Predatory Lending in a Rational World*

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Abstract

Regulators express growing concern over "predatory lending," which we take to mean lending that extracts excessive rent from 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 highly collateralized loans, inefficient rolling over of subprime loans, lending without due regard to ability to pay, prepayment penalties, balloon payments and poorly informed borrowers. Under most circumstances competition among lenders eliminates predatory lending. We use our model to analyze the effects of legislative interventions.

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1 Introduction

U.S. consumers finance their home ownership with over $10 trillion in mortgages. In recent years, legislators, regulators, and the press have expressed concern that this financing includes a significant fraction of "predatory lending." A particular concern is that some lending practices reduce welfare by causing too many foreclosures and misallocating assets, and furthermore, that the burden of this excessive default falls disproportionately on low-income homeowners. In short, predatory lending may not only reduce societal wealth but also worsen its distribution.

A recent report by the U.S. General Accounting Office (GAO) summarizes many of the main concerns, and singles out particular lending practices. These include practices with direct implications for borrower welfare, such as fraud, deception, and excessive fees and rates, and also practices suspected of threatening borrower welfare such as lending without regard to ability to pay, loan flipping, single-premium credit insurance, prepayment penalties and balloon payments. The suspicion is generally that these practices exploit borrowers' misunderstanding of how the loan will evolve. For example, balloon payments might exploit borrowers' overestimation of their access to new financing on the balloon date; and lending without regard to ability to pay might exploit a borrower's optimism about her ability to afford the mortgage.

In this paper we develop a model of predatory lending in the consumer mortgage market. Our model predicts when and where predatory lending is likely to occur, and can be used to assess its welfare consequences and to evaluate the effects of legislative interventions. The model considers a homeowner midway through repaying an existing mortgage, her existing lender, and (in the competitive version) several competing lenders. We analyze when the borrower obtains a "cash out" loan that puts her home equity at risk, when lenders provide refinancing to a struggling borrower, and when these loans are predatory.

Any explanation of predatory lending must account for how borrowers fall prey in the first place. The key friction in our model is that the borrower's existing lender knows more about at least some aspects of the borrower's repayment prospects than does the borrower herself. This feature captures the ability of the typical consumer lender to relate the experience of an existing borrower to that of many other individuals, and thereby to better predict the borrower's prospects. Thus, when a borrower contemplates refinancing her mortgage, her incumbent lender is likely to have more knowledge about whether this new financing improves the borrower's welfare. Accordingly, we define a loan as predatory if a lender knows when he makes the loan that the borrower would be better off turning down the loan offer. This definition embodies the concerns of the GAO and others, and does so without falling into the "20/20 hindsight" trap of declaring a loan as predatory solely because the ex post outcome is bad.

Two distinct forms of predatory lending arise in our model. One is the form most often described in media accounts: a borrower whose income is high enough to service her existing loan refinances to a loan with higher payments so she can access some of her home equity. In our model a loan of this type is predatory if the lender knows it increases the borrower's expected loss through foreclosure by more than it increases her gain through the new consumption it allows. We show that high house values foster this form of predation, and competition generally mitigates or eliminates it.

The second form of predatory lending occurs when a borrower is struggling to make her existing mortgage payments. In this case, her lender must decide between offering new loan terms and immediate foreclosure. Predatory lending occurs when the lender chooses the former even though he knows the borrower is likely to ultimately lose her home anyway. This form of predatory lending amounts to deferring a foreclosure to extract additional mortgage payments. Again, competition generally mitigates or eliminates the problem.

The question of harmful borrowing might seem to require an irrationality-based answer, rather than the rational approach taken here. Indeed, much of the related literature focuses on limits to rationality. The related legal literature (see, e.g., Engel and McCoy [13]) focuses on circumstances, such as the loan's interest rate or prepayment penalties, that are readily observable at origination. This approach has the virtue of increasing the enforceability of any proposed legal remedies, but also has the drawback of limiting attention to predation that is driven by irrationality. That is, the circumstances that are taken to signify predation are observable to the borrower when she agrees to the loan.

The related economic literature primarily analyzes high-interest unsecured borrowing, and associates it with several forms of irrationality. Addressing credit-card borrowing, Ausubel [2] sketches a theory of "consumers who do not intend to borrow but continuously do so." Gabaix and Laibson [16] examine consumers who do not consider borrowing costs when initiating new card accounts. Della Vigna and Malmendier [10] model consumers who combine time-inconsistent preferences with limited awareness of this inconsistency. Addressing payday lending, Morgan [19] considers whether consumers can be persuaded to overestimate their future income.

These irrationalities can all contribute to consumer borrowing decisions, and they appear sufficient to deliver predatory lending. However, they are not necessary. Restricting our analysis to the rational world sets a bound on the need to appeal to these and other pathologies, and also on the efficacy of combatting predation through consumer education. It also allows us to conduct welfare analysis of legislative interventions in a standard way.

The paper is organized as follows. Section 2 presents the relevant background and literature, Section 3 presents the model, and Section 4 presents an illustrative example. In Section 5 we present our analysis, and in Section 6 we consider welfare and policy implications. Section 7 summarizes and concludes. The Appendix provides all proofs and technical results.

2 Background

The controversy surrounding accusations of predatory lending is complicated by disagreement about what exactly predatory lending is. The main problem is that many of the practices associated with predatory lending are "subtle, involving the misuse of practices that most of time can improve credit market efficiency" (Gramlich [18]). Many of the practices listed by GAO report (see Introduction) arguably fall into this category.

Several recent laws directly target predatory lending in the mortgage market. The standard form of these laws has two parts: loans with sufficiently high interest rates or fees are labeled "high-cost," and in the second part, the form of high-cost loans is tightly restricted. A representative example is the North Carolina Predatory Lending Law of 1999, which is widely regarded as a model for other states' laws. Loans of up to $300,000 with interest rates at least 8% above Treasuries are considered high cost, and with high-cost loans 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. The Federal Home Ownership and Equity Protection Act (HOEPA) of 1994 is similar.

The regulatory attention to predatory lending raises the question of the extent of such lending in the economy. One approach to measuring predatory lending is to document the percent of loans to make use of a suspect practice. For example, Stock [36] studies foreclosed subprime mortgages and finds that 14% use balloon payments and 59% have prepayment penalties, and further, that these features are even more prevalent among the higher interest rate mortgages. Stock concludes that there is "strong evidence that predatory practices are occurring in the [sample] sub-prime market." Similarly, ACORN Fair Housing's survey [1] of subprime borrowers finds that nearly half report "problems paying their loans." Since less than 10% of these borrowers report a change in employment or wages, the study interprets this finding as "suggesting that a significant number of these loans were unaffordable from the outset."

Empirical studies also address the impact of the anti-predatory lending laws discussed above. Quercia *et al* [31], Elliehausen and Staten [12], and Litan [23] all study the North Carolina law. Ho and Pennington-Cross [21] construct an index that measures the comparative severity and scope of anti-predatory lending laws in different states, and use this index to study the effect of these laws. We postpone the discussion of these papers until Section 6.

None of these papers has much to say about why borrowers actually agree to predatory loan terms. Engel and McCoy [13], [14], Renuart [32], and Silverman [34] all stress a combination of wilful misrepresentation by the lender and the borrower's inability to understand the true terms of the loan, but do not provide a formal equilibrium model. Richardson [33] goes a step further and develops a model in which borrowers know that some lenders will deceive them. However, by assumption any borrower who deals with a predatory lender is made worse off, and Richardson's model is too reduced form to explain why this happens.

Relative to the literature surveyed in this section, our paper contributes a model that can explain why borrowers accept loans they should decline. We then use our model to characterize when predatory lending is most likely to occur, what practices are associated with it, and how it is affected by related policies.

3 The model

We model the interactions between a single borrower and one or more lenders. For expositional clarity, the borrower is female and all lenders are male. There are three dates, 0, 1 and 2. At date 0, the borrower borrows an amount L_0 from one of the lenders (henceforth, the incumbent) to purchase a house. The loan contract is a standard fixed-rate mortgage (there is no interest-rate risk in our model) with multiple repayment dates, and specifies a gross interest rate $R \geq 1$. For expositional transparency we consider a two-period mortgage, so that the borrower's scheduled repayment in each of dates 1 and 2 is $P \equiv \frac{L_0 R^2}{1+R}$.[1] We initially consider a mortgage contract with no prepayment penalty, meaning that if the borrower pays $P' > P$ at date 1, her scheduled date 2 payment is reduced to $(L_0 R - P')\, R < P$. None of our results depends on the details of how the loan size L_0 or interest rate R is determined, so we take these two values as exogenously given.

At each of dates 1 and 2 the borrower receives a publicly observable income $y_t \in \{K, I\}$, where $K < I$. If a borrower's date 1 income y_1 falls short of her scheduled mortgage payment P, we say that she is distressed. For borrowers with a given set of observable characteristics, the average probability of high income $(y_t = I)$ at both dates 1 and 2 is p. For simplicity, we assume that y_1 and y_2 are uncorrelated, so that the date 1 income realization reveals nothing about date 2 income prospects.[2] The borrower's house is worth H_0 at date 0, and at date 1 changes permanently to H, a draw from a distribution with lower bound H_d.[3]

The borrower is risk-neutral over non-negative consumption, with a gross discount rate of 1 between periods. She is able to save at a gross interest rate of 1. At the start of date 1 her only asset is her house. If she still owns the house after date 2, she receives an additional surplus of $H + X$, where H is the market value of the house at date 2 and $X > 0$ represents her additional private benefits from the house.[4] Finally, at date 1 the borrower may spend M (henceforth, the expenditure) to generate a non-pecuniary benefit of $M + S > M$ at date 2. Typical examples include payments for tuition, weddings, medical procedures, or just general consumption.

Like the borrower, the incumbent and any other potential lenders are risk neutral. All lenders have a gross opportunity cost of funds of 1. Whenever the borrower fails to make a scheduled payment, her lender can foreclose on the house, and if the proceeds fall short of the debt, he can also seize any savings to cover the difference. Thus, the lender keeps $\min\{H + A, Z\}$, where A is the borrower's savings and Z is the amount the lender is owed. The borrower is left with the remaining $H + A - \min\{H + A, Z\}$.

[1] That is, $\frac{P}{R} + \frac{P}{R^2} = L_0$.

[2] If the borrowers incomes at dates 1 and 2 are correlated, then after observing her date 1 income she will update her posterior beliefs to calculate the probability of high date 2 income, to $\hat{p}$ say. As long as date 1 income does not perfectly reveal date 2 income, then $\hat{p} \in (0, 1)$. Consequently, our results remain unchanged qualitatively with $\hat{p}$ replacing p in our analysis.

[3] The assumption that the house value H is constant after period 1 is inessential. For instance, if instead H followed a random walk process agents would have to take an additional expectation when calculating their expected utilities, but our results would be qualitatively unaffected.

[4] Allowing for a benefit at each date prior to date 2 would not qualitatively change our results, provided it is not too large.

We assume that the lender is unable to seize any of the borrower's income. This assumption captures the costs and legal restrictions associated with wage garnishment (see White [39]). Nonetheless, in Section 6 we consider the opposite case where garnishment is costless and unrestricted.

The lending decisions on which we focus occur at date 1. At this date, the incumbent, and potential new lenders too, can offer refinancing. Such refinancing might be just a restructuring of the original loan, or it could include extra lending to allow the borrower to undertake the expenditure. The borrower is free to reject all offers.

All quantities discussed so far are publicly observable. The key assumption in the model is that after observing the date 1 income y_1, but before payments and/or refinancing, the incumbent acquires some additional information about the borrower's date 2 income prospects. In contrast, both the borrower herself and any other lenders still know only that the average probability of high income at each date is p.[5] This assumption is intended to capture the fact that the typical consumer creditor deals with thousands or even millions of borrowers, and can use the information delivered by these relationships to forecast the repayment prospects of an individual borrower, perhaps through an internally generated propensity score. The borrower herself lacks this knowledge. We note that this advantage does not turn on whether the borrower knows and understands her FICO score, or other such third-party credit score, since these scores summarize only part of her debt history, and do not take into account any of her assets, income, or other relevant circumstances (see, e.g., Chatterjee et al. [8]). Furthermore, these scores represent the information of only the current credit report. In contrast, an existing lender has access to a time series of credit reports, and this extra information is economically valuable (Musto [28]).[6] For expositional convenience we focus on the extreme case in which the incumbent perfectly foresees the borrower's date 2 income after observing her date 1 income.[7] The timeline in Figure 1 summarizes the order of events.

