Regulating Consumer Credit with Over-Optimistic Borrowers*

Florian Exler
University of Vienna

Igor Livshits
Federal Reserve Bank of Philadelphia and BEROC

James MacGee
University of Western Ontario

Michèle Tertilt
University of Mannheim and CEPR

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– Preliminary –

Abstract

We quantitatively analyze consumer credit markets with behavioral consumers and default. Our model incorporates over-optimistic and rational borrower types into a standard incomplete markets with consumer bankruptcy framework. Lenders price credit endogenously, forming beliefs – type scores – about borrowers' types. Since over-optimistic borrowers incorrectly believe they have rational beliefs, lenders do not need to take strategic behavior into account when updating type scores. We find that the partial pooling of over-optimistic with rational borrowers results in spill-overs across types via interest rates, with over-optimists being cross-subsidized by rational consumers who have lower default rates. Higher interest rates lower the average debt level of realists compared to a world without over-optimists. Due to overestimating their ability to repay, over-optimists borrow too much. We evaluate three policies to address these frictions: reducing the cost of default, educating over-optimists about their true type, and increasing borrowing cost. Of the three, only the lower default costs improve the welfare of over-optimists. However, rational consumers are made worse off by that policy.

Keywords: Credit Cards, Endogenous Financial Contracts, Overoptimism, Bankruptcy.

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*Corresponding Author: Jim MacGee, Department of Economics, University of Western Ontario, e-mail: jmacgee@uwo.ca. We thank seminar participants for helpful comments. We thank the Social Science and Humanities Research Council (Livshits, MacGee). The views expressed here are those of the authors and do not represent those of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

1 Introduction

The growth of consumer credit since the 1970s has motivated debate over whether and how to regulate consumer credit products. Crystallized by the 2008 Financial Crisis, this has resulted in the creation of the Consumer Financial Protection Bureau (CFPB) as part of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 with a mandate to regulate credit products. The ensuing policy debate has centered around whether borrowers' cognitive biases create the possibility for active regulation — beyond requiring the disclosure of relevant information when making financial decisions — that can limit harmful borrowing decisions (Bar-Gill and Warren 2008; Campbell 2016). In particular, advocates of new regulations have argued that regulation should prevent households from over-borrowing and ending up "trapped in debt."[1]

A common view is that these "behavioral" consumers are "exploited" by the credit industry – for example through strategic pricing, – and that regulation is needed to protect these consumers (Campbell 2016). This line of thinking has been picked up in a recent theoretical IO literature (Heidhues and Koszegi 2010; Heidhues and Koszegi 2015; Eliaz and Spiegler 2006). Several papers show that under some conditions, behavioral (sometimes called naive) debtors pay more for the same product than informed rational debtors. The extra fees (or higher interest rates) benefit either the intermediary directly, or in models with competitive banking, the rational debtors benefit through lower prices. For example, Heidhues and Koszegi (2015) argue that lenders can take advantage of borrowers that underestimate their future impatience. These borrowers backload repayments and thus incur penalties that they did not anticipate ex-ante. However, none of these papers feature default in equilibrium. This is potentially important both because risk based pricing is a justification for higher pricing for some consumers, and since high default rates are cited as a concern in the policy debate.

In this paper, we quantitatively analyze consumer credit markets with behavioral consumers and default. Specifically, we introduce over-optimistic borrowers into an economy with unsecured debt and equilibrium default. Lenders price credit endogenously and spill-overs between rational and over-optimistic borrowers may arise. We study how lenders form beliefs about borrower types and how these beliefs influence the interest rates.

The key theoretical novelty is to incorporate "behavioral" consumers into incomplete

[1]Senator Chris Dodd, U.S. Senate, Congressional Record, 155, S5314 (2009).

markets models with consumer bankruptcy (Chatterjee et al. 2007; Livshits, MacGee, and Tertilt 2007). We model behavioral consumers via over-optimistic beliefs for two reasons. First, we show that this gives rise to a tractable model of type-scoring and partial pooling of behavioral and non-behavioral consumers. Second, there is substantial work documenting that some consumers are over-optimistic about future income (Arabsheibani et al. 2000; Dawson and Henley 2012; Balasuriya and Vasileva 2014), survival (Puri and Robinson 2007), the time it takes to complete everyday tasks (Buehler, Griffin, and Ross 1994), and that they generally underestimate the probability of negative events for themselves (Weinstein 1980).[2] Gathergood (2012) designed an add-on questionnaire to the U.K. DebtTrack survey and finds that consumers reporting financial difficulties are more likely to endure unforeseen expenditures.

In line with these findings, our model features over-optimists who believe that they face a lower probability of being hit by an expense shock than their true risk.[3] Over-optimists instead believe that they face the same risks as the rational consumers in our model. Thus, our behavioral consumers differ from realists in two ways – they are more prone to shocks *and* they are not aware of the higher risk they face. While conceptually these are distinct features (and we will decompose results that way), in practice they often come hand in hand. For example, a literature on impulse buying has documented that some people are particularly prone to impulse purchases (Beatty and Ferrell 1998; Verplanken and Sato 2011). Since impulse purchases are unanticipated, impulse buyers face higher risk but are not aware of it. In terms of our framework, impulse buyers can be thought of as being over-optimistic about their expense risk. Another context in which proneness to shocks appears coupled with over-optimism is among the self-employed. Clearly they face more risks than wage earners; yet, the self-employed have been found to be more over-optimistic than the average population (Åstebro 2003; Arabsheibani et al. 2000).

Our model is an incomplete-market economy with bankruptcy populated by finitely lived heterogeneous agents. Households are subject to idiosyncratic uncertainty about earnings and unforeseen expenditures (that we term "expense shocks"). Households decide on how much to borrow or save, as well as whether to file for bankruptcy. There

[2]Dawson and Henley (2012) finds that 30% of people in a British survey are over-optimistic about future income. Arabsheibani et al. (2000) use the same data to document that entrepreneurs are more over-optimistic than employees. Balasuriya and Vasileva (2014) finds that over-optimists save less for retirement.

[3]An alternative interpretation is that they have limited financial literacy in that they do not fully understand their expected future financial position.

are two types of households: rational households who hold correct beliefs over the uncertainty they face, and over-optimistic households that think of themselves as realists (and – conditional on their state – behave as realists) but actually face systematically higher expense risk. If households do not default, they can borrow or save in a one-period bond that is priced in a perfectly competitive debt market.

While financial intermediaries observe household earnings, age and current debt or asset positions, they do not know with certainty whether a household is overly optimistic or not. However, financial intermediaries observe income and expense shock realizations and form beliefs about the probability of a household being rational. We refer to these beliefs as type scores. In equilibrium, credit prices will depend on current income, age and the level of borrowing as well as on this type score. Furthermore, over-optimists are endogenously pooled with rational borrowers with the same type score. The pooling occurs naturally as over-optimists believe they are identical to the realists and consequentially behave identically. Hence, there is no way for lenders to design screening contracts. Lenders continuously update their beliefs about a borrower's type based on observed realizations of her idiosyncratic uncertainty. The model thus also gives a tractable theory of type scoring.

