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# CONSUMER LENDING WHEN LENDERS ARE MORE SOPHISTICATED THAN HOUSEHOLDS

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# ABSTRACT

## Consumer Lending When Lenders are More Sophisticated Than Households*

We present a simple model of household (or consumer) lending in which, building on past information and local expertise, an incumbent lender has an information advantage both vis-a-vis potential competitors *and* households. We show that if the adverse selection problem faced by other lenders is sufficiently severe, the incumbent preserves his monopoly power and may engage in *too aggressive lending*. The incumbent lender may then approve credit even against a household's best interest. In contrast, with effective competition it may now be less informed lenders who lend too aggressively to households who were rejected by the incumbent, though this only occurs if households 'naively' ignore the information contained in their previous rejection. We find that competition may also distort lending as less informed lenders try to free ride on the incumbent's superior screening ability.

JEL Classification: G1
Keywords: consumer and personal finance, irresponsible lending practices and predatory lending

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# 1 Introduction

This paper proposes a new framework to analyze household (or consumer) lending. We argue that by building on their past experience with borrowers in the same local area or borrowers facing similar economic conditions, a sophisticated lender may often have a better estimate of a household's default probability. Our main interest lies in deriving conditions for when this type of information asymmetry can induce lenders to be *too aggressive*, that is to approve credit even though this is (knowingly) against the household's own best interest. Our model identifies two instances when lending may be too aggressive. Too aggressive lending may arise if the better informed lender enjoys sufficient market power, but also if less informed competitors make loans to households that were previously rejected by the better informed lender.

The more "standard" approach towards informational asymmetries in lending is to assume that borrowers represent the better informed party. While we do not want to dismiss the importance of borrower adverse selection, the presumption that sophisticated and experienced lenders can better estimate the default probability than individual borrowers may be particularly suitable if borrowers are households - much more so than if borrowers are corporations.

Conceptually, we borrow the assumption of "informed lending" from Inderst and Müller (forthcoming), where a lender is better informed about the verifiable cash flow from a newly financed project. Our current analysis is tailored towards households and our focus is on whether too aggressive lending can occur in equilibrium. This focus is motivated by the particular attention that policymakers have given to this issue. Concerns about too aggressive lending seem to prevail on both sides of the Atlantic. Starting (for a change) with Europe, it is in particular the UK where numerous reports and taskforces on consumer lending practices (and, more generally, on the surge of household debt) have repeatedly brought up the issue of too aggressive or irresponsible lending.[1] For instance, too aggressive lending has been addressed by the Griffiths Commission and by the Department of Trade and Industry.[2] In addition,

[1]The term "irresponsible lending" is commonly used in the UK, next to those of "aggressive lending" and, though to a lesser extent, "predatory lending".

[2]The Griffiths Commission, named after its chairman Lord Griffiths of Fforestfach, proposed, amongst other remedies, to introduce a Statutory Bank Customers Charter, which would replace the Voluntary Banking Code, to which banks now subscribe in the UK ("The Griffiths Commission on Personal Debt", 2005). The report of the Department of Trade and Industry (DTI "Fair, Clear and Competitive - The Consumer Credit Market in the

the Financial Service Authority, one of the main financial regulators in the UK, has recently undertaken a number of investigations into the misselling of financial products, amongst them certain kinds of mortgage products.[3]

Turning to the US, policymakers and scholars alike have repeatedly raised concerns about predatory or abusive lending.[4] As discussed by Engel and McCoy (forthcoming), the terms "predatory" or "abusive" lending are not well defined or used coherently both among scholars and among policymakers and may be used to describe a wide array of practices ranging from fraud and the violation of common loan underwriting norms to earning "supranormal" profits. Amongst the criteria that Engel and McCoy suggest, the criterion that lending is too aggressive (or abusive) whenever the respective loan does not result in a net benefit to the borrower is closest to the one that we formalize and use in our model. We define lending as being too aggressive whenever given the information that is available to the *lender,* an approved loan will result in a negative expected utility for the household.[5]

In our model, an incumbent lender is in a better position to estimate a potential borrower's default probability than either competitors or the household itself. The assumption that the household is less sophisticated than the lender in estimating its own probability of default is key to our model. Likewise, it is important that there is no perfect competition between equally informed lenders, in which case the outcome would be efficient.[6] Our main findings are as following. In case the incumbent lender can set its terms relatively unconstrained by

21st Century", 2005) lead to the preparation of the new Consumer Credit Bill, which will include a definition of "unfair lending" next to provisions for how consumers can challenge supposedly unfair agreements.

[3]At the level of the European Union, the new Consumer Credit Directive was adopted in 2004 with the aim of harmonizing European legislation and better protecting consumers in their credit transactions.

[4]For instance, Wallace, Elliehausen, and Staten (2005) offer a recent and very detailed account of cases and policy responses to potentially abusive mortgage lending practices in the US.

[5]In both the UK and the US, the discussion of too aggressive lending is often linked to more general concerns about the surge in household debt and bankruptcies. For recent empirical studies that try to account for these trends see, for instance, Livshits, MacGee, and Tertlit (2005) for the US and May and Young (2005) for the UK. The aim of our analysis is more limited and our model does not try to contribute to these broader issues.

[6]Incidentally, the lack of competition in the subprime market has often been identified as one of the main culprits for the potential prevalence of predatory or abusive lending practices in this segment (see, for instance, Engel and McCoy (forthcoming) ).

competition, we find that too aggressive lending can arise even if households perfectly anticipate that the lender is better informed and that he will use his information to his own advantage. Too aggressive lending arises out of the lender's attempt to extract all consumer surplus. Once the lender is, however, forced to leave households with sufficient surplus, lending will no longer be too aggressive.

If less informed lenders (the entrants) can effectively compete as the problem of adverse selection, i.e., of only ending up with the "lemons", is not too severe, then households that were rejected by the better informed incumbent may take up a (more expensive) loan with entrants. If households are "naive" and do not anticipate the incumbent lender's informational advantage, then it may now be entrants who lend too aggressively. Moreover, competition by entrants, who try to free ride on the incumbent's better information, may altogether erode the potential for screening out bad applicants.

In light of the ongoing (policy) debate about the nature and implications of too aggressive or irresponsible lending, our paper can offer the following contributions. First and possibly most importantly, we show that too aggressive lending can be perfectly rationalized as an equilibrium outcome even if households do not err on average and even if they are not systematically deceived by lenders. Second, our model points to one potential source of too aggressive lending: the informational advantage of an incumbent lender. Importantly, to generate too aggressive lending this informational gap must exist vis-a-vis both households and competing lenders. As this gap erodes, either as households become more able to predict their probability of default or as competing lenders acquire the same knowledge as an incumbent, too aggressive lending should disappear and welfare should be higher. However, our model also shows that without levelling the informational gap between an incumbent and new lenders increased competition may not be a blessing after all. Amongst other things, we show that competition can give rise to an extreme form of free riding on the incumbent's information, which may even lead to the shut-down of the credit market for borrowers with sufficiently low prospects.

Our paper relates to the extant literature on household finance (see, for instance, Hynes and Posner (2002) or White (2005) for a recent overviews). This literature has identified a number of possible imperfections in the market for credit. Besides the potential of private information and moral hazard on the part of the *borrower*, there has been considerable emphasis also on households' limited understanding of the nature and details of financial products. As discussed in Beales, Craswell, and Salop (1981), for instance, one can not rely on lenders to properly inform and educate consumers.[7] Intuitively, far from fostering his own business, a lender who educates a consumer in how to read and compare, say, the terms of a loan contract may end up inducing the consumer to shop around for better deals.

As noted above, our model employs the "informed lending" framework of Inderst and Müller (forthcoming). There, the lender's superior information relates to the continuous and perfectly verifiable cash flow of a newly financed project and the paper's focus is, consequently, on the optimal design of the financial security. The potential for lending to be either too conservative or too aggressive has already been recognized in Inderst and Müller (forthcoming). Our present analysis differs as we focus on the role of competition and the role of whether households correctly anticipate the lender's informational advantage or whether they "naively" tend to ignore it. Also, as we will discuss further below in more detail, both the problem of adverse selection, which can preserve the incumbent's monopoly power, and that of free riding by entrants is novel to our present analysis.[8]

To our knowledge, only few other papers and all of them on corporate lending have used a framework where lenders are more informed or more sophisticated.[9] In Manove, Padilla, and Pagano (2001) banks can add value by screening out bad projects, which firms can not distinguish from good ones. Other papers have assumed that, in contrast to the firm's owner, a lender is more sophisticated in that he does not suffer from behavioral biases such as overconfidence or optimism (e.g., de Meza and Southey (1996), Manove and Padilla (1999), or Landier and Thesmar (2005)). Finally, it has been recognized in both empirical and theoretical work that due to bounded rationality and costs of search and decision making borrowers can make errors

[7]The issue that lenders may exhibit insufficient care or may even deceive consumers when selling their products has possibly received most attention by policymakers, e.g., in the U.S. through the Truth in Lending Act or in the European Union through the recently adopted Consumer Credit Directive.

[8]Apart from this, our model differs in a number of aspects that are important if borrowers are households, which typically enjoy more protection under prevailing bankruptcy laws.

[9]More common is the assumption that lenders must spend resources to uncover borrower's private information. For instance, Ruckes (2004) studies how competing banks optimally invest in screening, while Fulghieri and Lukin (2001) study how screening incentives depend on the nature of financial claims.

and are prone to be mislead and deceived by lenders (see, e.g., Woodward (2003) on errors in decision making and Hanson and Morgan (2005) on lenders' attempts to deceive potential borrowers).

The rest of this paper is organized as follows. Section 2 introduces and solves the core model with a monopolistic (incumbent) lender. Section 3 introduces competition by other less informed lenders. Section 4 concludes.

# 2 The Core Model with a Monopolistic Lender

## 2.1 Introducing the Model

We consider a single household that potentially wants to finance the purchase of a single indivisible good with a loan. The household has zero initial wealth. The required expenditure, which is thus equal to the size of the loan, is given by $l > 0$. There are three points of time in our model: $t = 0$, 1, and 2. The good must be purchased at $t = 0$. In $t = 1$ the household realizes a random income $y$, which for simplicity can only be either $y = 0$ or $y = \overline{y} > 0$. Throughout the paper we take $\overline{y}$ to be sufficiently large such that in the high state there will always be sufficient income to make the contractually stipulated repayment to the lender. We specify the probability with which the household has high income below as this will be the source of the lender's informational advantage vis-a-vis the household.

It is also in $t = 1$ that the household may make a repayment to the lender. We make the somewhat extreme - though quite standard - assumption that *any* positive repayment must be enforced by the threat of default. For instance, in the US until October 2005 debtors had the choice between filing for personal bankruptcy under Chapter 7 or Chapter 11. Under Chapter 7, debtors were not obliged to use future earnings to repay existing debt.[10] Even if a country's bankruptcy code did not specify such a generous exemption, our analysis may be applicable to borrowers whose earnings are hard to "verify", given the nature of their profession or the

[10] Strictly speaking, creditors were able to obtain a court order to garnish debtors' wages up to a certain limit. By filing for bankruptcy, however, the debtor could gain protection from these orders. Though the 100% exemption of post-bankruptcy earnings (the "fresh start") is quite extreme, partial exemptions of future earnings are quite typical also under other bankruptcy codes, in particular since many countries have reformed their laws over the last two decades (see Tabb (2005) for an overview).

lack of regular work. Incidentally, the assumption that not all income can be credibly pledged for repayment will *not* be binding whenever lending is too aggressive. Instead, and somewhat intuitive, whenever the resulting constraint binds the lender will be too conservative.

As the good does not yield consumption benefits beyond $t = 2$, the assumption that all repayment must be made in $t = 1$ is not restrictive. Our way of capturing these consumption benefits is conceivably simple. We assume that if the household remains in possession of the good after $t = 1$, then the utility derived from the good over the second and last period is given by $u$. In addition, in the first period and thus before the repayment must be made, the household derives the utility $\alpha u$, where $\alpha \geq 0$. Typically, we may think of $\alpha$ as being (relatively) small. An exception could be, however, loans that are used to finance immediate consumption such as holidays. We will show below that the lender is typically too conservative if a sufficiently large fraction of the total utility that can be derived from the good is already realized in the first period. This is intuitive as it reduces the household's incentives to repay the loan. Otherwise, the lender will be too aggressive.

Both the lender and the household are risk neutral. We set the risk-neutral interest rate to zero. In our model, the purpose of the loan is thus not to smooth consumption between different periods but to finance, for instance, the purchase or re-decoration of a house or the purchase of some long-lived household equipment. Without the purchase in $t = 0$, these consumption benefits are naturally lost for good.