Throughout the paper we refer to the borrower as having good prospects if the in-

[5]This assumption that the provider of funds has an informational advantage over the recipient about the recipient's prospects has precedents in analyses of other financial situations. Benveniste and Spindt [4] is an early example; more recent examples include Manove *et al* [24], Garmaise [17], Bernhardt and Krasa [5], Inderst and Mueller [22], and Villeneuve [38].

[6]In principle, corporations may face better informed lenders as well. However, the informational advantage we model is less likely to arise in that context (for example, a corporation's credit history is more public than a consumer's), so we keep the focus on the consumer market.

[7]For our results, the crucial assumption with respect to information structure is that the incumbent has more precise information in comparison to the borrower. However, assuming perfect information for the incumbent is inessential. It allows us to avoid one additional layer of notation.

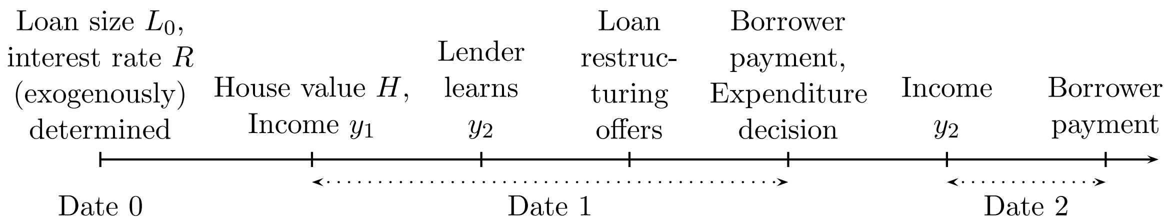

Figure 1: Timeline

cumbent knows privately that the borrower's date 2 income will be I, and as having bad prospects otherwise. So good or bad prospects is a distinction that only the incumbent can make directly at date 1, while everyone else can only try to infer it from the incumbent's actions.

Looking ahead to the analysis, the assumption that at date 1 the incumbent has an informational advantage relative to the borrower is key because it creates the possibility that the incumbent makes a date 1 loan that he knows makes the borrower worse off. Indeed, welfare-reducing lending to rational borrowers would appear impossible without an informational advantage of this type.

For our model to generate nontrivial forms of refinancing, we must ensure that at date 1, borrowers are sometimes in financial distress and/or sometimes interested in tapping into their home equity to increase their consumption. Thus, we make the following assumptions about relative parameter values:

Assumption 1 *The low income realization K is sufficiently low:*

$$K < \frac{1}{2} \min \{L_0, H_d\}.$$

Assumption 1 says that the borrower's worst-case income realization (two draws of low income K) is not sufficient either to pay off the initial mortgage L_0 or to buy the house from the lender, even if the house's market value goes down. Moreover, we note that since $R \geq 1$, it follows that $K < P$, so low income at date 1 puts the borrower in distress.

Assumption 2 *The high income realization I is neither too low nor too high:*

$$\max\left\{RL_0 - \frac{K}{R}, \frac{L_0R^2 + M}{1+R}\right\} < I < \min\left\{RL_0, L_0/2 + M, L_0 + M - K\right\}.$$

The lower bound in Assumption 2 says that the high income realization I is sufficiently high that an income stream of I and then K is enough to pay off the initial mortgage, and that an income of stream of I and then I is enough to cover both the expenditure and repayment of the original mortgage. The upper bound says that I is not so high as to allow the borrower to repay her entire loan at date 1; nor is it high enough to both make her scheduled mortgage payment and undertake the expenditure, even if $R = 1$; and that an income stream of I and then K is not enough to cover both the expenditure and the repayment of the mortgage, even if $R = 1$. We note that the lower bound implies that $I > P$,[8] so a borrower with high date 1 income is not distressed. For use below we also note that Assumption 2 implies that $I + K > L_0R$.

Assumption 3 *The borrower's private benefits X from the house are high relative to the expenditure surplus S, and are also high enough so that if she has high income in both periods, she prefers to repay the loan rather than default:*

$$X \geq \max\left\{\frac{S}{p}, R\left(L_0R - I\right) + I - H_d\right\}.$$

Assumption 3 ensures that a borrower will not give up a probability p chance of keeping her house to undertake the expenditure.

From Assumption 1, we know that a borrower with low income at date 1 defaults and loses X if not refinanced, and from Assumption 2 we know there is a $1-p$ probability that she eventually defaults even if she is refinanced. This implies an expected social loss of pX when she is not refinanced. On the other hand, if she gives up on repaying her mortgage at date 1, then if $M \leq K$ she reaps a partially offsetting gain of S from undertaking the expenditure instead. Accordingly, we denote the net loss due to foreclosure at date 1 by V_K, where

$$V_K \equiv \begin{cases} pX - S & \text{if } M \leq K \\ pX & \text{if } M > K \end{cases}.$$

Assumption 3 ensures that the net loss due to foreclosure V_K is strictly positive.

[8] Since $I > K$ then $I\left(1+R\right) > R^2L_0$, and hence $I > P$.

4 Example

Here, we offer a numerical example that illustrates the two ways borrowers can fall victim to predatory lending.

At date 0 the borrower enters a two-period \$100 mortgage at 5% interest, implying scheduled payments of \$53.78. At each of dates 1 and 2 the borrower's income is either \$30 or \$85, with probabilities 1/4 and 3/4 respectively. The market value of the house is \$100.

Suppose first that the borrower's date 1 income is \$30. In this case, the borrower is unable to make her scheduled payment of \$53.78. If her lender forecloses immediately he recovers \$100 from the house. However, the lender is prepared to refinance the loan to one in which the borrower pays just \$30 at date 1 and \$80 at date 2. The lender recovers more than \$100 under these terms, since the house value is high enough to fully secure the date 2 payment. Moreover, provided that the borrower's surplus from keeping her house exceeds \$13.33, she accepts these terms since she expects to keep the house with a probability of 3/4.

However, the refinancing terms are predatory for any borrower whom the lender expects to have low income at date 2. If such a borrower simply defaults and accepts immediate foreclosure, she loses only her house (worth \$100), but none of her income. Instead, under refinancing she pays her date 1 income of \$30 to the lender, along with \$80 of the foreclosure proceeds at date 2.

Next, suppose the borrower's date 1 income is \$85, and the borrower is contemplating a large expenditure that costs \$45 but delivers \$50 worth of benefits. The borrower can afford to make her mortgage payment, but if she does so she must forgo the expenditure. In this case, she pays \$85 to the lender at date 1 (since the mortgage has a positive rate of interest she prepays as much as possible), and the remaining balance of $(\$100 \times (1 + 5\%) - \$85) \times (1 + 5\%) = \$21$ at date 2, for a total of \$106. However, the lender is prepared to offer cash-out refinancing terms under which the borrower pays just \$40 at date 1, but \$67 at date 2. If the borrower accepts this offer, she pays an extra amount of \$1 to the lender and gains an additional surplus of \$5 from the expenditure resulting in a net surplus of \$4. However, she loses her house whenever her date 2 income is low. Since the borrower puts 1/4 probability on low date 2 income, she takes the cash-out refinancing if her surplus from keeping the house is less than 16. However, the cash-out refinancing is predatory for any borrower whom the lender expects to have low income at date 2 as long as her surplus from keeping the house exceeds \$4.

5 Analysis

Here, we characterize the model's equilibria and then to use this characterization to identify the economic conditions and consequences associated with predatory consumer lending. We use perfect Bayesian equilibrium as our equilibrium concept. As is common in games of incomplete information there are multiple equilibria. We focus in the main text on equilibria that involve predatory lending with a special emphasis on the equilibrium outcome that results in the highest level of lender profits. In the appendix we characterize the entire equilibrium set, including equilibria that do not involve predatory lending. We restrict attention to pure strategy equilibria, which always exist in our model.

First, we give a precise definition of what constitutes predatory lending, which we also refer to as predation.

Definition: *Predatory lending occurs when a lender offers, and a borrower accepts, a loan that takes more expected surplus from the borrower than it provides, relative to the borrower's expected surplus had the loan not been accepted, and conditional on the lender's information.*

In principle, under this definition predatory lending could afflict borrowers with either good or bad prospects. For example, borrowers with good prospects could be victims of predation if they underestimate their expected repayments by a sufficient amount. However, Proposition 1 establishes that in our model good prospects are never victims. This implication is consistent with public concern about predatory lending, which generally focuses on consumers who experience negative shocks to wealth. The result follows principally from the lender's inability to garnish income.

Proposition 1 *A borrower with good prospects is never the victim of predatory lending.*

5.1 Monopoly

Here, we assume the incumbent is the only possible lender at date 1. We gauge competition's effect on predatory lending by later introducing competing lenders and comparing the equilibria. We consider in turn the cases in which the borrower's date 1 income is low (K) and high (I).

Low income at date 1

In this case, the borrower cannot meet her scheduled mortgage payment (see Assumption 1) and might be interested in refinancing. If the lender knows that date 2 income will still be low, he knows that default is inevitable under any refinancing. However, he might be better off not revealing this knowledge to the borrower and refinancing the mortgage anyway. Without refinancing his recovery is bounded by the liquidation value of the house. But by refinancing, he might be able to extract some payment at date 1 and can still liquidate, if underpaid, at date 2. Thus, there are refinancing terms he is prepared to offer even when he knows the borrower has bad prospects. However, if the borrower knew her prospects were bad, she would prefer defaulting at date 1 and keeping her income over paying it towards an unattainable ownership. Therefore, the lender has a strong incentive not to reveal the borrower's prospects and to instead offer refinancing that the borrower can currently afford. Although such forbearance might at first seem charitable it can reduce the borrower's well-being.

Proposition 2 shows that there is always an equilibrium in which the lender makes an offer that the borrower accepts, and that he knows will make a bad-prospects borrower worse off than if she had just defaulted on the original mortgage. Thus, the loan is predatory.

Proposition 2 *Suppose the borrower's date* 1 *income is low* ($y_1 = K$)*. Then there exists an equilibrium in which the incumbent offers to refinance the loan by reducing the date* 1 *payment to* $\hat{P}_1 \leq K$*, the borrower accepts, and the loan is predatory. In the predatory equilibrium most profitable to the lender, the refinancing reduces the welfare of a borrower with bad prospects by* $\min\{K, V_K, I + K - H\}$ *for low collateral values,* $H \leq L_0 R$*, and by* $\min\{V_K, I + K - L_0 R\}$ *for high collateral values,* $H > L_0 R$*.*

One way to understand how predation arises is to recall Merton's [26] observation that a loan can be decomposed into risk free debt and a put option that represents the borrower's right to default. In our model, the put option is the borrower's right to sell the house to the lender for the amount she still owes. Exercise is always optimal for a borrower with bad prospects, but for a borrower with good prospects exercise entails the additional cost of surrendering her private house benefits X. Predation is possible because a borrower with bad prospects does not know her type, overestimates the cost of exercise, and hence undervalues the default option. Consequently, a borrower with bad prospects agrees to surrender her default option at terms that are too favorable to the lender.

We note that the form of predatory lending identified in Proposition 2 reduces societal welfare if the low-income borrower could have afforded the expenditure (i.e., $M \leq K$), and it also transfers wealth from the borrower to the lender. The proposition characterizes the maximum size of this transfer, which is determined by three constraints. First, the lender cannot increase the amount the borrower pays by more than the value the borrower places on avoiding foreclosure, V_K, which imputes the surplus of the expenditure. Second, the increase is limited by the borrower's actual date 1 income K. Third, the borrower must think she has some chance of repaying the refinancing loan, and so the total payments she agrees to must be less than $I + K$. The actual transfer from a borrower with bad prospects is determined by which of these three constraints binds first.

The existence of predatory equilibria over the whole range of parameter values raises the question of whether any parameter values also support non-predatory equilibria, where only good prospects are refinanced. In the Appendix (see Proposition 9) we show that the incumbent can make equilibrium profits without engaging in predatory refinancing *only if* house values are low enough. The reason is that when house values are high, any offer that is profitable to make to good prospects is also profitable to make to bad prospects. Thus to the extent that an equilibrium with strictly positive lender profits is more likely than one with zero profits, predatory lending is more likely to occur when house values are high. More generally, the equilibrium most profitable to the lender is predatory whenever the house value is high enough (see Proposition 11 in Appendix).