The equilibrium allocation in our model generates spill-overs between rational and over-optimistic borrowers. Given that over-optimists default particularly often, cross-subsidization through the interest rate goes from rational to behavioral consumers. If the fraction of over-optimists rises in our economy, the interest rate goes up and both types borrow less and default less on an individual level. However, aggregate debt and aggregate bankruptcies increase due to a composition effect: when increasing the fraction of over-optimists, the economy is composed of more risky households that borrow and default more.

Even though over-optimists benefit from the cross-subsidization, they are not doing as well as they could from a paternalistic perspective.[4] From a paternalistic point of view, over-optimistic debtors borrow too much. At the same time, they default too late. This arises because over-optimistic consumers have too optimistic views about the future and hence, rather than defaulting right away, they expect to repay their debt in the future. However, over-optimists will be surprised systematically by more bad realization in the future and end up unable to get out of debt.

[4]Paternalistic welfare weights the future at the true probabilities rather than using the over-optimistic beliefs.

To address these inefficiencies, we explore several potential policy interventions. First, we reduce the cost of default, inducing over-optimistic people to default earlier. Second, we investigate "financial literacy education" where we inform people about their true type, inducing them to internalize the true probabilities into their beliefs. Third, we explore the implications of making borrowing more costly through increased regulatory requirements or a proportional transactions tax. This should reduce over-borrowing. For all policies, we investigate how they impact behavioral and rational people individually and what the aggregate implications are.

The main results of the policy experiments are as follows. First, reducing default costs indeed makes over-optimists better off. However, this comes at the cost of making rational people worse off. Second, financial literacy education will backfire in the sense that precisely over-optimists will be made worse off by facing their true, higher than expected, exposure to risk. Rational people in fact benefit from the policy because they are no longer pooled with the high-risk over-optimists. Thus, some of the voiced concern about naive consumers could be driven by self-interested (rational) policy-makers not wanting to cross-subsidize over-optimists. Third, increasing transactions costs does reduce both debt levels and bankruptcy filing rates, but does not improve the welfare of either group of borrowers.

Despite broad evidence on behavioral traits in consumers, there is little work taking these traits into account when analyzing models of consumer debt that explicitly allow for default. Two exceptions are Laibson, Tobacman, and Repetto (2000) and Nakajima (2012, 2017). Both are concerned with self-control problems – Laibson, Tobacman, and Repetto (2000) analyze hyperbolic discounters while Nakajima (2012, 2017) uses "temptation preferences" based on Gul and Pesendorfer (2001) – and thus conceptually quite different from the over-optimists considered in our paper. Laibson, Tobacman, and Repetto (2000) and Nakajima (2012) are positive analyses not concerned with policy implications. The only other paper that analyzes the policy implications of introducing behavioral consumers into a consumer bankruptcy model is Nakajima (2017), which also finds contrasting views among the borrowers regarding bankruptcy reform. In Nakajima (2017), behavioral borrowers are made better off by lower default costs because the implied tighter borrowing constraints limit the temptation these borrowers are exposed to. Our proposed mechanism is complementary as (the paternalistic planner on behalf of) the over-optimistic borrowers benefit both from better ex-post insurance afforded by the more generous bankruptcy regime and from the tighter ex-ante borrowing con-

straints limiting over-borrowing. Moreover, models with self-control problems have, by design, nothing to say about financial literacy education.

Although our model features lenders who are better informed than borrowers about the risk of default, our structure differs from one common definition of predatory lending. Bond, Musto, and Yilmaz (2009) define a *predatory loan* as one which a borrower would decline if they had the same information as the lender. Depending on each household's type score, borrowing in our model pools borrowers with correct beliefs about future default risk with borrowers who incorrectly share the same beliefs. But – contrary to Bond, Musto, and Yilmaz (2009) – over-optimists are aware of and agree with their type score as it is simply a function of realized past shocks. They are ignorant about their fundamentally higher risk and just think of themselves as being unlucky and thus pooled with worse risks. As a result, they agree to the loan contract offered to them. Even more strikingly, if one was to resolve their ignorance, over-optimists would understand that their loan contracts have been subsidized by rational types and be more than happy to accept those contracts.

The remainder of the paper is organized as follows. We present our model and calibration in Section 2. Section 3 gives the main quantitative results – we show how the type scores evolve and how the presence of over-optimists matters. Section 4 analyzes how various policies affect behavioral and rational people – ranging from making default easier, financial literacy education to a tax on borrowing. Finally, Section 5 concludes.

1.1 Bankruptcy and Consumer Financial Protection

The rise in consumer credit and the number of household experiencing challenges in meeting their debt payments has sparked renewed debate over consumer financial protection. This debate has sparked not only a closer look at bankruptcy rules, but also at broader regulations of consumer lending.

A core element of consumer financial protection is the option to discharge debt. In the U.S., households can choose between Chapter 7 and Chapter 13 when filing for bankruptcy protection.[5] When a household's Chapter 7 bankruptcy filing is accepted, creditors lose any claims towards the bankrupt's future income in exchange for assets

[5]Mecham (2004) provides an in-depth description of U.S. bankruptcy law.

above a certain exemption level are seized. As a consequence of the 2015 Bankruptcy Abuse and Consumer Protection Act, Chapter 7 is now means-tested.[6] After declaring Chapter 7 bankruptcy, consumers are exempt from re-filing for six years. Total filing cost comprise court fees and legal fees and range from roughly $1,000 to $1,700 (Sullivan, Warren, and Westbrook 2000). The court also demands a full list of creditors, outstanding debt, available assets, regular cost of living and the details on a debtor's income. Typical Chapter 7 bankruptcies rulings take four months till completion.

Regulation of consumer lending has struggled with the trade-off between limiting the terms of financial products (e.g., usury law) and mandating disclosure (Zywicki 2013). The post financial crisis period has seen a shift towards more prescriptive legislative reforms, as evidenced by the creation of Consumer Financial Protection Bureau (CFPB) and the Credit Card Accountability Responsibility and Disclosure Act of 2009 (CARD Act). Proponents of that regulation regularly argued that some consumers were over-borrowing due to behavioral biases, or that less-sophisticated borrowers were exploited by sophisticated lenders. From a paternalistic point of view, these frictions allow for potential welfare gains from regulation. In the following section we develop a framework to analyze several reforms in the presence of borrowers that exhibit behavioral biases.

2 Model Environment

The model incorporates over-optimistic consumers and a use of type-scoring by lenders into a life-cycle economy where consumers borrow in incomplete credit markets and loans are subject to default. The economy is populated by measure 1 of consumers who live for J-periods and face idiosyncratic income and expense shocks. A fraction $\lambda \in (0, 1)$ of households have over-optimistic beliefs about the idiosyncratic uncertainty they face, while $(1 - \lambda)$ have realistic (correct) beliefs. To make the role of over-optimism more transparent, we assume that both types of consumers have identical beliefs over the distribution of income and expense shocks. However, over-optimistic consumers face higher probabilities of expense realizations than they believe, and thus higher risk than realist types.

Markets are incomplete as the only financial instruments are one-period bonds. We

[6] Roughly 70% of bankrupts file under Chapter 7. Chapter 13 – the other option – is not present in our model.

examine a small open economy, where we fix the risk free interest rate exogenously.[7] Since households can declare Chapter 7 bankruptcy, debt is partially state-contingent.

Debt is priced endogenously by competitive lenders who observe a history of consumer's income and expense shocks. While lenders know the fraction of the population, λ, that are over-optimists, they cannot observe a consumer's type directly. Thus, lenders form beliefs over consumer types, which we term *type scores*, and update these beliefs each period based on a consumer's realized income and expense shocks. The bond price schedule offered to a consumer reflects the expected default risk.

