \min\{F_g^D, F_b^C\}$ satisfies the intuitive criterion (the intuition is similar to footnote 12 above).

We turn now to separating equilibria when $H < L + S$.

Proposition 3 *If $H < L + S$, and lending after the good signal is socially efficient, $X \leq \frac{S}{1-p_g}$, and moreover $X \geq \frac{(p_g - p_b)(H-L) + p_b S}{p_g(1-p_b)}$, then there exist separating equilibria in which the lender offers $F_g = F_g^D$ after observing $\sigma = g$, and $F_b \neq F_g$ such that $F_b > F_b^D$ after observing $\sigma = b$; and in which the borrower accepts F_g but rejects F_b. There are no other separating equilibria in which lending occurs.*

In this case, all loans that are made are positive-NPV but if lending to bad prospects is socially efficient then some positive-NPV loans are not made. Lending after the bad signal does not occur even if it is socially efficient because the deviating offer would have to lie between $F_b^C > F_g$ and $F_b^D < F_b$, and the borrower's out-of-equilibrium beliefs associate such a deviation with $\sigma = g$.

Comparative statics

Under what parameter values is predation possible?

Comparative static in H: Provided that $X \leq \frac{S}{1-p}$, predation occurs whenever borrowers value their houses enough. Moreover, an increase in H can shift the equilibrium from predation of signal g borrowers to predation of signal b borrowers.

Comparative static in L: A *decrease* in loan size expands the range of (H, X) values for which predation is possible.[13] Moreover, a decrease in L can shift the equilibrium from predation of signal g borrowers to predation of signal b borrowers.

Comparative static in S: An *increase* in the surplus S that a borrower derives from funds L expands the range of (H, X) values for which predation is possible. However, an increase in S can shift the equilibrium from predation of signal b borrowers to predation of signal g borrowers, and can shift strong predation to weak predation.

Comparative static in p_b: What is the effect of an increase in p_b, corresponding to a deterioration in the lender's information quality? There are two opposing effects. On the one hand, predation becomes harder, since the requirement that the lender knows a loan is welfare-reducing for a borrower, but the borrower does not, becomes more demanding. On the other hand, the lender is now more willing to lend after observing the bad signal, which makes pooling equilibria easier to support.

It turns out that the latter effect is the dominant one, and so a deterioration in the lender's information quality expands the range of (H, X) values for which predation is possible.[14] However, it shrinks the range in which *strong* predation of signal b borrowers occurs, and (since $F_b^D \to F^D$) generally decreases the cost to the borrower of being predated.

Together, these results suggest that predation is most likely to affect borrowers who possess a large amount of housing equity and who seek a relatively small loan. Borrowers with an urgent need for a loan are also more at risk.

[13] A decrease in L clearly weakly increases the expression $\min\left\{\frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)}, \frac{S}{1-p}\right\}$.

[14] The expression $\min\left\{\frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)}, \frac{S}{1-p}\right\}$ is only affected by changes in p_b if $\frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)} < \frac{S}{1-p}$, which is equivalent to $H < L + \frac{S}{1-p}$. Differentiating, $\frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)}$ is increasing in p_b if and only if

$$(S - H + L)\, p\,(1 - p_b) + p\,((p - p_b)\,(H - L) + p_b S)$$

is positive — which is indeed the case when $H < L + \frac{S}{1-p}$.

4 Competition

As discussed, predatory lending is often attributed to monopolistic lending practices. In this section we explore whether or not predatory lending can occur in environments with several competing lenders. Our main interest in the paper is predatory lending affecting borrowers with bad prospects, and from Corollary 1 we know that a necessary condition for this to occur is $H > L + S$. For conciseness we restrict attention to this case.[15]

Formally, we extend our model to one with n identical lenders. The number of lenders n should be thought of as indexing the *degree* of competition, with larger values corresponding to fiercer competition.

We assume that all lenders receive the same signal σ about the borrower. This is consistent with our main interpretations about the source of the lender's informational advantage (see earlier). After observing the signal, each of the n lenders simultaneously announces the face value at which they are willing to lend to the borrower.

Throughout, we restrict attention to symmetric (pure strategy) perfect Bayesian equilibrium. We adopt the standard assumption that if a borrower receives an identical offer from k different lenders, and chooses to accept this offer, than the probability that he accepts a loan from each individual lender is $1/k$.

A Benchmark Competitive Equilibrium

A natural equilibrium to consider under competition is that in which lenders offer to provide funds at marginal cost, and make zero profits. That is, lenders offer F_g^C after $\sigma = g$ and F_b^C after $\sigma = b$:

Proposition 4 *If $H - L < X$ (and so $F_b^C > F_g^C$) then it is an equilibrium for lenders to offer F_σ^C after $\sigma = b, g$, and for the borrower to accept F_σ^C if $F_\sigma^D \geq F_\sigma^C$.*

If $H - L \geq X$ (and so $F^C = F_b^C = F_g^C$) and $X \leq \frac{S}{1-p}$, then it is an equilibrium for lenders to offer F^C after both $\sigma = g, b$, and for the borrower to accept.