A crucial feature in our model is that the household incurs some additional costs when defaulting, that is costs in addition to the loss of the future consumption benefits from the good. We can think of (at least) two types of such costs. For our purposes, it proves to be most convenient to work with some exogenous default costs $\gamma > 0$. For instance, Fay, Hurst and White (2002) list as "financial costs" from bankruptcy the loss of other (nonexempt) assets as well as payment of bankruptcy court filing fees and lawyers' fees. In addition, nonpecuniary costs include "the cost of acquiring information about the bankruptcy process, higher future borrowing costs, and the cost of bankruptcy stigma" (ibid, p. 707).[11]

[11] This list is surely not exhaustive. For instance, in the UK individuals who have been made bankrupt may not be admitted to certain professions. The use of an "utility penalty" in case of default is not novel to our model. Early examples are Diamond (1984) and Rea (1984). (See, for instance, Rampini (2005) for further references.)

Alternatively, additional real (deadweight) costs from bankruptcy could arise from the need to liquidate personal assets below their intrinsic value to the household, e.g., by selling residential property that is non-exempt. As we will argue below, our main insights continue to hold if costs of bankruptcy arise through this channel. However, in contrast to the exogenous costs of bankruptcy $\gamma$, which are not subject to the individual loan contract, matters are more complicated if the lender and the borrower can choose the extent to which a loan is backed up by the household's assets. For instance, a borrower may obtain funds to improve his home either via an unsecured loan or by taking out a mortgage on his home.[12] Depending on the prevailing law, it may only be in the second case that the lender has a lien on the home. We return to these issues in Section 2.4, where we consider the possibility of borrowing against existing assets.

A credit contract stipulates that the household repays in $t = 1$ both the principal, $l$, together with an interest $rl$. In what follows, it will be more convenient to work with the total repayment requirement $R := l(1 + r)$ instead. If repayment is not possible, the consumer loses the utility $u$ over the second period and, in addition, has to incur the personal bankruptcy costs $\gamma$. To make the contract incentive compatible, the repayment in case of high income must then satisfy $R \leq u + \gamma$. As noted previously, however, this constraint will only bind if the lender is too conservative and not if he is too aggressive.

Before proceeding with the specification of the model, it should be noted that while being purely wasteful in our simple model, it is straightforward to rationalize the imposition of strictly positive personal bankruptcy costs $\gamma > 0$. In a slightly richer model, without the presence of these costs households' incentives to repay the loan in case of high income may be insufficient and a loan may thus not be financially viable for the lender.[13]

[12] A somewhat opposite case is that where consumption is financed via a first or second mortgage on the household's property. In the UK, such schemes of "mortgage equity withdrawals" (e.g., via remortgaging in such a way that a homeowner increases his outstanding mortgage) have recently become ubiquitous.

[13] To briefly see this, suppose there are two possible levels of $u$, namely $\underline{u} < \overline{u}$. In this case, any sufficiently high $R$ that would allow the lender to break even may induce the borrower to (strategically) default in case his future consumption benefits turned out to be low with $u = \underline{u}$. Further increasing $R$ until the lender could make non-negative profits even if the loan was only repaid in case of both high income *and* high consumption benefits may, in turn, not be feasible as it then may exceed either $\overline{u}$ or $\overline{y}$. In this case, financing can become (only) viable by introducing costs $\gamma > 0$ and thereby extracting a positive repayment even when $u = \underline{u}$. Our model is, however, admittedly too simple to fully study the *optimal* design of bankruptcy procedures and statutes. A

We come now to the core and novel feature that distinguishes ours from existing work. The core feature of our model is the lender's informational advantage vis-a-vis the borrower. For the moment, we consider only a single (monopolistic) lender. One justification for this is that too aggressive lending has been often associated with market segments where there is little competition. For instance, Engel and McCoy (forthcoming) explicitly name the lack of competition in what are often spatially segmented local markets for subprime lending as one of the major culprit for abusive or predatory lending practices.[14] Further below we consider competition between a better informed (incumbent) lender and other less informed lenders. We show amongst other things that if the adverse selection problem faced by less informed lenders is sufficiently severe, then the incumbent can still act like an unconstrained monopolist.

To formalize the lender's information advantage vis-a-vis households (and also vis-a-vis entrants in the model with competition), we assume that during the credit approval process the lender privately learns the household's "type" $\theta \in \Theta = [\underline{\theta}, \overline{\theta}]$. Each type $\theta \in \Theta$ is associated with a probability $p(\theta)$ with which the household subsequently realizes high income: $p(\theta)$. Types are ordered such that high types are associated with a strictly lower probability of subsequent default, $1 - p(\theta)$. Also, it is convenient to assume that $p(\theta)$ is continuous and that $p(\underline{\theta}) = 0$ and $p(\overline{\theta}) = 1$ holds at the two boundaries of $\Theta$.[15]

recent contribution focused on personal bankruptcy is Wang and White (2000), while numerous papers on the role and the optimal design of bankruptcy rules have focused more on corporate bankruptcy (e.g., the tade-off between soft and tough bankruptcy procedures as in Povel (1999) or the role of a country's financial system as in Berkovitch and Israel (1999)).

[14]If "abusive" merely meant that lenders can charge high (that is, non-competitive) rates, then this would, of course, be tautologically the case. It is the possibility of loans being made against the household's best interest that we are interested in.

[15]An alternative interpretation could be that $\theta$ represents a noisy signal that the lender observes about some "state of the world" that is in turn informative about the household's future income and thus the likelihood of default. Precisely, there could be two such states $\phi = l, h$, where $p_h > p_l$ are the associated probabilities of high income and where $F_\phi(\theta)$ are the respective distribution functions for the lender's (noisy) signal-generating technology. The ex-ante probability of $\phi = g$ is $0 < \mu < 1$. If $F_\phi(\theta)$ satisfies the Monotone Likelihood Ratio Property (MLRP), then the posterior probability that $\phi = h$, which is $\mu(\theta) := \mu f_h(\theta)/[\mu f_h(\theta) + (1-\mu) f_l(\theta)]$, is strictly increasing in $\theta$, implying that also the conditional probability of high income $p(\theta) = \mu(\theta) p_h + [1-\mu(\theta)] p_l$ is strictly increasing in $\theta$. Finally, we have $f(\theta) = \mu f_h(\theta) + (1-\mu) f_l(\theta)$, which characterizes the ex-ante distribution of signals $F(\theta)$.

From an ex-ante perspective, types $\theta$ are distributed according to the distribution function $F(\theta)$, which is atomless and has the continuous density $f(\theta) > 0$ over $\theta \in \Theta$. Hence, from an ex-ante perspective the household will realize high income with probability

$$p := E[p(\theta) \mid \theta \in \Theta] = \int_{\underline{\theta}}^{\overline{\theta}} p(\theta) f(\theta) d\theta.$$

This coarse information is all the household has. The more precise information that comes from observing the type $\theta$ is the lender's private (proprietary) information. This information can also not be credibly communicated to a potential borrower, which makes it impossible to write a contract that is contingent on $\theta$.

As discussed in the Introduction, we feel that our key assumption that a sophisticated and experienced lender may be better able to estimate a borrower's probability of default should be particularly reasonable when borrowers are households (instead of corporations). Note that we do not assume that households make systematic mistakes. In contrast, a household's estimate is correct *on average* when using $p = E[p(\theta) \mid \theta \in \Theta]$. All we assume is that the lender possesses some additional information. As we focus on the *use* of the lender's information, we also abstract from any costs that may be associated with generating this information. In fact, the incremental costs to process an individual loan application may be quite small, though overall the lender may spend substantial resources on building up his informational advantage, e.g., by maintaining a large database on the performance of past loans

We close the description of the model by formalizing the contracting process. In $t = 0$ the lender offers a contract stipulating $R$.[16] The household can then apply for credit and, if approved by the lender, receives a loan of size $l$ to finance the purchase.[17] Note also that the lender offers $R$ *before* observing $\theta$. Moreover, the lender does not initiate renegotiations after observing $\theta$. These specifications are reasonable in our model. First, we can show that the optimal (!) $R$ would not be successfully renegotiated.[18] Second and more immediate, it is also optimal for the

[16]Note also that the household's zero wealth in $t = 0$ rules out contracts under which the household would have to pay an application fee. If it was possible to stipulate a sufficiently high payment to the lender already at this stage and if this did not engender new problems of moral hazard (i.e., this time on the side of the lender), then the inefficiencies that we study in what follows could be contracted away.

[17]Realistically, the household could also still reject the lender's offer after credit was approved, though this will only become relevant once we introduce competition.

[18]Precisely, if at the credit approval stage (but after the type $\theta$ was revealed to the lender) either the lender

lender to stipulate $R$ in advance. Note, however, that $R$ does depend on all information that is incorporated in the household's commonly known characteristics as captured by the functions $p(\theta)$ and $F(\theta)$.

## 2.2 Analysis of the Core Model

If granted credit, the household will repay $R$ after high income in $t = 1$. In case of low income, the household will default at private costs $\gamma$. Hence, if the lender approves credit after observing $\theta$, the household's expected utility is given by[19]

$$U(\theta) := \alpha u + p(\theta)(u - R) - [1 - p(\theta)]\gamma,$$

where we also use that the household can always enjoy the utility $\alpha u$ with $\alpha \geq 0$ over the first period and thus before a repayment is due. Likewise, the lender's expected net profits from approving credit after observing $\theta$ is given by

$$V(\theta) := p(\theta)R - l.$$

Note that the definition of $V(\theta)$ does not take into account a possible resale value for the seized good. Introducing such a value would not affect our results, provided of course that the value is below the household's future consumption benefits $u$.[20]

We come now to the lender's decision whether to approve credit in the first place. Note first that $V(\theta)$ is continuous and strictly increasing given that the same properties hold for $p(\theta)$. Unless $p(\overline{\theta})R < l$, in which case credit will never be approved, there thus exists a unique

or the household could propose another offer, then in the unique (perfect Bayesian) equilibrium of this game the optimal (commitment) contract would not be renegotiated. Intuitively, this follows as $\theta$ is the lender's private information and as there is no sorting variable.

[19]Note that $U(\theta)$ captures the *net* utility from receiving the loan and not the household's *gross* utility including the residual income.

[20]If the borrower had other loans as well then from the perspective of the individual lender there would, of course, be an important difference between loans that are secured by the purchased asset and non-secured loans. Note also that with an arbitrarily small but strictly positive liquidation value, the threat of personal bankruptcy would be strictly renegotiation proof after low income. In case of high income and if $R$ is larger than the liquidation value, the borrower may want to hold up the lender by threatening to default. In this case the lender can, however, rely on the fact that the borrower's threat of "strategic default" is not credible.

threshold $\underline{\theta} < \theta^* < \overline{\theta}$ where $V(\theta^*) = 0$, implying that the lender optimally approves credit if and only if $\theta \geq \theta^*$.[21] Clearly, $\theta^*$ depends on $R$, though in what follows we choose to only make this dependency explicit (by way of writing $\theta^*(R)$) whenever this is necessary to avoid ambiguity.

Anticipating the lender's (privately) optimal choice of $\theta^*$, the household's expected utility (both when initially applying for credit and when deciding whether to ultimately accept an approved credit offer) is then

$$E[U(\theta) \mid \theta \geq \theta^*] := \int_{\theta^*}^{\overline{\theta}} U(\theta) \frac{f(\theta)}{1 - F(\theta^*)} d\theta. \tag{1}$$

Equation (1) embodies an important assumption, namely that the household knows that the lender has access to better information and rationally takes this into account when accepting an approved credit offer. Below we will also study the case where the household is less sophisticated (or knowledgeable) and does not take this account. Formally, the difference will then be that instead of using the posterior distribution *conditional* on the incumbent's decision, the household will always continue to believe that it defaults with probability $1 - p$.

The lender's program is now simple. The lender offers a repayment requirement $R$ that maximizes his expected payoff

$$V := \int_{\theta^*}^{\overline{\theta}} V(\theta) f(\theta) ds$$

subject to the household's participation constraint

$$E[U(\theta) \mid \theta \geq \theta^*] \geq 0. \tag{2}$$

Before solving this program, note that to maximize total surplus credit should only be approved whenever

$$u[\alpha + p(\theta)] \geq [1 - p(\theta)]\gamma + l, \tag{3}$$

i.e., whenever the expected consumption benefit is at least equal to the expected costs of bankruptcy plus the initial purchasing expenditure $l$. We refer to this benchmark as the *second-best* benchmark. Clearly, if $u(1 + \alpha) > l$ (which is what we will assume below) and given that $\gamma > 0$ it would be first-best optimal if credit was always approved and if there was never default.

To reduce the necessary amount of case distinctions but without losing any insights, we want to ensure that it is sometimes but not always (second-best) efficient to grant credit, i.e., that

[21] This being a zero probability event, it is without consequence that the credit is also approved when $\theta = \theta^*$.