The model timing sees consumer productivity and expense shocks realized at the beginning of the period. Lenders update their type score. Then, consumers decide whether to file for bankruptcy, and if they do not file, how much to borrow or save.

2.1 Households

Consumers maximize expected discounted life-time utility, $\mathbb{E}^B \sum_{j=1}^{J} \beta^{j-1} u\left(\frac{c_j^B}{n_j}\right)$, where β denotes the discount factor and consumption c_j is adjusted by household size n_j at age j. $B \in \{R, O\}$ denotes a households type, rational ($B = R$) or over-optimistic ($B = O$). Consumer types differ in their beliefs over the distribution of shocks they face. Realists beliefs coincide with the true distribution they face. Over-optimists believe they face the same distribution of uncertainty as realists, but actually face a distribution with more downside risk. These beliefs are not updated as consumers age, so that over-optimists interpret bad realizations simply as continued bad luck.

Labor income at age j for consumer type B is the product of age-dependent labor productivity and productivity shocks:

$$y_j = \overline{e}_j z_j \eta_j, \tag{2.1}$$

where $\overline{e}_j$ is deterministic labor productivity, z_j is a persistent auto-regressive earnings shock, and η_j is a transitory earnings shock.

Households face unforeseen expenses that we capture by expense shocks $\kappa \geq 0$, drawn from a finite set $K = \{0, \kappa_1, ..., \kappa_N\}$ with independently and identically dis-

[7] This paper focuses on unsecured debt. Given the small share of unsecured debt in total debt in the United States, the assumption that this has little effect on the risk free rate of return is a reasonable approximation, and significantly reduces the computational burden. The latter is needed for us to track type scores over the life-cycle.

tributed probabilities $\{\pi_0^B, ...\pi_N^B\}$. An expense shocks alters a household's net asset position.[8]

Rational households have the correct beliefs over future income and expenditure shocks:

$$\mathbb{E}^R(x'|x) = \mathbb{E}(x'|x), \tag{2.2}$$

where x is any random variable, x' is next period's realization and $\mathbb{E}$ is the true mean. Over-optimists believe that they face the same income and expense shocks as realists. However, over-optimists face systematically higher expense risk than realists.

$$\begin{aligned} \mathbb{E}^O\kappa^O &= \mathbb{E}\kappa^R \\ \mathbb{E}\kappa^O &> \mathbb{E}\kappa^R. \end{aligned} \tag{2.3}$$

As a result, an over-optimist will make the same decision as a realist conditional on the state.

2.1.1 Bankruptcy

Consumers can file for bankruptcy. Filing for bankruptcy discharges the households debt so a filer enters the following period with zero debt. To proxy for six years of exclusion from bankruptcy, bankrupts cannot file for bankruptcy in consecutive periods.

Filers must repay a fraction γ of their income when they declare bankruptcy. This captures the good faith effort required from borrowers to repay their debt as well as filing fees and legal fees. Since a filer cannot borrow or save, consumption of a filer is $(1-\gamma)y_j$.[9] Bankrupts suffer a utility cost of filing, χ, which captures other costs (e.g, "stigma") associated with filing for bankruptcy.

2.2 Financial Intermediaries

Financial intermediaries are competitive and can borrow and save at the exogenous risk free rate r^s. They offer each borrower a one-period bond price schedule. The face value

[8]The associated probabilities carry a superscript B (while the shock sizes do not) because over-optimists will face higher expense risk (but the support of expense shocks remains the same).

[9]We do not allow bankrupts to save as assets are seized to repay creditors, as argued by Livshits, MacGee, and Tertilt (2010).

to be repaid next period is d'.[10] Due to bankruptcy, repayment is (partially) state contingent. Intermediaries take into account expected losses from default when determining the bond price schedule $q(d', \cdot)$.

Type Scores are the probabilities that intermediaries attach to a household being rational. Although intermediaries cannot observe a household's type directly (i.e., realist or over-optimist), they can observe debt d, the household's persistent and transitory income shocks z, η, expense shocks κ as well as age j. Lenders also observe the entering type score.[11]

Intermediaries update their type scores using Bayes' rule. A household of age $j+1$ receiving shocks z', η', κ' has the type score

$$s'(z',\eta', \kappa', j+1, s) = \frac{\Pr^R(z', \eta', \kappa' \mid z)\, s}{\Pr r^R(z', \eta', \kappa' \mid z)\, s + \Pr^O(z', \eta', \kappa' \mid z)\,(1-s)}, \tag{2.4}$$

where $s \in [0,1]$ and we set the prior to $s(z, \eta, \kappa, 1) = \lambda$.

Since over-optimistic households have biased expectations only about the expense shock, $\Pr^B(z', \eta', \kappa' \mid z)$ simplifies to $\Pr^B(\kappa')$, where we use the fact that expense shocks (κ) are uncorrelated to past income realizations.

The assumption that over-optimistic households do not learn they face systematically worse risk and believe they face the same risks as realist types, implies that household choices do not convey any additional information on the household type. The decision rules of an over-optimistic consumer, conditional on a household state (which includes the type score) and bond price, are the same as those of rational households. Since over-optimists face a higher probability of receiving an expense shock, by observing expenditure shock realizations lenders can update their beliefs of a household's types.[12]

Conditional on the probability that a household is rational (s), intermediaries accurately forecast the default probability of a borrower, $\theta(d', z, j, s)$, and price the loan accordingly.

[10] In our setting, savings are simply denoted as negative debts, i.e. $d' < 0$.

[11] The current realization of persistent income z is informative about future income and thus predictive of future default risk. Since the transitory shock η and the expense shock κ are idiosyncratic, their current value is not directly informative of future default risk. In standard models, loan prices do not depend on the realizations of these shocks. However, in our proposed model, the realization of κ is informative about the type score, and this indirectly provides information on future default risk.

[12] Since both types of agents are ignorant about their fundamental differences, they do not choose to signal their type by separating in equilibrium. Hence, there can only be a (partial) pooling equilibrium.

2.3 Equilibrium

Lenders earn zero expected profits on each loan. Conditional on observable characteristics (persistent labor income z and age j) as well as a household's type score (s), bond prices are determined by the default probability of a household and the risk-free rate. Free entry implies that there can be no cross-subsidization of interest rates between contracts for different types of consumers. If households default, banks receive a fraction $\gamma y/(d' + \kappa)$ of the original loan from required repayment. We assume that any debt recovery is proportionally allocated to outstanding loans and unpaid expenses.

The zero profit condition then implies a bond price schedule of

$$q^{ub}(d', z, j, s) = (1 - \theta(d', z, j, s))\overline{q}^b + \theta(d', z, j, s)E(\frac{\gamma y}{d' + \kappa'})\overline{q}^b, \tag{2.5}$$

where $\overline{q}^b = \frac{1}{1+r^s+\tau}$ is the hypothetical price of a save bond.