[15] It would be straightforward to extend our analysis to cover the case $H < L + S$.

Predation under Competition

Is predation possible under competition? That is, is there a pooling equilibrium in which lenders offer $F > F_b^D$? It turns out there are two separate cases to consider:

First, suppose that $F_b^D > F_g^C$. This condition is obviously satisfied if lending after a bad signal is socially efficient ($F_b^D > F_b^C$), and even if lending after a bad signal is socially inefficient, it will still often be satisfied.

When this condition holds, no predation is possible when the degree of competition is large enough. This can be easily seen as follows.

Suppose to the contrary that equilibria with predation exist even as n grows arbitrarily large. That is, for n large there exists a pooling equilibrium in which the equilibrium face value F exceeds F_b^D. The probability that each lender's offer F is accepted, $1/n$, converges to 0 as n grows large. Consequently, even conditional on observing a good signal each lender's payoff from offering F shrinks to 0 as $n \to \infty$.

In contrast, a lender has the option of instead offering $\tilde{F} = \frac{1}{2}\left(F_b^D + F_g^C\right)$ when he sees signal g. Since $\tilde{F} < F_b^D$, a borrower will accept this offer regardless of his off-equilibrium path beliefs. Moreover, the borrower will accept this offer in preference to the $n-1$ other offers of F. Finally, since $F_b^D > F_g^C$ the lender's profits under this deviation are bounded away from 0. But this contradicts the observation above that each lender's equilibrium profits converge to 0.

The above argument establishes:

Proposition 5 *If $F_b^D > F_g^C$ then there exists an $\hat{n}$ such that predatory lending does not exist in any equilibrium when $n > \hat{n}$.*

The second case to consider is that in which $F_b^D \leq F_g^C$. Under such parameter configurations pooling (and thus predatory lending) equilibria exist under any degree of competition. Specifically, for any $F \in \left[F_b^C, F^D\right]$ there is a pooling equilibrium in which all lenders offer F regardless of the signal observed, and the borrower accepts.

Once again, this is straightforward to see. Since both lenders and the borrower all have weakly positive payoffs under the behavior described, it suffices to check that no lender has a profitable deviation available. But for this, just note that clearly no offer $\tilde{F} > F$ will be accepted; while if borrowers interpret offers $\tilde{F} < F$ as indicating

that the signal was b, then no offer $\tilde{F} > F_b^D$ will be accepted. Finally, offers $\tilde{F} \leq F_b^D$ are unprofitable even if they are accepted, since by assumption $F_b^D \leq F_g^C$.

Thus we have established:

Proposition 6 *If $F_b^D \leq F_g^C$ then for any number of lenders $n \geq 2$ and $F \in \left[F_b^C, F^D\right]$ there exists a pooling equilibrium in which all lenders offer F regardless of the signal observed, and the borrower accepts. There are no other pooling equilibria in which lending occurs. Except for the case in which $F_b^C = F_g^C = F_b^D$, all of these equilibria entail predation of bad signal borrowers.*

When lending following a bad signal destroys sufficiently large value, then predatory lending cannot be precluded in equilibrium by competition. However, when loans cannot be fully collateralized, i.e. $H - L < X$, the plausibility of these equilibria is weak, as follows.

When $H - L < X$ then $F_g^C < F_b^C$. In this case, no equilibrium with $F > F_b^C$ satisfies the intuitive criterion. A rough argument is as follows.[16] Instead of making the equilibrium offer F, a lender always has the option of undercutting the competition and offering $\tilde{F} \in \left(F_g^C, F_b^C\right)$. If accepted, this will generate higher profits when competition is fierce (n large). So to support an equilibrium with $F > F_b^C$, the borrower must believe that some lenders make a loss-making offer $\tilde{F} < F_b^C$ after seeing $\sigma = b$. By a similar argument, the remaining possibility $F = F_b^C$ fails the intuitive criterion in the small offer-cost perturbation of the model that we have discussed previously.

One of the main messages delivered by our model is that predatory lending at the expense of borrowers with bad prospects is fundamentally associated with high collateral values. The above discussion only serves to reinforce this conclusion.

Corollary 6 *The only circumstances under which predation of bad prospects is a robust equilibrium phenomenon under arbitrarily fierce competition is when loans can be fully collateralized, i.e., $H - L \geq X$.*

[16] A full proof is available from the authors.

5 Home-improvement and House Purchase Loans

In our benchmark model, we assumed that the borrower spent the loan L on consumption generating a surplus of $L+S$. Importantly, while the borrower's house can be seized in the event of default, his consumption of $L+S$ cannot be. However, in practice loans made for the purposes of house purchase and home-improvement figure prominently in criticisms of sub-prime lending practices. In this section we extend our basic model and argue that this focus is well-founded.