(3) holds only for sufficiently high values of $\theta$. This is the case if

$$\alpha u - \gamma < l < u(1+\alpha). \tag{4}$$

In this case, we obtain from (3) a unique interior cutoff $\underline{\theta} < \theta_{SB} < \overline{\theta}$ such that total surplus would be maximized if credit was approved if and only if $\theta \geq \theta_{SB}$, i.e., if and only if the lender's privately optimal threshold satisfied $\theta^* = \theta_{SB}$.

Compared to a benchmark where $\theta^* = \theta_{SB}$ the lender is thus overall *too aggressive* if $\theta^* < \theta_{SB}$, implying that credit is granted too often, and *too conservative* if $\theta^* > \theta_{SB}$, implying that credit is denied too often. Recall now that $\theta^*$ is optimally chosen by the lender and thus satisfies $V(\theta^*) = 0$. Consequently, if $\theta^* < \theta_{SB}$ we also have that $U(\theta^*) < 0$. In words, if the lender is overall too aggressive this must also imply that for some lower $\theta \geq \theta^*$ the household is made worse off when taking out a loan. If the household could share the lender's information, for these values of $\theta$ the household would strictly prefer not to accept the offer.

To solve the model, we must now distinguish between three different cases. It is the first case that is potentially most interesting as it leads to too aggressive lending. In this case, the consumption benefits obtained *before* the repayment is due, $\alpha u$, are not too high. Precisely, the condition is that $\alpha u < \gamma$. Note that if this condition did *not* hold, then even if the household was sure to default (which it is not in our model) the household would still prefer to take out a loan as the maximum "punishment" in case of defaulting, $\gamma$, does not exceed the first-period consumption benefits $\alpha u$.[22]

If $\alpha u < \gamma$, we can show that the household's participation constraint (2) must bind in equilibrium. Moreover, to satisfy (2) the household must extract a strictly positive utility when income is high and the good is not repossessed. As the expected default probability is lower for high $\theta$, this implies that $U(\theta)$ is strictly increasing in $\theta$. From these two results, namely that (2) binds under the optimal contract and that $U(\theta)$ is strictly increasing, we have then immediately that $U(\theta^*) < 0$ and thus that $\theta^* < \theta_{SB}$. Under the optimal contract the monopolistic lender is thus too aggressive. Putting it somewhat differently, if the household could share the lender's information, then for all $\theta$ close to $\theta^*$ the household would strictly prefer *not* to borrow, though

[22]Regarding plausible sizes of $\gamma$, recall also from our previous discussion that $\gamma$ may comprise a wide range of costs, including the future exclusion from credit and the loss, i.e., the difference between the market and the private value, from selling non-exempt assets in case of default.

the lender finds it optimal to approve credit.

The two remaining cases to consider are the case where $\alpha u = \gamma$ holds with equality, for which we obtain that $\theta^* = \theta_{SB}$, and the case where $\alpha u > \gamma$, for which the lender becomes too conservative as $\theta^* > \theta_{SB}$. To see the intuition for the last case, recall that the maximum the lender can extract in case of high income is $R = u + \gamma$. For any higher $R$ the household would (strategically) choose to default even after high income as the utility from non-defaulting, $u - R$, is strictly below the costs of defaulting $\gamma$. In case $\alpha u > \gamma$, the household's participation constraint (2) then remains slack and the lender's credit approval decision is too conservative.

**Proposition 1.** *The game with a monopolistic lender has a unique equilibrium with the following characteristics:*

*i) Suppose $\alpha u < \gamma$, which holds whenever a household would not take out a loan in case of sure default. Then the lender is always too aggressive. That is, for a strictly positive range of types $\theta \geq \theta^*$ the household would be better off and total surplus would be higher if credit was not approved, though the lender strictly prefers to do so.*

*ii) In the opposite case where $\alpha u \geq \gamma$, the repayment constraint binds and the lender optimally sets $R = u + \gamma$, implying that the household is in $t = 1$ indifferent between defaulting and non-defaulting. In this case, lending is (second-best) efficient if $\alpha u = \gamma$ holds with equality, while lending is too conservative if $\alpha u > \gamma$ holds strictly.*

**Proof.** See Appendix.

Exploring further the potential inefficiency in lending, we have the following additional results.

**Corollary 1.** *The two standards, i.e., the standard of whether a loan is in the household's best interest and the standard of whether it maximizes total surplus, compare as follows for the two cases in Proposition 1:*

*i) If $\alpha u < \gamma$, then there exists a threshold $\theta_{SB} < \theta' < \overline{\theta}$ such that the household's expected utility from the loan is strictly negative if and only if $\theta \in (\theta^*, \theta')$. Hence, while for types $\theta \in [\theta^*, \theta_{SB})$ the loan both reduces total surplus and the household's utility, for $\theta \in [\theta_{SB}, \theta')$ it is efficient to make the loan but given the size of the required repayment the household is still strictly worse off than without credit.*

*ii) If $\alpha u > \gamma$ and the repayment constraint binds, the household would prefer to be granted credit even if $\theta \in [\underline{\theta}, \theta^*)$, while it would only be socially beneficial to extend credit also to types $\theta \in [\theta_{SB}, \theta^*)$.*

**Proof.** See Appendix.

In Case i), where lending is overall too aggressive as $\theta^* < \theta_{SB}$, there is an interval of types $\theta \in (\theta_{SB}, \theta')$ for which total surplus is maximized if the credit is granted, which it is also in equilibrium, but for which given the stipulated repayment requirement the household still realizes a strictly negative utility $U(\theta)$. Depending on whether one takes consumer surplus or total welfare as the relevant benchmark, for these types lending could be either described as being (still) too aggressive or not.

The main result in Proposition 1 is that too aggressive lending can arise in equilibrium even when borrowers are perfectly rational and fully incorporate all information they have. In our model, however, the crux is that the monopolistic lender can better estimate a potential borrower's probability of defaulting. While in expectation the household is thus not "fooled" in any way, a household whose credit was approved for low $\theta$ would be strictly better off if it did not take out the loan after all.

In essence, the finding in Proposition 1 that lending is too aggressive is the consequence of a monopoly pricing problem. In order to maximally extract the household's surplus, the lender offers a contract that subsequently makes it optimal to approve credit even against the household's best interest. The lender thereby extracts (in expectation) the surplus that the household makes in case of non-defaulting. Extracting the household's surplus in this way is not welfare neutral. As $\theta^*$ is pushed down below $\theta_{SB}$, total welfare is lower than in the (second-best) benchmark case.

The case in assertion ii), where lending is too conservative, is more standard. As the lender is not able to extract all of the consumer surplus in this case given that $R$ is bounded by the household's threat of "strategic" default, the lender will only approve credit if he is sufficiently optimistic that the household will be able to repay.[23]

[23]Incidentally, if $\gamma + u < l$ then lending will no longer take place with positive probability. This case is, however, ruled out by (4) for all $\alpha < l$.

We next explore the role that is played by the household's limited commitment to repay the loan, which is captured by the repayment constraint $R \leq \alpha + u$. This constraint is responsible for the case where the lender is too conservative. If it is relaxed, the lender consequently becomes less conservative, while if it becomes stricter than we are less likely to be in the case where the lender is even too aggressive.

**Corollary 2.** *Consider the following variations of what the household can credibly promise to repay in $t = 1$.*

*i) If there is no longer any restriction on what fraction of $\overline{y}$ the household can commit to pay in $t = 1$, then lending is still too aggressive for $\alpha u < \gamma$ and still too conservative if $\alpha u > \gamma$, albeit in the latter case the gap $\theta^* - \theta_{SB}$ is reduced.*

*ii) If the good that is purchased with the loan is exempt, e.g., as it is residential property and the loan is not mortgaged, then the lender is only too aggressive if $u(1 + \alpha) < \gamma$.*

**Proof.** See Appendix.

Our analysis also suggests that too aggressive lending is more likely to arise if the utility derived from the purchased good is more "back-loaded" relative to the repayment schedule, which in our model is concentrated on $t = 1$.[24] One would think that this is particularly the case if the loan finances the purchase of long-lived consumer goods or residential property. Also, we are more likely to be in case i) of Proposition 1, where lending is too aggressive, in case the costs of personal bankruptcy $\gamma$ are higher. We thus have the following results.

**Corollary 3.** *The monopolistic lender is more likely to be too aggressive if personal costs of bankruptcy are higher or if the consumption benefits from the purchased good are more back-loaded.*

Our previous arguments suggest that the result that lending can be too aggressive should be quite sensitive to the lender's degree of market power. We explore this in two steps. Further below we analyze a model of competition where an incumbent lender enjoys market power

[24] A possible extension could be to allow for more than one period where repayments can be made. While this may allow to incorporate the optimal design of the repayment schedule, it would require as well to specify to what extent the lender is better informed about the household's income (shocks) in the different periods.

vis-a-vis competitors due to his superior knowledge. For the moment, we want to abstract from the complexities of explicitly modelling competition between differentially informed lenders and consider, instead, a simpler way how to incorporate competitive pressure. We study how the equilibrium outcome changes if the lender is forced to share surplus with the household. Precisely, we now go to the opposite extreme and suggest that competitive pressure forces the lender to choose the offer under which the household's (!) expected utility is maximized.[25]

The household's maximum expected utility is given by

$$U_{\max} := \max_R \left\{ \int_{\theta^*}^{\overline{\theta}} U(\theta) f(\theta) d\theta \right\}, \tag{5}$$

where we used that the household realizes zero utility in case credit is not approved. Note that in the expression (5) the repayment $R$ affects the borrower's expected utility both directly via the utility $u - R$ in case of high income and indirectly by affecting the lender's choice of the threshold $\theta^*$. The only change to the lender's program is to replace the borrower's participation constraint (2) by the requirement that

$$\int_{\theta^*}^{\overline{\theta}} U(\theta) f(\theta) d\theta \geq U_{\max}. \tag{6}$$

We have the following result.

**Proposition 2.** *If instead of satisfying the participation constraint in (2) the lender's offer must leave the borrower with the highest possible utility that is feasible (as expressed by the new participation constraint (6)), then the lender is always too conservative ($\theta^* > \theta_{SB}$).*

**Proof.** See Appendix.

Once the lender must leave the household with a sufficiently high surplus, the lender ceases to be too aggressive. In fact, under the constraint of (6), which grants the household the maximum feasible utility, the lender now becomes even too conservative.[26]

[25] One could argue that this is in the spirit of the literature on contestable markets (as in Baumol and Willig (1981)). The monopolistic lender could be seen as having to defend his (local) market in the long run.

[26] Using the results in the proof of Proposition 2, one can show more generally that if the lender's constraint is given by $\int_{\theta^*}^{\overline{\theta}} U(\theta) f(\theta) d\theta \leq U$, where $0 \leq U \leq U_{\max}$, then as $U$ increases the approval threshold $\theta^*$ that the lender applies under the optimal contract strictly increases and satisfies $\theta^* < \theta_{SB}$ for all sufficiently low $U$ and $\theta^* > \theta_{SB}$ for all sufficiently high $U$.

If we take the interpretation of a contestable market somewhat literally, a comparison of Propositions 1 and 2 reveals that the likelihood with which a given household receives credit is higher under an unconstrained monopoly. This result comes, however, with an important caveat. Our model does not contain a *standard* monopoly pricing problem. This could, for instance, arise if households were privately informed about their different consumption benefits from owning the asset. By choosing a higher $R$, an unconstrained monopolist would then exclude some households, creating less credit and a higher deadweight loss.

### 2.3 Discussion

In this section we discuss further implications of Proposition 1 as well as potential variations to some of our key assumptions. Here and in what follows, it is helpful to introduce a formal way to distinguish between households with different *ex ante* characteristics, which are known also to the household (and to potential competitors in our extension further below).

