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**PREDATORY MORTGAGE LENDING**

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## Abstract

Regulators express growing concern over *predatory* loans, which we take to mean loans that borrowers should decline. Using a model of consumer credit in which such lending is possible, we identify the circumstances in which it arises both with and without competition. We find that predatory lending is associated with highly collateralized loans, inefficient refinancing 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 attenuates predatory lending. We use our model to analyze the effects of legislative interventions.

# 1 Introduction

The U.S. mortgage market of recent years shows a high rate of both originations and foreclosures, especially in the riskier subprime sector. This trend, which has emerged as a major economic event, has provoked significant discussion of how it occurred and how regulation might prevent its reoccurrence. A particular concern, voiced for example in a 2004 report of the U.S. Government Accountability Office (GAO), is that many mortgages are "predatory," which the GAO defines as transactions that "contain terms and conditions that ultimately harm borrowers" (GAO [20], p.3). We consider how such predation can arise, its consequences, and the likely effects of regulatory intervention.

Any loan can cause harm in an ex post sense. However, it is much harder to explain why borrowers enter loans that harm them in an ex ante sense, as the term "predatory" implies. The explanations proposed to date focus primarily on fraud and confusion. The GAO report, for example, cites "forgery and false statements" on the part of lenders, and "mental infirmities" and "diminished cognitive capacity" on the part of borrowers. In fact, much of the discussion of the recent foreclosure surge contemplates whether borrowers actually understand the terms of their loans (see, e.g., Bar-Gill [4] and the references therein). The law implicitly shares this view. The federal Home Ownership and Equity Protection Act (HOEPA) and state predatory-lending laws purport to identify predation by features observable to the borrower at origination (e.g., a balloon payment on a high-interest loan). The existing literature on predatory mortgages, which is largely in law journals, also generally shares this view.[1],[2] A drawback to this approach, however, 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 [22]).

Fraud and confusion appear sufficient cause for borrowers to enter loans causing expected harm. But before resorting to such pathologies, a natural starting point for

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[1]See, e.g., Engel and McCoy [14], [15], Renuart [35], Silverman [37].

[2]Related, a common way to measure the extent of predatory lending is to report the percentage of loans that make use of a suspect practice. For example, Stock [39] 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] subprime market." Similarly, ACORN Fair Housing's survey [1] of subprime borrowers finds that nearly half report "problems paying their loans." Because 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."

economic analysis is with agents who understand their economic environment. This might at first seem incompatible with predation, in that borrowers do not knowingly accept expected harm, but the information structure of the subprime market suggests otherwise. The information structure arises from the high concentration of the subprime market, in which over half of originations in 2006 were by lenders with at least a 5% market share, which translates to over 250,000 subprime mortgages. Such extensive experience with other borrowers' outcomes can impart an informational advantage over a borrower regarding her own likely outcome. Furthermore, this advantage is likely to grow with the loan's tenure, as the lender compiles a time series unobservable to others.

We model a homeowner partway through a mortgage who has risky income and a new spending opportunity. If income is currently high, then she can use cashout refinancing to pursue the opportunity; if it is low, then she can use distressed refinancing to attempt to keep the house. However, both these refinancings end in foreclosure if future income is low, and the current lender has private information about future income. This scenario offers the possibility of predatory lending: the lender offers refinancing he knows will harm the borrower through foreclosure. The key questions are whether predatory lending actually occurs in equilibrium, and how competition affects its incidence.

We find predatory lending in two forms. In one form, the lender refinances a homeowner facing foreclosure into a new mortgage that will also end in foreclosure, to extract more cash. We find that distressed borrowers are always vulnerable to this form of predation when their lenders are monopolists, but when we introduce competing lenders we find that the predation generally reduces or vanishes. However, if borrowers are sufficiently behind on their mortgages, competition is no help.

In the other form of predation, the lender provides cash-out refinancing that ends in foreclosure to a homeowner who is successfully paying down the mortgage. We find that homeowners with sufficient equity are vulnerable to this type of predation, and spending the cash on home improvement only makes matters worse. Again, competition among lenders generally reduces or eliminates the problem.

Recent concerns about predatory lending have led to direct policy responses, such as the introduction of anti-predatory lending laws at state and federal levels. Moreover, a number of other current policy debates overlap with the issue: prominent examples are concerns about securitization; the protection granted to defaulted borrowers; and ongoing efforts to reduce foreclosure. We use our framework to analyze these issues.

The existing literature commonly attributes predatory lending to lender fraud and borrower misunderstanding. Morgan [30] offers arguably the most fully articulated version of this view, and presents a model of payday lending in which a lender can, at cost, persuade borrowers to overestimate their future incomes.[3] Related, a number of papers model borrowers who poorly anticipate their own future actions (see, e.g., Ausubel [2]; Gabaix and Laibson [19]; and Della Vigna and Malmendier [11]).

Confusion, fraud and other criminality doubtless contribute to the incidence of predation. What our analysis demonstrates is that a realistic information asymmetry between borrowers and lenders is enough to generate predation and can explain (at least qualitatively) when and where it occurs. In this sense, predatory lending may be a more pervasive phenomenon than commonly believed. Moreover, our analysis places an upper bound on the efficacy of consumer education and anti-fraud legislation at combating predatory practices, and it allows us to evaluate alternate policy responses in a standard way.

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 analyzes when predatory lending occurs. Section 4 discusses empirical predictions. Section 5 studies the effects of competition. Section 6 considers a variety of regulatory interventions. Section 7 concludes. All proofs are in the Appendix.

# 2 The model

We model the interactions between a single borrower and one or more lenders. To ease exposition we use female and male pronouns for the borrower and the lenders respectively. 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 with multiple repayment dates and specifies a gross interest rate, $R \geq 1$. We consider a two-period mortgage, so that the borrower's scheduled repayment on each of dates 1 and 2 is $P \equiv \frac{R^2 L_0}{1+R}$, i.e., $\frac{P}{R} + \frac{P}{R^2} = L_0$. 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 $R(RL_0 - P') < P$. None of our results depend 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.

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[3]See also Richardson [36], who 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.

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 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 $p$. The value of the borrower's house is $H_0$ at date 0, and, at date 1, changes permanently to $H$, a draw from a distribution with lower bound $H_d$.[4]

The borrower is risk-neutral over non-negative consumption, with a gross discount rate of 1 between periods. The borrower enters date 1 without any assets other than her house. She is able to save at a gross interest rate of 1. 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, along with the potentially large transactions costs associated with selling the house.[5] 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 $H + A - \min\{H + A, Z\}$. We assume that the lender is unable to garnish (i.e., seize) any of the borrower's income. This assumption captures the costs and legal restrictions associated with wage garnishment (see White [42]). Nonetheless, in Section 6 we consider the opposite case in which garnishment is costless and unrestricted.

We focus on lending decisions at date 1, when the incumbent — as well as potential new lenders — 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 refinancing terms are summarized by $P_1$ and $P_2$, the net payments from the borrower to lender at dates 1 and 2. The interest rate after refinancing is $\frac{P_2}{RL_0 - P_1}$. The borrower is free to reject all offers.

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[4]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.

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

All quantities discussed thus far are publicly observable. The model's key assumption is that the incumbent privately acquires additional information about the borrower's date 2 income prospects before date 1 payments and/or refinancing. In contrast, both the borrower herself and any other lenders still know only that the average probability of high income at each date is $p$.[6] This assumption is intended to capture the ability of typical consumer creditors, who deal with thousands or even millions of borrowers, to use the information delivered by these relationships to forecast the repayment prospects of an individual borrower (e.g., 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, because 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. [9]). Furthermore, these scores represent only the information of the current credit report, whereas an existing lender has access to a time series of credit reports, which is economically valuable (Musto [32]). Because lenders to corporations are less likely to enjoy these informational advantages, our model is a better fit to the consumer than to the corporate credit market.