Home-improvement Loans

We start by analyzing home-improvement loans. We consider the following variant of our model. Instead of spending the loan L on consumption, the borrower spends the loan to increase his personal valuation of his home from H to $H+\Delta H$, and to increase the bank's recovery in foreclosure from $H-X$ to $H+\Delta H-X-\Delta X$. The borrower's expected utility from taking the loan is now

$$p\left(H+\Delta H+I-F\right)+(1-p)\max\left\{H+\Delta H-X-\Delta X-F,0\right\},$$

while his expected utility if he does not take the loan is simply $H+pI$. Similarly, the lender's expected payoff from making a loan is

$$pF+(1-p)\min\left\{H+\Delta H-X-\Delta X,F\right\}.$$

The key differences with respect to our standard model are that now the benefit to the loan is ΔH instead of $L+S$, the borrower loses this benefit in the event of default, and an additional $\Delta H-\Delta X$ is available for the lender to recover.

Parallel to before, straightforward algebra implies that the highest face value an uninformed borrower will agree to is

$$\hat{F}^D=\begin{cases}\Delta H-(1-p)\left(X+\Delta X\right) & \text{if } H\geq p\left(X+\Delta X\right)\\ \frac{p\Delta H-(1-p)H}{p} & \text{otherwise}\end{cases}$$

while the lowest face value that a lender who has observed $\sigma=b$ will agree to is

$$\hat{F}_b^C=\begin{cases}L & \text{if } H+\Delta H-X-\Delta X\geq L\\ \frac{L-(1-p_b)(H+\Delta H-X-\Delta X)}{p_b} & \text{otherwise.}\end{cases}$$

Our main result is that, other things equal, a home-improvement loan is more likely to allow predatory lending than a loan made for consumption purposes. By "other things equal" we mean that the home-improvement loan generates the same surplus to the borrower in the non-default state, $\Delta H = L + S$, and that the wedge between the borrower's and lender's valuations of the house remains unchanged, $\Delta X = 0$.

Proposition 7 *Suppose* $\Delta H = L + S$ *and* $\Delta X = 0$. *Then* $\hat{F}_b^C \leq \hat{F}^D$ *whenever* $F_b^C \leq F^D$, *while the reverse is not true.*

That is, if predatory lending is a possible equilibrium outcome for a consumption loan, it is for a home-improvement loan also (all else remaining equal).

House Purchase Loans

We turn now to loans made for the purposes of house purchase. Observe first that in our benchmark model such loans cannot possibly be predatory. If a borrower begins without a house, then in the zero-income state his utility from taking the loan is 0.[17] On the other hand, taking the loan must weakly improve the borrower's welfare in the state where his income is $I > 0$, for otherwise he would not take the loan at all. Given this, there is no way for taking the loan to make the borrower worse off.

To allow for the possibility of predatory lending in this context, then, we must change our model to one in which the borrower's utility in the low-income state is affected by whether or not he takes the loan. One possibility would be to extend the model to cover more than one period, which would allow the borrower to derive surplus from living in his house before it is repossessed.[18] A second possibility, which is the one we adopt here, is simply to change the borrower's possible income realizations from $\{0, I\}$ to $\{I_1', I_2'\}$, where $I_2' > I_1' > 0$.[19]

This model is in fact isomorphic to the home-improvement model we developed immediately above: simply take $I_1' = H$, $I_2' = L + H$, let the borrower's valuation of the house be $H' = \Delta H$, and let the lender's valuation of the house be $H' - X' = \Delta H - X - \Delta X$.

[17] The only case where this would not be true is if $H - X > L$. However, in this case the lender would prefer to buy the house directly.

[18] A model of this type is available from the authors upon request.

[19] We assume that $I_1' < L$, so that as in the benchmark model the borrower defaults in the low income state.

By the same logic as Proposition 7, we can conclude that other things equal loans made for the purpose of house purchase are more exposed to predation than consumption loans backed by housing equity.

6 Policy Experiments

Consumers borrow in the context of considerable State and Federal regulation. Some of this regulation originated in predatory-lending concerns, and some in other concerns. In this section we consider the equilibrium effects of three high-profile regulations: state-level legislation aimed at combatting predatory lending, the Federal Equal Credit Opportunity Act, and the Federal Community Reinvestment Act.

Interest-rate Constraints

There are two groups of laws constraining consumer-loan pricing: usury laws, which date back centuries, and more recent laws explicitly aimed at combatting predatory lending. Usury laws are hard constraints on interest rates, whereas the predatory-lending laws are soft. Their standard form is a set of restrictions that apply to loans whose interest rates (and/or fees) exceed a threshold. For example, the North Carolina Predatory Lending Law, passed in 1999 and widely regarded as the model for other states' laws, determines a home loan to be "high cost" if the interest rate is at least 8% above the comparable Treasury rate (and the principal amount is $\leq \$300,000$). High cost home loans are not forbidden, but rather tightly restricted in their form.[20] The Federal Home Ownership and Equity Protection Act (HOEPA) of 1994 imposes similar constraints. Since these laws are specifically targeted at abusive lending, their equilibrium effect on predation is especially relevant to our analysis. As our primary interest is in predation of bad prospects, we focus on the parameter region where that is possible, i.e. $F_b^D < F^D$, or equivalently $H > L + S$, and $F_b^C \leq F^D$.