To distinguish between different households in this way, we introduce a real-valued index $\xi \in [\underline{\xi}, \overline{\xi}]$, where $\underline{\xi} < \overline{\xi}$. This index captures the distribution of the types $\theta$, which are only observed by the incumbent lender. We capture this by writing $F_\xi(\theta)$, where the respective densities $f_\xi(\theta)$ are continuous in $\xi$ for all $\theta$ and satisfy $f_\xi(\theta) > 0$ for all $\theta \in \Theta$ and $\xi \in (\underline{\xi}, \overline{\xi})$. As we said before, the index $\xi$ describes the borrower's commonly known characteristics. The index set is ordered such that higher $\xi$ are "good news" in a standard sense: $\xi$ shifts the distribution in the sense of the Monotone Likelihood Ratio Property (MLRP) such that $f_{\xi'}(\theta)/f_\xi(\theta)$ is everywhere strictly increasing in $\Theta$ in case $\xi' > \xi$. MLRP implies that the household's ex-ante probability of having high income

$$p_\xi := \int_{\underline{\theta}}^{\overline{\theta}} p(\theta) f_\xi(\theta) ds$$

is strictly increasing in $\xi$.[27]

Furthermore, to make the set of ex-ante types $\xi$ sufficiently rich we assume that for very low $\xi$ (almost) all probability mass is put on the lowest type $\theta = \underline{\theta}$, while for very high $\xi$ (almost) all

[27] What is more (and what we will use in the proof of the following Propositions), for any strictly positive interval $[\theta', \theta''] \in \Theta$ also the conditional expected probability of success $E[p(\theta) \mid \theta \in [\theta', \theta'']] = \int_{\theta'}^{\theta''} p(\theta) f_\xi(\theta)/[F(\theta'') - F(\theta')] d\theta$ is strictly increasing in $\xi$. (Though this is a standard result, we will derive it below formally in the precise form that we need for our proofs.)

probability mass is put on the highest type $\theta = \overline{\theta}$. Formally, we thus have that $p_\xi \to p(\underline{\theta}) = 0$ as $\xi \to \underline{\xi}$ and that $p_\xi \to p(\overline{\theta}) = 1$ as $\xi \to \overline{\xi}$.[28] As a last bit of notation, we define for the case where $\alpha u < \gamma$ a threshold $\widehat{\xi}$ at which, without the incumbent lender's superior information, the surplus from making a loan would just be zero. That is, we have at $\xi = \widehat{\xi}$ that[29]

$$u(\alpha + p_{\widehat{\xi}}) = (1 - p_{\widehat{\xi}})\gamma + l. \tag{7}$$

*Aggressive Lending and Households' Expected Probability of Default*

We find that the lender will be more aggressive when making a loan to a household that is less likely to default from an ex-ante perspective. This result follows naturally from the lender's monopoly power. The lower the household's expected probability of default $1 - p_\xi$, the higher the repayment that the optimal contract can stipulate while still satisfying the household's participation constraint (2). This further pushes down the lender's optimal cutoff $\theta^*$, making him willing to approve (still) lower types $\theta$.

**Proposition 3.** *In case i) of Proposition 1, where $\alpha u < \gamma$ and where the lender is too aggressive, the gap between $\theta^*$ and $\theta_{SB}$ widens the lower the household's ex-ante probability of default, i.e., the higher $\xi$. In case ii), where the lender is too conservative, the lender's cutoff $\theta^*$ is unaffected as the required repayment $R$ is always at its maximum feasible limit, $R = u + \gamma$.*

**Proof.** See Appendix.

The result in Proposition 3 is clearly quite sensitive to the assumption that the lender enjoys considerable market power. As we show in Section 3, at least borrowers with high $\xi$ will manage to obtain a lower $R$ once there is sufficient competition.

*Monopolistic Lending to "Naive" Borrowers*

So far we assumed that though being less informed than the lender, the household was sufficiently "sophisticated": The household was perfectly aware of this information gap and took this into account when deciding whether to ultimately accept or reject an approved loan

[28] This uses also that all $p(\theta)$ are finite. Besides continuity of all $f_\xi$ (and that MLRP holds), we need not make further assumptions on the nature of convergence.

[29] Existence of $\widehat{\xi}$ follows from our assumptions on the limits where $\xi \to \overline{\xi}$ and $\xi \to \underline{\xi}$ together with MLRP and continuity of all $f_\xi$, where the latter implies continuity of $p_\xi$.

offer. We ask next what happens if households are more "naive" as they are either not aware of the lender's better information or as they fail to take this into account when deciding whether to take out an approved credit.

Formally, a household whose credit was approved no longer updates its expected probability of default, as captured by (1). Instead, the household continues to use its prior probability of default, $1 - p_\xi$, when evaluating the lender's offer. Consequently, following approval the household will take up an offer $R$ whenever

$$\alpha u + p_\xi(u - R) - (1 - p_\xi)\gamma \geq 0. \tag{8}$$

For future reference, it is convenient to denote the contract that solves (8) with equality (and leaves the "naive" household with zero utility in expectation) by $R_0$.[30]

Previously, even if the lender was in equilibrium too aggressive the household could nevertheless rationally anticipate that credit was only approved for sufficiently high $\theta$ and thus sufficiently high $p(\theta)$, which in turn made the household willing to accept a higher $R$. With a naive household this is no longer the case as the household continues to evaluate the lender's offer based on its prior estimate $p_\xi$. A first consequence of this is that with a "naive" household lending may no longer take place with positive probability. Intuitively, this is the case if $\xi$ is sufficiently low. Given the associated high expected probability of default and thus high expected costs of personal bankruptcy, the household is only willing to pay a low $R$. But at this value $R = R_0$ the lender may no longer make profits even with the highest type $\theta$.[31]

This insight also extends to somewhat better borrowers, i.e., those with an intermediate $\xi$, for whom lending will be feasible, albeit the lender is then still too conservative: $\theta^* > \theta_{SB}$. The opposite case, namely that the lender is again too aggressive, arises only if $\xi$ is sufficiently high. To see this, suppose we approach the highest possible ex-ante type $\xi = \overline{\xi}$, in which case the household is (almost) sure not to default. Consequently, the lender can charge (almost) $R = R_0 \to u(1 + \alpha)$ (that is, as long as this is not above $u + \gamma$) and will subsequently choose a threshold $\theta^* > \theta_{SB}$.

[30] Note that a value $R_0$ satisfying (8) with equality always exist, though it may have to be strictly positive. In this case, however, there will be no lending in equilibrium.

[31] Formally, given $p(\overline{\theta}) = 1$ this is the case if $R_0$ does not exceed the loan size $l$.

**Proposition 4.** *Suppose that in contrast to Proposition 1 the household is "naive" and does not anticipate that the lender can generate better information. In case i) of Proposition 1, the lender is now only too aggressive ($\theta^* < \theta_{SB}$) if the household's ex-ante probability of default is sufficiently low (i.e., $\xi$ sufficiently high). At the other extreme of very low $\xi$, lending is no longer feasible. In case ii), where $\alpha u > \gamma$, the results from Proposition 1 are unchanged..*

**Proof.** See Appendix.

Interestingly, the monopolistic lender can again be too aggressive. Somewhat similar to the finding in Proposition 3, this is also more likely the lower the borrower's ex-ante probability of defaulting. What is common in the two analyzed cases, i.e., the case where the household updates its beliefs and the case where the household "naively" continues to use its prior beliefs, is that in both cases the lender can not condition the repayment on the observed (true) type $\theta$. It is this "pooling" that can make the lender too aggressive. Incidentally, while under a monopoly the outcomes with and without a "naive" household are thus quite similar, the difference will be much more pronounced if there is effective competition as in our model in Section 3.

*Adverse Selection and the Preservation of Monopoly Power*

We conclude the discussion of the monopoly model by taking a first stab at competition. The objective of the following analysis is, however, still very limited. In essence, we want to show that the adverse selection problem that less informed lenders face may be so severe that the incumbent continues to enjoy a monopoly position. From this perspective, our previous analysis may then not seem too special after all. In Section 3, we consider a somewhat different model of competition, which will allow us to get more nuanced results. There, we will also discuss in more detail our choice of how to model competition between lenders with differential information.

Consider thus the following game of competition, which is chosen to highlight the role adverse selection can play. In $t = 0$, where previously only the monopolistic lender offered a contract and screened the household, the following game takes now place. There are now three subperiods in $t = 0$. First, two or more potential entrants can compete in making offers. It is convenient to denote their lowest offer by $R_E$. Subsequently and after observing $R_E$, the incumbent can respond by making an offer $R_I$. Finally, the household can choose between the different offers, that is provided that the incumbent approved its application.

The advantage of moving second together with the information advantage allows the incumbent to still behave like a monopolist. To see this, suppose entrants offer some $R_E$ that was strictly below the incumbent's monopoly offer from Proposition 1 or Proposition 4, depending on whether the household is "naive" or not. The incumbent's optimal response is to choose the highest feasible $R_I \leq R_E$ that would still ensure that a subsequently approved household still chooses the incumbent's offer over that of the entrants. As the incumbent just expects to break even at $\theta^*$, entrants would make strictly negative profits with a household that was rejected by the incumbent. Hence, any competitive offer by entrants will either not be taken up at all or may lead to negative profits if it is acceptable to a household that is subsequently rejected by the incumbent. Summing up, we then have the following results.[32]

**Proposition 5.** *Suppose that potential entrants, who only have the same information as the household, can also make an offer, though before the incumbent chooses his offer. In this case the entrants' problem of adverse selection is so extreme that the monopolistic outcome (of Proposition 1 and Proposition 5, respectively) is still an equilibrium outcome.*

### 2.4 Borrowing Against the Household's Assets

We discussed in Section 2.1 the possibility that costs of bankruptcy could also arise as some of the household's assets must be sold below their value to the household. We now approach this issue more formally. We first assume that the level of "collateralization" can be freely chosen. One example could be a loan that is mortgaged only to a certain extent, irrespective of whether this loan is taken out to finance, say, consumption or home improvement (cf. footnote 12 above). Further below we address the case where the set of the borrower's assets that are liquidated in case of bankruptcy is *not* a contractual variable. For instance, this set may just coincide with the set of assets that are legally non-exempt.

Suppose thus that the loan contract can now also specify that in case of default the household

[32]There is a slight difference between the two cases. We can show that if the household is "naive", the monopolistic outcome is also the unique equilibrium outcome. This is, however, in general no longer the case if the household updates its beliefs after the incumbent's decision. In this case, entrants who make an offer that is somewhat below the monopoly offer can rationally expect that given the optimal response of the incumbent a rejected household prefers not to accept the entrants' offer.

loses assets of personal value $c$, which in turn have the liquidation value $c\beta$, where $\beta < 1$. For ease of exposition, we do not impose a constraint on $c$. Moreover, as we will not conduct a comparison between households with different ex-ante characteristics, it is again more convenient to drop the subscript $\xi$ in this section.

With assets of intrinsic value $c$ at stake in case of default, the household's utility is now

$$U(\theta) = \alpha u + p(\theta)[u - R] - [1 - p(\theta)]c,$$

while the lender's payoff is

$$V(\theta) = p(\theta)R + [1 - p(\theta)]\beta c - l.$$

Moreover, it is now second-best efficient to approve credit whenever

$$u[\alpha + p(\theta)] \geq [1 - p(\theta)][\gamma + c(1 - \beta)] + l,$$

which takes into account that in addition to the costs $\gamma$ the surplus $c(1 - \beta)$ is lost when liquidating the assets. We have the following results.

**Proposition 6.** *Suppose that it is possible to back a loan with some of the borrower's (otherwise exempt) assets. Moreover, this choice is continuous and represented by* $c$, *which is the household's personal value of the assets, while the liquidation value is just* $c\beta$ *with* $\beta < 1$. *Then we have the following results.*
*i) If the lender is too aggressive at* $c = 0$ *(i.e., if* $\alpha u < \gamma$*), then it is uniquely optimal to set* $c = 0$.
*ii) If the lender is too conservative at* $c = 0$ *(i.e., if* $\alpha u > \gamma$*), then the optimal contract sets* $c > 0$ *just sufficiently high to extract all consumer surplus. Given this choice* $c > 0$, *the lender's subsequent decision whether to approve credit is second-best efficient:* $\theta^* = \theta_{SB}$.

**Proof.** See Appendix.

Collateral to back the household's loan is thus only chosen if, otherwise, the lender would be too conservative. In fact, we can show that even for $\beta = 1$, i.e., if there was no (deadweight) loss from liquidating the assets, then in case i), where the lender is too aggressive, it is *strictly* optimal not to post any collateral. Intuitively, as the lender sets $c > 0$ and reduces the required repayment $R$ to still satisfy the household's participation constraint, this tends to increase the household's expected utility $U(\theta)$ at high $\theta$ but reduces it at low $\theta$. As a consequence, the lender's payoff $V(\theta)$ increases for low $\theta$, which pushes $\theta^* < \theta_{SB}$ even further down.[33]

One important upshot of Proposition 6 is that *endogenous* costs of bankruptcy, which arise from the inclusion of assets that must be liquidated below value in case of bankruptcy, are different from *exogenous* costs of bankruptcy, which we captured by $\gamma$ and which can not be avoided. As Proposition 6 shows, if it is possible to continuously adjust the amount of assets that are used as collateral, then assets will only be pledged if the lender is too conservative, not if the lender is too aggressive.

We show next that the (deadweight) loss from liquidating assets can, however, constitute part of the costs of bankruptcy even in the case where the lender is too aggressive. In this case, however, the inclusion of the respective assets must be exogenous. In other words, these assets are (already) part of the household's non-exempt assets.

**Proposition 7.** *Suppose that in contrast to the assumption in Proposition 6, there are assets of fixed value $c > 0$ that are non-exempt and that will be liquidated in case of bankruptcy. Then, the lender will be too aggressive if and only if $\alpha u < c + \gamma$.*

**Proof.** See Appendix.

## 2.5 Policy Evaluation

Our model with its novel feature that a lender may be better informed or more sophisticated than households may shed new light on some of the policy recommendations that have been discussed in the literature on consumer lending. Given space constraints, we confine ourselves to discussing only two policy options: the imposition of a cap on the loan rate and an option

[33]Note that Proposition 6 covers only the case where the household knows that the lender is better informed and consequently updates its beliefs following approval of its application. We can show that the results from Proposition 6 extend qualitatively to the case with a "naive" household. That is, unless the repayment constraint binds, $c = 0$ is still optimal. Here, the intuition is, however, slightly different. In a nutshell, as the lender only approves types $\theta \geq \theta^*$ the lender's beliefs about an approved household's probability of default are always more favorable than the "naive" household's own beliefs. The household thus attaches a strictly higher than warranted personal cost to pledging collateral.

that would allow households to waive some of their statutory rights under bankruptcy.