High income at date 1

If a borrower has high income at date 1 she is able to make her scheduled mortgage payment (by Assumption 2). However, she might still be interested in refinancing her loan so that she can also benefit from the expenditure. When a borrower with bad prospects refinances in this way she subsequently defaults when she learns that her date 2 income is low (again by Assumption 2). Therefore, refinancing reduces the welfare of a borrower with bad prospects, because while it allows her to undertake the expenditure, it also causes her to lose her home.

For a borrower with bad prospects to accept this refinancing, two conditions must be met. First, since at date 1 the borrower realizes that her date 2 income might be low, she needs to derive enough surplus from the expenditure to justify placing her house at risk. In our notation, the surplus S from the project must exceed the probability that the borrower attaches to low date 2 income, $1 - p$, multiplied by the surplus associated with keeping her home, X.

The second condition is that the lender receives at least what he would have if the borrower had not refinanced. In that case the lender receives I at date 1 (since $R \geq 1$ the borrower prepays as much as possible) and the remaining loan balance $(RL_0 - I)\,R$ at date 2. The most the lender can obtain from a refinanced borrower at date 1 is $I - M$, otherwise the borrower cannot afford the expenditure, and the most he can recover from a defaulting borrower at date 2 is the house value H. So the second condition is that $I - M + H$ exceed $I + (RL_0 - I)\,R$, or equivalently, that H exceed $\bar{P}_2 \equiv (RL_0 - I)\,R + M$. Economically, $\bar{P}_2$ is the date 2 payment the lender requires for refinancing to be worthwhile.

Proposition 3 establishes that these two conditions are both necessary and sufficient for equilibrium predation of a borrower with high date 1 income:

Proposition 3 *Suppose the borrower's date* 1 *income is high* ($y_1 = I$)*. There exists an equilibrium with predatory lending if and only if* $H \geq \bar{P}_2$ *and* $S - (1-p)\,X \geq 0$*. In such equilibria, the incumbent offers new loan terms that enable the borrower to afford the expenditure, and the borrower accepts. In the most profitable predatory lending equilibrium, the borrower with bad prospects suffers a net loss* $\min\{S - (1-p)\,X, H - \bar{P}_2, I - \bar{P}_2\} + X - S$.

In the predatory equilibria identified by Proposition 3, a borrower with substantial equity in her house and affordable current payments refinances into eventually unaffordable payments. Arguably, this is the form of predation most commonly cited in the popular press. The lender finances new spending even when he knows that doing so means the borrower will lose the house she could have kept. Among the terms applied to such lending are "lending without regard to ability to pay" and "asset-based lending." By whatever name, it destroys total social surplus by increasing foreclosure. It contrasts with the case in which the borrower's date 1 income is low, when lost surplus results from redirecting investment from the expenditure to the doomed mortgage.

An important implication of Proposition 3 is that this predatory cash-out refinancing can occur only when house values (H) are high. In common with Proposition 2, this result leaves open the question of whether *non*-predatory equilibria exist. The answer is similar: Proposition 10 in the Appendix shows that when house values are high, there is no equilibrium that is profitable for the lender and non-predatory. As before, this conclusion follows because any loan terms that are profitable to extend to borrowers with good prospects can also profitably be offered to bad prospects. Consequently, the incidence of predatory lending relates closely to collateral value: borrowers with more valuable houses (higher H) are more susceptible. Similarly, for a given house value, smaller existing loans (lower L_0), lower costs of new expenditures (M) and higher current income (I) raise the threat of predatory lending.

When house values are not high enough for predatory lending to occur, the equilibrium outcome is the socially desirable one. The lender finances the expenditure if and only if the borrower can ultimately afford it, and foreclosure never occurs. (Again, see Proposition 10 in the Appendix.)

Discussion

The parameter p in our model determines the variance of the borrower's income, and by the same token, the lender's information advantage relative to a borrower with bad prospects. The effect of p on the incidence of predation reflects both roles.

On the one hand, when we compare different lending markets, we find that fewer borrowers fall victim to predatory lending when income is less uncertain, i.e., when p is larger.[9] This is an immediate consequence of the fact that when p is high few borrowers are hit by an adverse income shock. It follows that predatory lending is more likely to occur in regions facing more economic uncertainty, and in times when the future of the economy is less clear.

On the other hand, as the lender's information advantage relative to a borrower with bad prospects increases (i.e., p rises), the severity of predation when it does occur is greater. Formally, this is readily seen from the expressions for the borrower's maximum welfare loss in Propositions 2 and 3. Consequently, when a borrower does fall victim to predation in a market segment in which expected future income is relatively high (i.e., p is high), then the welfare loss she experiences is larger. But again, the probability of a borrower in this segment suffering from predatory lending is smaller.

An important implication of the comparative static in p is for the difference between prime and subprime markets. We take a prime market to be one in which there is negligible risk of low borrower income at date 2, i.e., $p \approx 1$. For comparison purposes, we briefly describe the equilibrium outcome in prime markets. If a prime borrower suffers a temporary shock to her income at date 1 (i.e., $y_1 = K$), then she is able to

[9] Higher p corresponds to lower income variance when p exceeds $1/2$.

refinance, and if her date 1 income is sufficient to cover her loan payment, she is able to restructure her loan so as to afford the new expenditure. Since the prime borrower is almost sure her date 2 income will be good, there is very little danger of her losing her house. As such, refinancing is very rarely predatory.

The magnitude of the surplus a borrower derives from her house, X, affects predation differently depending on whether she is distressed. When she is distressed, Proposition 2 implies that higher X makes her more anxious to keep her house, and thus increases the severity of predation. When she is not distressed, higher X makes her more wary of placing her house at risk with further borrowing, which reduces the likelihood of predation. However, when predation occurs, Proposition 3 implies that its severity increases since the inefficiency associated with foreclosure is now greater.

From Proposition 3, a borrower's susceptibility to predation depends on the urgency of the expenditure of M. Greater urgency (e.g., medical expenses versus vacation) corresponds to higher S, and therefore implies a wider range of parameters under which predation is possible. However, as the expenditure becomes more important the severity of predation declines: even though the borrower loses her house, the greater importance offsets more of the welfare loss. Indeed, really essential expenditures are likely to be more important to the borrower than keeping her house. In this case Assumption 3 is violated since S exceeds X, and predation does not occur. Economically, in this case a borrower would agree to loan terms that she knows place her at risk of losing her home, but the urgency of the expenditure justifies this trade-off.

The effect of loan-to-value is somewhat at odds with conventional wisdom. Some researchers argue that predatory lending is associated with high loan-to-value (see, e.g., Quercia *et al* [31]), but our analysis argues for the opposite. As discussed above, our analysis associates predation with higher, not lower, collateral value. It also associates predation with smaller loans. To see this, note that the size of the new loan granted the borrower is $P - K$ and $P + M - I$ when the borrower's date 1 income is low and high, respectively. From Propositions 2 and 3, predation is both more likely to occur, and more severe, when K, I are high and M is low, that is, when the new loan is small.

Our model matches several key stylized facts relating to the effects of a run-up in house prices. First, high house prices increase both refinancing activity in general and predatory lending in particular. Second, high house prices initially reduce foreclosure, since low-income borrowers are more likely to be able to restructure their loans, even if some of this restructuring activity is predatory. Third, high house prices increase foreclosure at subsequent dates. For borrowers who were previously in distress, this increase in foreclosure corresponds to the earlier decrease. That is, high house prices postpone but do not eliminate foreclosure for borrowers with bad prospects. However, for borrowers who were not distressed the increase in foreclosure stems from an increase in predatory cash-out refinancings.

Although some appreciation in the value of a house reflects general market trends, some is due to the loan itself, i.e., when the loan is earmarked for home improvement. How susceptible are these loans to predatory lending? We address this question by recasting the extra date 1 spending as home improvement, so that the expenditure of M increases the market value of the house to $H + M$. As before, the borrower derives a surplus of S from this home improvement.[10]

Economically, the key difference between a home improvement loan and the consumption loans analyzed thus far is that the money spent on home improvement can be recovered by the lender if the borrower defaults. Given that high home values engender predatory lending, it follows that home improvement loans are more likely than other forms of lending to involve predation. In particular, the minimum house value that makes a borrower vulnerable is lower when the loan itself increases the collateral value.

Proposition 4 *Suppose the borrower's date* 1 *income is* I*. If the expenditure is home improvement, then there exists a predatory equilibrium if and only if* $H \geq \bar{P}_2 - M$ *and* $S \geq (1 - p) X$*.*

Robustness

Since the incumbent's informational advantage is key to the results, we consider the robustness of our results to alternative specifications. One such specification is that the lender has private information about the borrower's house value, rather than her income. This asymmetry can also generate predation, even absent any uncertainty about income. For example, consider a distressed borrower who knows her future income prospects, but is not sure whether her house value is H_1 or $H_2 > H_1$. The lender, on the other hand, knows the true house value. Suppose the amount $L_0 R$ owed on the loan exceeds even H_2, and let $\bar{H}$ be the borrower's expectation of her

[10] For expositional convenience we continue to assume that the surplus S accrues immediately. However, our results would be little changed if instead the borrower gained S only if and when she keeps her house at the end of date 2.

house value, so that if the borrower defaults she expects to pay $\bar{H}$ to the lender. Then provided $H_2 - X < \bar{H}$, the borrower would agree to refinancing terms in which she pays y_1 at date 1 and $P_2 = H_2 - y_1$ at date 2. This loan is predatory if $H_2 - X > H_1$.

Another alternative is that the lender's private information on the borrower's income is less precise. Lower precision implies a smaller informational advantage over the borrower. Thus, when the lender extends credit to a borrower whose prospects privately appear bad, the lender's expectation of the borrower's loss is less than it would have been with perfect negative information. In this sense, a less precise signal is similar to a lower p in our model: in both cases the expected loss of the borrower is smaller.

So far, we have assumed that the incumbent's private information arises costlessly from his ongoing lending relationship with the borrower. This raises the question of whether the lender would pay for the information if it were costly. The answer is yes, the lender would pay a cost if the information gathering preceded the revelation of date 1 income and the house value.[11] When the house value turns out to be low, the lender is better off denying cash-out refinancing to high-income borrowers with bad prospects. In other words, the lender does not find predatory lending attractive when the house value is sufficiently low. Therefore, at the time of information acquisition, information is valuable, and to avoid a possibility of a bad loan he is willing to incur a cost.[12]

5.2 Competition

In this subsection we analyze the effects of competition. To borrowers with monopolist lenders, refinancing brings two potential benefits: for low-income borrowers, keeping the house, and for high-income borrowers, extra consumption. Competition at the refinancing stage adds a third potential benefit, the possibility of a reduction in the interest rate. We analyze the effect of competition by introducing additional

[11] This would be the order of events if, for example, the information gathering involves pulling regular credit reports on existing borrowers once the relationship starts.

[12] Our results are also robust to costly information acquisition in more general specifications of the model. For example, consider a richer model that allows several income levels, some of which are high enough to cover both the mortgage and the expenditure even if the income at the other date is low. When date 1 income is low, the lender is better off offering cash-out refinancing to a borrower only if he knows that her income is high enough to cover all the payments. Therefore, he is willing to incur a cost to acquire this information.

potential lenders. There are, in addition to the incumbent, at least two[13] more lenders who can make refinancing offers to the borrower. Like the incumbent, they have limitless cash to lend, are risk neutral and require an expected gross return of 1, but unlike the incumbent, they possess only public information about the borrower's prospects. The borrower knows the entrants have no private information, and the borrower can see which offer is from whom.[14]

The mechanics of competition are that all offers are simultaneous, and lenders are bound to honor terms if their offers are accepted. The borrower chooses which, if any, offer to accept. We assume that she chooses the incumbent's offer when she is otherwise indifferent. If the borrower is indifferent between multiple offers from entrants and strictly prefers them to the incumbent's offer, then she randomizes between the entrant offers.

As before, we begin with the case of low date 1 income, and then address high income.

Low income at date 1

In the presence of price competition among lenders, the zero profit benchmark is inevitably relevant. Consequently, a key quantity in our analysis is the date 2 loan payment that makes an uninformed entrant indifferent between lending and not lending. In the low-income case we denote this payment by P_2^K. That is, at date 1 an entrant is prepared to lend the borrower the amount needed to repay the original loan, $RL_0 - K$, if the borrower promises to pay P_2^K at date 2.[15] Competition among lenders pushes interest rates to their zero profit level, but even at these low rates predatory lending can still persist if collateral is low enough:

Proposition 5 *Suppose the borrower's date* 1 *income is low* ($y_1 = K$). *If* $H \geq RL_0 - pX$ *there is an equilibrium in which the borrower refinances her loan by paying* K *at date* 1 *and agreeing to pay* P_2^K *at date* 2. *Refinancing makes the borrower*

[13] The assumption that there are at least two competing lenders rules out equilibria in which an uninformed lender makes an above-cost offer, and the informed incumbent cannot undercut it because of borrower beliefs.