Recent laws, then, make it costly for lenders to offer consumer credit at high interest

[20]There can be no call provision, balloon payment, negative amortization, interest-rate increase after default, advance payments or modification or deferral fees. Furthermore, there can be no lending without home-ownership counseling, or without due regard to repayment ability (though repayment ability is presumed if the borrower's debt payments are $\leq$50% of his current income) (see http://www.responsiblelending.org/pdfs/longsumm.pdf).

rates. For simplicity, we model the effect of these laws as if the cost were so large that creditors choose *never* to lend at high interest rates. That is, we assume that predatory-lending laws, like usury laws, impose a cap on the interest rate that can be offered.

In some respects, the effects of putting a cap on the interest rate that a monopolist can charge are standard. If the cap is high it has no effect. If the cap is very low, then the lender completely withdraws from the market. For some levels in between, the effect of the cap is to reduce the interest rate charged, while leaving the basic structure of the equilibrium unchanged — i.e., a straightforward wealth transfer from the lender to the borrower. In Appendix B we detail these effects; here, we focus on the effect of an interest rate cap $\bar{F}$ in the interval $\left(F_g^C, F_b^C\right)$, where the effects are less standard.

Consider first the case in which lending to bad prospects is socially efficient, i.e. $F_b^D > F_b^C$. From Corollary 3 we know that, absent the interest rate cap, the only equilibria are pooling equilibria. In contrast, after the cap is introduced the creditor is no longer prepared to lend after observed $\sigma = b$, and so a pooling equilibrium no longer exists. Instead, there is a unique separating equilibrium in which the lender offers $F_g = \bar{F}$ to good prospects, and they accept. Consequently the cap has eliminated predation of bad prospects while preserving lending to good prospects. However, overall social surplus is reduced, since the predatory loans to bad prospects were socially efficient.

Next, consider the case in which in which lending to bad prospects is socially inefficient, i.e. $F_b^D < F_b^C$. Absent the interest cap there exist both pooling equilibria featuring predation, and separating equilibria in which good prospects receive loans. As above, the interest cap eliminates the pooling equilibrium, and leaves only a separating equilibrium in which the lender offers $F_g = \bar{F}$ to good prospects. Again, the cap has eliminated predation of bad prospects while preserving lending to good prospects. This time, though, overall social surplus is also increased.

The Community Reinvestment Act (CRA)

The stated goal of the 1977 Community Reinvestment Act (CRA) is to encourage banks to meet the credit needs of low-income neighborhoods within their geographic markets. According to one of the regulatory agencies charged with overseeing the

CRA,[21] as a consequence of its passage banks have "opened new branches, provided expanded services, adopted more flexible credit underwriting standards, and made substantial commitments to state and local governments ... to increase lending to underserved segments of local economies and populations."

In terms of our model, the CRA can be viewed as encouraging competition. Specifically, consider a market equilibrium in which n lenders currently compete within some neighborhood, where n should be thought of as small. Further lenders are prevented from entering by fixed start-up costs, and the reduction in profits their own entry would engender. By altering the cost-benefit calculus of potential entrants, the CRA strives to increase the equilibrium number of lenders.

The CRA is usually motivated by concerns that borrowers in underserved neighborhoods pay too much for their credit, or else receive no credit at all. Our analysis suggests that the CRA may also have a quite distinct benefit: by increasing competition, it may *reduce* the incidence of predatory lending (see Proposition 5). It is worth noting that when lending to bad prospects is socially inefficient, the benefits from the CRA stem precisely from a reduction in lending. That is, at low levels of competition both good and bad prospects receive loans — where the latter both hurts bad prospects, and reduces overall social surplus. Increases in competition eliminate the loans to borrowers with bad prospects.

The Equal Credit Opportunity Act (ECOA)

The Equal Credit Opportunity Act (ECOA) of 1974 (amended 1976) combats discriminatory lending. In particular, it "prohibits creditors from discriminating against credit applicants on the basis of race, color, religion, national origin, sex, marital status, age, or because an applicant receives income from a public assistance program."[22] This law is not about predatory lending but could be relevant to it nonetheless. To the extent that the lender's signal about future income correlates with one of these partitions, the ECOA prevents him from conditioning on it. To gauge the effect on predation, we impose this constraint on our model.

Suppose the model's b and g now stand for *blue* and *green*, respectively, and the lender's private information is that blue borrowers are more likely to have low incomes

[21] See the Office of the Comptroller of the Currency's discussion of the CRA at http://www.occ.treas.gov/crainfo.htm.

[22] See www.usdoj.gov/crt/housing/housing_ecoa.htm.

in the future. That is, observing that a borrower is blue is akin to observing $\sigma = b$ in our model. However, whether a consumer is blue or green is publicly observable and verifiable. Finally, suppose that the ECOA obliges the lender not to condition on blue *vs.* green, so his offer must be either the same F to both or no F at all.