In the numerical solution of the model, the interest rate is restricted by a ceiling $\bar{r}$ which yields the *equilibrium bond price*

$$q^b(d', z, j, s) = \begin{cases} q^{ub}(d', z, j, s) & \text{if } q^{ub}(d', z, j, s) \geqslant \frac{1}{1+\bar{r}} \\ 0 & \text{otherwise.} \end{cases} \tag{2.6}$$

Consumers take the equilibrium bond price schedule as given. The households' optimization problem is summarized by a value function V which is the value of not defaulting, while $\overline{V}$ is the value of filing for bankruptcy. Since bankruptcy cannot be declared in successive periods, we define the value of informal default, W, when not eligible for bankruptcy.[13] With an informal default, the same fraction of income is garnished as in bankruptcy and the debt is rolled over at a fixed interest rate r^r.

Additionally, all value functions depend on whether beliefs are rational or over-optimistic, $B \in \{R, O\}$:

$$\begin{aligned} V_j^B(d, z, \eta, \kappa, s) = &\max_{c,d'} \left[u\left(\frac{c}{n_j}\right) + \beta \mathbb{E}^B \max\left\{ V_{j+1}^B(d', z', \eta', \kappa', s'), \overline{V}_{j+1}^B(z', \eta', s') \right\} \right] \\ &\text{s.t. } c + d + \kappa \leqslant y_j^B + q^b(d', z, j, s)d' \end{aligned} \tag{2.7}$$

[13] Informal default addresses the possibility of an empty budget set for a consumer that is ineligible for bankruptcy but draws a large expense shock. The only debt held in this case stems from an expense shock. This option is rarely used in our simulations.

$$\begin{aligned}\overline{V}_j^B(z,\eta,s) = & \; u\left(\frac{c}{n_j}\right) - \chi + \beta \mathbb{E}^B \max\left\{V_{j+1}^B(0,z',\eta',\kappa',s'), W_{j+1}^B(z',\eta',\kappa',s')\right\} \\ & \text{s.t. } c = (1-\gamma)y_j^B\end{aligned} \tag{2.8}$$

$$\begin{aligned}W_j^B(z,\eta,\kappa,s) = & \; u\left(\frac{c}{n_j}\right) - \chi + \beta \mathbb{E}^B \max\left\{V_{j+1}^B(d',z',\eta',\kappa',s'), \overline{V}_{j+1}^B(z',\eta',s')\right\} \\ & \text{s.t. } c = (1-\gamma)y_j^B, \qquad d' = (\kappa - \gamma \bar{e}_j z \eta)(1+r^r).\end{aligned} \tag{2.9}$$

An equilibrium is a set of value functions, optimal decision rules for consumption $c^B(\cdot)$ and default $n^B(\cdot)$ for the consumer, default probabilities $\theta(\cdot)$, and bond prices $q^b(\cdot)$, such that households optimize (equations (2.7)-(2.9)), and bond prices are the solution to intermediaries' problem (zero profit condition in equation (2.6)), taking the default probabilities as given. In order to solve the model numerically, we iterate backwards on the value functions.

2.4 Benchmark Calibration

We calibrate to a benchmark with no over-optimistic households (i.e., $\lambda = 0$). This approach is consistent with our objective of showing how varying the fraction of behavioral consumers in the population impact credit markets. In addition, it allows us to use the established approach of Livshits, MacGee, and Tertilt (2010), who calibrate a similar model to the US economy in 1995-1999.

Consumers enter the economy at age 20 and live for 54 years, which are modelled in 18 three year periods. For the first 15 periods, consumers face stochastic (labor) income. During the last three model periods, households are retired and receive non-stochastic retirement benefits. The felicity function is $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma}$. The consumers (annual) discount factor is set to $\beta = 0.94$, and the coefficient of relative risk aversion to $\sigma = 2$. To proxy household size over the life-cycle, we use the equivalence units n_j from Livshits, MacGee, and Tertilt (2007).

Livshits, MacGee, and Tertilt (2010) parameterized the expense shocks to U.S. estimates of medical expenses, divorces and unplanned parenthood. The support of expense shocks K has three elements: $\kappa \in K = \{0, \kappa_1, \kappa_2\}$. The smaller shock (divorces

and unplanned parenthood) is 26.4% of average (three year) income. The large medical shock corresponds to 82.18% of average endowment. The probabilities $[\pi_1, \pi_2]$ of these shocks realizing are 7.1% and 0.46%, respectively.[14] Livshits, MacGee, and Tertilt (2003) contains a more detailed account of the expense shock parameterization.

We represent the persistent shock as a five state Markov process. The parameters of this process map into an auto-correlation $\rho_z = 0.95$ and a variance $\sigma_z^2 = 0.043$. For the transitory shock, we assume that 10% of households are hit with a positive or negative realization each period. Then, the support of the shock is set to match the variance $\sigma_\eta^2 = 0.043$. Each retiree receives a deterministic pension of 20% of average income in the economy, plus receive 35% of their last persistent income realization before retirement.

We set the risk-free rate to 4%, in line with Gourinchas and Parker (2002). Following Livshits, MacGee, and Tertilt (2007), the transaction costs of lending, τ, is set to 2% annually, which implies a risk-free consumer loans annual interest rate of 6%. The rate at which informally defaulted debt is rolled over (r^r) is fixed at 20% per year.

In our baseline, we follow Livshits, MacGee, and Tertilt (2010) and set the utility cost of declaring bankruptcy to $\chi = 0$ and the garnishment rate γ to roughly 32% (Nakajima (2017) calibration is similar at 34%).[15] This implies that there are no dead weight costs of bankruptcy, as the cost imposed on filers is transferred to lenders. We set a rather loose interest rate ceiling at 100% annually.[16]

2.5 Welfare Measures

Since over-optimists have distorted beliefs about the risks they face, their expected value at birth does not correspond to the value that a planner would attach to their life or the value that over-optimists would expect were they educated about their bias. Over-optimistic beliefs weigh positive outcomes too heavily and vice versa. Consequently, over-optimists' expectations do not correspond to the average outcomes of over-optimistic individuals or – since over-optimists are not aware of their own presence – to average outcomes of all types in the economy. In order to compare the welfare

[14] Expense shocks are assumed to only hit working-age households.

[15] See Livshits, MacGee, and Tertilt (2010) for a discussion of how to interpret this cost.

[16] This value is substantially larger than implied by current usury laws. However, official legal ceilings can be avoided. See Livshits, MacGee, and Tertilt (2010) for a more detailed discussion. Numerically, the ceiling does not have strong effects as it rarely binds for borrowers.

of over-optimists being born into one of our experiments, we introduce a welfare measure that is not distorted by biased expectations.