For simplicity, we focus on the case in which the informational advantage of the incumbent is as large as possible: the incumbent perfectly foresees the borrower's date 2 income $y_2$, and $y_1$ and $y_2$ are uncorrelated, so that the date 1 income realization reveals nothing about date 2 income prospects. These assumptions have no qualitative effect on our results, as we discuss in Section 5. Throughout the paper we refer to the borrower as having good prospects if the incumbent knows privately that the borrower's date 2 income will be $I$, and as having bad prospects otherwise. Looking ahead to the analysis, the incumbent's informational advantage over the borrower is key because it creates the possibility that the incumbent makes a loan on date 1 that he knows is detrimental to the borrower. 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 sometimes interested in tapping into their home equity to increase their consumption. Thus, we make the following assumptions about relative parameter values:

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[6]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 [5] is an early example; more recent examples include Manove et al. [27], Garmaise [21], Bernhardt and Krasa [6], Inderst and Mueller [25], and Villeneuve [41].
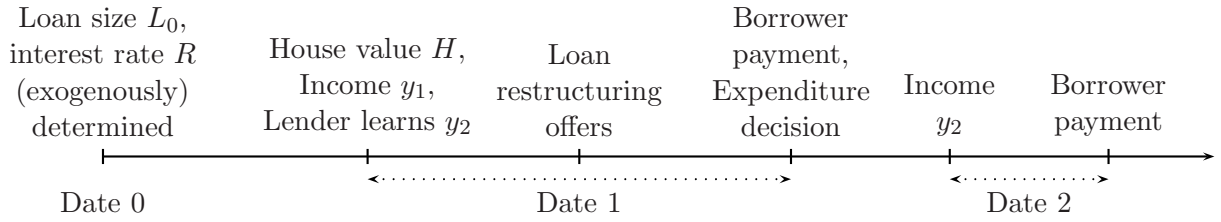
| Loan size $L_0$, interest rate $R$ (exogenously) determined | House value $H$, Income $y_1$, Lender learns $y_2$ | Loan restructuring offers | Borrower payment, Expenditure decision | Income $y_2$ | Borrower payment |

Date 0            Date 1            Date 2

Figure 1: Timeline

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

$$K < \frac{1}{2} \min\{RL_0, H_d\}.$$

By Assumption 1, 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 falls. Moreover, because $R \geq 1$, it follows that $K < P$, so low income at date 1 puts the borrower in distress. Finally, $K$ may or may not be high enough to cover the expenditure cost $M$; for use below, let $S_K = S$ if $K \geq M$, and $S_K \equiv 0$ otherwise.

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

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

By the lower bound of Assumption 2, 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 stream of $I$ and then $I$ is enough to cover both the expenditure and repayment of the original mortgage. It follows that $I > P$, and $I + K > RL_0$. By the upper bound, $I$ is not high enough to allow the borrower to repay her entire loan at date 1, or to allow her to make both her scheduled mortgage payment and the expenditure, and an income stream of $I$ and then $K$ is not enough to cover both the expenditure and the repayment of the mortgage.

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**Assumption 3** *The borrower's private benefits $X$ are high enough that the borrower never strategically defaults; exceed $K + I - \min\{H, RL_0\}$; and are high in relation to the expenditure surplus, $X/S \geq p$.*

If the house value falls below the present value of outstanding loan payments, the borrower may be tempted to default on a loan payment that she has enough income to cover, i.e. strategically default. Because the possibility of strategic default is tangential to our analysis, we assume that the borrower's valuation of the house, $H + X$, is always high enough that she repays when she can. The second part of the assumption simplifies the analysis (but is not essential; see footnote 10) by ensuring that a borrower with low and then high income is prepared to pledge her entire income to the lender to save her house, rather than accept immediate foreclosure. By the third part of the assumption the surplus from home ownership is high enough relative to the surplus from the expenditure that the borrower would not give up a probability $p$ of keeping her house to make the expenditure.

# 3   Analysis

To identify the economic conditions associated with predatory consumer mortgage lending, we characterize the model's (perfect Bayesian) equilibria. We restrict attention to pure strategy equilibria, which always exist in our model. First, we give a precise definition of predatory lending.

**Definition:** A predatory loan is one that the borrower would decline if she possessed 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 fall victim if they underestimate their expected repayments by a sufficient amount. However, Proposition 1 establishes that this does not occur. 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.*

Because predatory lending can occur both when the borrower's date 1 income is low $(K)$, and when it is high $(I)$, we consider these two cases in turn. In this sense, it is the borrower's income prospects rather than her current income that determine her susceptibility to predation. We first assume the incumbent is the only possible lender at date 1; we gauge competition's effect on predatory lending by introducing competing lenders in Section 5.

**Low income at date** 1

In this case, the borrower cannot meet her scheduled mortgage payment (Assumption 1) and might be interested in refinancing. If the lender knows the borrower's prospects are bad, then he knows foreclosure is inevitable. However, he might choose to withhold this information from the borrower and refinance the mortgage anyway. Without refinancing, his recovery is bounded by the liquidation value of the house. If he refinances, he can extract some payment at date 1 and still liquidate, if underpaid, at date 2. Thus, there exist refinancing terms he is prepared to offer even when he knows the borrower's prospects are bad. However, if the borrower knew her prospects were bad, she should default at date 1 and keep her income rather than pay it toward unattainable ownership. Therefore, the lender has a strong incentive to keep private the borrower's prospects and offer refinancing. Although such forbearance at first seems charitable it can be predatory if it reduces the borrower's well-being. For this reason, the practice is sometimes referred to as "phantom help."[7]

**Proposition 2** *Suppose the borrower's date 1 income is low $(y_1 = K)$. Then an equilibrium exists in which the incumbent offers to refinance the loan by reducing the date 1 payment to $P_1 \leq K$, the borrower accepts, and the loan is predatory. In the predatory equilibrium most profitable to the lender, refinancing reduces the welfare of a borrower with bad prospects by $S_K + K$ for low house values, $H \leq I$, and by $S_K + K + I - \min\{H, RL_0\}$ for high house values, $H \geq I$. Relative to no refinancing, the lender's profits are increased by $K + p(I - H)$ and $I + K - \min\{H, RL_0\}$ for low and high house values, respectively.*

The form of predatory lending identified in Proposition 2 reduces the welfare of a borrower with bad prospects in two ways. First, if $M \leq K$, the borrower foregoes the expenditure but still loses her house, a welfare loss of $S_K$ relative to accepting

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[7]See, for example, various press releases from the Illinois Attorney General's office, and consumer advice from organizations such as the AARP and the FTC.

immediate foreclosure. Second, the borrower transfers some of her resources to the lender. When house values are high ($H > RL_0$), equity-stripping[8] may contribute toward this transfer. Moreover, any fraction of date 1 income that the borrower pays is money that she could have instead consumed and, by analogy, is income-stripping.[9] The proposition characterizes the maximum size of the transfer, which is determined by two constraints.[10] First, the increase is limited by the borrower's actual date 1 income $K$. Second, the borrower must think she has some chance of repaying the refinancing loan, and, therefore the total payments to which she agrees must be less than $I + K$. The actual transfer from a borrower with bad prospects is determined by which of these constraints binds first.

Merton [29] observes that a loan can be decomposed into risk-free debt and a put option, which represents the borrower's right to default. In our model, the lender's inability to garnish income means that the borrower's default option allows her to sell her income for a price equal to that income plus the monetary gain of default. Therefore, exercise is always optimal for a borrower with bad prospects, but, for a borrower with good prospects, exercise entails the additional cost of surrendering private house benefits $X$. Predation is possible because a borrower unaware that she has bad prospects overestimates the cost of exercise, and hence undervalues the default option. Consequently, such a borrower surrenders her option at terms that are too favorable to the lender.

In addition to predatory equilibria, non-predatory equilibria also exist. However, unless house values are low, the incumbent does not profit in non-predatory equilibria. 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:

**Proposition 3** *Suppose the borrower's date 1 income is low ($y_1 = K$). Then the lender's profits are strictly greater in the most profitable predatory equilibrium than in*

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[8] "Equity stripping occurs when a loan is made based on the equity in a property rather than on a borrower's ability to repay the loan," FTC [18].

[9] We thank Don Morgan for suggesting this terminology.