If the lender is a monopolist, it is easily seen that the regulation expands the incidence of predation. Without the regulation, we know that predation can arise if and only if $F_b^C \leq F^D$. But with the regulation forcing the same offer to both types, the only equilibrium with lending is that in which the lender offers F^D, and it exists if and only if $F^C \leq F^D$. And aside from the knife-edge case $H = L + S$, the equilibrium is necessarily predatory for either blue or green. The predatory parameter space has annexed the space where $F^C \leq F^D < F_b^C$ because while the creditor would rather *not* lend after $\sigma = b$, he is willing to pay this price for the right to profit after $\sigma = g$.

More striking, perhaps, is that under some circumstances in which competition eliminates predatory lending, ECOA-style regulation can allow predation to survive. When lenders compete subject to this regulation, lending at a face value $F > F^C$ cannot occur in equilibrium, because any one lender can slightly undercut and capture the whole market. There is no longer any disincentive to undercut provided by borrowers' off-equilibrium beliefs about σ, because the regulation removes all information about σ from the offer. Thus the only equilibrium with lending after either signal is at a face value of F^C, and this equilibrium exists whenever $F^C \leq F^D$. This is predatory if either F_b^D or F_g^D is strictly below F^C.

As an illustration, consider the following numerical example. A borrower has a house he values at $\$120K$ but from which a lender would derive only $\$97K$ in the event of foreclosure. He seeks a loan of $\$100K$, from which he will derive a net surplus of $\$15K$. The income he has available for meeting the loan repayments over the life of the loan is either $I = \$150K$ or $\$0K$; the probability of the former is given by $p_g = .7$, $p = 0.4$, $p_b = .3$.

Given these parameter values, $F^D = \max\left\{115 - .6 \times 23, \frac{115-.6\times120}{.4}\right\} = \$107.5K$ and $F_b^C = \max\left\{100, \frac{100-.7\times97}{.3}\right\} = \$107$. Since $F_b^C < F^D$, predation of blue borrowers is an equilibrium outcome under monopolistic lending (see Proposition 1).

Similarly, $F_b^D = \max\left\{115 - .7 \times 23, \frac{115-.7\times120}{.3}\right\} = \$103.33K$ and $F_g^C = \max\left\{100, \frac{100-.3\times97}{.7}\right\}$ $= \$101.29$. Since $F_g^C < F_b^D$, a sufficient degree of competition eliminates predatory lending (see Proposition 5).

Finally, $F^C = \max\left\{100, \frac{100-.6\times97}{.4}\right\} = \$104.5$. Since $F_b^D < F^C < F^D$, predatory lending occurs under the ECOA, even under competition.

To summarize, laws against discriminatory lending can have an unintended adverse consequence. The incidence of welfare-reducing lending can rise, even under arbitrarily stiff competition.

7 Conclusion

Consumers' debt finance comes generally from very active creditors with long and wide experience. It is therefore likely that creditors have private information about borrowers' prospects. Starting from this observation, this paper provides both a definition and a working model of predatory lending.

Overall, our analysis suggests that predatory lending is associated with monopolistic lending and high collateral values. Loans which are used to create collateral, such as home-improvement and house purchase loans, are particularly susceptible. Competition generally ameliorates predation. However, loans which are fully collateralized remain at risk when lending to borrowers with bad prospects is socially inefficient.

The main legislative response to predatory lending has been to subject high-interest consumer loans to strict scrutiny. In our framework, this policy can be effective in reducing the incidence of predation. Though motivated by other criteria, the Community Reinvestment Act is also helpful. However, and perhaps more speculatively, our analysis suggests that the Equal Credit Opportunity Act may have perverse effects.

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A Appendix: Omitted Proofs

Proof of Lemma 3

Observe that

$$\bar{X} \equiv \min\left\{\frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)}, \frac{S}{1-p}\right\} = \begin{cases} \frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)} & \text{if } H-L < \frac{S}{1-p} \\ \frac{S}{1-p} & \text{otherwise} \end{cases}.$$

First, consider the case in which $H-L \geq \frac{S}{1-p}$ and so $\bar{X} = \frac{S}{1-p}$. Consequently, if $X \leq \bar{X} = \frac{S}{1-p}$ then (i) the loan can be fully collateralized, so $F_b^C = F^C$, and (ii) $F^C \leq F^D$. Consequently $F_b^C \leq F^D$. Conversely, if $X > \bar{X}$ then $F_b^C \geq F^C > F^D$.