[14] For related work on competition among asymmetrically informed lenders, see Dell'Ariccia *et al* [9], Hauswald and Marquez [20], and von Thadden [37].

[15] If $H \geq RL_0 - K$ then $P_2^K = RL_0 - K$, since the house value H is high enough to ensure that the entrant can recover this amount regardless of the borrower's date 2 income. On the other hand, if $H < RL_0 - K$ then P_2^K is higher, reflecting the uninformed entrant's exposure to date 2 default. Evaluating, $P_2^K = \frac{1}{p}\left(RL_0 - K - (1-p)\,H\right)$ in this case.

strictly better off, but is predatory when $H < RL_0$. There is no equilibrium in which the borrower with bad prospects refinances at terms more disadvantageous to her than P_2^K.

Propositions 2 and 5 show the effect of competition on predatory lending when the borrower's income at date 1 is low. As Proposition 6 establishes, in many cases this effect is to ameliorate the problem of predatory lending:

Proposition 6 *Suppose date 1 income is low ($y_1 = K$). If $H \geq RL_0$ competition eliminates predatory lending. If $H \in (RL_0 - \min\{pX, K\}, RL_0)$ then competition reduces predatory lending in the following sense: there is an equilibrium under monopolistic conditions in which the bad borrower's welfare loss strictly exceeds the maximum loss under competitive conditions. If $H \leq RL_0 - \min\{pX, K\}$ then competition has no impact on predatory lending.*

To gain intuition for this result, we first consider the case in which house values are high enough that the incumbent can fully recover the amount owed via foreclosure, i.e. $H \geq RL_0$. In this case, a monopolist incumbent's predation of distressed borrowers means the incumbent charges a high interest rate to extract some of the borrower's surplus from home ownership. However, because the house value is high, the break-even date 2 payment P_2^K for an uninformed entrant is $RL_0 - K$. So competition limits the amount the incumbent can recover from the borrower to RL_0, and there is no way the borrower can be made worse off than under immediate foreclosure. That is, predation is impossible.

On the other hand, when collateral is lower, new lending is predatory even with competition. The problem is that when house values are low the incumbent knows he cannot recover the outstanding loan balance RL_0 from a borrower with bad prospects. Consequently, he is willing to refinance the loan to one with total payments below this amount, provided that by doing so he raises his recovery above the potential foreclosure proceeds H. Competition from entrants does not help here because they will not lend the borrower RL_0 unless they expect to recover at least this amount. This is similar to the debt overhang problem identified in the corporate context (Myers [29]): when new borrowing boosts the value of existing debt, it becomes hard to borrow except from existing creditors. Thus, the incumbent profits, and the bad-prospects borrower loses, from a refinancing that a competitor would not undercut.

Overall, distressed borrowers benefit most from competition when house values are high. They can refinance at break-even rates, and do not pay more than they would have without refinancing. If house values are lower the borrower suffers from a debt overhang problem, and competition does not eliminate predation.

High income at Date 1

Competition can also help the high-income borrower, by reducing her interest rate. As in the low-income case, a key quantity in the analysis is the date 2 payment that enables an uninformed entrant to break even, which we denote analogously as P_2^I.[16] Recall that under monopoly, predatory lending to a non-distressed borrower occurs only if the borrower's surplus S from the expenditure is high enough to justify risking her house, and the house value H is high enough for the incumbent to refinance a borrower with bad prospects. In the competitive case, these same two conditions still apply, but are joined by a third: for the loan to be predatory, the expected loss of surplus from the house, net of the surplus from the expenditure, must exceed the interest savings delivered by competition. Under these conditions, predatory lending withstands competition:

Proposition 7 *Suppose the borrower's date 1 income is high ($y_1 = I$). An equilibrium with predatory lending exists if and only if $H \geq RL_0 - I + M$, $S - (1-p)X \geq 0$, and $(R-1)(RL_0 - I) < X - S$. In any equilibrium, the maximum welfare loss of the borrower with bad prospects is $(RL_0 - I)(R-1) - (X - S)$.*

When we contrast Propositions 3 and 7, we see that whenever predatory lending is possible under monopoly, competition benefits the borrower:

Proposition 8 *Suppose date 1 income is high ($y_1 = I$). If conditions are such that predatory lending is possible under monopolistic conditions, then (except for the boundary case $S = (1-p)X$) competition either eliminates predatory lending or reduces its severity, in the sense that the highest welfare loss of the bad prospects borrower is lower under competitive conditions.*

[16] Evaluating analogously to footnote 15,

$$P_2^I = \begin{cases} RL_0 - I + M & \text{if } RL_0 - I + M \leq H \\ \frac{1}{p}\left(RL_0 - I + M - (1-p)H\right) & \text{if } RL_0 - I + M > H \end{cases}.$$

In cases in which non-distressed borrowers are at risk of predation under monopoly, competition either eliminates, or at least ameliorates, it. Competition also helps when borrowers are distressed, by improving the terms of refinancing.

However, if the borrower's original mortgage rate is high enough, competition can have the opposite effect, by allowing predation of nondistressed borrowers to occur in cases in which it is not possible under monopoly. To see this, recall first that a monopolist incumbent will refinance a borrower only to a loan in which the date 2 payment is sufficiently high, specifically, above $\bar{P}_2$. Equilibrium predatory lending occurs only if this payment is fully collateralized, i.e. the house value H exceeds $\bar{P}_2$ (see Proposition 3). When H is not this high, but at the same time is high enough to fully collateralize refinancing at a zero interest rate, competition actually engenders predation. Under these conditions, without competition the incumbent would stick with the status quo, and there would be no foreclosure. Competition affects the incumbent's decision by reducing his payoff under the status quo, since now the borrower can obtain zero interest refinancing. This leads the incumbent to offer cash-out refinancing, even though it is predatory and leads to foreclosure.

If the house value is sufficiently low, then the desirable outcome from the monopoly case still obtains under competition. Specifically, there is no predatory lending, and the lender extends new credit only to the good prospects if the house is not sufficiently valuable.

6 Welfare and policy implications

Our analysis identifies situations in which lenders extend financing they know is going to reduce their borrowers' welfare. We use this framework to explore the welfare implications of related policies and market practices. The implications differ substantially from those elsewhere in the lending literature because the problem lies in too much lending, not too little. In traditional analyses, frictions (informational or otherwise) generally depress the supply of credit and reduce welfare.[17] In contrast, in our framework the problem is just the opposite: the informational friction increases the supply of credit, reducing welfare. We note that some forms of this welfare-reducing expansion of credit may superficially resemble "good" lending, such as when a lender refinances a borrower facing payment difficulties. The challenge for policy is to find

[17]See, however, papers such as De Meza and Webb [11] in which asymmetric information leads to socially excessive lending.

a way to eliminate welfare-reducing lending in such a way that welfare-improving lending is affected as little as possible.

Loan contract features

The concern over predatory lending focuses on several common features of loan contracts. A prominent such feature is the prepayment penalty: commentators often associate it with predation (see, for example, the GAO report discussed in the Introduction), and predatory-lending laws often directly limit it (e.g. Section 30 of Illinois' High Risk Home Loan Act, Public Act 93-0561). Our analysis provides support for both the concern and the policy.

Limits on prepayment penalties make loans less valuable to lenders, so at the time of the initial mortgage they tend to increase rates. However, at the time of refinancing, they entrench the incumbent's position and therefore boost the monopoly power he enjoys. Our analysis finds that competition generally reduces the extent and severity of predation, and therefore predicts a positive welfare effect, with respect to predation, of the regulatory limits. So while the limits are not a "free lunch" for borrowers, they are beneficial in this respect.

Another contract feature often called into question is the balloon payment, i.e. an outsized terminal payment that typically necessitates new financing. That is, the status quo without refinancing is default and foreclosure. We can approximate the balloon structure in our framework by making the initial mortgage a one-payment loan due at date 1. This change in the structure of the mortgage has no effect on borrowers with low income at date 1, since they need to obtain refinancing even under the standard mortgage. However, borrowers with high date 1 incomes are affected. Now, these borrowers need to obtain refinancing to avoid foreclosure. In essence, the balloon payment makes all borrowers "distressed" at date 1. As a consequence, borrowers with high date 1 income are now vulnerable to predation under circumstances under which they are *not* vulnerable absent the balloon payment.[18]

[18] Specifically, when the mortgage contract calls for a payment of RL_0 at date 1, a high-income borrower is subject to predation if there exist refinancing terms under which she agrees to pay I at date 1 and P_2 at date 2, with $I + P_2 \geq \min\{H, RL_0\}$, $p(I + P_2) + (1 - p)(I + \min\{H, P_2\}) \leq \min\{H, RL_0\} + V_K$, and $P_2 > K$. These three conditions ensure that the lender offers refinancing, the borrower accepts, and that a borrower with low income at date 2 defaults. Recall that $I + K > RL_0$ (from Assumption 2) and $K < H$ (Assumption 1). So there exists a P_2 satisfying these three inequalities if and only if the second inequality holds strictly at $P_2 = K$, i.e., $I + K < \min\{H, RL_0\} + V_K$. Since this last condition can hold when the conditions of Proposition 3 fail, it follows that balloon payments expose high income borrowers to additional predation.

Interest rate controls

Interest rates on consumer loans have been constrained throughout modern times by usury laws. Predatory-lending laws add to these constraints by restricting the features of loans with sufficiently high rates. But although lower interest rates naturally increase a borrower's benefit from any given loan, our analysis suggests a more complex relation between these constraints and predatory lending.

On the one hand, interest-rate limits restrict the severity of predatory lending to distressed borrowers. (Of course, an overly aggressive interest rate limit will prevent even borrowers with good prospects from being refinanced.) But on the other hand, it is actually possible for interest-rate limits to increase the incidence of predation in cash-out refinancing. The reason is that, as noted earlier, cash-out refinancing occurs only if a borrower has enough collateral for the lender to recover more by refinancing and then foreclosing than by sticking with the original loan terms. Interest-rate limits reduce the latter quantity, which leaves the borrower exposed to predation for a larger range of house values. Formally, we see this effect by noting that the expression $\bar{P}_2$ in Proposition 3 is decreasing in the original interest rate R.

Lending without due regard to repayment ability

Predatory loans in our framework are loans that the lender knows the borrower will be unable to service. In commonly used legal language, they are loans made without due regard to repayment ability.

If a court were able to directly observe the lender's information, predatory lending would be easy to eliminate. Even though courts do not have access to such information, some states have still tried to legislate along these lines. For example, the North Carolina predatory lending law mandates that lenders "reasonably believe" that the borrower can repay the loan, considering both current and expected income and other resources.

These laws risk substantial type I and II errors. For example, it is easy to imagine a lender making a loan to a low-income borrower based on a well-founded belief that the borrower's income will rise. Such a loan might falsely appear predatory. Similarly, a lender might make a loan to a high-income borrower even if he (correctly) believes the borrower's income will fall. In this case, a predatory loan might appear non-predatory.

The North Carolina law provides a safe harbor to lenders by stating that repayment ability is presumed if, at the time of the loan's origination, the borrower's total monthly debts (including the loan) do not exceed half of her verified income (North Carolina G.S. § 24-1.1E(c)(2)). Clauses of this type reduce the risk of wrongly classifying a nonpredatory loans as predatory, but at the same time exempt some predatory loans from the law's reach.

Predatory lending and borrower protection laws

So far we have assumed that lenders are unable to seize a borrower's income. This form of borrower protection encourages predation, in that a lender who sees foreclosure as inevitable is encouraged to postpone it with refinancing to collect cash that would otherwise be off limits. Since lenders do have some ability to garnish wages, albeit limited and depending on the jurisdiction, we consider how this might affect the incidence of predation. We suppose that if the borrower fails to make her date 1 loan payment, the incumbent can garnish as much of the borrower's date 1 and date 2 income as is needed to repay the loan. The relevant question is whether, given this unlimited access to the borrower's income under the status quo, the lender can extract anything more through refinancing.