*"Capping" the Informed Lender's Monopoly Power*

Our results so far point to monopoly pricing as a potential culprit for too aggressive lending. A tempting policy response would then be to simply impose an upper boundary on what the lender can charge, say a boundary $\overline{R}$ on the total repayment.[34] The following proposition analyzes the implications for consumer surplus and welfare.[35]

**Proposition 8.** *Suppose we would impose on the lender a binding cap $R \leq \overline{R}$. Then consumer surplus and welfare would be affected as follows:*
*i) In case i) of Proposition 1, where the lender is too aggressive, the imposition of a cap would increase the household's expected utility and, if $\overline{R}$ is not too low, also welfare. In case ii) of Proposition 1, where the lender is too conservative, the cap reduces welfare, but has an ambiguous effect on the household's utility.*
*ii) If it is possible to choose the level of assets that back the loan and that are liquidated in case of default (as in Proposition 6), then welfare is always strictly lower if a binding cap is imposed on $R$, while the household's utility is always at zero and thus unaffected.*

**Proof.** See Appendix.

Consider first assertion i) of Proposition 8. If the lender is too aggressive under the optimal contract, then imposing a binding but not too low cap on $R$ brings the cutoff $\theta^*$ closer to the second-best cutoff $\theta_{SB}$, which increases welfare. In addition, consumer surplus is also strictly higher. This has two reasons. First, a lower $R$ directly benefits the household in case a loan is made and it did not default. Second, as $\theta^*$ is pushed upwards, the set of types $\theta$ at which the household receives a loan against its own best interest shrinks. If the lender is already too conservative, a further reduction of the maximum feasible $R$ makes the lender even more

[34]One way to impose such a constraint on lenders could be to strengthen or introduce an usury law. For instance, in the US the state of Carolina has recently modified its usury law provisions to curb predatory lending practices. Stopping short of imposing a cap on loan rates, the legislation contains a definition of "high cost home loans", on which special requirements are imposed.

[35]Proposition 8 is restricted to the case where the household is not "naive". The analysis with "naive" households generates similar results.

conservative, which reduces overall surplus. For the household, however, there is a trade-off between a lower repayment requirement and a lower likelihood of obtaining credit in the first place.

Assertion ii) points to another potential drawback of a simple policy that would only target loan rates. By requiring that more or all of the loan is secured by the borrower's (otherwise exempt) assets, a lender can find different means to extract consumer surplus, albeit ones that are less efficient than a high price.

*Waiving the Right to File for Personal Bankruptcy*

Researchers - more so than policymakers - have also frequently discussed the possibility of letting debtors waive some of their rights in case of default, in particular the right to have their debt discharged by filing for personal bankruptcy.[36] An economist's first response to this should be that by allowing for more flexibility, such a provision should enhance efficiency - unless it wasn't for some externalities that are not taken into account by only privately optimal contracts.[37] With an informed lender, the implications are as follows.

**Proposition 9.** *Suppose we allow households to waive their "rights" such that it is possible to credibly pledge all future income. Then results change as follows.*
*i) Even if the household is not "naive", it is made strictly worse off if the lender's contract requires such a waiver. Such a clause is only imposed if the lender is otherwise too conservative, though it will not fully reduce the lender's conservatism.*
*i) If the household is "naive", then both the household's utility and welfare are strictly lower if the imposition of such a clause makes the lender too aggressive, which happens if the household's ex-ante probability of default is not too high.*

**Proof.** See Appendix.

Case i) in Proposition 9 is relatively straightforward. The possibility to default "strategically" imposes a cap on $R$, which if it binds ensures that not all consumer surplus can be

[36] Though this is a common theme in the literature (see, e.g., Schwartz (1997)), we are not aware of any country where such waivers would be legally enforceable.

[37] One such externality is analyzed in Aghion and Hermalin (1990), who show that forcing privately informed borrowers to "pool" at less onerous terms in case of default can be a Pareto improvement.

extracted by the lender. If this is possible, the lender's offer will force the household to give up this option. Somewhat surprisingly, the lender will then still be too conservative, which without private information on $\theta$ would clearly not be the case. If the household is "naive", then this additional option can now make the lender too aggressive in cases where he was previously too conservative. Besides reducing consumer surplus, this can also lead to lower welfare.

# 3 Competition

This section considers a modified model of competition, in which - in contrast to the model in Section 2.3 - it is no longer the incumbent but the less informed entrants who move second. As a consequence, we will no longer encounter the extreme problem of adverse selection, which lead to the monopoly outcome (Proposition 5). Instead, it will now be the incumbent who will suffer from entrants' attempts to free-ride on the incumbent's better information by trying to poach approved borrowers.[38]

Letting either the incumbent or the entrants move first seems like an arbitrary - though for the analysis crucial - choice. The two game forms capture the two somewhat diametric problems of adverse selection and free riding. Market and organizational characteristics may give some guidance as to what problem may be more important in a given setting. For instance, if the considered type of lending is done on a face-to-face level and if the incumbent has more staff on the ground, the incumbent may be better able to react to entrants' offers than vice-versa. Finally, the extant literature on competition between differentially informed lenders has typically taken a somewhat different route than we do in this paper. Papers following the approach of Sharpe (1990) assume that a better informed lender and, typically, a single less informed lender make simultaneous offers.[39] Even in the most simple cases these models have only equilibria in mixed strategies.[40]

[38] As we make more explicit below, we will assume throughout this section that it is not possible for the incumbent or any other lender to "lock in" the household and force it to take up the loan in case of approval. We are not aware of any circumstances where such a clause would be legally enforceable. (In contrast, transactions involving consumer lending typically have to allow even for a "cooling off" period *after* contracts are signed.)

[39] For a list of references see, for instance, von Thadden (2004), who restates Sharpe's original problem.

[40] Also, the information of the better informed lender is typicall very coarse: He either observes a low signal, in which case it is better not to lend, or a high signal. In the former case, the less informed lender will suffer from

In what follows, we want to restrict consideration to the case where the repayment constraint $R \leq u + \gamma$ does not bind. Recall that only in this case too aggressive lending could arise, both with a household that correctly anticipates that the lender is better informed and with a "naive" household. A simple way to ensure that only this case arises is to set $\alpha = 0$ in what follows, which has not further qualitative implications on our results besides ensuring that we can safely ignore the repayment constraint.

### 3.1 Competition and Free-Riding

Entrants know only the household's average characteristics as captured by $p$. In addition, they do not observe whether the household's application was approved by the incumbent.[41] Note also that if a household surely accepts the entrants' offer, then entrants only break even if

$$R_E \geq R_\varnothing := \frac{l}{p_\xi}.$$

Note that in light of the subsequent analysis, it is now again helpful to distinguish between households that are different from an ex-ante perspective, as characterized by $\xi$. Before characterizing the equilibrium outcome, we show first that competition now puts sufficiently strong pressure on the incumbent so that the incumbent is no longer too aggressive. (In fact, we show in Proposition 10 that the incumbent will become too conservative.) That $\theta^* \geq \theta_{SB}$ can be easily seen by arguing to a contradiction. Suppose thus to the contrary that $\theta^* < \theta_{SB}$, in which case we know that a rejected household would *strictly* prefer not to be granted credit under the respective contract $R_I$. Hence, by only slightly undercutting the incumbent an entrant can make strictly positive profits given that his offer attracts only an approved household with type $\theta \geq \theta^*$.[42]

the "winner's curse" if his randomly chosen) loan rate ends up being below that of the better informed lender.

[41]If entrants could fully trace the "history" of a potential borrower, i.e., whether he already applied to the better informed lender and whether he was rejected or not, then even the game where entrants could not observe $R_I$ would have an equilibrium in pure strategies. This is exploited in the competitive model of Inderst and Müller (forthcoming), where consequently neither the free-riding problem nor the (extreme) adverse-selection problem arise. In the present context of consumer finance, we think that the assumption that lenders can perfectly trace a borrower's history of credit applications (and rejections) is too stark.

[42]It is important to note that entrants can *not* directly observe whether the incumbent approved the household's credit or not.

**Proposition 10.** *If there is competition and if the incumbent lender moves first, then in any equilibrium in which the incumbent makes a loan with positive probabilty the incumbent must be too conservative:* $\theta^* > \theta_{SB}$.

**Proof.** See Appendix.

To fully characterize the equilibrium, we must distinguish between the following different cases that can arise.

*Case I:* In this case, the free riding problem is extreme and there will be no lending in equilibrium. Precisely, for any offer $R_I$ that would be attractive to the household, entrants can always make a marginally better offer that lures away (only !) an approved household.

*Case II:* In this case, the incumbent can make a defensive offer that ensures that entrants can not free ride by poaching an approved household. The incumbent's offer is now chosen such that any lower offer $R_E < R_I$ would not allow entrants to break even as also a rejected household would take up the offer. The optimal defensive offer is uniquely determined and denoted by $R_D$. (We relate a formal definition to the proof of Proposition 11.)

*Case III.* In this case, the incumbent's offer is determined by the constraint that entrants are willing to offer a repayment requirement as low as $R_\varnothing$ if this attracts a household irrespective of whether its credit was approved by the incumbent. Consequently, the incumbent offers just $R_I = R_\varnothing$.

We find that Case III has two subcases. In the first subcase, to which we refer to as Case IIIa, only the incumbent will make a loan in equilibrium - just as in the previous Case II. In Case IIIb, entrants offer a contract that *only* attracts a rejected household. Consequently, in Case IIIb a household will borrow with probability one - either from the incumbent (and at a lower rate) or from the entrants (and at a higher rate).

When do the different cases apply? As the household's ex-ante probability of default decreases, i.e., as $\xi$ increases, we gradually move from Case I to Case II and finally to Case III. This is intuitive. To see this, take first the two extreme cases: Case I and Case IIIb.

If the household's ex-ante expected probability default is high, a rejected household will be quite pessimistic about its probability of default. (Recall that the household is not “naive” and thus learns from the rejection decision of the better informed lender.) This makes it easy for entrants to undercut the incumbent while still ensuring that only an approved household takes up their offer. This extreme form of free-riding (or poaching) makes it impossible for the incumbent to lend in Case I. At the other extreme is Case IIIb, where the household has a low expected probability of default. Even a rejected borrower has now a sufficiently low expected probability of default to make an offer financially viable for entrants, though the required repayment will be higher than in the incumbent's offer: $R_E > R_I = R_\varnothing$. In the intermediate cases, that is in Case II and in Case IIIa, only households whose application was approved by the incumbent receive credit. The household's expected profitability of default is neither sufficiently high to give rise to the aforementioned extreme form of free-riding nor sufficiently low to make it feasible for entrants to only target a rejected household.

**Proposition 11.** *Suppose there is competition and that the incumbent lender moves first. Then as $\xi$ increases, thus making it less likely that the household will default, we move successively from Case I to Case IIIb. Formally, there exist three cutoffs $\xi'$, $\xi''$,* and *$\xi'''$ satisfying*

$$\underline{\xi} < \xi' < \widehat{\xi} < \xi'' < \xi''' < \overline{\xi}$$

*such that Case I applies for $\xi \in (\underline{\xi}, \xi')$, Case II applies for $\xi \in (\xi', \xi'')$, Case IIIa applies for $\xi \in (\xi'', \xi''')$, and Case IIIb applies for $\xi \in (\xi''', \overline{\xi})$.*[43]

**Proof.** See Appendix.

Proposition 11 has immediate implications for the availability of credit. Before deriving these implications, it should be recalled that as we shift $\xi$ it is more likely that high types $\theta$ are realized, while a given type $\theta$ has still the same conditional probability of non-defaulting, $p(\theta)$. Consequently, also the second-best cutoff type $\theta_{SB}$ does not change, though as $\xi$ increases it becomes increasingly more likely that the household's true type $\theta$ lies above it.

**Corollary 4.** *Suppose there is competition and that the incumbent lender moves first. As $\xi$ increases, thus making it less likely that the household will default, the household is first unable*

[43]Note that we exclude the boundary cases where $\xi = \underline{\xi}$ and $\xi = \overline{\xi}$, which have degenerate probability distributions. Also, in case $\xi$ takes on the value of one of the three thresholds there exist multiple equilibria.