Second, consider the case in which $H-L < \frac{S}{1-p}$ and so $\bar{X} = \frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)}$. As a preliminary, observe that in this range

$$\frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)} > \max\left\{\frac{H-L-S}{p}, H-L\right\}, \tag{5}$$

as follows. The condition $H-L < \frac{S}{1-p}$ is equivalent to $\max\left\{\frac{H-L-S}{p}, H-L\right\} = H-L$. Moreover, if $H-L < \frac{S}{1-p}$ then

$$\frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)} - (H-L) = \frac{-p_b(1-p)(H-L)+p_bS}{p(1-p_b)} > 0.$$

Given inequality (5), if $X > \bar{X}$ then $X > \max\left\{\frac{H-L-S}{p}, H-L\right\}$. But for such values the pooling condition $F^D \geq F_b^C$ is

$$\frac{L+S-(1-p)H}{p} \geq \frac{L-(1-p_b)(H-X)}{p_b} \tag{6}$$

which rewrites to

$$X \leq \frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)} = \bar{X}.$$

Thus no pooling equilibrium exists.

On the other hand, if $X \leq \bar{X}$ then since $H-L < \frac{S}{1-p}$, it follows that $\bar{X} = \frac{(p-p_b)(H-L)+p_bS}{p(1-p_b)} < S/(1-p)$, and so $F^C \leq F^D$. If $X \leq \max\left\{\frac{H-L-S}{p}, H-L\right\} =$

$H - L$ then the loan is fully collateralized and so $F_b^C = F^C \leq F^D$. Finally, if $X > \max\left\{\frac{H-L-S}{p}, H - L\right\}$, then $F_b^C \leq F^D$ is equivalent to inequality (6), which holds since $X \leq \bar{X}$.

Proof of Corollary 5

Throughout, we make use of the observation that since $F_g^D < F_b^D$, a borrower will accept an offer of $\tilde{F} = F_g^D - \varepsilon$ regardless of his beliefs.

First, observe that there can be no separating equilibrium in which only borrowers with bad prospects receive a loan. For if this were the case, lending to bad prospects would need to be weakly socially efficient, and so lending to good prospects would be strongly socially efficient, i.e., $F_g^C < F_g^D$. But then the offer $\tilde{F}$ is a strictly profitable deviation for the lender after $\sigma = g$.

Second, if $F_b^C < F_g^D$ then there is no equilibrium in which no lending occurs. This is almost immediate: since $F_g^C \leq F_b^C < F_g^D < F_b^D$, the offer $\tilde{F}$ is strictly profitable deviation for the lender after both signals.

Third, if $F_b^C < F_g^D$ then there is no separating equilibrium in which only borrowers with good prospects receive a loan. For suppose such an equilibrium existed, with the good prospects receiving a loan with face value F_g. Clearly $F_g \leq F_g^D$. In fact, it must be that $F_g = F_g^D$, since otherwise the lender could profitably deviate by offering $\tilde{F}$. Finally, it must be that $F_g \geq F_b^C$, since otherwise the lender could profitably offer F_g after observing $\sigma = b$.

The above establishes that when $F_b^C < F_g^D$ the only equilibria are pooling. Finally, by an argument exactly analogous to Lemma 3, the condition $F_b^C < F_g^D$ is equivalent to $X < \min\left\{\frac{(p_g-p_b)(H-L)+p_bS}{p_g(1-p_b)}, \frac{S}{1-p_g}\right\}$. Moreover, since $H - L < S < \frac{S}{1-p_g}$, in this range $\min\left\{\frac{(p_g-p_b)(H-L)+p_bS}{p_g(1-p_b)}, \frac{S}{1-p_g}\right\} = \frac{(p_g-p_b)(H-L)+p_bS}{p_g(1-p_b)}$.

Proof of Proposition 2

First, note that $F_g^C \leq F_g^D$ given it is socially efficient to lend after signal g. Furthermore, we know that $F_g^C \leq F_b^C$ and $F_b^D < F_g^D$. Finally, $F_b^D < F_b^C$ by the assumption

that lending is socially inefficient after the signal $\sigma = b$ is observed. So the interval $[\max\left\{F_b^D, F_g^C\right\}, \min\{F_g^D, F_b^C\}]$ is non-empty.

Next, we argue that for any pair (F_g, F_b) with $F_g \in [\max\left\{F_b^D, F_g^C\right\}, \min\{F_g^D, F_b^C\}]$, $F_b \neq F_g$ and $F_b \geq F_b^D$, a separating equilibrium of the following form exists: the lender offers F_g and F_b after signals $\sigma = g, b$ respectively, and the borrower accepts the offer F_g but rejects the offer F_b. Since $F_g \leq F_g^D$ and $F_b \geq F_b^D$, the borrower's strategy clearly constitutes a best response. For the lender, it is not profitable to offer F_b after $\sigma = g$, since it is rejected while $F \geq F_g^C$ is profitable and is accepted; and it is not profitable to offer F_g after $\sigma = b$, since $F \leq F_b^C$. It remains only to consider lender deviations to offers $\tilde{F} \notin \{F_b, F_g\}$. We assume that the borrower believes out-of-equilibrium offers of this type come only from a lender who has seen a bad signal. Consequently, under these beliefs it is a best response for the borrower to reject any offer $\tilde{F} \geq F_b^D$. So the only offers $\tilde{F} \notin \{F_b, F_g\}$ that would be accepted are those below F_b^D. But since $F_b^D \leq F$ the lender prefers to offer F_g after $\sigma = g$. Finally, after $\sigma = b$ the lender prefers having the offer F_b rejected to having an offer $\tilde{F} < F_b^D \leq F_b^C$ accepted.