[10] In general, the refinancing terms also have to satisfy a third constraint, namely, that the increase in the borrower's expected payment to the lender is less than the gain to keeping her house. The second part of Assumption 3 ensures that this third constraint never binds. An earlier draft of this paper allows for lower values of $X$. The lender's maximal profits and the bad-prospects borrower's worst welfare loss are both (weakly) reduced, but otherwise our results are unaffected.

*any non-predatory equilibrium. In particular, if $H \geq I$, the lender's non-predatory profits are zero.*

**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). Although refinancing makes the expenditure possible, it reduces the borrower's welfare when it leads to the loss of her home.

For a borrower with bad prospects to accept this refinancing, two conditions must be met. First, because 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 losing her house with probability $1 - p$, i.e., $S \geq (1 - p) X$. Second, the lender needs to receive at least what he would have if the borrower had not refinanced. In that case, the lender receives $I$ at date 1 (because $R \geq 1$, the borrower prepays as much as possible) and the remaining loan balance $R (RL_0 - I)$ 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 $H$. Therefore, the second condition is that $I - M + H$ exceeds $I + R (RL_0 - I)$ or, equivalently, that $H$ exceeds $\bar{P}_2 \equiv R (RL_0 - I) + M$. Economically, $\bar{P}_2$ is the date 2 payment the lender requires for refinancing to be worthwhile. Proposition 4 establishes that these two conditions are both necessary and sufficient for equilibrium predation of a borrower with high date 1 income:

**Proposition 4** *Suppose the borrower's date 1 income is high ($y_1 = I$). An equilibrium exists with predatory lending if and only if $H \geq \bar{P}_2$ and $S - (1 - p) X \geq 0$. In such an equilibrium, 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 $\min\{S - (1 - p) X, H - \bar{P}_2, I - \bar{P}_2\} + X - S$. Relative to no refinancing, the lender's profits are increased by $\min\{I - \bar{P}_2, pI + (1 - p) H - \bar{P}_2, S - (1 - p) X\}$.*

In the predatory equilibria identified by Proposition 4, a borrower with substantial equity in her house and affordable current payments refinances into eventually un-

affordable payments. As in the low-income case, predation entails a transfer from the borrower to the lender, achieved via a mixture of income- and equity-stripping. The lender finances new spending even when he knows that doing so will result in the borrower losing the house she would otherwise have kept, causing a social loss. Among the terms applied to such lending are "lending without regard to ability to pay" and "asset-based lending." From the option perspective, such lending resurrects the borrower's option to default, which was otherwise sure to expire unused. However, exercising the default option at date 2 is very costly for the borrower, as it entails the loss of her house. Consequently, the resurrected default option has negative value for a borrower with bad prospects, which is the source of predation.

An important implication of Proposition 4 is that this predatory cash-out refinancing can occur only when house values ($H$) are high. Moreover, as in the low-income case, it is impossible for the lender to make equilibrium non-predatory profits when house values are high. The reason is the same as before: any loan terms that are profitable to extend to borrowers with good prospects can also profitably be offered to bad prospects. More generally, the following analogue to Proposition 3 holds:

**Proposition 5** *Suppose the borrower's date 1 income is high ($y_1 = I$) and the conditions of Proposition 4 are satisfied with strict inequality. Then the lender's profits are strictly greater in the most profitable predatory equilibrium than in any non-predatory equilibrium whenever the house value $H$ is high enough. In particular, if $H \geq I$, the lender's non-predatory profits are zero.*[11]

When house values are not high enough for predatory lending to occur, the equilibrium outcome is socially desirable (see Appendix B on non-predatory equilibria). The lender finances the expenditure if and only if the borrower can ultimately afford it, and foreclosure never occurs.

# 4 Empirical predictions

Propositions 2 and 4 characterize both the incidence of predatory lending (i.e., when it occurs) and its severity (i.e., the maximal welfare loss of its victims). Table 1 summarizes the comparative statics for both aspects of predatory lending with

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[11]The highest predatory profit strictly exceeds the highest non-predatory profit if $S - (1 - p) X > p \left( I - \bar{P}_2 \right)$, or if $H \geq I$.

|   |   | Severity, low income | Severity, high income | Incidence, high income |
|---|---|---|---|---|
| $H$ | *house value* | $-$ | $+$ | $+$ |
| $p$ | *probability of high income* | no effect | $+$ | $+/-$ |
| $X$ | *private benefits from house* | no effect | $+$ | $-$ |
| $S$ | *surplus from expenditure* | $+$ | $-$ | $+$ |
| $K$ | *low income* | $+$ | no effect | no effect |
| $I$ | *high income* | $+$ | $+$ | $+$ |
| $M$ | *expenditure cost* | $-$ | $-$ | $-$ |
| $R$ | *interest rate on initial mortgage* | $-$ | $-$ | $-$ |

Table 1: Comparative statics for the incidence and severity of predatory lending

respect to the main parameters of our model. Note that because predatory lending is always possible in the low-income case, there is no column for how the parameters affect the incidence of low-income predation. Moreover, the parameters $p$ and $X$ have no effect on the severity of low-income predation only because of Assumption 3: see footnote 10.

The surplus a borrower derives from her house, $X$, affects the severity and incidence of the predation of high-income borrowers differently. On the one hand, when $X$ is higher a borrower suffers more under foreclosure. On the other hand, higher values of $X$ make the borrower more careful about refinancing into a higher repayment loan and, thus, reduce the incidence of predation.

The urgency of the expenditure $M$ is reflected by $S$. Greater urgency (e.g., medical expenses vs. vacation) both increases the severity of low-income predation, and the incidence of high-income predation. In the former case, predation diverts the borrower away from the expenditure into a failed effort to avert foreclosure. In the latter case, more urgent expenditures make the borrower more willing to risk foreclosure. However, the severity of high-income predation is decreasing in the urgency of the expenditure: even though the borrower loses her house, the greater importance at least partially offsets the welfare loss. Indeed, expenditures deemed vital or essential can be more important to the borrower than keeping her house. In this case, Assumption 3 is violated because the borrower strategically defaults on her house to undertake the urgent expenditure.

The parameter $p$ determines the variance of the borrower's income, with higher values associated with lower variance.[12] In general, the number of borrowers preyed upon is

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[12]The borrower's income variance is $p(1-p)(I-K)^2$ and is decreasing in $p$, provided $p \geq 1/2$.

non-monotonic in $p$ and, hence, in income variance because predation of high-income borrowers is possible only when $p$ exceeds some threshold. However, for values of $p$ above this threshold, the number of predatory victims declines as income variance declines. Moreover, both the number of predatory victims and their total welfare loss (i.e., the number of victims times their average welfare loss) converge to zero as income uncertainty vanishes (i.e., $p \to 1$). The associated empirical prediction is that more borrowers fall victim to predatory lending in regions facing more economic uncertainty, and in times when the future of the economy is less clear. Another prediction is that few borrowers are preyed upon in prime (i.e., high $p$) markets.

The effect of loan-to-value that we find is somewhat at odds with conventional wisdom. Specifically, some researchers argue that a high ratio is evidence that a loan is predatory (see, e.g., Quercia et al. [34]), whereas we argue that it discourages predatory refinancing of the loan. In general, predation is increasing in collateral values $(H)$.[13] Predatory lending is also associated with smaller loans: 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. Hence the loan size increases in $M$ and decreases in $K$, $I$, and both the severity and incidence of predation decrease in loan size.

Our model matches several key stylized facts relating to the effects of a run-up in house prices. Consider the equilibrium outcomes in two parameterizations of our model, one with low house prices, and the other with high house prices. First, high house prices increase both refinancing activity in general and predatory lending in particular. Second, high house prices reduce foreclosure at date 1, because 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 date 2. For borrowers who were in distress at date 1, this increase in foreclosure simply represents the postponement of foreclosure from date 1 to date 2. 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 may also stem from home improvement undertaken by the borrower. We consider whether refinancing for home improvement is particularly susceptible to predation by recasting the date 1 expenditure $M$ as one that increases the market value of the house to $H + M$. As before, the borrower's gain $S$ from the expenditure is immediate, although our analysis would change little if the gain were instead contingent

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[13]However, the intensity of low-income predation declines in $H$, because the lender obtains $\min\{H, RL_0\}$ from immediate foreclosure, and the higher house values reduce the additional amount he can obtain from predatory refinancing.

on keeping the house at date 2.