When the mortgage is poorly collateralized, the loan balance not covered by liquidation, known as the "deficiency," is high. In this case, absent refinancing the lender collects a large fraction of the borrower's total income when garnishment is possible, leaving little or nothing to add through refinancing.[19] However, when house values are sufficiently high predatory lending can occur just as before. Instead of foreclosing and recovering the full amount owed, the lender can offer to refinance at a higher interest rate. Such refinancing is predatory because in a futile effort to keep her house, a borrower with bad prospects ends up paying money she would otherwise have kept.

[19] Although laws that inhibit garnishment leave borrowers more exposed to predatory lending, they do nonetheless improve the welfare of borrowers. For example, with sufficiently low house values a borrower with low income K in both periods ends up with zero surplus absent borrower protection laws — she loses her house and all her income. In contrast, under a law which protects her income she keeps her date 2 income even when she is the victim of predatory lending. As such, borrower protection laws do provide borrowers with some protection — but predatory lending reduces the amount.

Securitization

The incidence of predation has been linked to the practice of securitizing after origination (see the GAO report, and Engel and McCoy [14],[15]). The concern is generally that if they expect to sell it off originators care too little about a borrower's ability to repay a loan. Our analysis suggests a countervailing effect, whereby securitization may curtail predatory lending.

We look again at the form predation takes when the borrower is distressed and the incumbent refinances bad prospects to extract more cash before liquidating. If the liquidation recovers only some of the incumbent's loss on the original mortgage, then even though the refinancing benefits the incumbent, the refinancing loan itself loses money.

If the mortgage is securitized, it is sold to a third party that services it and passes its payments through to investors, and the original lender might or might not retain exposure to its default risk (see, e.g., "Bad Loans Draw Bad Blood," *Wall Street Journal*, October 9, 2006). If the lender remains exposed then our existing analysis applies. But if he does not, then the borrower faces a debt-overhang problem, not only with the incumbent, but also with anyone else except the investors in the securitization. If, as seems likely, it is not feasible to get new financing from these investors, then the borrower does not refinance and defaults, and no predation occurs. Moreover, if the incumbent knows the borrower's future income prospects (which he might not, considering he is not currently exposed to her default risk) then he is prepared to refinance a distressed borrower with good prospects.

This mechanism by which securitization curtails predatory lending is related to the standard corporate finance argument that dispersion of creditors makes refinancing more difficult.[20] But while in the standard models this difficulty tends to be costly, in this model, where refinancing may reduce welfare, it can be beneficial.

Fostering competition

Our analysis suggests that, under most circumstances, competition either ameliorates or eliminates predatory lending.

One implication is that predatory lending is most likely to occur in the subprime

[20]See, e.g., Bolton and Scharfstein [6].

segment of the mortgage market, which is generally considered to have few active lenders. Indeed, the U.S. Congress cited the scarcity of lenders in poor neighborhoods as a prime motive for the Community Reinvestment Act (CRA) of 1977 (see Barr [3], page 523).

A second implication of our results relating to competition is that credit market interventions that increase competition may effectively combat predation. The CRA is a leading example of such an intervention. As described by the Federal Reserve, it "requires that each depository institution's record in helping meet the credit needs of its entire community be evaluated periodically. That record is taken into account in considering an institution's application for deposit facilities."[21] This law is not a response to predatory lending but, as others have noted,[22] it may have relevant consequences.

To the extent this law encourages local banks to compete with the big subprime lenders to offer credit in their communities, it pushes entrants into the market, thereby moving the local economy from the monopoly to the competitive case. As discussed above, our model predicts that this is generally a benefit to borrowers, since under many circumstances competition either eliminates or ameliorates predatory lending. A notable feature of this effect is that when predatory lending is eliminated the volume of lending may actually decrease, and this decrease benefits the most vulnerable consumers. To see this, simply note that predatory lending necessarily entails loans to both good and bad prospects; while from the proof of Proposition 7, non-predatory loans are only to good prospects.

The chief exception to the beneficial effects of competition occurs when both borrower income and collateral are low, such as in a recession (see Proposition 5). In this case predatory lending occurs when the incumbent lender makes a loss-making loan to a borrower with poor future income prospects in order to extract additional funds from the borrower. Even though the incumbent loses money on the loan, he loses less than under the alternative of not offering refinancing. In this case the borrower is not helped by the willingness of entrants to break even.

If the local banks are rewarded for closing loans, rather than just offering them, this corresponds in our framework to a below-zero required return. That is, when entrants need to break even they affect the equilibrium but do not actually lend, so to lend they must discount further. This translates to better terms for borrowers, though again, in a deep-enough recession there may be no effect because the discounting

[21] http://www.federalreserve.gov/dcca/cra/

[22] See, for example, Marisco [25].

necessary to undercut the incumbent may be too much.

Identifying predatory lenders

The primary goal of our model is to help identify how predatory lending occurs. Can our model also help identify predatory lenders? In the model, predatory loans are identifiable ex post as refinancings that end in foreclosure, implying that predatory lenders are identifiable as those that ever made such loans. However, this reflects our simplifying assumption that foresight is perfect; in realistic conditions, both predatory and non-predatory lenders would experience a variety of outcomes, and higher default could result from non-predatory lending in a riskier environment.[23] However, a more robust identification, one that gets to the crucial question of foresight, is possible if one is prepared to take a structural approach.

The lender in our model is a predatory lender, i.e., a lender who makes predatory loans if they benefit him. To distinguish this lender from one who abstains from predation, perhaps the cleanest test involves cash-out refinancings. In the model, all cash-out refinancings of bad prospects are predatory, but they occur only when the house value is sufficiently high. By comparison, a non-predatory lender would not provide this financing, whether house value is high or low. Thus, in cash-out refinancings, a more predatory lender would show a higher correlation between house value and subsequent foreclosure.

Consequences of anti-predatory laws

Several empirical studies debate the effects of the laws recently passed, particularly in North Carolina (Elliehausen and Staten [12], Litan [23], Quercia *et al* [31]; Ho and Pennington-Cross [21] study a broader cross-section of states). These studies agree that subprime originations fell after the law took effect,[24] but they dispute whether this benefitted consumers. On the one hand, Elliehausen and Staten [12] argue that the decline reflects a general withdrawal by subprime lenders, and that consumer welfare consequently decreased also. On the other hand, Quercia *et al* argue that

[23] As we have already observed, our assumption that at date 1 the incumbent can perfectly forecast the borrower's date 2 income is made only to simplify the exposition, and is not essential for our results. See footnote 7.

[24] In their multi-state analysis, Ho and Pennington-Cross [21] find that when anti-predatory laws are more restrictive, credit declines by a greater amount.

the lending decrease was largely isolated to refinancing loans, and that the fraction of subprime refinancing loans with prepayment penalties, high loan-to-value (LTV) ratios, and balloon payments decreased. They conclude that the eliminated loans would have been predatory, and therefore, consumers were made better off.

The disagreement over the effects of North Carolina's law reflects in part the absence of a consistent framework with which to think about predatory lending. In the current paper, we have endeavoured to provide one possible such framework. In some respects, our analysis concurs with Quercia *et al*: loans that include prepayment penalties and balloon payments are more likely to foster predation in our model. Thus, to the extent that Quercia *et al* are correct that the incidence of such lending disproportionately declined, our analysis supports their conclusion that North Carolina's law had beneficial effects.

In two important respects, however, our analysis suggests the need for more care in interpreting the data. First, our model provides only limited support for Quercia *et al*'s claim that high LTV ratios are indicative of predatory lending. In our analysis, high LTV - which is to say, low collateralization - promotes the efficient, non-predatory outcome when a borrower's income is high, with cash-out refinancing only for those who can afford it.

Second, our model suggests that Elliehausen and Staten [12] and others are too quick to declare that a reduction in subprime credit hurts borrowers. Although credit is beneficial for the average borrower in our model (otherwise borrowing would be irrational), under many circumstances it hurts borrowers with the worst income prospects. So it is possible for a credit reduction to arise from lenders abandoning loans to specifically borrowers with bad prospects, in which case the welfare of those borrowers actually goes up.

7 Conclusion

In this paper we present a framework for analyzing the incidence of predatory lending. The key element of our analysis is the informational advantage lenders gain over their existing borrowers. We consider the implications of this informational advantage for the refinancing of mortgages in the subprime market. When the goal of refinancing is to relieve financial distress, predatory loans extract cash from doomed mortgages. This form of predation is always possible under monopolistic conditions, but if house values are high enough is eliminated by competition. When a borrower instead refinances to obtain cash for immediate consumption, predatory lending occurs when house values are high enough. Home improvement loans are especially at risk. In contrast to predatory refinancing of distressed loans, this form of predation leads to more foreclosure. Again, competition between lenders generally reduces or eliminates the problem.

The generally beneficial effect of competition in the subprime market argues for laws such as the CRA that encourage entry. In the same way, predatory-lending laws that weaken monopoly power by restricting loan features such as prepayment penalties appear attractive. But laws that limit interest rates leave at least some borrowers more exposed to predation, since these laws widen the range of home values for which predatory cash-out refinancing is possible. Securitization, often suspected of contributing to predation, has an upside, in that it frustrates distressed refinancing by specifically those borrowers who would lose from refinancing.

We close with a discussion of possible avenues for future research.

Accusations of predatory behavior are made in the payday lending market as well as in the subprime mortgage market. Just as we have shown that a model based on borrowers suffering an information disadvantage relative to their lenders can fruitfully be used to analyze the mortgage market, it would be interesting to ask if the same is true of the payday lending market. Certainly an informational asymmetry would generate the possibility of predation by payday lenders. To see this, recall that payday loans are expensive only if they are rolled over for many months. One could analyze this market with a model in which a borrower rationally takes a payday loan in the belief that he will repay the following month, while the lender is able to identify a subset of borrowers who are in fact unlikely to be able to repay so quickly. Loans to this identifiable subset of borrowers are predatory. Whether a model along these lines is capable of producing further insights is a question we leave for future research.

The empirical identification of predatory lending remains an important challenge for the literature. The previous section outlines one identification strategy based on our framework. Another and quite different strategy would be to follow the lead of several recent empirical studies of payday lending (see Morse [27], Morgan [19], Skiba and Tobacman [35]), and try to identify whether an empirically distinguishable segment of subprime mortgage activity reduces welfare. For example, one could examine whether interstate variation in the anti-predatory lending laws (see, e.g., Ho and Pennington-Cross [21]) is related to welfare outcomes. Possible welfare outcomes to consider range from those related specifically to the housing market, such as foreclosure and bankruptcy, to more general measures such as health or crime.

Finally, at the time of writing delinquency and default in the subprime mortgage market are very much in the news, with these problems in turn often blamed on "abusive" lending. Our analysis addresses important elements of the situation. In particular, it explains why banks lent to borrowers who were later unable to service their loans; why borrowers agreed to such loan terms; and suggests that banks' behavior may indeed have been abusive in the sense of reducing welfare. Inevitably, however, our analysis has omitted some significant issues. These omissions include the agency problems that are conjectured to exist between banks and their loan officers on the one hand, and between banks and the investors who subsequently purchased the loans on the other. We leave the exploration of these topics for future research.

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Appendix A: Mathematical proofs

Proof of Proposition 1: Fix a date 1 income realization y_1. Absent refinancing, both borrower types pay the same amount to the incumbent, and attain the same surplus from the expenditure and/or house (for example, if $y_1 = K$, both borrower types pay $\min\{L_0R, H\}$, lose the house, and undertake the expenditure if $K \geq M$). Now, consider any equilibrium in which both borrower types agree to refinancing terms involving payments of P_1 and P_2 in dates 1 and 2 respectively, and in which the borrower does not learn his type at date 1. (Clearly if the borrower learns his type no predation can occur.) Since the borrower does not learn his type, both borrower types take the same actions at date 1. At date 2, either both borrower types take the same action, or else only the high income borrower makes payment P_2. The latter case only occurs if the difference between P_2, the scheduled payment, and $\min\{P_2, H\}$, the payment made in default, exceeds the surplus from the house, X. It follows that the payment net of surplus gained is weakly greater for the date 2 high income borrower than the low income borrower. So if the refinancing makes the good prospects borrower strictly worse off, the same must be true for the bad prospects borrower. But then the borrower would not accept the refinancing terms, completing the proof. **QED**

Proofs of Propositions 2 and 3 below include characterization of all predatory equilibrium outcomes.