Finally, we argue there is no other separating equilibrium in which lending occurs. If it is strictly socially inefficient to lend after a bad signal, $X > \frac{S}{1-p_b}$, then there cannot be a separating equilibrium in which F_b is accepted. Therefore, in a separating equilibrium in which lending occurs, it must be that F_g is accepted. Borrower and lender individual rationality imply $F_g \in \left[F_g^C, F_g^D\right]$. Moreover, $F_g \leq F_b^C$ since otherwise the lender would deviate and offer F_g after $\sigma = b$. Finally, we must have $F \geq F_b^D$: for if instead $F < F_b^D$, after $\sigma = g$ a lender would prefer to offer $\tilde{F} \in \left(F_g, F_b^D\right)$ instead of F_g, since the borrower is sure to accept any offer below F_b^D.

Proof of Proposition 3

Observe first that when $H < L + S$, the condition $\frac{(p_g - p_b)(H-L) + p_b S}{p_g(1-p_b)} \leq X$ is equivalent to $F_g^D \leq F_b^C$ — see the proof of Corollary 5. From Corollary 5, we also know that if $\frac{(p_g - p_b)(H-L) + p_b S}{p_g(1-p_b)} > X$ then no separating equilibrium exists.

Suppose now that $\frac{(p_g - p_b)(H-L) + p_b S}{p_g(1-p_b)} \leq X$ and so $F_g^D \leq F_b^C$. We claim an equilibrium exists in which the lender offers $F_g = F_g^D$ after signal g and $F_b > F_b^D$ after signal b, and the borrower accepts F_g but not F_b. Given the offers, the borrower's acceptance behavior is clearly a best response. By construction, offering $F_g = F_g^D$ is weakly

profitable for a lender who has seen g, but weakly unprofitable for a lender who has seen b. Finally, if the borrower's off-equilibrium-path beliefs are that an offer above F_g^D comes from a lender who has observed the signal g, then no offer higher than F_g^D will be accepted. Meanwhile, deviating to an offer below F_g^D is clearly unprofitable for a lender who has seen g, and since $F_g^D \leq F_b^C$ is also unprofitable for a lender who has seen b.

Proof of Proposition 4

By construction the borrower's accept/reject decision is a best response, and the lender makes zero profits. If the lender deviates by offering $\tilde{F} > F_\sigma^C$ after σ, the borrower will reject the offer since he has $n-1$ more attractive offers to choose among. Clearly no profitable downwards deviations are possible.

Proof of Proposition 7

A numerical example suffices to establish that $\hat{F}_b^C \leq \hat{F}^D$ can hold even when $F_b^C > F^D$. Consider the following: $L = \$100K$, $H = \$120K$, $X = \$23K$, $I = \$120K$, $S = \$14K$, $p_g = 0.7$, $p_b = 0.3$, $p = 0.4$. Under these parameters, $F^D = \max\left\{114 - 0.6 \times 23, \frac{114-0.6\times 120}{0.4}\right\} = \$105K$ and $F_b^C = \max\left\{100, \frac{100-0.7\times(120-23)}{0.3}\right\} = \$107K$, so that $F_b^C > F^D$. On the other hand, $\hat{F}^D = \max\left\{114 - 0.6 \times 23, \frac{0.4\times 114-0.6\times 120}{0.4}\right\} = \$100.2K$ and $\hat{F}_b^C = \max\left\{100, \frac{100-0.7\times(120+114-23)}{0.3}\right\} = \$100K$, so that $\hat{F}_b^C \leq \hat{F}^D$.

We next prove that whenever $F_b^C \leq F^D$ then $\hat{F}_b^C \leq \hat{F}^D$ holds also. The proof requires consideration of three distinct cases, each of which is straightforward:

Case: $H - \Delta H \geq pX$

Here, $H \geq pX$ also, so $F^D = \hat{F}^D = \Delta H - (1-p)X$. Certainly $\hat{F}_b^C \leq \hat{F}_b^C$ (this is strict if $H + \Delta H - X < L$). So if $F_b^C \leq F^D$ then $\hat{F}_b^C \leq \hat{F}^D$ also.