Economically, the key difference between home improvement refinancing and the consumption refinancing 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 6** *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* $S \geq (1 - p) X$.

# 5   Competition and robustness

We now turn to 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 potential lenders. There are, in addition to the incumbent, at least two[14] 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. Unlike the incumbent, however, they lack an informational advantage over the borrower and know only that the borrower's date 2 income is high with probability $p$. The borrower knows the entrants have no private information, and the borrower can see which offer is from

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[14]Engelbrecht-Wiggans et al. [17] study an auction in which a single informed bidder competes against one or more uninformed bidder(s). They show that the informed bidder's payoff is independent of the number of uninformed bidders, and that each uninformed bidder makes zero expected profits. This result does not apply in our environment, however, because the borrower may decline an apparently attractive offer from the incumbent (the informed lender) if she believes the incumbent knows she has bad prospects. (In contrast, in a standard auction the seller's beliefs about a buyer's information are irrelevant.) Consequently, at least two uninformed lenders are required in our setting for competition to have its full effect. In particular, with only one uninformed lender equilibria exist in which an uninformed lender makes an above-cost offer, and the informed incumbent cannot undercut it because of borrower beliefs.

whom.[15]

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 among multiple offers from entrants and strictly prefers them to the incumbent's offer, she randomizes between the entrant offers.

**Low income at date 1**

The effect of competition depends critically on the level of house prices. 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, uninformed entrants are prepared to lend the borrower the amount she needs to pay off her loan, $RL_0 - K$, in exchange for a promise to pay $RL_0 - K$ at date 2. (The high house value ensures that the entrant is able to recover $RL_0 - K$ even if the borrower defaults.) Given the outside option provided by the entrant, the incumbent cannot get the borrower to pay him more than a total of $RL_0$ over dates 1 and 2. Consequently, the borrower pays the incumbent $RL_0$ if she defaults at date 1 and is foreclosed, and pays a total of $RL_0$ across dates 1 and 2 if she refinances. In this case, competition eliminates both predatory lending and the incumbent's refinancing profits.

Second, consider the opposite extreme, in which the house value $H$ is low, in particular, below $\frac{RL_0 - K - pI}{1-p}$. In this case, a lender cannot recover the date 1 loan balance $RL_0$ from the borrower in expected terms.[16] Consequently, uninformed entrants are unwilling to refinance the borrower. The incumbent, however, is willing to refinance because by doing so he increases his recovery beyond that he obtains from immediate foreclosure, namely $H$. Hence, the incumbent enjoys a monopoly position even though potential entrants exist.

Analysis of intermediate house values produces similar results:

**Proposition 7** *Suppose the borrower's date 1 income is low ($y_1 = K$). (A) If $H < \frac{1}{1-p}(RL_0 - K - pI)$, the set of predatory equilibria is the same as for the*

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[15]For related work on competition among asymmetrically informed lenders, see Dell'Ariccia et al. [10], Hauswald and Marquez [23], and von Thadden [40].

[16]Total recovery is bounded above by total income, $K + I$, for borrowers with good prospects and by income plus house value, $K + H$, for borrowers with bad prospects.

*monopoly case. (B) Otherwise, the worst equilibrium welfare loss for a borrower with bad prospects is $S_K + \max\{0, \min\{K, RL_0 - H\}\}$. Relative to no refinancing, the incumbent's profits are increased by, at most, $\max\{0, RL_0 - H\}$. (C) The severity of predatory lending is strictly reduced by competition if and only if $H > RL_0 - K$.*

Recall from our discussion following Proposition 2 that refinancing can be understood as a borrower redeeming her current position (short a risk-free bond and long a default put option) by issuing a new security. Predation occurs when a borrower with bad prospects agrees to issue a security that is more valuable than the position she redeems. When the borrower is in a position to issue a security with a market value above $RL_0$, lenders compete with each to offer her the most favorable redemption terms. In contrast, when house values are low, any security issued by the borrower has a low market value, and entrants will not pay $RL_0$ for it. The incumbent lender still refinances because he is the short counterparty on the default put option. The failure of competition to help the borrower when house values are low is similar to the debt overhang problem identified in the corporate context (Myers [33]). We return to this point when we discuss securitization in Section 6.

**High income at Date 1**

A borrower with high date 1 income and bad prospects is vulnerable to predation by a monopolist incumbent only when house values are high enough to fully secure the refinancing loan. Her welfare loss can be decomposed into two terms: $X - S$, representing the loss of her home offset by the gain of the expenditure, and a term corresponding to the increase in payments she agrees to make to the incumbent (see Proposition 4). Competition from entrants overturns the latter of these welfare losses. Absent refinancing, she pays a total of $R(RL_0 - I) + I$. Competitive refinancing reduces her total payments to $RL_0$, a saving of $(R - 1)(RL_0 - I)$. However, if the former welfare loss, $X - S$, exceeds this reduction in payments, the borrower is still worse off, and predatory lending occurs under competitive conditions, although it is less severe than when the incumbent is a monopolist.

**Proposition 8** *Suppose the borrower's date 1 income is high ($y_1 = I$). Predatory lending occurs if and only if $H \geq RL_0 - I + M$, $S - (1 - p)X \geq 0$, and $(R - 1)(RL_0 - I) < X - S$. Under these conditions, the worst equilibrium welfare loss for a borrower with bad prospects is $X - S - (R - 1)(RL_0 - I)$, and in any equilibrium the incumbent recovers exactly the outstanding loan balance, $RL_0$. When-*

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*ever predatory lending is possible under monopolistic conditions, competition either eliminates it or reduces its severity.*

In spite of the generally positive conclusion of Proposition 8, competition also has a (perhaps surprising) drawback, namely, that under some circumstances it engenders predatory lending. Specifically, this case arises when house values are high enough for predation under competition but too low for predation under monopoly; i.e. $H$ lies between $RL_0 - I + M$ and $R(RL_0 - I) + M$, and additionally $S - (1-p)X \geq 0$ and $(R-1)(RL_0 - I) < X - S$. Under these conditions, without competition the incumbent would stick with the status quo, and no foreclosure would occur. Competition affects the incumbent's decision by reducing his payoff under the status quo, because the borrower can now obtain zero-interest refinancing. Under these conditions the incumbent offers predatory cash-out refinancing that leads to foreclosure.

## Robustness

We consider several alternative versions of our model to test the robustness of our results. First, in an online supplement we examine a version of our model in which the lender's informational advantage is less pronounced so that he can forecast the borrower's date 2 income only imperfectly. The main results remain qualitatively unchanged. From the lender's perspective, replacing perfect foresight with imperfect foresight means that a borrower with "bad prospects" has at least some chance of being able to repay a loan. In turn, the borrower's expected welfare loss from refinancing and, therefore, the severity of predation, is reduced. However, the effect on the incidence of predation is ambiguous. Although refinancing terms that were previously predatory are no longer so, a lender now finds a borrower with bad prospects more attractive, and thus new predatory opportunities can arise.

A second way to reduce the lender's informational advantage would be to allow correlation between incomes $y_1$ and $y_2$. In this case, a borrower can learn about her date 2 income from her date 1 income. Formally, she would update her posterior beliefs of the probability of high date 2 income, to $\hat{p}$, say. As long as date 1 income does not perfectly reveal date 2 income, $\hat{p} \in (0,1)$. Consequently, our results remain unchanged qualitatively when we replace $p$ with $\hat{p}$ in our analysis.

Third, we consider a version of our model in which the lender's information advantage is superior knowledge of the borrower's house value rather than her income. This asymmetry can also generate predation, even absent any uncertainty about income.

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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 $RL_0$ owed on the loan exceeds even $H_2$, and let $\bar{H}$ be the borrower's expectation of her 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 $H_2 - X > H_1$.