*to obtain a loan even from the incumbent due to the extreme free-rider problem ($\xi < \xi'$). For somewhat higher $\xi$ only sufficiently promising types $\theta \geq \theta^*$ obtain a loan from the incumbent ($\xi' < \xi < \xi'''$), while finally also a household that was rejected by the incumbent obtains credit from the entrants ($\xi > \xi'''$). The incumbent's cutoff $\theta^*$ is always above $\theta_{SB}$, while it is strictly decreasing over $\xi < \xi''$ and strictly increasing over $\xi > \xi''$.*

**Proof.** See Appendix.

The first part of Corollary 4 concerning the different regimes (Cases I, II, and III) follows immediately from Proposition 11. As we show in the proof of Corollary 4, the different implications for $\theta^*$ in Case II and Case III arise from the difference in the incumbent's offer: in Case II the incumbent chooses $R_N$ as a defence against free-riding, while in Case III the incumbent chooses $R_\varnothing$.

Note finally that in Case IIIb, where a household always receives a loan either from the incumbent or the entrant, the informed lender no longer performs a socially valuable screening function. The only use of its better information is to allow him to extract strictly positive profits from the market, which reduces a household's ex-ante utility (i.e., the average utility of a household over all types $\theta$). As is easy to show, a household with a higher $\theta$ will gain from the presence of the better informed lender, though a household with a lower $\theta$ loses.

### 3.2 Competition when the Household is "Naive"

We suppose now once more that the household (naively) fails to acknowledge the lender's better information. Our first insight is that this shields the incumbent lender from free riding. Any offer by the entrants that is more attractive to an approved household will also attract the rejected household. To see this, just recall that a naive household does not update its beliefs about the probability of having high income, neither after approval nor after rejection. Consequently, the only constraint that entrants now impose on the incumbent is that the incumbent must not choose $R_I$ above $R_\varnothing$, provided of course that entrants can break even with $R_\varnothing$ as the household's ex-ante probability of default is sufficiently low ($\xi > \widehat{\xi}$). In case the household's ex-ante probability of default is higher as $\xi < \widehat{\xi}$, the incumbent can still act like a monopolist if the household is "naive".

If the borrower's ex-ante probability of default is sufficiently low, also a household that was rejected by the incumbent can obtain credit, which mirrors Case IIIb in Proposition 11. Importantly, entrants may now, however, grant a naive household credit even if this is against the household's best interest.

**Proposition 12.** *Suppose there is competition and that the incumbent lender moves first. With a "naive" household we have the following results. Whenever it would not be efficient to grant credit without the incumbents's additional information ($\xi < \widehat{\xi}$), the equilibrium is the same as under monopoly (Proposition 5). For all higher $\xi > \widehat{\xi}$ the incumbent's offer is constrained by competition and the incumbent lender offers $R_I = R_\varnothing$. Entrants subsequently only make an offer $R_E > R_I$ for all sufficiently high $\xi > \widetilde{\xi}'$, where $\xi < \widetilde{\xi}' < \overline{\xi}$. For a lower subset of this range the entrants' offer is now too aggressive: Given the information contained in the incumbent's rejection, a rejected household would better not accept credit from the entrants.*

**Proof.** See Appendix.

It should be noted that entrants are perfectly sophisticated and know the true (conditional) default probability of a household that was rejected by the incumbent. Hence, calling their lending behavior too aggressive for a subset of values $\xi$ is perfectly in line with our previous definition: Given the lenders' estimate of the probability with which a household that was rejected by the incumbent will default, the household is made strictly worse off by taking out the loan. Note finally that as entrants just break even at $R_E$, this also implies that in these cases total surplus would be higher if entrants did not grant a loan to a household that was rejected by the incumbent.

# 4 Conclusion

This paper identifies two instances in which lending can be too aggressive: one as the outcome of a monopoly problem and one as the outcome of competition for "naive" households.

In case of a monopoly - or likewise if adverse selection allows the incumbent to essentially preserve a monopoly - too aggressive lending can arise even if households perfectly anticipate that the lender is better informed. Too aggressive lending then arises from the lender's attempt to extract all consumer surplus. Efficient lending or even too conservative lending arise only if extracting the total consumer surplus is not feasible as the borrower's threat of strategic default puts a boundary on the maximum repayment that the lender can demand. If the household is naive and does not anticipate the lender's better information, too aggressive lending may also arise, albeit only with households that have a sufficiently high (ex-ante) probabilty of non-defaulting.

If there is effective competition, the incumbent will no longer be too aggressive. The threat of losing an approved household to entrants' competing offers sufficiently constrains the incumbent's offer and makes it subsequently optimal to approve credit only for households with a sufficiently low probability of defaulting. Entrants may now be active and may lend - albeit at more onerous terms - to those households that were rejected by the incumbent. If households are "naive" and do not learn from the incumbent's rejection decision, then it may now be entrants who lend too aggressively.

As discussed in the Introduction, that lending may be too aggressive (or predatory or irresponsible) is an assertion that is part of the ongoing policy debate about whether households are currently served well by the lending industry. The main contribution of our paper to this debate is the following. We show that such a phenomenon can be perfectly rationalized in a simple model that does not invoke systematic errors that are made by households. Further reaching policy implications are, however, harder to come by for the following reasons.

Taking the information gap between lenders and the household as given, our analysis shows that if households are aware of this information gap then too aggressive lending will disappear under competition. This need, however, not be welfare improving. First, we showed that competition can give rise to too conservative lending. Second, we showed that the possibility of free-riding on the incumbent may even eradicate the potential for more informed lending.

On the other hand, our analysis draws attention to a source of inefficiency in the lending process that policy makers may want to address: the information gap between lenders and the household. If households have more accurate estimates about their likelihood of defaulting on a given loan, i.e., in our model if they know their types $\theta$, then both consumer surplus and total welfare would be higher.

Our model has been conceivably simple. The main justification for this was to focus on the novel feature: the information gap between the (incumbent) lender and the household. There are many obvious ways in which one may want to extend the analysis, including the introduction of risk aversion and an extension to more than two periods. There is, however, one less obvious but - at least in our view - potentially more important shortcoming of our analysis. In our model, the lending decision is made so as to maximize the lender's profits. In reality, both the creditor and the debtor are to some extent at the "mercy" of a third agent such as a broker, whose interests may diverge quite substantially even from that of the lending institution. In fact, cases of too aggressive lending seem to be more often than not associated with (asserted) misbehavior of more or less independently acting agents employed by the ultimate lenders.[44] In future research it seems key to incorporate opportunistic behavior of such agents.

# 5 Appendix

**Proof of Proposition 1.** It is first convenient to fully restate the lender's program. The lender chooses the repayment level $R$ to maximize his expected payoff $V$ subject to (i) the borrower's participation constraint (2), where the threshold $\theta^*$ is chosen (ex-post) optimally by the lender such that $V(\theta^*) = 0$, and subject to (ii) the constraint that $R \leq \min\{u+\gamma, \overline{y}\}$. As noted in the main text, we will always assume that $\overline{y}$ is sufficiently high such that the constraint $R \leq \overline{y}$ will not bind. (Formally, this is the case whenever $\overline{y} > u + \gamma$.)

Suppose first that $\alpha u < \gamma$, which by the argument in the main text implies that $u - R > -\gamma$ as otherwise (2) would not be satisfied. We show next that (2) binds at an optimum. To see this, note first that by continuity of $p(\theta)$ also $U(\theta)$ and $V(\theta)$ are continuous in $\theta$. This also implies that $\theta^*$, which is defined by $V(\theta^*) = 0$, is continuous in $R$ such that finally also the borrower's expected utility $E[U(\theta) \mid \theta \geq \theta^*]$ is continuous in $R$. As the lender's payoff $V$ is strictly increasing in $R$, it is thus uniquely optimal for the lender to choose the highest possible $R$ such that $E[U(\theta) \mid \theta \geq \theta^*] = 0$ is satisfied with equality. (Note that $E[U(\theta) \mid \theta \geq \theta^*]$ need not be monotonic in $R$ over the relevant range of $R$.) That $U(\theta^*) < 0$ and $\theta^* < \theta_{SB}$ follows then again from the arguments in the main text.

Suppose next that $\alpha u \geq \gamma$. In this case, the unique optimal contract for the lender is to extract as much as possible in $t = 1$ by setting $R = u + \gamma$. As is easily checked, this implies that

[44] See, for instance, the introductory examples in Renuart (2004) for the US.

(2) then holds with equality in case $\alpha u = \gamma$, while (2) is slack in case $\alpha u > \gamma$ holds strictly. In case of $\alpha u = \gamma$, we have that $U(\theta) = 0$ for all $\theta \in \Theta$ and thus, in particular, at $\theta = \theta_{SB}$, implying that $V(\theta_{SB}) = 0$ and thus $\theta^* = \theta_{SB}$. In case of $\alpha u > \gamma$, we have that $U(\theta) = \alpha u - \gamma > 0$ for all $\theta \in \Theta$ and thus, in particular, at $\theta = \theta_{SB}$, implying that $V(\theta_{SB}) < 0$ and thus by strict monotonicity and continuity of $V(\theta)$ that $\theta^* > \theta_{SB}$. **Q.E.D.**

**Proof of Corollary 1.** Take first assertion i). Given that $V(\theta^*) = 0$ and that $V(\theta)$ is strictly increasing, we have at $\theta_{SB} > \theta^*$ that $V(\theta_{SB}) > 0$. As the total surplus from making a loan to a type $\theta = \theta_{SB}$ is by definition zero, we thus have that $U(\theta_{SB}) = 0$. Recall next that from $\alpha u < \gamma$ it also holds that $U(\theta)$ is strictly increasing, while clearly $U(\overline{\theta}) > 0$. Together with continuity of $U(\theta)$ this implies the existence of the asserted threshold $\theta_{SB} < \theta' < \overline{\theta}$ such that $U(\theta') = 0$ while $U(\theta) > 0$ for all $\theta > \theta'$ and $U(\theta) < 0$ for all $\theta < \theta'$. Assertion ii) follows next immediately from Proposition 1, where we showed that in this case it holds that $U(\theta) = \alpha u - \gamma > 0$ for all $\theta \in \Theta$. **Q.E.D.**

**Proof of Corollary 2.** Consider first assertion i). Clearly, as the constraint $R \leq u + \gamma$ was previously not binding in case $\alpha u < \gamma$, for which we obtained $\theta^* < \theta_{SB}$, relaxing this constraint does not change the equilibrium outcome. In case $\alpha u > \gamma$, where the repayment constraint was previously binding, it is now optimal for the lender to increase $R$ until the household's participation constraint (2) binds. Given that this implies now that $R > u + \gamma$, we have in this case that $U(\theta)$ is strictly decreasing. It then must hold that $U(\theta^*) > 0$, which together with $V(\theta^*) = 0$ implies again that $\theta^* > \theta_{SB}$.

For assertion ii) note first that the repayment constraint now becomes $R \leq \gamma$, while we have that $U(\theta) = u(1 + \alpha) - p(\theta)R - [1 - p(\theta)]\gamma$. If $u(1 + \alpha) > \gamma$ then the repayment constraint now binds and we have that $\theta^* > \theta_{SB}$, while from the arguments in Proposition 1 we have that $\theta^* = \theta_{SB}$ if $u(1 + \alpha) = \gamma$ and $\theta^* < \theta_{SB}$ if $u(1 + \alpha) < \gamma$. **Q.E.D.**

**Proof of Proposition 2.** To show that the lender is now always too conservative we can clearly restrict consideration to the case where $\alpha u < \gamma$. By the same argument as in the first case of Proposition 1, the household's participation constraint binds. The lender will then optimally choose the highest possible $R$ such that $\int_{\theta^*}^{\overline{\theta}} U(\theta) f(\theta) d\theta = U_{\max}$ holds with equality. It remains to show that at this value of $R$ it holds that $\theta^* > \theta_{SB}$.