Proof of Proposition 2: The proof we offer for Proposition 2 is constructive: we will characterize a predatory equilibrium for all total payments levels $\hat{P}_1 + \hat{P}_2$ that can exist in a predatory equilibrium. For expositional ease we restrict attention to $\hat{P}_1 = K$; the proof can easily be extended to the case $\hat{P}_1 < K$. In a predatory equilibrium the incumbent makes the following offer, independent of his private information: in place of your existing mortgage, pay me K today and $\hat{P}_2 = \min\{H, L_0R\} - K + \delta$ at date 2, where $\delta \in (0, \bar{\delta}]$, and $\bar{\delta}$ is characterized below. The borrower's off-the-equilibrium-path belief is that if the incumbent asks for more payment, then the incumbent believes that $y_2 = K$. If he offers a lower payment, we do not put any restrictions on beliefs. We will show that for all δ, the incumbent makes the offer, the borrower accepts it, and it makes the borrower worse off if $y_2 = K$. The most profitable equilibrium for the lender is the one that involves the highest payment, i.e., $\delta = \bar{\delta}$.

First, note that due to Assumption 1, the borrower cannot pay $\hat{P}_2 \geq \min\{H, L_0R\} - K$ if $y_2 = K$. Next we characterize the highest $\hat{P}_2$ that she can and is willing to pay when $y_2 = I$. Without refinancing she pays $\min\{H, L_0R\}$ in total. Therefore, with refinancing the highest she would be willing to pay is $\min\{H, L_0R\} + V_K$, which leads to a maximum date 2 payment of $\min\{H, L_0R\} - K + V_K$, i.e., $\delta \leq V_K$. On the other hand, for her to agree on a refinancing with a higher total payment, the date 2 payment must be less than I, i.e., $\delta \leq I + K - \min\{H, L_0R\}$. Thus, the borrower accepts any offer with $\hat{P}_1 = K$ and $\hat{P}_2 = \min\{H, L_0R\} - K + \delta$, where $\delta \in (0, \bar{\delta}]$, and $\bar{\delta} = \min\{V_K, I + K - \min\{H, L_0R\}\}$.

Next, we show that, given the borrower's beliefs, the incumbent makes the offer. If the incumbent makes a higher offer, the borrower rejects it. Therefore, any deviations result in foreclosure. Then the incumbent's payoff will be $\min\{H, L_0R\}$. On the other hand, in equilibrium his expected payoff is $K + \min\{H, \min\{H, L_0R\} - K + \delta\}$ if the borrower has bad prospects, and $\min\{H, L_0R\} + \delta$ if the borrower has good prospects. However, since $\delta > 0$, both of these equilibrium payoffs are weakly higher than $\min\{H, L_0R\}$ so there are no profitable deviations.

Finally, we calculate the expected loss for the borrower with bad prospects. Her house is foreclosed even after refinancing. Therefore, all we have to do is compare her payments. If $H \geq L_0R$, the foreclosure payment is L_0R. Otherwise, it is H. Under the most profitable refinancing her payment is $K + \min\left\{H, \min\{H, L_0R\} - K + \bar{\delta}\right\}$. If $H \geq L_0R$, then $\bar{\delta} = \min\{V_K, I + K - L_0R\}$. From Assumption 2 we have $I < L_0R$. Thus, $\bar{\delta} < K$. This implies that $\min\left\{H, \min\{H, L_0R\} - K + \bar{\delta}\right\} = L_0R - K + \bar{\delta}$. Therefore, the overpayment is $\bar{\delta} = \min\{V_K, I + K - L_0R\}$ if $H \geq L_0R$. If $H < L_0R$, then $\bar{\delta} = \min\{V_K, I + K - H\}$. If $\bar{\delta} \geq K$, $\min\left\{H, \min\{H, L_0R\} - K + \bar{\delta}\right\} = H$.

Then the overpayment is K. If $\bar{\delta} < K$, $\min\left\{H, \min\{H, L_0R\} - K + \bar{\delta}\right\} = H - K + \bar{\delta}$. Then the overpayment is $\bar{\delta}$. Therefore, if $H < L_0R$, the overpayment is $\min\left\{K, \bar{\delta}\right\} = \min\{K, V_K, I + K - H\}$. **QED**

Proof of Proposition 3: Let P_1 and P_2 stand for date 1 and date 2 payments in for the new loan. We first show that the conditions, $H \geq \bar{P}_2 = (RL_0 - I)R + M$ and $S \geq (1-p)X$ are necessary for predatory lending. First, suppose that $H < \bar{P}_2$. We show that the incumbent will never offer to refinance a bad borrower in this case. The incumbent gets at most $P_1 + P_2$ from the new loan. So he will only offer the new loan if

$$P_2 \geq I + R(RL_0 - I) - P_1 \geq M + R(RL_0 - I) \geq M + L_0 - I.$$

Since by assumption $L_0 + M > I + K$, it follows that any new loan terms that the incumbent is prepared to offer lead to default in date 2 when the borrower's income is low. Moreover, since $P_2 \geq M + R(RL_0 - I) > H$, the incumbent collects the full value of the house when the borrower defaults. So the incumbent obtains at most $P_1 + H$ from the borrower, which is strictly less than $I - M + (RL_0 - I)R + M$. Therefore, the incumbent does not offer a bad borrower new loan terms that the borrower would accept. Next, suppose that $S < (1-p)X$. As we showed above, if the incumbent offers new loan terms then the borrower will default, and therefore lose surplus X when she has low income at date 2, which to the borrower has probability $1-p$. So the new loan terms produce a net surplus of at most $S - (1-p)X < 0$. So there is no set of new loan terms that the incumbent and the borrower can agree on.

For the rest of the proof we suppose that both $H \geq \bar{P}_2$ and $S \geq (1-p)X$ and characterize a predatory equilibrium for all total payments levels $P_1 + P_2$ that can exist in a predatory equilibrium. For expositional ease we restrict attention to $P_1 = I - M$; the proof can easily be extended to the case $P_1 < I - M$. In a predatory equilibrium the incumbent offers $P_1 = I - M$ and $P_2 = \bar{P}_2 + \delta$, where $\delta \in [0, \bar{\delta}]$, and $\bar{\delta}$ is characterized below. The borrower's off-the-equilibrium-path belief is that if the incumbent asks for more payment, then the incumbent believes that $y_2 = K$. If he offers a lower payment, we do not put any restrictions on beliefs. We will show that for all δ, in equilibrium, the incumbent makes the offer, the borrower accepts it, and it makes the borrower worse off if $y_2 = K$. The most profitable equilibrium for the lender is the one that involves the highest payment, i.e., $\delta = \bar{\delta}$.

First, we characterize the highest P_2 that an average borrower is willing to pay. For her to agree on a refinancing, the date 2 payment must be less than I, i.e., $\delta \leq I - \bar{P}_2$, so that she knows that she can avoid foreclosure as long as $y_2 = I$. Conditional on her information, she also does not agree on a loan that makes her pay additional interest more than S-(1-p)X, i.e., $\delta \leq S-(1-p)X$. Therefore,she accepts any offer with $P_1 = I - M$ and $P_2 = \bar{P}_2 + \delta$, where $\delta \in [0, \bar{\delta}]$, and $\bar{\delta} = \min\left\{S-(1-p)X, I-\bar{P}_2\right\}$.

Next, we show that, given the borrower's beliefs, the incumbent makes the offer. If the incumbent makes a higher offer, the borrower rejects it given her beliefs. Therefore, any deviations result in keeping the existing loan. Then the incumbent's payoff will be $I + (RL_0 - I)R$ independent of the type of the borrower since the loan is fully collateralized. On the other hand, in equilibrium his expected payoff is $I + (RL_0 - I)R + \delta$ if the borrower has good prospects. This is weakly greater than $I + (RL_0 - I)R$ given that $\delta \geq 0$. If the borrower has bad prospects, then his expected equilibrium payoff is $I - M + \min\left\{H, \bar{P}_2 + \delta\right\}$. Given that $H \geq \bar{P}_2$ and $\delta \geq 0$ this equilibrium payoff is higher than $I + (RL_0 - I)R$. Thus, there are no profitable deviations.

Finally, we calculate the expected loss for the borrower with bad prospects. Recall that by refinancing the borrower agrees to pay an additional amount δ to the lender. So the increase in the borrower's payment to the lender is bounded above by $\bar{\delta} = \min\left\{S-(1-p)X, I-\bar{P}_2\right\}$. The total payment by the borrower with low income at date 2 is also bounded above by $K + H$, and so the increase in the total payment is bounded above by $I - M + H - (I + R(RL_0 - I)) = H - \bar{P}_2$. She also suffers foreclosure costs net of the surplus of the expenditure, $X - S$. In sum her loss is $\min\left\{S-(1-p)X, I-\bar{P}_2, H-\bar{P}_2\right\} + X - S$ in the equilibrium most profitable for the lender. **QED**

Proof of Proposition 4: The proof is very similar to that of Proposition 3. The sufficiency of the conditions follows exactly as before. For necessity, suppose to the contrary that a predatory lending equilibrium exists when $(RL_0 - I)R > H$. By the same argument as before, the incumbent will only offer new financing terms with $P_2 \geq \bar{P}_2 > M + H$. As such, at date 2 the incumbent will recover only $M + H$ from the borrower if he has bad prospects. So under refinancing, the total net payment in dates 1 and 2 from the borrower with bad prospects to the ncumbent is weakly less than $(I - M) + (M + H)$. By assumption, this is strictly less than $I + R(RL_0 - I)$, which the incumbent can obtain from the borrower by not offering refinancing. **QED**

Proof of Proposition 5: We first construct an equilibrium with lending at P_2^K and characterize when it entails predatory lending. Second, we show that there is no equilibrium in which a borrower with bad prospects agree to pay more than P_2^K at date 2.

The following is an equilibrium. All lenders offer P_2^K. The borrower accepts the incumbent's offer. If the incumbent offers $P_2 < P_2^K$ the borrower can have any belief.

If the incumbent offers $P_2 > P_2^K$, the borrower believes that she has bad prospects, and rejects all offers when $RL_0 - K > H$. (As we will make clear below, it is irrelevant how the borrower responds when $RL_0 - K \leq H$.)

We start with the borrower. In equilibrium she is uninformed. If she rejects the equilibrium offer P_2^K she pays $\min\{RL_0, H\}$ to the incumbent and loses her house; while if she accepts the offer she pays out a total of RL_0 in expectation, and keeps her house with probability p. When $RL_0 \geq H$ the latter option is clearly preferable; when $RL_0 < H$, it is preferable provided $pX \geq RL_0 - H$. Given the stated out of equilibrium beliefs, she will clearly accept any better offer than P_2^K. Finally, when $RL_0 - K > H$ she will respond to an upwards deviation by the incumbent by rejecting all offers, as follows. If she borrows at all, she will clearly do so from an entrant. She expects to pay $K + \min\left\{H, P_2^K\right\} = K + H$. If she instead defaults today she pays just H.

The uninformed entrants make zero profit. Since P_2^K is constructed to be the minimum payment at which they can profitably lend, offering lower payments results in negative expected profits. Higher offers are clearly rejected.

The informed incumbent cannot make higher profits by offering lower payments as this will result in strictly lower expected profit. If he deviates and makes a higher offer after observing a good signal, then his offer will be rejected — resulting in lower profit. Finally, can he profitably deviate after observing a bad signal? Following an upwards deviation by the incumbent, the borrower will certainly *not* borrow from the incumbent. So a necessary condition for the deviation to be strictly profitable is that the equilibrium offer P_2^K is loss-making, i.e., $RL_0 - K > H$. However, in this case the borrower responds by not borrowing at all, and so the incumbent receives $\min\{RL_0, H\} = H$ today. This is less than the $K + H$ the incumbent receives when he sticks to the equilibrium offer.

When $H \geq RL_0$ the equilibrium is not predatory. When $H \leq RL_0$ the equilibrium entails the borrower with bad prospects paying $K + \min\left\{H, P_2^K\right\}$ in place of H. So if $RL_0 - K \leq H < RL_0$ he pays $RL_0 - H$ more; while if $H < RL_0 - K$ he pays K more.