Fourth, we consider a version of our model in which the incumbent's private information does not arise costlessly from his ongoing lending relationship with the borrower. In this case, the lender would be willing to pay for the information. In particular, suppose that at some date prior to the revelation of date 1 income and the house value, the lender can pay to acquire information about the borrower's date 2 income. This would be the order of events if, for example, the information gathering involves pulling regular credit reports on existing borrowers once the relationship begins. Provided the cost is not too high, the lender would use this costly screening technology, because lending only to borrowers with good prospects is more profitable than predatory lending when house values are low.

# 6 Welfare and policy implications

A number of issues confront policymakers in the consumer credit market. We use our model to evaluate the welfare consequences at stake. The implications differ substantially from those elsewhere in the lending literature because predatory lending entails too much lending, not too little. In traditional analyses, frictions (informational or otherwise) generally depress the supply of credit, which reduces welfare.[17] In contrast, in our framework, informational frictions increase the supply of credit, which reduces welfare. A key challenge for policy is to eliminate welfare-reducing lending in such a way that welfare-improving lending is affected as little as possible.

**Fostering competition**

The Community Reinvestment Act (CRA), which rewards a bank for "helping meet the credit needs of its entire community," is a leading example of legislative efforts to

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[17]See, however, papers such as De Meza and Webb [12] in which asymmetric information leads to socially excessive lending.

foster competition to lend.[18] To the extent that it succeeds, it pushes entrants into the local lending market. In our model, the entrants are themselves non-predatory, and benefit borrowers by reducing incumbents' profits from predatory lending. Thus, our model predicts that the CRA generally benefits borrowers. When predation is eliminated, lenders offer refinancing only to borrowers with good prospects; therefore, an important prediction is that the benefits of laws such as the CRA may take the form of reduced lending to vulnerable borrowers.

The CRA is less help when both borrower income and collateral are low, such as in a recession (see Proposition 7). In this situation, refinancing would allow the incumbent to reduce his expected losses on the existing loan, but is not profitable enough to attract new lenders. Consequently, attempts to push entrants into the market are effective only if regulators provide sufficient rewards that lenders will offer refinancing even at loss-making terms.

**Securitization**

Securitization is often suspected of fostering predation (see GAO [20]; Engel and Mc-Coy [15],[16]), because originators who expect to sell a loan may care too little about the borrower's ability to repay it. Our analysis suggests an opposing effect, whereby securitization may deter predation. Consider again the case in which income and collateral are low. The lender's willingness to lend to both good and bad prospects in this scenario follows from his continuing exposure to the original mortgage. If, instead, the original lender sold the loan into a securitization, provided he still possessed the private information, he would offer this refinancing only to the good prospects. The borrower could look for refinancing from the servicer of the securitization, but the contracts between servicers and the securitization's creditors tend to have little latitude for such restructuring.[19] Thus, the outcome can be the socially beneficial one – refinancing for borrowers who can ultimately afford it, and foreclosure for those that cannot.

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[18]See http://www.federalreserve.gov/dcca/cra/. The U.S. Congress cites the scarcity of lenders in poor neighborhoods as a prime motive for the CRA of 1977 (see Barr [3], p. 523). For related analysis of the CRA and predatory lending, see, e.g., Marisco [28].

[19]See, e.g, the testimony of Julia Gordon to the House Committee on Financial Services' Subcommittee on Housing and Community Opportunity, April 16, 2008; the remarks of FDIC Chairman Sheila C. Bair to the Joint Venture Silicon Valley Network State of the Valley Conference, February 22, 2008; Emmet Pierce, "Homeowners find loan aid is limited; Consumer groups claiming inaction," *San Diego Union-Tribune*, June 26, 2008.

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] However, in standard models, this difficulty tends to be costly; in our model, in which refinancing can be welfare reducing, creditor dispersion can be beneficial. Securitization and the debt-overhang problem together prevent a bad-prospects borrower from receiving "phantom help."

**Predatory lending laws**

Laws aimed at predatory lending have passed in many states (see, e.g., Bostic et al. [8]). These laws are generally structured to identify high-cost loans by their rates and fees and then restrict them in various ways. Because these restrictions depend entirely on facts observable to borrowers at origination, they are not aimed directly at the predation we model. They do, however, interact with it in several ways, which we briefly sketch.

One of the contractual features commonly restricted is the prepayment penalty (e.g., Section 30 of Illinois' High Risk Home Loan Act, Public Act 93-0561). Because a prepayment penalty raises the cost of refinancing with an entrant, it tends to reduce competition at the refinancing stage, so as Propositions 7 and 8 indicate, the restriction tends to reduce the incidence and severity of predation. However, limits on prepayment penalties are unlikely to be a "free lunch" for borrowers, as lenders may raise the interest rate $R$ on the initial loan to make up for the reduction in refinancing profits.

Another common restriction is on balloon payments (Bostic et al. [8]), i.e. large terminal payments that effectively require refinancing. We can approximate the balloon structure in our framework by making the initial mortgage a one-payment mortgage due at date 1. This change has no effect on borrowers with low income at date 1, because they would need refinancing anyway. However, borrowers with high income at date 1 are affected, because they now need refinancing to avoid foreclosure. This gives the lender bargaining power that can lead to predatory refinancing of high-income borrowers similar to the predation of low-income borrowers established in Proposition 2. Specifically, the lender uses his monopoly position to offer refinancing terms that the borrower will not be able to repay if her date 2 income is low. These terms make a borrower with bad prospects worse off because she pays some of her date 1 income but nonetheless loses her house. Formally, we can state the result as follows:

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[20]See, e.g., Bolton and Scharfstein [7].

**Proposition 9** *Borrowers with low income at date* 1 *are equally vulnerable to predation under one-period and two-period mortgages. Borrowers with high income at date* 1 *are vulnerable to predation under a one-period mortgage in circumstances in which they are not vulnerable under a two-period mortgage.*

Another type of restriction common to predatory-lending laws is a prohibition on loans made without due regard to repayment ability. For example, the North Carolina law obliges lenders to "reasonably believe" that the borrower can repay the loan, considering both current and expected income. Although the inclusion of expected income directly targets the predation we model, lenders have a wide safe harbor: if the borrower's total monthly debts (mortgage included) at origination are not more that half her verified income, repayment ability is presumed. This presumption may reflect the practical difficulty of observing, let alone verifying, what a lender really expects.

The restrictions on high-cost loans are similar in effect to interest-rate caps, in that they do not ban high interest rates but they do discourage them. Such caps can either help or hurt borrowers. All else being equal, although lower interest rates benefit borrowers, our comparative statics (see Table 1) show that lower $R$ on the original mortgage actually increases the incidence of predation.

Several studies ask whether the realized effect of these restrictions has been positive or negative. Although the studies (Elliehausen and Staten [13], Litan [26], Quercia et al. [34], Ho and Pennington-Cross [24]) agree that one effect is reduced subprime originations, they disagree on whether this outcome is beneficial. For example, Elliehausen and Staten argue that the reduction reflects a withdrawal by potential lenders that reduces consumer welfare, whereas Quercia et al. suggest that the reduction in restricted loan features — specifically prepayment penalties and balloon payments — is de facto evidence that predation decreased. Our model gives a different take on these findings. The reduction in loan volume could be welfare improving because lending can decrease when predation is suppressed. The reductions in balloon payments and prepayment penalties are most effective at suppressing predation not at origination but later, when they reduce the lender's power over the borrower.

**New legislation**

The recently-signed Housing and Economic Recovery Act[21] addresses the high rates of default and foreclosure by, among other things, allowing borrowers and their lenders to exit distressed mortgages at a discount. Lenders approved by the Federal Housing Administration would refinance borrowers out of mortgages they apparently cannot currently afford into new mortgages that they can currently afford, which have principal amounts at least 10% lower. In the aggregate, this may help serve the act's stated goal of avoiding foreclosures through creating new equity for troubled homeowners. However, it may also worsen the problems our analysis identifies. An incumbent lender would welcome this exit opportunity even if he knows the borrower has bad prospects and the new loan will fail to avert eventual foreclosure, i.e. is "phantom help."