To see this, recall that $\theta^*$ is strictly decreasing and continuous in $R$. As long as $\theta^* < \theta_{SB}$, we also have that $\int_{\theta^*}^{\overline{\theta}} U(\theta)f(\theta)d\theta$ is strictly decreasing in $R$, which follows as $U(\theta)$ is strictly decreasing in $R$ for all $\theta \in \Theta$ and as $U(\theta) < 0$ holds for all $\theta$ sufficiently close to $\theta^*$. It thus remains to show that a further (marginal) decrease of $R$ at $\theta^* = \theta_{SB}$ is also optimal. This follows immediately from the envelope theorem. Formally, we have at $\theta^* = \theta_{SB}$ that[45]

$$\frac{d}{dR}\left[\int_{\theta^*}^{\overline{\theta}} U(\theta)f(\theta)d\theta\right] = -\int_{\theta^*}^{\overline{\theta}} p(\theta)f(\theta)d\theta - U(\theta_{SB})\frac{d\theta^*}{dR},$$

where we can substitute $U(\theta_{SB}) = 0$. **Q.E.D**

**Proof of Proposition 3.** Note first that a change of $\xi$ has no impact on the contract in case ii), where the repayment constraint binds. For case i), where the optimal $R$ is determined by the binding participation constraint (2) instead, recall that $U(\theta)$ is strictly increasing. Consequently, for given $R$ and thus given $\theta^*$ the household's expected utility is thus strictly increasing in $\xi$. (Formally, this follows from Strict First-Order Stochastic Dominance, which is implied by MLRP.) Using continuity of the household's utility (see the proof of Proposition 2), this allows the lender to strictly increase $R$, which pushes down $\theta^*$. The claim then follows as $\theta_{SB}$ does not depend on $\xi$. **Q.E.D.**

**Proof of Proposition 4.** We take first the case i) of Proposition 1, where $\alpha u < \gamma$. Moreover, suppose first that $\xi = \widehat{\xi}$. In this case, we have that $R_0 = R_\varnothing$ as well as $p(\theta^*(R_0)) = p_\xi$ and $p_\xi = p(\theta_{SB})$, which together imply that $\theta^*(R_0) = \theta_{SB}$. As $\xi$ increases, $R_0$ increases such that $\theta^*(R_0) < \theta_{SB}$, while the opposite holds as $\xi$ decreases. Also, at $\xi = \widehat{\xi}$ it clearly holds that $p(\overline{\theta})R_0 > 0$. Hence, we have shown that for all sufficiently high $\xi$ lending is feasible and it is strictly too aggressive (too conservative) whenever $\xi > \widehat{\xi}$ ($\xi < \widehat{\xi}$). Note next that as $\xi \to \underline{\xi}$ and thus $p_\xi \to p(\underline{\theta}) = 0$, we clearly have that $p(\overline{\theta})R_0 < 1$ for all sufficiently low $\xi$. This together with the previous results implies the existence of the asserted threshold $\underline{\xi} < \xi' < \widehat{\xi}$. Finally, for case ii) in Proposition 1, where $\alpha u > \gamma$, note that the optimal contract is still $R = \alpha u + \gamma$ and does thus not depend on whether the borrower is "naive" or not. **Q.E.D.**

**Proof of Proposition 6.** Take first assertion i). In light of the further assertions made in the main text, we choose to prove the following somewhat stronger claim.

[45] We can substitute $d\theta^*/dR < 0$ from implicitly differentiating the definition of $\theta^*$, from which it holds that $p(\theta^*)R - l = 0$.

**Claim 1.** *Suppose that $\alpha u < \gamma$. Then even for $\beta = 1$ the unique optimal contract prescribes $c = 0$.*

**Proof.** As argued in the main text, the claim holds intuitively as a rise in $c$ together with a lower $R$ makes the borrower's expected utility $U(\theta)$ less steep, increasing $V(\theta)$ for low $\theta$ and thus pushing $\theta^*$ still further down. To see this formally, it is convenient to introduce only for the purpose of this claim the following additional notation. We denote the cutoff depending on an offer $(R, c)$ by $\theta^*(R, c)$. The respective payoffs are denoted by $U(\theta, R, c)$ and $V(\theta, R, c)$, respectively. Finally, the expected surplus for given $\theta$ is $\mu(\theta) := p(\theta)u - [1 - p(\theta)]\gamma$. Using that $V(\theta^*(R, c), R, c) = 0$, for given $(R, c)$ the participation constraint (2) then binds whenever

$$\int_{\theta^*(R,c)}^{\overline{\theta}} \mu(\theta)f(\theta)d\theta = (R - c)\int_{\theta^*(R,c)}^{\overline{\theta}} p'(\theta)f(\theta)d\theta. \tag{9}$$

Compare now some $(R, c)$ with $c = 0$ and another contract $(R', c')$ with $c' > 0$ and $R' < R$, where both times (9) is satisfied with equality. That $\theta^*(R', c') < \theta^*(R, c)$ follows then from $R - c > R' - c'$ and (9), together with $\mu(\theta) < 0$ for all $\theta < \theta_{SB}$ and the fact that $\theta^*(R, c) < \theta_{SB}$, which in turn follows from Proposition 1 and as we have by assumption that $\alpha u < \gamma$. **Q.E.D.**

Consider next the case $\alpha u > \gamma$, for which we have from Proposition 1 that with $c = 0$ the household realizes $U(\theta) = \alpha u - \gamma > 0$ for all $\theta$. Recall that the lender's expected payoff is strictly increasing in $R$. Consequently, it is optimal for the lender to always increase $R$ as far as possible, that is until either (2) or $R \leq u + \gamma + c$ becomes binding. The highest feasible value of $c$ together with the corresponding choice $R = u + \gamma + c$ makes (2) just binding, which is the case at $c = \alpha u + \gamma$. Note that for this choice of $c$ and $R$ we then have $U(\theta) = 0$ for all $\theta \in \Theta$ and thus $\theta^* = \theta_{SB}$, where $\theta_{SB}$ depends on $c$ according to the equation $p(\theta_{SB})u(1 + \alpha) = [1 - p(\theta_{SB})][\gamma + c(1 - \beta)]$. **Q.E.D.**

**Proof of Proposition 7.** The assertion follows immediately from applying the arguments in Proposition 1 and after noting that the repayment constraint is now $R \leq u + \gamma + c$ and that the second-best cutoff is now determined by the requirement that $p(\theta_{SB})u(1+\alpha) = [1-p(\theta_{SB})][\gamma + c(1 - \beta)]$. **Q.E.D.**

**Proof of Proposition 8.** For assertion i), we consider the case where by $\alpha u < \gamma$ the lender would be too aggressive under his optimal choice of $R$. Recall also that in this case the participation constraint (2) is satisfied with equality, implying that the household's expected utility is just zero. We consider now a marginal reduction in $R$, which by the arguments in Proposition 1 leads to a marginal increase in $\theta^*$. Given that $\theta^* < \theta_{SB}$ holds under the (uncapped) monopoly offer, this strictly increases total surplus. To see that also the household's utility strictly increases, note that $U(\theta)$ is strictly decreasing in $R$ for all $\theta \in \Theta$ and that $U(\theta) < 0$ holds for all $\theta$ sufficiently close to $\theta^* < \theta_{SB}$.

Note next that for $\alpha u > \gamma$ the lender is too conservative when offering $R = u + \gamma$. A further reduction in $R$ leads to a further increase in $\theta^*$ and thus reduces total surplus. To determine how a marginal reduction in $R$ affects the household, note first that we are interested in a change of the household's expected (ex-ante) utility: $\int_{\theta^*}^{\overline{\theta}} U(\theta) f(\theta) d\theta$. Differentiating w.r.t. $R$, we obtain

$$-\int_{\theta^*}^{\overline{\theta}} p(\theta) \frac{f(\theta)}{1 - F(\theta^*)} d\theta - U(\theta_{SB}) \frac{d\theta^*}{dR}, \tag{10}$$

where after implicit differentiation of $p(\theta^*)R - l = 0$ we can substitute $d\theta^*/dR < 0$. The derivative (10) reveals that the impact is in general ambiguous.

We turn next to assertion ii). By the arguments in Proposition 7, the lender chooses $c > 0$ until (2) binds, implying that the household's expected utility is always zero. This together with the fact that the imposed constraint makes the lender strictly worse off then immediately implies that total surplus must be strictly lower. **Q.E.D.**

**Proof of Proposition 9.** Recall that it is the lender who can choose the contract subject to the household's participation constraint (2) and, if applicable, the repayment constraint $R \leq u + \gamma$. Clearly, if the repayment constraint was not binding previously (i.e., if $\alpha u \leq \gamma$), then there is no need to impose the additional clause under which the household would "waive its rights". We can thus focus on the case where $\alpha u > \gamma$.

In assertion i), where the household is not "naive" and where the lender was previously too conservative, the results follow immediately from the arguments in Corollary 2. With a "naive" household (assertion ii), it is again strictly optimal for the lender to impose the additional clause. Given that we can thus ignore the constraint $R \leq u + \gamma$, we can apply the arguments from Proposition 4, from which it follows that the lender now offers $R = R_0$ and that he is always too aggressive. Note also that the difference $\theta^* - \theta_{SB}$ is strictly increasing in $\xi$. Hence, if the distortion under the binding constraint $R \leq u + \gamma$ was sufficiently small, which is the case if $\alpha u - \gamma$ is sufficiently small, then for all high enough $\xi$ total surplus is lower if the lender can impose such a clause.[46] Turning to the household, there are two possible criteria to evaluate the household's expected utility. We could first take the household's own perspective in $t = 0$ by calculating its expected utility without taking into account the lender's better information. Clearly, a higher $R$ then makes the household strictly worse off. Another criterion would take into account the lender's information by calculating $\int_{\theta^*}^{\overline{\theta}} U(\theta)f(\theta)d\theta$. As in the case of total surplus, a sufficient condition for this to strictly decrease is that $\alpha u - \gamma$ is sufficiently small and $\xi$ sufficiently high. **Q.E.D.**

**Proof of Proposition 10.** In this proof - as well as in some of the following proofs - it may sometimes be helpful to make the dependency of the lender's cutoff on the loan contract explicit by writing $\theta^*(R)$. In addition, it is sometimes useful to denote the household' expected utility by $U(\theta, R)$. To complete the proof of Proposition 10, we have to fully specify the equilibrium that is played in the continuation game following an offer $R_I$ by the incumbent lender such that $\theta^*(R_I) \leq \theta_{SB}$. To characterize the entrants' (competitive) response, we introduce the following additional notation. If only a household whose credit was also approved by the incumbent accepts the entrants' offer, then entrants would break even as long as $R_E \geq R'$ with $R' = l/E[p(\theta) \mid \theta \geq \theta^*(R_I)]$. Note that by the strict monotonicity of $p(\theta)$ we have that $R' < R_I$ and also that $R' < R_\varnothing$.

Consider next a household whose application was rejected by the incumbent. The household's posterior belief about its likelihood of having high income in $t = 1$ is then given by $\int_{\underline{\theta}}^{\theta^*(R_I)} p(\theta)\frac{f(\theta)}{F(\theta^*(R_I))}d\theta$. Consequently, the rejected household will not (strictly) prefer to take up the entrants' offer $R_E$ as long as $R_E \geq R''$ where $R''$ uniquely solves[47]

$$\int_{\underline{s}}^{\theta^*(R_I)} U(\theta, R'')\frac{f(\theta)}{F(\theta^*(R_I))}d\theta = 0. \tag{11}$$

Given $\theta^*(R_I) \leq \theta_{SB}$, which holds by assumption, we have that $R'' < R_I$. Note that if entrants only want to attract a household that was approved by the incumbent, then they must not offer a repayment requirement that is lower than $R''$.

Given these constructions, we can now characterize the entrants' equilibrium response. We have to distinguish between three cases. In the first case, the entrants' unique optimal offer is

[46] More formally, we also invoke here that $f_\xi(\theta) > 0$ for all $\theta$ and $\xi$.

[47] Using continuity of $U(s, R'')$ and strict monotonicity in $R''$, existence of $R''$ is immediate. Note, however, that $R''$ as defined in (11) need not necessarily be positive.

$R_E = \max\{R', R''\}$ and they only attract an approved household. This case applies whenever $R'' \leq R_\varnothing$.[48] In the second case where $R'' > R_\varnothing$, entrants offer $R_E = R_\varnothing$ and attract the household irrespective of the incumbent's decision. Finally, if $R'' = R_\varnothing$ then entrants offer $R_E = R'' = R_\varnothing$ and we have multiple equilibria in which a rejected household turns to entrants with some probability between zero and one. **Q.E.D.**

**Proof of Proposition 11.** Note first that by offering $R_E = R_I - \varepsilon$ entrants can always attract an approved household. An offer $R_E$ will in turn not be strictly preferred by a rejected household if

$$\int_{\underline{\theta}}^{\theta^*(R_I)} U(\theta, R_E) \frac{f_\xi(\theta)}{F_\xi(\theta^*(R_I))} d\theta \leq 0. \tag{12}$$

Taken together, it is thus not possible for entrants to make an offer that is strictly preferred by an approved but not so by a rejected household if and only if the incumbent's offer satisfies

$$\int_{\underline{\theta}}^{\theta^*(R_I)} U(\theta, R_I) \frac{f_\xi(\theta)}{F_\xi(\theta^*(R_I))} d\theta \leq 0. \tag{13}$$

We argue first that the left-hand side of (13) is strictly decreasing $R_I$. To see this, note that a lower $R_I$ strictly reduces $U(\theta, R_I)$ for all $\theta \geq \theta^*(R_I)$. Moreover, as a lower $R_I$ also reduces $\theta^*(R_I)$, the assertion follows as the conditional probability of non-defaulting, $\int_{\underline{\theta}}^{\theta^*(R_I)} p(\theta) \frac{f_\xi(\theta)}{F_\xi(\theta^*(R_I))} d\theta$, is strictly increasing in $\theta^*(R_I)$. Moreover, from $p(\underline{\theta}) = 0$ the left-hand side of (13) is surely strictly negative for all $\theta^*$ sufficiently close to $\underline{\theta}$ (and thus for all sufficiently high $R_I$).