Case: $H - \Delta H < pX$ and $H - X \geq L$

First, note that $H \geq pX$; for if $H < pX$, then $L \leq H - X < 0$. Second, observe that certainly $H + \Delta H - X \geq L$. So $\hat{F}_b^C = L$ and $\hat{F}^D = \Delta H - (1-p)X$. In this case,

$\hat{F}_b^C \leq \hat{F}^D$ holds since

$$L \leq H - X = H - pX - (1-p)\,X < \Delta H - (1-p)\,X.$$

Case: $H - \Delta H < pX$ and $H - X < L$

Here,

$$\begin{aligned} F^D &= \frac{\Delta H - (1-p)H}{p} \\ F_b^C &= \frac{L - (1-p_b)(H-X)}{p_b} \end{aligned}$$

If $H + \Delta H - X < L$ then $\hat{F}_b^C = \frac{L-(1-p_b)(H+\Delta H-X)}{p_b}$ and so

$$F_b^C - \hat{F}_b^C = \frac{1-p_b}{p_b}\Delta H$$

while

$$\begin{aligned} F^D - \hat{F}^D &\leq \frac{\Delta H - (1-p)H}{p} - \frac{p\Delta H - (1-p)\,H}{p} = \frac{1-p}{p}\Delta H \\ &\leq F_b^C - \hat{F}_b^C \end{aligned}$$

since $p_b < p$. Thus $\hat{F}_b^C \leq \hat{F}^D$ whenever $F_b^C \leq F^D$.

If $H + \Delta H - X \geq L$ and $H < pX$ then $\hat{F}_b^C = L$ and $\hat{F}^D = \frac{p\Delta H - (1-p)H}{p}$, and so $\hat{F}_b^C \leq \hat{F}^D$ holds since

$$pL - p\Delta H \leq p\,(H - X) < -\,(1-p)\,H.$$

Finally, if $H + \Delta H - X \geq L$ and $H \geq pX$ then

$$\begin{aligned} \hat{F}^D &= \Delta H - (1-p)\,(X + \Delta X) \\ \hat{F}_b^C &= L. \end{aligned}$$

So we must show that if

$$\frac{L - (1-p_b)(H-X)}{p_b} \leq \frac{\Delta H - (1-p)H}{p}$$

then

$$L \leq \Delta H - (1-p)\, X.$$

Rewriting the first inequality,

$$pL \leq p_b \Delta H + (p - p_b)\, H - p\,(1 - p_b)\, X.$$

It is thus sufficient to show that

$$p_b \Delta H + (p - p_b)\, H - p\,(1 - p_b)\, X \leq p\,(\Delta H - (1-p)\, X)\,,$$

i.e.,

$$(p - p_b)\, H + (p_b - p)\, \Delta H \leq (p\,(1 - p_b) - p\,(1-p))\, X,$$

i.e.,

$$H - \Delta H \leq pX,$$

which does indeed hold. So again, $\hat{F}_b^C \leq \hat{F}^D$ whenever $F_b^C \leq F^D$.

B Appendix: Analysis of the effect of interest-rate constraints

In the model, an interest-rate cap is an upper bound $\bar{F}$ on allowable face values. We consider its effect first when lending to bad prospects is socially efficient, i.e. $F_b^D > F_b^C$. In this case we have $F_b^C < F_b^D < F^D$, and (from Corollary 3) the only equilibria are pooling equilibria with $F \in [F_b^D, F^D]$. The question is what effect $\bar{F}$ has on the interest rate or on the type of equilibrium, and the answer depends on which interval it falls in:

1. $\bar{F} > F^D$: The cap has no effect.
2. $F^D > \bar{F} > F_b^D$: The range of pooling equilibria shrinks to $\left[F_b^D, \bar{F}\right]$, but there is no separating equilibrium.
3. $F_b^D > \bar{F} > F_b^C$: There is a pooling equilibrium at $\bar{F}$ (but no others). There is no separating equilibrium.
4. $F_b^C \geq \bar{F} \geq F_g^C$: There is no pooling equilibrium. Instead there is a unique separating equilibrium in which the lender offers $F_g = \bar{F}$ to good prospects.
5. $F_g^C > \bar{F}$: There is no lending.

Now suppose lending after the bad signal b is socially inefficient ($F_b^D < F_b^C$). Absent an interest rate cap, there exists both a range of pooling equilibria $\left[F_b^C, F^D\right]$, and a range of separating equilibria in which the lender offers $F_g \in \left[\max\left\{F_b^D, F_g^C\right\}, \min\left\{F_b^C, F_g^D\right\}\right]$ $= \left[\max\left\{F_b^D, F_g^C\right\}, F_b^C\right]$ (given our parameter assumptions) to good prospects.

The effect of an interest rate cap on the *pooling* equilibria is as follows:

1. $\bar{F} > F^D$: The cap has no effect.
2. $F^D > \bar{F} > F_b^C$: The range of pooling equilibria shrinks to $\left[F_b^C, \bar{F}\right]$.
3. $F_b^C > \bar{F}$: There is no pooling equilibrium.

The effect of an interest rate cap on the *separating* equilibria is as follows:

1. $\bar{F} > F_b^C$: The cap has no effect.
2. $F_b^C > \bar{F} > \max\left\{F_b^D, F_g^C\right\}$: The range of separating equilibria shrinks to $\left[F_b^C, \bar{F}\right]$.
3. $F_b^D \geq \bar{F} \geq F_g^C$: There is a separating equilibrium at $F_g = \bar{F}$.
4. $F_g^C > \bar{F}$: There is no lending.