**Wage garnishment**

Thus far we assume that lenders are unable to seize a borrower's income. This form of borrower protection encourages predation, because a lender who sees foreclosure as inevitable is encouraged to postpone it by refinancing to collect cash that would otherwise be off limits. Since lenders do have some ability to access a borrower's earnings — albeit limited and depending on the jurisdiction — we consider how wage garnishment 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.

When house values are low, lenders have no incentive to refinance if wage garnishment is possible. If the loan balance not covered by liquidation, i.e. the deficiency, is greater than total date 1 and date 2 income, the lender is due to get everything — the house and all income — and there is no more to be gained. However, if the deficiency is small then the lender of a distressed borrower with bad prospects can improve on immediate foreclosure by refinancing into a high-interest mortgage that takes more income than the original deficiency. 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.

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[21]See "Summary of the Housing and Economic Recovery Act of 2008," Section B, at http://banking.senate.gov/public/_files/HousingandEconomicRecoveryActSummary.pdf.

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**Identifying predatory lenders**

One of the goals of regulators, as evidenced by enforcement actions, is to identify predatory lenders. Our model shows how predation can arise, but there remains the question of how those who partake in it can be distinguished from those who abstain. Perhaps the cleanest test is on 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. With a non-predatory lender, cash-out refinancings of bad prospects would not occur, regardless of house value. Thus, in cash-out refinancings, a more predatory lender would show a higher correlation between house value and subsequent foreclosure.

Another and quite different strategy would be to follow the lead of several recent empirical studies of payday lending (Morse [31]; Morgan [30]; Skiba and Tobacman [38]), 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 [24]) 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.

# 7    Conclusion

This paper presents 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 borrowers refinance to relieve financial distress, predatory lenders extract extra cash before inevitable foreclosure. This form of predation is always possible under monopolistic conditions, but is eliminated by competition if house values are high enough. When a borrower 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 foreclosures. Again, competition between lenders generally reduces or eliminates the problem.

The generally beneficial effect of competition in the subprime market supports legis-

lation that encourages entry such as the CRA. Predatory-lending laws, which weaken monopoly power by restricting loan features such as prepayment penalties, also appear to be beneficial to borrowers. However, laws that limit interest rates leave at least some borrowers more exposed to predation, because these laws widen the range of home values for which predatory cash-out refinancing is possible. Finally, securitization, which is often suspected of contributing to predation, imparts a benefit by frustrating refinancing of precisely those borrowers who would lose from refinancing.

The model addresses financial distress arising from low income. Financial distress can also arise from high payments, as can occur with adjustable-rate mortgages. Such mortgages are especially prevalent in the subprime market, and account for a disproportionate number of foreclosures.[22] Many of our results would extend to an alternative framework in which the lender's informational advantage is instead about the distribution of future interest rates. In this case, a form of predatory lending would arise in which borrowers take floating-rate loans that the lender anticipates will result in unaffordable future payments. Because the lender's information advantage here relates to a macroeconomic variable, a notable implication is that both predation and ensuing defaults are necessarily temporally clustered. For the same reason, competition is likely to have a greater effect than in our model, since competitors would be more likely to share the incumbent's informational advantage.

Finally, accusations of predatory behavior are made in the payday lending market as well as in the subprime mortgage market. Just as we show that a model based on borrowers suffering an information disadvantage relative to their lenders can be used to analyze the mortgage market, it would be interesting to analyze a similar model of the payday lending market. Certainly, an informational asymmetry would generate the possibility of predation by payday lenders. Payday loans are particularly expensive if they are rolled over for many months. Thus, one could analyze this market with a model in which a borrower rationally takes a payday loan with the expectation that she 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 such a model is capable of producing further insights is a question we leave for future research.

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[22]See, e.g., "Delinquencies and Foreclosures Increase in Latest MBA National Delinquency Survey," Mortgage Bankers Association Press Release, December 2007.

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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 (e.g., if $y_1 = K$, both borrower types pay $\min\{RL_0, H\}$, 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 $P_2$ on dates 1 and 2 respectively, and in which the borrower does not learn her type at date 1. (Clearly, if the borrower learns her type, no predation can occur.) Because the borrower does not learn her type, both borrower types take the same actions at date 1. At date 2, either both borrower types take the same action or only the high-income borrower makes payment $P_2$. The latter case occurs only 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. Therefore, if the refinancing makes the good prospects borrower strictly worse off, the same must be true for the bad prospects borrower. However, under these conditions the borrower would not accept the refinancing terms, completing the proof. **QED**

**Proof of Proposition 2:** Because the lender recovers $\min\{H, RL_0\}$ under the existing loan contract, in any refinancing $P_1 + P_2 \geq \min\{H, RL_0\}$, and because the borrower has low date 1 income, $P_1 \leq K$. Assumption 1 implies that $P_2 > K$; therefore a borrower with bad prospects defaults on the refinancing loan at date 2. Moreover, $P_1 + P_2 \leq I + K$; otherwise, a borrower with good prospects also defaults

at date 2, and in this case refinancing has exactly the same foreclosure outcomes as the existing loan, and so the total equilibrium payments also remain unchanged.

Given these preliminaries, the lender's profits and the bad-prospects borrower's welfare loss are both bounded above by the quantities associated with the refinancing terms $P_1 = K$ and $P_2 = I$. Evaluating, the lender's profits (relative to not refinancing) are bounded above by $K + pI + (1-p)\min\{H, I\} - \min\{H, RL_0\}$, and the bad-prospects borrower's loss is bounded above by $K + \min\{H, I\} - \min\{H, RL_0\} + S_K$. The expressions in the proposition statement follow from the observation that $H \leq I$ implies $H < RL_0$ because (by Assumption 2) $I < RL_0$.

It remains to show there is an equilibrium in which the lender offers the refinancing terms $P_1 = K$ and $P_2 = I$ regardless of his information, and the uninformed borrower accepts.[23] The borrower accepts this offer, because she avoids foreclosure when her date 2 income is high, and (by Assumption 3) this gain exceeds the increase in payments and possible loss of the expenditure. Even if the borrower has bad prospects, the lender recovers more from this refinancing than from immediate foreclosure because (by Assumption 2) $K + \min\{H, I\} > \min\{H, RL_0\}$. Finally, the lender does not want to deviate to another refinancing offer since doing so would raise his profits only if $P_2$ strictly exceeded $I$; but since this would cause the borrower to default regardless of her income, she would accept such an offer only if the total payments are less than $\min\{H, RL_0\}$. **QED**

**Proof of Proposition 3:** The result uses the following characterization of non-predatory equilibria.

**Proposition 10** *Suppose $y_1 = K$ and the incumbent is a monopolist. Two types of non-predatory equilibrium exist:*

(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.*

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[23]In an earlier working paper we characterize the full set of predatory equilibria. We also characterize the predatory equilibrium when $X$ is smaller and limits the amount the lender can charge in refinancing.

Because our main focus is on predatory equilibria, we relegate the proof of Proposition 10 to Appendix B.

Given Proposition 10, the result is almost immediate. From Proposition 2 the lender's highest predatory profit is always strictly positive and so exceeds the highest non-predatory profit if $H \geq I$. If instead $H < I$, the lender's highest predatory profit is $K + p(I - H)$, which exceeds $p(I - H)$, the highest non-predatory profit. **QED**

**Proof of Proposition 4:** Necessity of the conditions $H \geq \bar{P}_2$ and $S - (1 - p) X \geq 0$ for predation is proved in the main text. Taking these conditions, the proof establishes sufficiency and characterizes the lender's highest profits and the worst bad-prospects borrower's welfare loss. For use throughout the proof, note that the borrower's total payments under the existing loan can be written $I - M + \bar{P}_2$. Refinancing affects payoffs only if it allows the borrower to afford the expenditure, $P_1 \leq I - M$. An uninformed borrower accepts refinancing only if she can afford it when her date 2 income is high, $P_1 + P_2 \leq 2I - M$, and the increase in her total payments is less than her welfare gain,[24]

$$P_1 + pP_2 + (1 - p) \min\{H, P_2\} - (I - M + \bar{P}_2) \leq S - (1 - p) X. \tag{1}$$

Consider any refinancing terms that satisfy these three inequalities and also increase the lender's total payment, $P_1 + pP_2 + (1 - p) \min\{H, P_2\} \geq I - M + \bar{P}_2$. An equilibrium exists in which the lender offers these terms regardless of his information; the borrower accepts; the borrower interprets any other refinancing terms as meaning she has bad prospects; and the loan is predatory. This follows by construction, and since given the borrower's beliefs she rejects any deviating offer that is strictly profitable for the lender.