We define *realized welfare* $\mathcal{V}^O$ as the welfare that over-optimists would expect if they used the correct rational expectations but still behaved ignorantly over their whole life:

$$\mathcal{V}_1^O(d, z, \eta, \kappa, s) = u\left(\frac{c^O}{n_j}\right) + \beta \mathbb{E}^R \max\left\{\mathcal{V}_2^O(d', z', \eta', \kappa', s'), \overline{\mathcal{V}_2^O}(z', \eta', s')\right\}, \tag{2.10}$$

where c^O represents the optimal over-optimistic consumption policy and $\max^O$ represents the default choice induced by the optimal over-optimistic default policy n^O. These policies solve the household problem in equations (2.7)-(2.9) for over-optimistic beliefs $B = O$. Note that while behavior is unchanged, expected values are formed using rational expectations $\mathbb{E}^R = \mathbb{E}$.[17]

The expected *realized welfare* $\mathcal{V}$ of being born into a certain economy is simply the average of *realized welfares* $\mathcal{V}_1^O$ weighted by the ergodic distribution of newborns, μ:

$$\mathcal{V} = \sum_{z,\eta,\kappa} \mathcal{V}_1^O(0, z, \eta, \kappa, \lambda)\, \mu(z, \eta, \kappa). \tag{2.11}$$

3 Quantitative Analysis with Over-optimistic Borrowers

In our benchmark, we introduce a measure $\lambda = 0.2$ of over-optimistic households into the economy. While expecting the same income and expense risk, these over-optimists actually face higher expense shocks. We set the degree of overoptimism by $\psi = 2$ so as to generate experiments that clearly illustrate the effects of overoptimism on the equilibrium.[18]

If households are over-optimistic, they face a ψ-fold higher probability of incurring an expense shock: $[\pi_1^R, \pi_2^R] = \psi[\pi_1, \pi_2]$. This implies that the probability of not receiving

[17] When solving the model numerically, we calculate each household's discounted utility flow that is derived from realized consumption over the life-cycle. We obtain these realized welfare measures by simulating $N = 100,000$ overlapping generations over 30 periods. Since N is large, this measure is a very close proxy to the theoretical measure in equation (2.11).

[18] We ran several experiments with lower ψ and found the same basic forces to be at work. While quantitatively smaller, the effects of lower degrees of overoptimism exhibit the same qualitative features.

any expense shock is decreased one-for-one with the increased probability of receiving a shock.[19]

While there is evidence pointing to the presence of non-sophisticated consumers, there is no consensus as to which bias is most important or the fraction of consumers in the US whose behavior is not rational. Thus, the following analysis is intended to illustrate the effects of introducing over-optimistic households without taking a stand on how large the actual fraction might be. Consequently, we introduce a range of plausible measures of over-optimists, and evaluate the effects of these different measures in Section 3.2. When we turn to policy analysis in Section 4, we fix $\lambda = 0.2$.

3.1 Type Scoring

Type scores correspond to the probability that lenders attach to a certain household being a realist. Conditional on these scores, lenders quote their credit prices. As discussed in Section 2.2, intermediaries update type scores by observing the shocks that households face.

To illustrate how information is incorporated into individual type scores, Figure 1 plots four simulated type scores over the working life of a consumer. The left panel illustrates two example realists, while the right panel gives two examples of over-optimists. Scores start at 0.8 since this is the unconditional probability of being a realists (in our example there are 20% over-optimists, i.e. $\lambda = 0.2$). Type scores monotonically increase by age as long as the person is not hit by an expense shock. As soon as an expense shock hits, the score drops. This is true both for realists and over-optimists. The two types only differ in the underlying probability of expense shocks. Over-optimists face them more often and hence the scores are more likely to decline over time. Even so, as the dashed line in the right panel illustrates, a lucky over-optimist score can remain relatively high for their entire life, while the score for an unlucky realist can decline dramatically as they age (as the solid line in the left panel shows). On average, the type scores of over-optimists decline with age, while realists' type scores increase. This life-cycle pattern is illustrated in Figure 2, where the solid line gives the average score for realists while the dashed line gives the average score for over-optimists.

[19] In order to keep average risk in the economy constant, we proportionally decrease expense shock probabilities of realists: $[\pi_1^R, \pi_2^R] = [\pi_1, \pi_2](1 - \lambda\psi)/(1 - \lambda)$.