There are now two cases to distinguish. In the first case, the left-hand side of (13) is strictly positive at $R_I = l/p(\overline{\theta})$, i.e., it holds that

$$p_\xi \left( u - \frac{l}{p(\overline{\theta})} \right) - (1 -_\xi) \gamma > 0, \tag{14}$$

where we substituted that $p_\xi = \int_{\underline{\theta}}^{\theta^*(R_I)} p(\theta) \frac{f_\xi(\theta)}{F_\xi(\theta^*(R_I))} d\theta$ in case $\theta^*(R_I) = \overline{\theta}$. In this case, there exists a unique value of $R_I$ at which the left-hand side of (13) is just equal to zero. We denote this value as $R_I = R_N$, which thus solves

$$\int_{\underline{\theta}}^{\theta^*(R_N)} U(\theta, R_N) \frac{f_\xi(\theta)}{F_\xi(\theta^*(R_N))} d\theta = 0 \tag{15}$$

[48] Incidentally, if it also holds that $R_E = R'' > R'$, then entrants make strictly positive profits with the average borrower.

with $\underline{\theta} < \theta^*(R_N) < \overline{\theta}$. In the second, case, (14) does not hold and there does not exist an offer $R_I$ satisfying (13) such that $\theta^*(R_I) < \overline{\theta}$. From these results we thus have the following first claim.

**Claim 1.** *If* (14) *does not hold, it is not possible for the incumbent to make an offer $R_I$ that, given the entrants' optimal response, ensures that an approved household stays with the incumbent. If (14) holds, then $R_I = R_N$ is the highest possible offer that will ensure that entrants can not make a counteroffer that is only attractive for an approved household.*

Note next that from the argument in Proposition 10 we have immediately that in case (14) holds it also holds that $\theta^*(R_N) > \theta_{SB}$. We ask now when (14) holds.

**Claim 2.** *There exists a threshold $\underline{\xi} < \xi' < \widehat{\xi}$ such that (14) holds if and only if $\xi > \xi'$.*

**Proof.** Recall first that $p_\xi$ is strictly increasing in $\xi$. Moreover, as $p_\xi \to p(\underline{\theta}) = 0$ for $\xi \to \underline{\xi}$, we thus have that the converse of (14) holds strictly for all sufficiently low $\xi$. Moreover, by definition of $\widehat{\xi}$ and as $p_{\widehat{\xi}} < p(\overline{\theta})$ we have that (14) holds at $\xi = \widehat{\xi}$. As the left-hand side of (14) is also continuous in $\xi$ (by continuity of $p_\xi$), we thus have a unique value $\underline{\xi} < \xi' < \widehat{\xi}$ at which (14) holds with equality, while it holds strictly for all $\xi > \xi'$ and the converse holds strictly for all $\xi < \xi'$. **Q.E.D.**

For all $\xi$ satisfying (14), we next compare $R_N$ with $R_\varnothing = l/p_\xi$.

**Claim 3.** *There exists a threshold $\widehat{\xi} < \xi'' < \overline{\xi}$ such that $R_N = R_\varnothing$ holds at $\xi = \xi''$, while $R_N < R_\varnothing$ holds over $\xi' < \xi < \xi''$ and $R_N > R_\varnothing$ holds over $\xi > \xi''$.*

**Proof.** Note first that $R_N = R_\varnothing$ holds if and only of $p(\theta^*(R_N)) = p_\xi$, while $R_N < R_\varnothing$ ($R_N > R_\varnothing$) holds if and only if $p(\theta^*(R_N)) > p_\xi$ ($p(\theta^*(R_N)) < p_\xi$). By definition of $\xi$ we have that $R_\varnothing$ is strictly decreasing in $\xi$ (and continuous by continuity of $p_\xi$). We argue next that $R_N$ is strictly increasing in $\xi$. To see this, note first that for some fixed $R_I$ and thus fixed $\theta^*(R_I)$ we have that

$$\int_{\underline{\theta}}^{\theta^*(R_I)} U(\theta, R_I) \frac{f_\xi(\theta)}{F_\xi(\theta^*(R_I))} d\theta \tag{16}$$

is strictly increasing in $\xi$. This follows from MLRP of $F_\xi$ and as $U(\theta, R_I)$ is strictly increasing in $\theta$.[49] Given that the left-hand side of (13) is strictly decreasing $R_I$ (holding this time $\xi$ fixed),

[49]Precisely, partial differentiation of (16) shows that a sufficient condition for this to hold is that $f_\xi(\theta)/F_\xi(\theta)$ is

we thus have that a higher $\xi$ leads to a higher $R_N$. That $R_N$ is also continuous in $\xi$ follows next from continuity of all $f_\xi(\theta)$.

Hence, to conclude the proof of Claim 3 it remains to show that $p(\theta^*(R_N)) > p_\xi$ holds for all $\xi$ close to $\widehat{\xi}$ while $p(\theta^*(R_N)) < p_\xi$ holds for all $\xi$ close to $\overline{\xi}$. This follows as by definition of $R_N$ we have for $\xi \to \widehat{\xi}$ that $\theta^*(R_N) \to \overline{\theta}$, while for $\xi \to \overline{\xi}$ we have $p_\xi \to p(\overline{\theta}) > p(\theta^*(R_N))$. **Q.E.D.**

From Claim 3 we thus have that for all $\xi' < \xi < \xi''$ the unique equilibrium offer of the incumbent is $R_I = R_N$. Given that $R_N < R_\varnothing$ holds in this case, it is also immediate that entrants can also not profitably target only the rejected household.

To complete the proof of Proposition 11, it thus remains to treat the case where $\xi > \xi''$. There, the incumbent can no longer charge $R_N$ and make strictly positive profits. In this case, entrants could counter with an offer $R_E = R_\varnothing - \varepsilon$, which would attract all households and, given that $\xi'' > \widehat{\xi}$, would allow entrants to break even. Hence, for all $\xi > \xi''$ the incumbent's offer can not be higher than $R_\varnothing$. Given that $R_\varnothing < R_N$ it is in this case also not possible for entrants to only poach the approved household, implying that the unique equilibrium offer for the incumbent is now $R_I = R_\varnothing$. For the entrants' offer there are now two subcases to distinguish (namely, Cases IIIa and IIIb). If it is feasible for entrants to make an acceptable offer to a rejected household, then competition ensures that this offer satisfies

$$R_E = \frac{l}{\int_{\underline{\theta}}^{\theta^*(R_\varnothing)} \frac{f_\xi(\theta)}{F_\xi(\theta^*(R_\varnothing))} p(\theta) d\theta}, \tag{17}$$

where we substituted $R_I = R_\varnothing$. In turn, this offer is only acceptable to a rejected household if with

$$p_R = \int_{\underline{\theta}}^{\theta^*(R_\varnothing)} \frac{f_\xi(\theta)}{F_\xi(\theta^*(R_\varnothing))} p(\theta) d\theta \tag{18}$$

it holds that

$$p_R u + (1 - p_R)\gamma \geq l. \tag{19}$$

strictly increasing in $\xi$ for all interior $\theta$. This holds in turn if, for two given $\xi_1 > \xi_2$ we have that $f_{\xi_2}(\theta)/f_{\xi_1}(\theta) > F_{\xi_2}(\theta)/F_{\xi_1}(\theta)$. To see that this is finally implied by MLRP, note that from $f_\xi(\theta) > 0$ for all $\theta \in \Theta$ we have that $F_{\xi_2}(\theta)/F_{\xi_1}(\theta) \to f_{\xi_2}(\theta)/f_{\xi_1}(\theta)$ as $\theta \to \underline{\theta}$, while clearly for $\theta = \overline{\theta}$ MLRP requires that $f_{\xi_2}(\overline{\theta})/f_{\xi_1}(\overline{\theta}) > F_{\xi_2}(\overline{\theta})/F_{\xi_1}(\overline{\theta}) = 1$. Note next that at any $\theta$ where $f_{\xi_2}(\theta)/f_{\xi_1}(\theta) = F_{\xi_2}(\theta)/F_{\xi_1}(\theta)$ holds with equality, the derivative of the right-hand side is just zero (the sign is given by $F_{\xi_1}(\theta)f_{\xi_2}(\theta) - F_{\xi_2}(\theta)f_{\xi_1}(\theta)$), while the derivative of the left-hand side is strictly positive by MLRP. (We use differentiability only for convenience at this point.) Hence, we have showed that for all $\theta > \underline{\theta}$ the graph of $f_{\xi_2}(\theta)/f_{\xi_1}(\theta)$ must always lie above that of $F_{\xi_2}(\theta)/F_{\xi_1}(\theta)$.

Consequently, whenever (19) holds strictly, entrants offer $R_E$ as characterized in (17) and a household that was previously rejected by the incumbent now receives a loan from the entrants. If the converse of (19) holds strictly, then a rejected household does not take out a loan.

We finally ask when condition (19) holds. Observe first that the left-hand side of (19) is strictly increasing in $\xi$. To see this, note that $R_\varnothing$ is strictly decreasing such that $\theta^*(R_\varnothing)$ is strictly increasing. Consequently, together with MLRP of $F_\xi$ the conditional probability $p_R$ is strictly increasing in $\xi$ (cf. footnote 49). By continuity of all $f_\xi$ it is also continuous in $\xi$. Next, at $\xi = \xi''$ we have by definition that $R_I = R_N = R_\varnothing$, implying that an offer $R_E < R_\varnothing$ would not attract the rejected household and (19) can thus not hold. Hence, there exists a unique threshold $\xi'''$ with $\xi'' < \xi''' < \overline{\xi}$ such that (19) holds with equality at $\xi = \xi'''$ if and only if (19) holds for all sufficiently high $\xi$ and thus, in particular, at the limit $\xi \to \overline{\xi}$. This follows from our assumption on $F_\xi(\theta)$ as $\xi \to \overline{\xi}$.[50] **Q.E.D.**

**Proof of Corollary 4.** To prove the assertions, it remains to show how $\theta^*(R_I)$ changes in $\xi$ if the different cases apply. If $R_I = R_N$, we have already argued in the proof of Proposition 11 that $R_I$ is then strictly increasing in $\xi$, implying that $\theta^*(R_I)$ is strictly decreasing. In contrast, for $R_I = R_\varnothing$ we have that $R_I$ is strictly decreasing in $\xi$, implying that $\theta^*(R_I)$ is strictly increasing. **Q.E.D.**

**Proof of Proposition 12.** As we can rely on arguments from both the proofs of Proposition 4 and Proposition 11, we can now be relatively short. As in Proposition 4, lending (with strictly positive probability) is not feasible for all $\xi < \xi'$ where $\underline{\xi} < \xi' < \widehat{\xi}$, which is the same threshold as in Proposition 4. Next, for all $\xi' < \xi < \widehat{\xi}$ the incumbent offers $R_I = R_0$, while entrants do not make a successful offer. As in Proposition 4, the incumbent is too conservative with $\theta^*(R_M) > \theta_{SB}$. For all $\xi > \widehat{\xi}$ the incumbent is now forced to offer $R_\varnothing$ as otherwise entrants could successfully undercut $R_M$ and attract the household while making non-negative profits. As in Proposition 11, over $\xi > \widehat{\xi}$ there are again two subcases for the entrants' offer. We deal with these in the rest of the proof.

[50] The last argument can be made more explicit as follows. Note first that $R_\varnothing \to l/p(\overline{\theta})$ and thus that $\theta^*(R_I) \to \overline{\theta}$. Then the assertion surely holds if we can find an arbitrarily small $\varepsilon_1 > 0$ such that for all $\xi > \overline{\xi} - \varepsilon_2$ where $\varepsilon_2 > 0$ it holds that $p'_R := \int_{\underline{\theta}}^{\overline{\theta}-\varepsilon_1} \frac{f_\xi(\theta)}{F_\xi(\overline{\theta}-\varepsilon)} p(\theta) d\theta > p_{\widehat{\xi}}$. This follows from continuity of all $F_\xi(\theta)$ in $\xi$ together with MLRP.

Note first that due to competition among entrants (of which there are by assumption at least two), if an offer is made that attracts (only) the rejected household then entrants just break even. That is, $R_E$ is then again determined by (17) as in the proof of Proposition 11. However, the condition when such an offer $R_E$ is acceptable to the rejected household is now different from that in (19). The difference is that instead of using the updated probability $p_R$ as defined in (18), the naive household continues to evaluate the entrants' offer with the prior probability $p_\xi$. As $p_R$ is strictly lower than $p_\xi$, the threshold on $\xi$ from when on the offer is feasible is thus strictly lower than that derived from (19) in Proposition 11.[51] **Q.E.D.**

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[51] That the new threshold exists and lies strictly between $\widehat{\xi}$ and $\overline{\xi}$ follows from the same arguments as in Proposition 11.

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