It remains to establish that there is no equilibrium in which the borrower with bad prospects refinances at worse terms than P_2^K. Suppose to the contrary that such an equilibrium exists, with $P_2 > P_2^K$ the terms accepted. The equilibrium cannot be a separating equilibrium. We showed above that the bad prospects borrower is either indifferent between refinancing at P_2^K and defaulting, or else strictly prefers defaulting. So she strictly prefers defaulting to refinancing at $P_2 > P_2^K$. However, the equilibrium cannot be a pooling equilibrium either: for in this case, one of the entrants could profitably deviate by offering $P_2 - \varepsilon$ (where ε is arbitrarily small) and capturing the whole market. **QED**

Proof of Proposition 6: Proposition 5 establishes that under competition the borrower never agrees to refinancing with a date 2 payment above P_2^K. As the Proposition statement makes clear, we have three cases to consider:

Case: $H \geq RL_0$*:* In this case $P_2^K = RL_0 - K$. Since no predation occurs when the borrower agrees to make a date 1 payment of K and a date 2 payment of $RL_0 - K$, the same is true for any lower date 2 payment.

Case: $H \in (\max\{RL_0 - pX, RL_0 - K\}, RL_0)$*:* We claim the following is an equilibrium when the incumbent enjoys a monopoly: the incumbent offers $P_2^K + \varepsilon$ (where ε is small) and the borrower accepts. Here, $P_2^K = RL_0 - K$, and the incumbent receives this payment in full from both types of borrower at date 2. As such, the incumbent is certainly prepared to refinance the borrower with bad prospects at terms $P_2^K + \varepsilon$. Provided ε is small enough that $RL_0 - pX + \varepsilon \leq H$, the borrower accepts. Since $H > RL_0 - K$ the bad prospects borrower is strictly worse off under refinancing terms $P_2^K + \varepsilon$ than terms P_2^K. As in Proposition 2, it is straightforward to exhibit off-equilibrium-path beliefs such that the incumbent has no profitable deviation. Because the incumbent has a monopoly, undercutting from other lenders does not arise.

Case: $H > RL_0 - pX$ and $H \leq RL_0 - K$*:* Take any pooling equilibrium under monopolistic conditions in which the borrower accepts refinancing at terms P_2. We will establish that there is also a pooling equilibrium under competitive conditions in which the bad prospects borrower pays weakly more.

This is straightforward. In any equilibrium, the bad prospects borrower pays at most $K + H$ over the two periods. In the parameter case under consideration, $P_2^K \geq H$. So in the equilibrium established by Proposition 5 the bad prospects borrower pays $K + H$ over the two periods.

Case: $H \leq RL_0 - pX$*:* Take any pooling equilibrium under monopolistic conditions in which the borrower accepts refinancing at terms P_2. We will establish that there is also a pooling equilibrium under competitive conditions in which the borrower accepts refinancing at these same terms.

Note first that $P_2 \leq P_2^K$. To see this, suppose to the contrary that $P_2 > P_2^K$.

By construction, the refinancing terms P_2^K are such that the *average* borrower pays $RL_0 - K$ to the lender at date 2. However, this implies that the borrower would not accept these terms: by defaulting immediately she pays $\min\{RL_0, H\} = H$ to the lender, while by accepting refinancing she pays K at date 1, $RL_0 - K$ at date 2, and keeps her house with probability p. Since $pX - RL_0 \leq -H$ in the case under consideration, it follows that the borrower would never agree to pay strictly more than P_2^K in equilibrium — even under monopolistic conditions.

Given that $P_2 \leq P_2^K$, it is then immediate that there is an equilibrium under competitive conditions in which the incumbent offers to refinance at terms P_2 and the borrower accepts. Given that an equilibrium with these properties exists under monopolistic conditions, the only condition to check is that the Entrants do not want to undercut P_2. Since $P_2 \leq P_2^K$, the proof is complete. **QED**

Proof of Proposition 7: We start with a couple of preliminaries. If the borrower does not undertake new consumption in equilibrium she cannot experience a welfare loss — under her existing loan she pays the incumbent a total of $I + (RL_0 - I)\,R$ and keeps her house, and any refinancing must lower her payment. Moreover, the only candidate for a pooling equilibrium in which the borrower undertakes additional consumption is that in which the borrower promises to pay the amount P_2^I at date 2. By construction, P_2^I is the payment that makes an Entrant indifferent between not lending, and lending $RL_0 + M - I$ to both types of borrower at date 1 in return for a promise of P_2^I at date 2. Therefore, if the borrower promises to pay strictly more than P_2^I as part of an equilibrium, one of the Entrants can profitably deviate by undercutting. An Entrant will never lend at strictly less than the break-even P_2^I in a pooling equilibrium, and neither will the incumbent, since if he does not refinance he receives $I + (RL_0 - I)\,R \geq RL_0$.

When the inequalities

$$RL_0 - I + M \leq H, \tag{1}$$
$$S - (1-p)\,X \geq 0, \tag{2}$$
$$(RL_0 - I)\,(R-1) < (X - S) \tag{3}$$

hold we claim the following is an equilibrium: all Entrants offer to supply $RL_0 + M - I$ at date 1 in return for a promise to pay P_2^I at date 2, while the incumbent offers to accept a payment $I - M$ at date 1 in return for a promise to pay P_2^I at date 2. The borrower accepts the incumbent's offer. The borrower accepts any better offer, and interprets any worse offer from the incumbent as independent of the incumbent's private information.

By (1), the borrower always makes her promised date 2 payment — though she loses her house in doing so when date 2 income is low.

The borrower is indifferent between the Entrant and incumbent offers. If the borrower rejects all offers she pays a total of $I + (RL_0 - I)\,R$ to her existing lender. If instead she accepts the incumbent's offer her total net payment at dates 1 and 2 is RL_0; she enjoys new consumption with a surplus of S; but loses the surplus flow X from her house with a probability of $(1-p)$. Therefore, she accepts the incumbent's offer if

$$S - (1-p)\,X - RL_0 \geq -I - (RL_0 - I)\,R,$$

which is certainly implied by condition (2). The loan is predatory if it makes the borrower worse off when she has bad prospects, which (by an analogous calculation) occurs whenever condition (3) is satisfied. The welfare loss is $(RL_0 - I)\,(R-1) - (X - S)$.

It remains to show that the lenders are happy to make the offers described. The Entrants make zero profits from their offer. They would make a loss from any alternate offer in which they provide $RL_0 + M - I$ at date 1 but accept a promise of less than P_2^I at date 2; while the borrower would never accept an offer in which she promises more than P_2^I at date 2. Moreover, there is no profitable deviation in which the Entrant offers to supply less than $RL_0 + M - I$ at date 1. To see this, suppose to the contrary that such a deviation exists. The Entrant must make strictly positive profits on the loan, and so the borrower's total net transfer to all lenders across dates 1 and 2 is strictly more than RL_0. Because the borrower is unable to afford the additional consumption Project, by condition (2) she strictly prefers to accept the incumbent's refinancing offer, in which her total net payment is exactly RL_0, she obtains an additional surplus S, but loses the surplus X from her house with probability $1-p$.

In equilibrium the incumbent receives a total of RL_0 from the borrower. Under any lower offer, he would receive less. Under any higher offer, the borrower would accept one of the Entrants' offers, and the incumbent would still receive just RL_0. Finally, a similar argument to above establishes that he cannot make higher profits by offering terms that do not allow the borrower to afford the Project at date 1.

Next, we establish that $(RL_0 - I)\,(R-1) - (X - S)$ is the maximum loss of surplus experienced by the borrower with bad prospects in *any* equilibrium. A loss of surplus can only occur as part of a pooling equilibrium in which the borrower undertakes new consumption. If the borrower undertakes new consumption in a pooling equilibrium he promises to pay P_2^I at date 2 (see the start of the proof). If (1) holds the welfare loss is exactly $(RL_0 - I)(R-1) - (X - S)$. Suppose instead that (1) does not hold, so that if the borrower's date 2 income is low a lender recovers just H from the borrower. If the borrower accepts refinancing from an Entrant, he must receive at least $RL_0 + M - I$ at date 1 (otherwise refinancing is useful). Since he pays RL_0 to the incumbent, his total net payment in dates 1 and 2 to the Entrant and incumbent is less than $M - I + H < RL_0$. By a parallel calculation, the same is true if he accepts refinancing from the incumbent. So the borrower's welfare loss is strictly less than $(RL_0 - I)(R-1) - (X - S)$.

Finally, conditions (1) - (3) are necessary as well as sufficient for predatory lending to occur in equilibrium, as follows. If (1) does not hold the candidate pooling equilibrium entails a payment of $P_2^I > H$. However, the incumbent will never lend to the borrower with bad prospects at this rate: he receives RL_0 if the borrower takes a loan from an Entrant, and $I + (RL_0 - I)R$ if the borrower sticks with his existing loan. Both give him a higher income than supplying $M - I$ at date 1 and receiving H at date 2.[25] If (1) holds but (2) does not hold, then the borrower will not refinance at the terms P_2^I; finally, if (1) and (2) both hold but (3) does not, refinancing at terms P_2^I does not reduce the borrower's surplus. **QED**

Proof of Proposition 8: Proposition 3 establishes that predatory lending arises under monopoly conditions if and only if $H \geq (RL_0 - 1)R + M$ and $S \geq (1-p)X$. Throughout the proof we assume these conditions are satisfied (and that the latter is satisfied strictly). It is then immediate from Proposition 7 that predatory lending is possible under competitive conditions if and only if condition (3) holds. From the proof of Proposition 7, when predatory lending occurs under competitive conditions the refinancing terms are given by P_2^I. To establish the result, we will show that there is an equilibrium under monopolistic conditions in which the incumbent proposes to supply $M - I$ to the borrower at date 1, in return for a promise of $P_2^I + \varepsilon$ (where ε is small) at date 2, and the borrower accepts.

Since certainly $H \geq RL_0 - I + M$, the payment P_2^I equals $RL_0 - I + M \leq H$. So the incumbent is willing to provide $M - I$ at date 1 in return for a promise of any amount above P_2^I at date 2. The borrower accepts the terms $P_2^I + \varepsilon$, as follows.

[25] There remains the possibility of an equilibrium in which the Entrants offer to lend at a terms P_2^I, while the incumbent makes a higher offer that is always rejected. Under our definition, this equilibrium is not predatory because the lender making the loan does not know that it reduces the borrower's welfare. Moreover, even if one were to view this equilibrium as predatory, it does not satisfy weak refinement concepts. In particular, it requires out-of-equilibrium borrower beliefs in which the borrower interprets an offer just below P_2^I as coming from an incumbent who knows the borrower is bad — even though the incumbent would lose money from such an offer, while an incumbent who knows the borrower is good would make money.

By construction the financing terms P_2^I entail her making a total payment of RL_0 to the incumbent over the two periods, whereas under the terms of the existing loan she pays $I + (RL_0 - I) R \geq RL_0$. Additionally, she receives a surplus S from the consumption Project, but loses surplus X when she loses her house with probability $1 - p$. Since $S > (1 - p) X$, the borrower accepts the terms $P_2^I + \varepsilon$ when ε is small enough. As in Proposition 3, it is straightforward to exhibit off-equilibrium-path beliefs such that the incumbent has no profitable upwards deviation. Because the incumbent has a monopoly, undercutting from other lenders does not arise. **QED**

Appendix B: Analysis of non-predatory equilibria

Below, we classify any equilibrium in which borrowers either take no loan, or take a loan which leaves both types' expected payoff and foreclosure outcomes unchanged, as degenerate. We characterize non-degenerate equilibria.

Proposition 9 *Suppose* $y_1 = K$ *and the incumbent is a monopolist. There exist two types of non-predatory equilibrium:*

(i) The lender offers the same refinancing to all borrowers. The borrowers accept the offer. The lender's expected profit is zero.

(ii) The lender offers different refinancing terms to each type of borrower. In the equilibrium most profitable for the lender, his expected profit is $\max \{0, p (I - H)\}$. *In particular, if* $H \geq I$ *the lender's expected profit is zero.*

Proof: Under the original loan contract, both types of borrower default at date 1 and the lender receives $\min \{H, L_0 R\}$. Since, by Assumption 1, $2K < \min \{H, L_0 R\}$, there is no non-predatory equilibrium in which the bad borrower obtains refinancing that allows her to avoid foreclosure. As such, in any non-predatory equilibrium the bad borrower's welfare is the same as under the original loan contract, and she loses her house in foreclosure.

We now prove part (i). The lender offers refinancing to a borrower only if $P_1 + P_2 \geq \min \{H, L_0 R\}$. From above, refinancing lowers the welfare of a borrower with bad prospects unless $P_1 + P_2 \leq \min \{H, L_0 R\}$. So the only possible non-predatory equilibrium in which both borrower types receive financing has $P_1 + P_2 = \min \{H, L_0 R\}$.