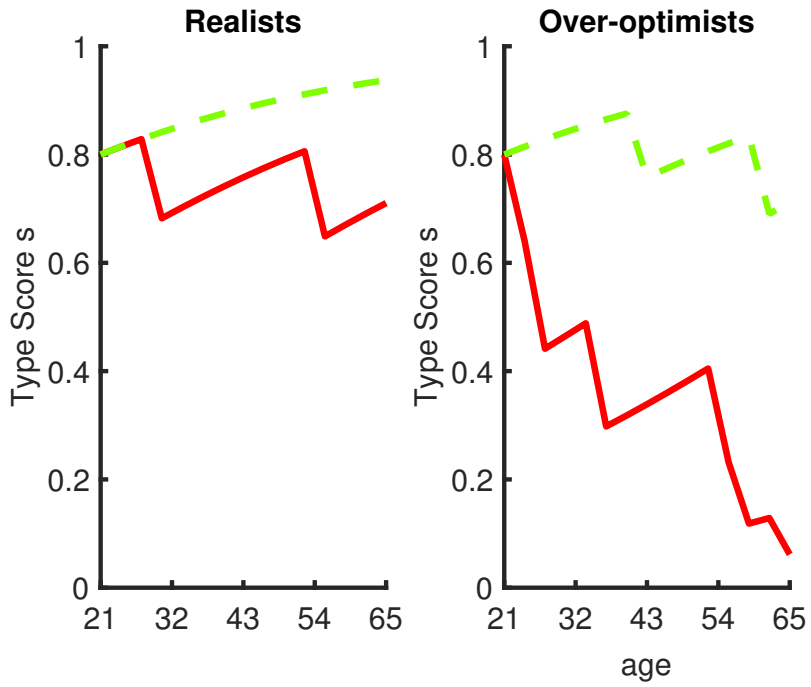

Figure 1: Type Score Evolution over Life-Cycle, Examples

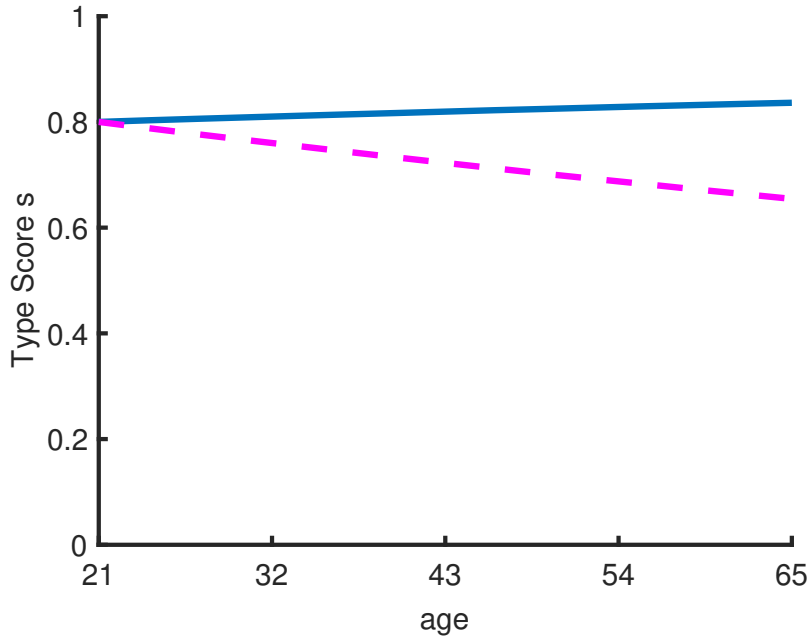

Figure 2: Evolution of Type Scores, over-optimists vs. realists, averages

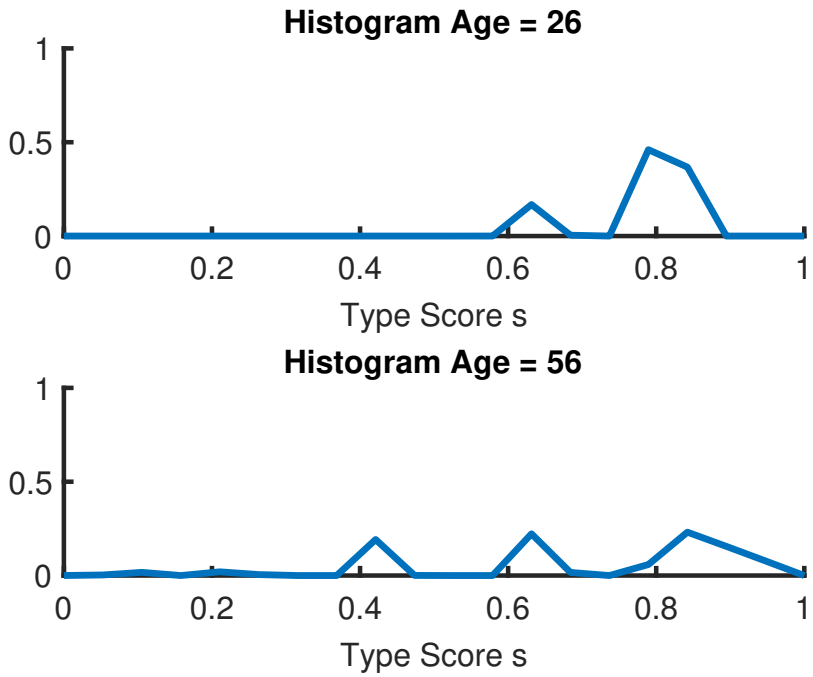

Figure 3: Type Score Distribution, young vs. old

Another way to look at this is to compare the distribution of scores over the life cycle. Figure 3 depicts the distribution of type scores at two different ages. At the age of 26, intermediaries have only observed households for a few periods. Accordingly, most households have not incurred expense shocks. Their type score increases to slightly above 0.8. Those households hit by an expense shock are more likely to be over-optimistic, hence there is a small mass around a type score of 0.65.

Towards the end of the working life, different people have experienced very different sequences of expense shocks. Thus, the distribution of type scores is much more disperse than early in life. Intermediaries still do not know with certainty who is who, and hence much pooling still goes on at age 56, but there is mass now at 0.4, 0.6 and above 0.8. Thus, compared to the beginning of the life cycle, intermediaries have more informative priors that someone is an over-optimists. Accordingly, interest rates will be much more disperse, too. Less pooling of type scores later in life implies less cross-subsidization in interest rates across types, too. This point is illustrated in Figure 4. Early in life (age 26), the type score distribution of over-optimists nearly coincides with that of realists. This is no longer true for older households. At age 56, the distribution of over-optimists is clearly to the left of the distribution of realists.

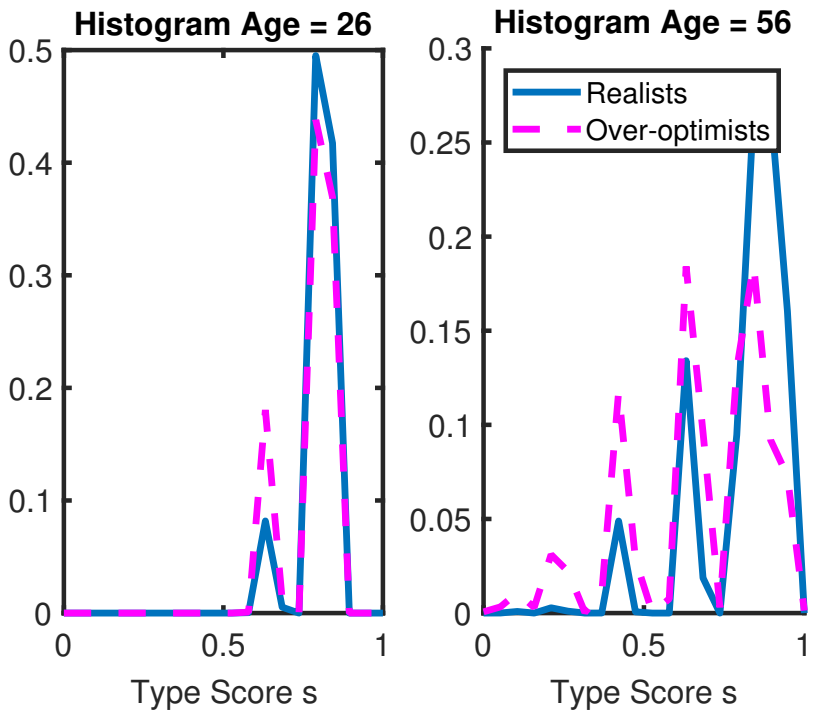

Figure 4: Type Score Distribution, over-optimists vs. realists, 2 ages

3.2 How Over-optimists Affect Rational Consumers and Aggregates

The model with only realists yields an average borrowing interest rate of 11.1%, a filing rate of 0.75% and a debt-to-income ratio of 9.1%. Table 1 shows how things change once over-optimists are added. In the table we vary the fraction of over-optimists from 0 to 100 percent. The first thing to note is that the average interest rate increases in the fraction of over-optimists. The average interest rate goes up for two reasons. First, over-optimists default more and hence, as they make up a larger fraction of the population, the average interest rate goes up through a simple composition effect. Secondly, conditional on type score, lenders cannot tell realists and optimists apart and hence pool them into the same contract. This means that the interest rate even for realists goes up. This effect is sizable. In a world with 50% over-optimists, realists face an interest rate of 13.3% which is more than two percentage points higher than in a world without over-optimists.

The higher interest rate discourages borrowing. The debt-income ratio of realists, in a world with 50% over-optimists, is 7.9% relative to 9.1% in a world with only realists. Since over-optimists systematically face higher interest rates than realists, average debt in the economy falls by even more due to the composition effect – namely to 7.8% percent

Table 1: Debt, Interest rates, Bankruptcy and Welfare

	Fraction of Over-optimists λ					
	0	0.1	0.2	0.3	0.5	1
Debt-to-income						
Realists	9.05%	8.88%	8.69%	8.42%	7.92%	
Over-optimists		8.64%	8.40%	8.12%	7.68%	6.63%
Average		8.86%	8.63%	8.33%	7.80%	
Bankruptcy Filings						
Realists	0.75%	0.75%	0.75%	0.75%	0.75%	
Over-optimists		1.45%	1.45%	1.45%	1.45%	1.43%
Average		0.82%	0.89%	0.96%	1.10%	
Average Interest Rates						
Realists	11.12%	11.47%	11.82%	12.28%	13.28%	
Over-optimists		12.49%	13.01%	13.60%	14.80%	17.85%
Average		11.57%	12.06%	12.67%	14.03%	
Net Gains from Pooling						
Realists	BENCH	-0.06%	-0.13%	-0.20%	-0.34%	
Over-optimists		0.49%	0.54%	0.50%	0.36%	BENCH

in a world with 50% over-optimists.

The default rate of realists and over-optimists is essentially constant in λ. However, due to the composition effect, average filing rates go up with λ – so that in a world with 50% over-optimists, the filing rate is almost 50% higher than in the fully rational world.