The lender's highest profit and the bad-prospects borrower's worst loss are achieved when $P_1$ and $P_2$ are set as high as possible. Hence the lender's highest profit is $\min\{I - \bar{P}_2, pI + (1 - p) H - \bar{P}_2, S - (1 - p) X\}$. If $H$ is high, $H \geq \bar{P}_2 + S - (1 - p) X$, inequality (1) binds at a level of $P_2$ below $H$, so that the borrower always repays. In this case, the worst loss is $\min\{I - \bar{P}_2, S - (1 - p) X\} + X - S$. Otherwise, inequality (1) binds at a level of $P_2$ above $H$, and the worst loss is $\min\{I - \bar{P}_2, H - \bar{P}_2\} + X - S$. Combining these two cases gives the result. **QED**

**Proof of Proposition 5:** The result uses the following characterization of non-predatory equilibria.

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[24] As noted in the main text, any refinancing that allows the borrower to afford the expenditure causes her to default if her date 2 income is low.

**Proposition 11** *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.*

Because our main focus is on predatory equilibria, we relegate the proof of Proposition 11 to Appendix B.

Given Proposition 10, the result is almost immediate. From Proposition 4, the lender's highest predatory profit is always strictly positive, and so exceeds the highest non-predatory profit if $H \geq I$. If instead $H < I$, the lender's highest predatory profit is $\min\left\{pI + (1-p)H - \bar{P}_2, S - (1-p)X\right\}$; and the lender's highest non-predatory profit is $p\min\left\{S, I - H\right\}$ (because $I - \bar{P}_2 \geq I - H > 0$). The former expression is increasing in $H \in [\bar{P}_2, I)$, whereas the latter is decreasing over the same range and equals $0$ at $H = I$. So when $H$ is large enough the highest predatory profit strictly exceeds the highest non-predatory profit. **QED**

**Proof of Proposition 6:** The proof is very similar to that of Proposition 4. The sufficiency of the conditions and the necessity of $S \geq (1-p)X$ follow exactly as before. For the necessity of $H \geq \bar{P}_2 - M$, suppose, to the contrary, that a predatory lending equilibrium exists when $H < \bar{P}_2 - M = R(RL_0 - I)$. The lender will offer new financing terms only with $P_2 \geq \bar{P}_2 > M + H$. At date 2, the lender will recover only $M + H$ from the borrower if she has bad prospects. Thus, under refinancing, the total net payment in dates 1 and 2 from the borrower with bad prospects to the lender is weakly less than $(I - M) + (M + H)$. Given $H < R(RL_0 - I)$, this amount is strictly less than $I + R(RL_0 - I)$, which the lender can obtain from the borrower by not offering refinancing. **QED**

**Proof of Proposition 7:** As a preliminary, define $P_2^K$ as the date 2 payment a borrower must promise for a lender to recover $RL_0 - K$ in expectation at date 2, i.e. $pP_2^K + (1-p)\min\left\{P_2^K, H\right\} = RL_0 - K$. If $H \geq RL_0 - K$, then $P_2^K = RL_0 - K$, and otherwise $P_2^K = \frac{1}{p}(RL_0 - K - (1-p)H)$. Note that $P_2^K \geq I$ implies $H < RL_0 - K$, because otherwise $P_2^K = RL_0 - K \geq I$, violating Assumption 2.

**Part (A):** Competition has no effect if $P_2^K > I$, because in this case an uninformed entrant cannot recover $RL_0$. By above, $P_2^K > I$ implies $P_2^K = \frac{1}{p}(RL_0 - K - (1-p)H)$. Rearranging terms gives the result.

**Part (B):** If $H \geq \frac{1}{1-p}(RL_0 - K - pI)$ then $P_2^K \leq I$ and an equilibrium exists in which both the incumbent and entrant lenders offer to refinance the borrower at terms

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$\left(K, P_2^K\right)$, and the borrower accepts. The borrower accepts because under the status quo, she defaults, loses her house, pays $\min\{H, RL_0\}$ to the incumbent, and gets surplus $S$ from the expenditure if $M \leq K$. If she accepts the refinancing, she keeps her house with probability $p$ (because $P_2^K \leq I$), does not undertake the expenditure, and pays $RL_0$ in expectation to her lender. Therefore, she certainly accepts due to Assumption 3. The lenders will make such an offer because it nets zero profits for the entrants and weakly increases the incumbent's recovery from $\min\{H, RL_0\}$ to $RL_0$.

This is the worst equilibrium outcome for a bad-prospects borrower. To see this, note first that a separating equilibrium cannot result in a loss for any type of borrower, because in such an equilibrium a borrower learns her type. So the only candidate for an equilibrium with a larger welfare loss entails both borrower types accepting a refinancing with $P_1 + P_2 > K + P_2^K$. But then one the entrants can profitably deviate by offering $(P_1, P_2 - \varepsilon)$ (where $\varepsilon$ is arbitrarily small) and capturing the entire market. By the same argument, no equilibrium exists in which the incumbent's profits are increased by more than $RL_0 - \min\{H, RL_0\}$.

The welfare calculation follows from straightforward algebra.

**Part (C):** Follows from a direct comparison of the bad-prospects welfare loss calculated above, and in Proposition **2**. **QED**

**Proof of Proposition 8:** Predation can occur only as part of an equilibrium in which the incumbent makes the same offer to borrowers with good and bad prospects, and moreover, the offer allows the borrower to afford the expenditure. The necessity of the conditions $H \geq RL_0 - I + M$ and $S - (1 - p)X \geq 0$ follows as in the monopolistic case (Proposition 4). From these two conditions, it is straightforward to see that in any predatory equilibrium the borrower's total expected payment to the incumbent across dates 1 and 2 is $RL_0$, because otherwise either an entrant could undercut him, or the incumbent would not lend. Absent refinancing, a borrower pays $I + R(RL_0 - I)$ to the incumbent and keeps her house. Under predatory refinancing, a bad-prospects borrower pays, at most, a total of $RL_0$ to the incumbent across dates 1 and 2, gains the expenditure surplus, $S$, but loses her house. Hence, the bad-prospects borrower's worst loss in any equilibrium is $X - S - (R - 1)(RL_0 - I)$, and a necessary condition for predation is that this term is strictly positive.

For sufficiency, suppose that the three conditions identified above 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 $P_2^I = RL_0 - I + M$ 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. We do not impose any specific off-the-equilibrium-path beliefs.

The borrower is indifferent between the entrant and incumbent offers. If the borrower rejects all offers, she pays a total of $I + R(RL_0 - I)$ to her existing lender. If instead she accepts the incumbent's offer, her total net payment at dates 1 and 2 is $RL_0$. Although she enjoys new consumption with a surplus of $S$, she loses the surplus $X$ from her house with a probability of $(1 - p)$. She accepts the incumbent's offer because $S \geq (1 - p) X$ and additionally her total payments fall by $(R - 1)(RL_0 - I)$. The bad-prospects borrower's surplus loss equals the upper bound identified above, namely, $X - S - (R - 1)(RL_0 - I)$.

Under the equilibrium refinancing terms, the incumbent recovers exactly the outstanding loan balance, $RL_0$. So the incumbent is willing to lend at these terms, entrants cannot profit by undercutting the incumbent, and competition from the entrants rules out any strictly profitable deviation for the incumbent.