Such an equilibrium exists, since both borrower types are weakly better off accepting refinancing under these terms, and the lender makes zero profits (relative to immediate foreclosure). (To prevent the lender deviating to other offers, borrowers' beliefs are such that if a higher total payment is offered then the borrower believes that she has bad prospects and therefore rejects the offer.)

We now proceed with part (ii). Recall that in a non-predatory equilibrium the bad borrower's welfare does not change due to refinancing. Therefore, in such equilibrium both parties must be indifferent due to refinancing the borrower with bad prospects. Consequently, any profit has to be made by lending to the borrower with good prospects. Next, we claim that for $H \geq I$ there is no non-predatory equilibrium with strictly positive profits for the lender. To see this, suppose to the contrary that there exist P_1 and P_2 such that the lender offers these terms to the good borrower, who accepts and repays, and $P_1 + P_2 > \min\{H, L_0 R\}$. Let $A \geq 0$ be the equilibrium savings of the good borrower, and note that repayment at date 2 demands $I + A \geq P_2$. If the lender offers the same loan to the bad borrower, he gets $P_1 + \min\{P_2, H + A\}$. Since $H + A \geq H + P_2 - I \geq P_2$, the lender recovers $P_1 + P_2 > \min\{H, L_0 R\}$ from the bad borrower, implying that he has a strictly profitable deviation.

For $H \geq I$, there is a non-predatory equilibrium with the following features: the lender offers to refinance the good borrower to $P_1 = K$, $P_2 = \min\{H, L_0 R\} - K$, and the borrower accepts. By Assumption 2, $I + K > L_0 R \geq \min\{H, L_0 R\}$, and so a good borrower can afford to pay P_2 at date 2. Since $P_2 < H$, the good borrower would be worse of if she strategically defaulted at date 2. As such, if she accepts the offer, she will repay. Since the lender's payoff is the same, and social surplus is increased (foreclosure is avoided), it follows that the good borrower is strictly better off accepting the offer. Moreover, the lender clearly gains nothing from offering this loan to the bad borrower.

Finally, consider any other offer $\left(\tilde{P}_1, \tilde{P}_2\right)$. The lender has no incentive to deviate to an offer with $\tilde{P}_1 + \tilde{P}_2 \leq \min\{H, L_0 R\}$. Consider any offer with $\tilde{P}_1 + \tilde{P}_2 > \min\{H, L_0 R\}$, and suppose that the borrower interprets such an offer as indicating she has bad prospects. As such, if she accepts the loan she will not save, and she anticipates paying $\tilde{P}_1 + \min\left\{H, \tilde{P}_2\right\}$ to the lender. If this amount is strictly more than $\min\{H, L_0 R\}$ it is a best response to reject. On the other hand, if this amount is weakly less than $\min\{H, L_0 R\}$, then certainly $\tilde{P}_2 > H \geq I$. But then if the borrower accepts and does not save she defaults at date 2 even if she is good, and the lender recovers $\tilde{P}_1 + \min\left\{H, \tilde{P}_2\right\}$, which is weakly less than $\min\{L_0 R, H\}$. So the lender has no profitable deviation.

Next, we show that for $H < I$, there is a non-predatory equilibrium in which the lender recovers strictly more than under the status quo. First, note that $H < L_0 R$ by Assumption 2, and so under the status quo the lender recovers H. From Assumption 3, we also know that $H + X > I$. Now we construct a non predatory equilibrium that is profitable for the incumbent. He offers $P_1 = 0$ and $P_2 = I$ to the borrower with good prospects and does not offer refinancing to the borrower with bad prospects. To simplify the arguments we assume that for any other offer the borrower believes that she has bad prospects. The borrower accepts.

Note that the borrower with good prospects is strictly better off given $H + X > I$. Therefore, it remains to check that the lender has no other strictly profitable deviation $\left(\tilde{P}_1, \tilde{P}_2\right)$. The deviation is only strictly profitable if $\tilde{P}_1 + \tilde{P}_2 > H$. Given the borrower believes she has bad prospcts, if $\tilde{P}_1 > 0$ she rejects this offer, while if $\tilde{P}_1 \leq 0$ she accepts the offer and does not save. In both cases the lender's total recovery is at most $H < I$. Finally, if the lender offers $P_1 = 0$ and $P_2 = I$ to the bad borrower as well as to the good borrower, his payoff does not change as the borrower pays none of her income if $y_2 = K$.

To complete the proof, note that when $H < I$ the lender cannot recover more than I in equilibrium. Suppose to the contrary that such an equilibrium exists. It must entail acceptance of a contract (P_1, P_2) with $P_1 + P_2 > I$, which in turn requires $P_1 > 0$. But then the lender would recover at least $P_1 + H > H$ from offering this contract to a borrower with bad prospects, implying he has a profitable deviation. **QED**

Proposition 10 *Suppose $y_1 = I$ and the incumbent is a monopolist. In non-predatory equilibria, only a borrower with good prospects is refinanced. In the equilibrium most profitable for the lender his expected profit is* $\max\left\{0, p\min\left\{I - \bar{P}_2, S, I - H\right\}\right\}$. *In particular, if $H \geq I$ the lender's expected profit is zero.*

Proof: By Assumption 2, the borrower with bad prospects cannot afford both the house and the expenditure. Consequently, by Assumption 3, there is a total welfare loss whenever she refinances to incur the expenditure. This implies that in a non-predatory equilibrium, the lender does not find it profitable to extend credit to her. Therefore, without loss of generality we restrict our analysis to equilibria that involves lending to the borrower with good prospects only.

The $H \geq I$ case is just the same as low income monopoly case, by parallel arguments. That is, under the status quo the incumbent gets $I + R(RL_0 - I)$. If an offer has

$P_1 + P_2$ greater than this, the incumbent would get $P_1 + \min\{H + A, P_2\}$ from giving these terms to the bad borrower. As before, we need $A \geq P_2 - I$. Since $H - I > 0$, the incumbent has a strictly profitable deviation.

The actual non-predatory equilibrium in this case is: $P_1 = I - M$ and $P_2 = \bar{P}_2 = M + R(RL_0 - I)$.

Next, consider the case $H < I$. In any non-predatory equilibrium with strictly positive profits, the payments P_1 and P_2 must satisfy $P_1 + P_2 \leq 2I - M$ (otherwise the borrower cannot afford both the payments and the expenditure) and $P_1 + P_2 \leq I + R(RL_0 - I) + S$ (otherwise the borrower prefers the status quo). In addition, if $P_1 + P_2 > 2I - H + R(RL_0 - I)$, then the lender would recover strictly more than $I + R(RL_0 - I)$ from giving the loan to the bad borrower, since $P_1 + H + A \geq P_1 + H + P_2 - I$. So the lender's maximal recovery from the good borrower is

$$I + R(RL_0 - I) + \min\{I - M - R(RL_0 - I), S, I - H\}. \tag{4}$$

We claim that this upper bound is obtained in the following equilibrium: $P_1 = R(RL_0 - I) + \min\{I - M - R(RL_0 - I), S, I - H\}$, and $P_2 = I$, along with no saving by the good borrower. By construction, a good borrower would accept this loan and repay it. Since $P_2 > H$, the lender would recover $P_1 + H \leq I + R(RL_0 - I)$ by offering this loan to a bad borrower.

It remains to check that the lender does not have a strictly profitable deviation $\left(\tilde{P}_1, \tilde{P}_2\right)$. First, suppose that $\min\{I - M - R(RL_0 - I), S, I - H\} \neq I - H$. In this case, let the borrower interpret any deviation as indicating he is good. Then if $\tilde{P}_1 + \tilde{P}_2$ strictly exceeds (4), the payments are either too high for the borrower to repay along with the expenditure, or else exceed the status quo payment to the lender by more than the expenditure surplus S. In either case the borrower rejects the offer. Second, suppose that $\min\{I - M - R(RL_0 - I), S, I - H\} = I - H$. In this case, let the borrower interpret any deviation as indicating he is bad, and consider a deviation with $\tilde{P}_1 + \tilde{P}_2$ strictly above (4). The borrower will not accept this contract if he intends to repay, and so anticipates paying $\tilde{P}_1 + \min\left\{\tilde{P}_2, H\right\}$ to the lender, along with experiencing a loss of X in foreclosure, and a gain S if takes the expenditure. If $\tilde{P}_2 \leq H$ the borrower certainly rejects the contract. If $\tilde{P}_2 > H$ then the borrower accepts the contract only if

$$\tilde{P}_1 + H + X - S \leq I + R(RL_0 - I)$$

(with a comparable expression without the S if the borrower does not take the expenditure). But then the lender recovers either $\tilde{P}_1 + H$ if the borrower does indeed default, or at most $\tilde{P}_1 + I$ if the borrower is in fact good. Neither of these represents a profitable deviation, since $\tilde{P}_1 + H$ is less than the status quo recovery $I + R(RL_0 - I)$, while

$$\begin{aligned} \tilde{P}_1 + I &= \tilde{P}_1 + H + X - S + I - H - (X - S) \\ &\leq I + R(RL_0 - I) + I - H - (X - S). \end{aligned}$$

This is strictly less than the lender's payoff when the good borrower accepts (P_1, P_2), and so again is not a profitable deviation. **QED**

Proposition 11 *Suppose the incumbent lender is a monopolist.*

(A) Suppose the borrower's income is low ($y_1 = K$). There exists $\hat{H}_K$ such that the lender's profits are strictly greater in the most profitable predatory equilibrium than in any non-predatory equilibrium if and only if $H \geq \hat{H}_K$, where $\hat{H}_K < I$ and $\hat{H}_K = 0$ if $V_K \geq pI$.

(B) Suppose the borrower's income is high ($y_1 = I$). Suppose moreover that $S - (1-p)X \geq 0$ and $H \geq \bar{P}_2$, so that a predatory equilibrium exists (see Proposition 3). There exists $\hat{H}_L$ such that the lender's profits are strictly greater in the most profitable predatory equilibrium than in any non-predatory equilibrium if and only if $H \geq \hat{H}_L$, where $\hat{H}_L \in [\bar{P}_2, I)$ and $\hat{H}_L = \bar{P}_2$ if $S - (1-p)X \geq p\left(I - \bar{P}_2\right)$.

Proof: Consider the low income ($y_1 = K$) case first. The lender's profit is $\bar{\delta} = \min\{V_K, I + K - \min\{H, L_0 R\}\}$ in the most profitable predatory equilibrium (see the proof of Proposition 2), and $p\max\{0, (I - H)\}$ in the most profitable non-predatory equilibrium. If $H \geq I$ the former expression is greater (since $I + K - L_0 R > 0$ by Assumption 2). If $H < I$ then $H < L_0 R$ and the former expression is greater if and only if $\min\{V_K, I + K - H\} \geq p(I - H)$. If $V_K \geq pI$ then this is true at $H = 0$, and so at all $H < I$. Otherwise, if $V_K < pI$ there exists some $\hat{H}_K \in (0, I)$ such that this is true whenever $H \geq \hat{H}_K$.

Second, consider the high income ($y_1 = I$) case. The lender's profit is $\bar{\delta} = \min\left\{S - (1-p)X, I - \bar{P}_2\right\}$ in the most profitable predatory equilibrium (see the proof of Proposition 3), and $\max\{0, p\min\{S, I - H\}\}$ in the most profitable non-predatory equilibrium. If $H \geq I$ the former expression is greater (since $I \geq \bar{P}_2$ by Assumption 2). If $H \in [\bar{P}_2, I)$ the former expression is certainly greater if

$$\min\left\{S - (1-p)X, I - \bar{P}_2\right\} \geq p\min\left\{S, I - \bar{P}_2\right\}, \quad (5)$$

while otherwise the former expression is greater if and only if $H \geq \hat{H}_I$ for some $\hat{H}_I \in [\bar{P}_2, I)$.

Finally, inequality (5) is equivalent to $S - (1-p)\,X \geq p\left(I - \bar{P}_2\right)$, as follows. On the one hand, if $S - (1-p)\,X \geq p\left(I - \bar{P}_2\right)$ then $S \geq I - \bar{P}_2$ since $S \geq \frac{S-(1-p)X}{p}$ by Assumption 3, and so both $S - (1-p)\,X$ and $I - \bar{P}_2$ exceed the righthand side of (5). Conversely, if $p\left(I - \bar{P}_2\right) > S - (1-p)\,X$ then (5) does not hold, since the lefthand side equals $S - (1-p)\,X$ which is less than both pS (by Assumption 3) and $p\left(I - \bar{P}_2\right)$. **QED**