In terms of welfare, not surprisingly, realists' welfare monotonically declines in the fraction of over-optimists. They are hurt through the higher interest rates they face through pooling with people more default-prone than themselves, and there is nothing to gain from the presence of over-optimists. Relative to being by themselves, the realists lose -0.13% in consumption equivalent units if living in an economy with 20% over-optimists. The over-optimists, on the other hand, benefit from the presence of realists – using our paternalistic welfare concept.[20] Compared to living in a world with only other over-optimists, they gain 0.54% in terms of consumption equivalence units in our benchmark economy (with only 20% over-optimists).

Recall that by assumption over-optimists face higher risks but are not aware of that. To better understand the results, we now decompose results into the effects of adding high risk people vs. over-optimistic people, that are both high risk but also have biased expectations. The decomposition results are summarized in Table 2. The last column is the benchmark economy – i.e. numbers are identical to those in Table 1 for $\lambda = 0.2$. The first column, on the other hand, gives results for an economy without any over-optimists (c.f. Table 1, $\lambda = 0$). Starting from a world without over-optimists and adding simply 20% high risk people which are *not* biased (i.e. have correct expectations and hence are not pooled), we see that bankruptcy filings go up quite a bit and so does the interest rate. This is simply due to the composition effect, as there is no interaction between the two types of people in column (2). Column (3) now adds the biased beliefs into the picture, still abstracting from pooling. Being over-optimistic makes the high risk people file less – as they hope to get into a better financial position down the road. Yet, average interest rates increase even further. This is because people default on larger loans (not shown). Finally, moving from column (3) to (4) we see the effect of pooling. By construction, the numbers for our low risk realists are identical across columns (1) through (3). In column (4), on the other hand, realists now face different (higher) interest rates as they are being partially pooled with high risk types. The higher interest rate leads them to borrow less and accordingly default slightly less. The effect of pooling on the high risk people is the opposite. They face lower interest rates now and accordingly borrow more and file

[20] See Section 2.5 for details.

Table 2: Decomposition

	Only low risk people	**Adding 20% high risk people**		
		not biased not pooled	biased not pooled	biased pooled
	(1)	(2)	(3)	(4)
Debt-to-income				
Realists	9.05%	9.05%	9.05%	8.69%
Over-optimists		8.72%	6.63%	8.40%
Average	9.05%	8.99%	8.57%	8.63%
Bankruptcy filings				
Realists	0.75%	0.75%	0.75%	0.75%
Over-optimists		1.53%	1.43%	1.45%
Average	0.75%	0.91%	0.88%	0.89%
Average interest rates				
Realists	11.12%	11.12%	11.12%	11.82%
Over-optimists		16.27%	17.85%	13.01%
Average	11.12%	12.15%	12.47%	12.06%

slightly more.

Summing up, adding over-optimists (i.e. high risk people with biased expectations) to the model (i.e. comparing columns 1 and 3) increases bankruptcy filings and increases interest rates – predominantly because more risky people were added. The effect of adding biased expectations and pooling (i.e. comparing columns 2 and 4) is a small decrease in the interest rate, a decrease in debt and somewhat lower filing rates.

4 Policy Analysis

4.1 Lower Cost of Default

In our model, over-optimists default too little. A potential policy to address this particular problem is to make default easier. Since, conditional on type score, over-optimists are indistinguishable from realists, we consider a policy that makes default less costly for everyone. Results are given in Table 3. Consider lowering the repayment requirement γ from the benchmark 32% to 10% of period income. Making default less costly increases the default rate of over-optimists significantly. The filing rate doubles from 1.5% to 3%. Easier default makes debt less sustainable in equilibrium. Lenders will anticipate higher default rates and adjust interest rates accordingly. As a result, interest rates shoot up from 13% to 30%. Higher borrowing cost reduce the debt-to-income ratio for over-optimists from 8.4 to 1.9%. Even though interest rates increase significantly, over-optimists like this policy. Their welfare increases by half a percentage point in consumption equivalence units.

However, this policy adversely affects realists. When moving to $\gamma = 0.1$, realists lose more than over-optimists gain in consumption equivalence units. The reason is that they are also subject to significant interest rate increases – their rates increase from 12 to 29%. The interest rate hike is fueled by two factors – realists default more themselves (bankruptcy filings increase from 0.75% to 1.9%) and they are partially pooled with over-optimists that default more, too. Accordingly, realists hold less debt in equilibrium: their debt-to-income falls from 8.7% to 2.0%.

In sum, even though making default easier is desirable for over-optimists, implementing it should be done with caution in a world where intermediaries cannot fully tell the types apart. Rational people would loose in welfare terms.

4.2 Financial Literacy Education

One main argument in favor of increased regulation of consumer credit is that "sellers of credit products have learned to exploit the lack of information and cognitive limitations of consumers" (Bar-Gill and Warren 2008). Indeed, there is strong evidence that consumers do not understand financial products (which we term a lack of financial literacy). 63% of Americans display a significant lack of financial literacy in the FINRA

Table 3: Changing Repayment Requirements in Bankruptcy

Garnishment Rates γ (Benchmark $\gamma = 0.319$)				
	0.1	0.2	0.319	0.5
Debt-to-income				
Realists	1.98%	4.65%	8.69%	14.43%
Over-optimists	1.85%	4.39%	8.40%	14.97%
Average	1.95%	4.60%	8.63%	14.54%
Bankruptcy filings				
Realists	1.90%	1.48%	0.75%	0.29%
Over-optimists	2.98%	2.43%	1.45%	0.65%
Average	2.11%	1.67%	0.89%	0.36%
Average interest rates				
Realists	28.90%	24.70%	11.82%	7.22%
Over-optimists	29.90%	27.12%	13.01%	7.40%
Average	29.09%	25.17%	12.06%	7.26%
Paternalistic Welfare Change (% CEV)				
Realists	- 0.55%	- 0.21%		0.26%
Over-optimists	0.50%	0.32%		- 0.51%
Average	- 0.34%	- 0.10%		0.10%

National Capability Study.[21] Furthermore, only 53% of Americans count as financially literate according to Standard and Poor's Global Financial Literacy Survey.[22]

It is generally argued that financial literacy education would improve financial outcomes and welfare of behavioral consumers.[23] It is thought to prevent exploitation of behavioral people who – armed with more knowledge – would better protect themselves against financial mistakes or against being exploited of by the financial industry.

Since in our model, over-optimists are misinformed about their future risks, one might think that educating them about their true risks could potentially improve outcomes. We now explore what happens in the model if agents were perfectly informed about their true expense risks. We assume this means over-optimists are perfectly identified to themselves but also to the lenders.[24] As before, we focus on a paternalistic measure of welfare. However, since misinformation changes the expected utility of agents also by changing beliefs, in this section we also report how perceived welfare (including the potentially distorted beliefs) changes.

In Table 4 we report the results of this experiment. Better informed over-optimists file for bankruptcy more often. Understanding their higher risk, they now realize that getting out of debt in the future is not so likely. Consequently, for high enough levels of debt, they decide to file for bankruptcy earlier and thus obtain partial insurance against the risk they face. Their filing rate goes up from 1.45% to 1.53% per annum.

Expecting higher write-offs, lenders raise interest rates by more than three percentage points. This increase is further amplified since over-optimists are now perfectly identified and thus do not profit from cross-subsidization anymore.

Despite higher interest rates, over-optimists also take on more debt. When facing more frequent expenditure shocks that force over-optimists into bankruptcy, they borrow in order to front-load consumption because they now understand that the probability of repayment is lower than for realists.