Whenever predation is possible under monopoly, its severity is reduced by competition, since competition either eliminates it or reduces the bad-prospects borrower's loss.[25]

Finally, under the conditions of Proposition 8, the incumbent recovers $RL_0$ in any equilibrium. We already show this for predatory equilibria. For non-predatory equilibria either the incumbent does not lend, entrants refinance the borrower, and incumbent receives $RL_0$; or the incumbent only lends to good-prospects borrowers and competition again drives the amount the incumbent recovers down to $RL_0$. **QED**

**Proof of Proposition 9:** Under both the one-period and two-period mortgage contracts, the status quo for a borrower with low date 1 income is foreclosure and a payment of $\min\{RL_0, H\}$ to the lender.

Next, consider the case in which the borrower's date 1 income is high. We claim that a predatory lending equilibrium exists under the one-period mortgage whenever

$$I + K < \min\{H, RL_0\} + pX - S\mathbf{1}_{I \geq M}. \tag{2}$$

Because this condition can hold when the conditions of Proposition 4 fail, the result follows.

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[25]Note that the bad-prospects borrower's worst loss in the monopoly case is at least $X - S + I - \bar{P}_2$, which exceeds $X - S - (R - 1)(RL_0 - I)$, because $2I > RL_0 + M$ (from Assumption 2).

To establish the claim, choose $P_2 > K$ such that

$$p\left(I + P_2\right) + \left(1 - p\right)\left(I + \min\left\{H, P_2\right\}\right) \in \left(\min\left\{H, RL_0\right\}, \min\left\{H, RL_0\right\} + pX - S\mathbf{1}_{I \geq M}\right]$$

(Such a choice is possible because at $P_2 = K + \varepsilon$, where $\varepsilon$ is small, the lefthand side term equals $I + K + \varepsilon$ by Assumption 1.) An equilibrium exists in which the lender refinances the borrower in exchange for a payment $I$ at date 1 and a promise to pay $P_2$ at date 2. The uninformed borrower accepts because, by construction, the increase in her payment is less than the gain of avoiding foreclosure when her date 2 income is high. The lender agrees to refinance at these terms as it increases his total recovery. **QED**

# Appendix B: Proof of Propositions 10 and 11

We classify any equilibrium in which borrowers either take no loan or take a loan that leaves both types' expected payoff and foreclosure outcomes unchanged, as degenerate. Propositions 10 and 11 relate to non-degenerate and non-predatory equilibria:

**Proof of Proposition 10:** Under the original loan contract, both types of borrower default at date 1 and the lender receives $\min\left\{H, RL_0\right\}$. Because by Assumption 1, $2K < \min\left\{H, RL_0\right\}$, no non-predatory equilibrium exists in which the bad-prospects borrower obtains refinancing that allows her to avoid foreclosure. As such, in any non-predatory equilibrium, the bad-prospects 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 $P_1 + P_2 \geq \min\left\{H, RL_0\right\}$. From above, refinancing lowers the welfare of a borrower with bad prospects unless $P_1 + P_2 \leq \min\left\{H, RL_0\right\}$. So the only possible non-predatory equilibrium in which both borrower types receive financing has $P_1 + P_2 = \min\left\{H, RL_0\right\}$. Such an equilibrium exists because 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 from 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.)

To prove 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 must be made by lending to the borrower with good prospects. We deal with the case $H \geq I$ and $H < I$ separately.

**Case:** $H \geq I$. We claim that no non-predatory equilibrium exists 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 a good-prospects borrower, who accepts and repays, and $P_1 + P_2 > \min\{H, RL_0\}$. Let $A \geq 0$ be the equilibrium savings of the good-prospects borrower; note that repayment at date 2 demands $I + A \geq P_2$. If the lender offers the same loan to the bad-prospects borrower, he gets $P_1 + \min\{P_2, H + A\}$. Because $H + A \geq H + P_2 - I \geq P_2$, the lender recovers $P_1 + P_2 > \min\{H, RL_0\}$ from the bad-prospects borrower, implying that he has a strictly profitable deviation.

For $H \geq I$, a non-predatory equilibrium exists with the following features: the lender offers to refinance the good-prospects borrower to $P_1 = K$, $P_2 = \min\{H, RL_0\} - K$, and the borrower accepts. By Assumption 2, $I + K > RL_0 \geq \min\{H, RL_0\}$, and so a good-prospects borrower can afford to pay $P_2$ at date 2. Because $P_2 < H$, the good-prospects borrower would be worse off if she strategically defaulted at date 2. As such, if she accepts the offer, she will repay. Because the lender's payoff is the same, and social surplus is increased (foreclosure is avoided), it follows that the good-prospects borrower is strictly better off accepting the offer. Moreover, the lender clearly gains nothing from offering this loan to the bad-prospects 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 $\tilde{P}_1 + \tilde{P}_2 \leq \min\{H, RL_0\}$. Consider any offer with $\tilde{P}_1 + \tilde{P}_2 > \min\{H, RL_0\}$ and suppose that the borrower interprets such an offer as indicating that 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 $\min\{H, RL_0\}$ it is a best response to reject. On the other hand, if this amount is weakly less than $\min\{H, RL_0\}$, 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 her prospects are good, and the lender recovers $\tilde{P}_1 + \min\left\{H, \tilde{P}_2\right\}$, which is weakly less than $\min\{RL_0, H\}$. So the lender has no profitable deviation.

**Case:** $H < I$. We first show that in equilibrium the lender cannot recover more than $I$ from a good-prospects borrower. 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 either $P_1 > 0$ or equilibrium savings $A > 0$. But then the lender would recover strictly more than $H$ from offering this contract to a borrower

with bad prospects, implying he has a profitable deviation.

Finally, we show that there is an equilibrium in which the lender attains this upper bound and recovers $I$ from a good-prospects borrower: specifically, the lender 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. The borrower accepts this offer because it lets her avoid foreclosure, and by Assumption 3, this gain exceeds the increase in payments and possible loss of the expenditure. The borrower does not save. The offer is profitable for the lender because he recovers $\min\{H, RL_0\} = H$ (because $I < RL_0$ by Assumption 2) absent refinancing. Moreover, the lender would not gain by offering these terms to a borrower with bad prospects. It remains to check that the lender has no other strictly profitable deviation $\left(\tilde{P}_1, \tilde{P}_2\right)$. The deviation is strictly profitable only if $\tilde{P}_1 + \tilde{P}_2 > H$. Let the borrower interpret any such a deviation as meaning she has bad prospects. So if $\tilde{P}_1 > 0$, she rejects this offer. If instead $\tilde{P}_1 \leq 0$, she accepts the offer and does not save, and the lender's total recovery is bounded above by $\max\{H, I\} = I$. **QED**

**Proof of Proposition 11:** By Assumption 2, the borrower with bad prospects cannot afford both the house and the expenditure. Consequently, by Assumption 3, total welfare falls whenever she refinances to incur the expenditure. This implies that in a non-predatory equilibrium, the lender does not extend credit to her because it is not profitable.

The $H \geq I$ case is just the same as the low-income monopoly case, by parallel arguments. 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-prospects borrower. As before, we need $A \geq P_2 - I$. Because $H - I > 0$, the incumbent has a strictly profitable deviation. The 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 $P_1 + P_2 > 2I - H + R(RL_0 - I)$, the lender would recover strictly more than $I + R(RL_0 - I)$ from giving the loan to the bad-prospects borrower, because $P_1 + H + A \geq P_1 + H + P_2 - I$. So the lender's maximal recovery from the good-prospects borrower is

$$I + R(RL_0 - I) + \min\{I - M - R(RL_0 - I), S, I - H\}. \tag{3}$$

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-prospects borrower. By construction, a good-prospects borrower would accept and repay this loan. Because $P_2 > H$, the lender would recover $P_1 + H \le I + R(RL_0 - I)$ by offering this loan to a bad-prospects borrower.

It remains to check that the lender does not have a strictly profitable deviation $\left(\tilde{P}_1, \tilde{P}_2\right)$. Let the borrower interpret any deviation as indicating he has bad prospects. A necessary condition for the deviation to be strictly profitable is that $\tilde{P}_1 + \tilde{P}_2 > I + R(RL_0 - I)$. Given the stated beliefs, the borrower rejects any such offer because it leads either to the loss of her house or to an increase in her total repayment (but without the benefit of the expenditure). **QED**