[21] A lack of financial literacy is defined as passing three or less out of five basic questions. See `http://www.usfinancialcapability.org/results.php?region=US#financial-knowlege`

[22] See `http://gflec.org/initiatives/sp-global-finlit-survey/` for more details.

[23] However, Miller et al. (2015) offers a negative view on the effectiveness of existing financial literacy efforts to lower defaults. This argument is supported by our findings – bankruptcy rates increase in response to financial literacy education.

[24] It should be noted that it is unclear how such a policy could be implemented. In our set-up neither consumers nor lenders know who is an over-optimist. In such a world it is hard to think of an omniscient government that knows each consumer's type. In this section we abstract from implementation and simply ask what would happen if such a policy was somehow feasible.

Table 4: Increasing Financial Literacy

	Benchmark	Financial Literacy
Debt-to-income		
Realists	8.69%	9.05%
Over-optimists	8.40%	8.72%
Average	8.63%	8.99%
Bankruptcy filings		
Realists	0.75%	0.75%
Over-optimists	1.45%	1.53%
Average	0.89%	0.91%
Average interest rates		
Realists	11.82%	11.12%
Over-optimists	13.01%	16.27%
Average	12.06%	12.19%
Paternalistic Welfare Change (% CEV)		
Realists		0.13%
Over-optimists		– 0.36%
Average		0.03%
Perceived Welfare Change (% CEV)		
Realists		0.13%
Over-optimists		– 2.65%
Average		– 0.43%

For over-optimistic consumers in our model, financial education does the opposite from what is often argued: they borrow and file even more after being educated. At the same time, they do worse in welfare terms. Since by assumption lenders are perfectly informed about borrower types after financial literacy education has taken place, pooling no longer occurs. This means over-optimists no longer benefit from cross-subsidization and face higher interest rates (16.3% instead of 13% previously). Thus, welfare declines by 0.36% in consumption equivalence units – using a paternalistic welfare measure. When asking them whether they liked the education (i.e. using their upward biased perceived welfare as a benchmark), they believe they lost even more in welfare terms (2.65%).

Turning to the realists, the picture is quite different. The education campaign does not affect them directly, of course, as they always held correct beliefs about their risk. However, the policy removes the cross-subsidization which reduces the average interest rate for realists (from 11.8 to 11.1 percent). Equipped with better credit terms, they borrow more. Realists marginally gain in welfare terms – 0.13% in consumption equivalence units.

4.3 Higher Borrowing Costs

In the current policy debate, one central argument for regulating the credit market is to preempt "over-borrowing." There are many policies aimed at reducing the incentives to borrow: limiting roll-over, restricting the amount of simultaneous loans, introducing cool-off periods, increasing underwriting requirements, and introducing centralized loan databases to name just a few.

One indisputable outcome of many forms of consumer financial regulation is that it increases the costs of lending. Higher cost of lending translate into higher interest rates which – independent of the specificities of the law – hamper borrowing. If individuals make financial mistakes such as "over-borrowing," higher cost of lending might actually be beneficial if they discourage borrowing and reduce financial mistakes.

Since over-optimists in our model consistently commit financial mistakes, making borrowing more costly might create welfare gains in our framework, too. In this section, we explore the effects of increasing the proportional costs of creating loans, τ. Lending cost could increase due to a higher regulatory burden or due to the introduction of a proportional transaction tax. In any case, we assume these costs to be fully wasteful.

Table 5: Higher Borrowing Cost

$r^S + \tau$	$= 6\%$	$= 7\%$	$= 8\%$
Debt-to-income			
Realists	8.69%	7.14%	5.86%
Over-optimists	8.40%	6.96%	5.80%
Average	8.63%	7.10%	5.85%
Bankruptcy filings			
Realists	0.75%	0.73%	0.71%
Over-optimists	1.45%	1.42%	1.38%
Average	0.89%	0.87%	0.85%
Average interest rates			
Realists	11.82%	13.84%	16.03%
Over-optimists	13.01%	15.31%	17.62%
Average	12.06%	14.13%	16.35%
Paternalistic Welfare Change (in % CEV)			
Realists		– 0.39%	– 0.73%
Over-optimists		– 0.46%	– 0.85%
Average		– 0.41%	– 0.75%

Table 5 depicts the results of increasing the borrowing cost by one and two percentage points. This implies risk-free lending rates of 7% and 8% relative to the benchmark of 6% per annum. As borrowing costs go up, people borrow less. Interestingly, the average interest rate goes up by more than the increase in transactions costs – even though bankruptcy filings slightly drop. This over-proportional increase is due to people defaulting on larger loans. While the average debt/income ratio falls, the distribution of loans across people changes significantly (not shown in the table): as transaction costs increase, people at the margin who were previously borrowing small amounts stop borrowing altogether. Meanwhile, people who need larger loans now borrow even more because they roll over at higher interest rates. The composition of loans thus comprises less small lower-risk loans and more large higher-risk loans. Lenders expect higher write-offs and average interest rates rise by more than the increase in borrowing cost.

Not surprisingly, realists dislike such an increase in borrowing cost. They behave optimally and thus do not gain from restricted (or more expensive) access to debt. Surprisingly though, the welfare loss is even larger for over-optimists. It seems that higher borrowing cost discourage default because fewer people borrow to begin with. However, discouraging default amplifies the financial mistakes that over-optimists commit since they already filed for bankruptcy too little in our benchmark. As a result, over-optimists fare even worse than realists when borrowing costs are increased.

5 Conclusion

In this paper, we quantitatively analyze consumer credit markets with behavioral consumers and default. To that end, we introduce over-optimistic borrowers into an economy with unsecured debt and equilibrium default. Households are subject to idiosyncratic earnings and expense shocks. Rational households hold correct beliefs about the future while over-optimistic households think of themselves as realists but actually face systematically higher expense risk. Lenders price credit endogenously but cannot directly distinguish household types. By observing income and expense shock realizations they form type scores (i.e. beliefs about the probability of a household being rational). In equilibrium, spill-overs arise between rational and over-optimistic borrowers with the same type score. Because over-optimists default particularly often, cross-subsidization goes from rational to behavioral consumers.

When more over-optimists populate our economy, the average interest rate goes up. Both types borrow less and default less on an individual level. However, aggregate debt and aggregate bankruptcies increase due to a composition effect: when increasing the fraction of over-optimists, the economy is composed of more risky households that borrow and default more. Due to overestimating their ability to repay, over-optimists borrow too much and default too late compared with the paternalistic benchmark.

To address these inefficiencies, we explore three potential policy reforms. First, we reduce default cost, inducing over-optimistic people to default earlier. While this increases over-optimistic welfare, rational people suffer from tighter borrowing limits they face. Second, we investigate financial literacy education where we inform consumers and lenders about the true types. Over-optimists are be made worse off by facing their true, higher than expected, exposure to risk. Furthermore, they do not benefit from cross-subsidization anymore. Rational people on the other hand benefit from the policy because they are no longer pooled with the high-risk over-optimists. Linking to the current policy debate, some of the voiced concern about naive consumers could be driven by self-interested (rational) policy-makers not wanting to cross-subsidize behavioral borrowers. Third, we explore the implications of making borrowing more costly in order to reduce over-borrowing. However, both groups are made worse off by facing significantly higher interest rates.

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