Naïve Consumers and Financial Mistakes

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(Preliminary)

Abstract

Financial contracts are complicated and consumers often do not grasp them in their entirety. This may lead to financial mistakes. We develop a quantitative theory of unsecured credit and equilibrium default where borrowers can sign debt contracts that trade off interest rates for penalty fees. These fees make unforeseen financial shocks—such as paying late or borrowing over limit—costly. The economy is populated with sophisticated and naïve borrowers. Naïves face higher financial uncertainty without internalizing this fact. They make financial mistakes as they choose inefficiently high penalty fees. In equilibrium, these fees cross-subsidize interest rates for sophisticates. We use this framework to analyze two unexplored features of the CARD act: transparency requirements and penalty fee limits. More transparency leads to less financial uncertainty for naïve borrowers, while fee limits constrain everyone. Both policies reduce financial mistakes and increase the welfare of naïves. The effects on sophisticates, in contrast, are negative: If naïves make fewer mistakes due to clearer language, sophisticates lose cross-subsidization and experience welfare losses. The same holds true in the case of fee limits. When high-fee contracts are banned, expected revenue from naïve fee payments falls and interest rates rise. As a result, sophisticates experience a welfare loss.

JEL Codes: E21, E43, G18, G41, G51, K12

Keywords: Consumer Credit, Naïveté, Financial Mistakes, Bankruptcy, CARD Act, Cross-Subsidization

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1 Introduction

Financial contracts can be quite complicated. According to the Wall Street Journal, credit card contracts in 2013 are up to 50 times longer than in 1980—20,000 words in 2013 versus 400 words in 1980.[1] Complicated contracts are harder to understand. Indeed, many cardholders fail to understand key aspects of their contracts, including when late payments trigger penalty fees (GAO, 2006).[2]

Despite not being fully internalized, penalty fees constitute a significant part of the cost of banking to consumers. In 2011, nearly 28% of US consumer checking accounts experienced non-sufficient funds or overdraft fees. Nearly one third of those accounts accrued more than 10 penalty items with an average fee of $225 (CFPB, 2014). Besides paying interest, credit card borrowers incur penalty fees for repaying financial obligations too late or for exceeding lines of credit. With late fees and over limit fees constituting the largest items, Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015) document that the average credit card holder paid $58 in fees per year.

While some of these penalty fees are certainly the consequence of a rational optimization of one's financial situation, some of these fees seem to occur by mistake. Missing important aspects of their credit contract,[3] consumers can lose track of financial commitments, misunderstand minimum payments, or forget to pay bills on time. These financial mistakes are quite common. For example, 52% of borrowers that were charged overdraft fees do not recall opting in to overdraft at all (PEW, 2014). Besides leading to unexpected penalty fees, financial mistakes can cause financial distress. According to Warren, Sullivan, and Jacoby (2000), "credit card debt out of control" and "trouble in managing money" are the third and fourth most common reasons given for a consumer bankruptcy. Only job loss and medical reasons rank higher.

Due to their potentially high cost and severe consequences, financial mistakes are at the center of many pieces of regulation. The 2009 Credit Card Accountability Responsibility and Disclosure (CARD) Act in the U.S. is the most prominent recent example. Policy makers tackle financial mistakes along two dimensions: firstly, transparency requirements and reporting standards make contracts easier to understand, lowering the likelihood of incurring penalty fees by mistake. Secondly, the CARD Act caps penalty fees, reducing the cost of financial mistakes that trigger a penalty fee.

Despite the importance of penalty fees and financial mistakes for consumers and policy makers, state-of-the-art quantitative research cannot inform regulators about their costs and consequences. Standard models of consumer debt simply abstract from penalty fees and have no roll for financial mistakes. Without these important ingredients, transparency

[1] See `https://www.wsj.com/articles/SB10001424127887324000704578386652879032748`.

[2] According to the United States Government Accountability Office, this lack of understanding is a consequence of lenders deliberately complicating their contracts.

[3] See GAO (2006).

requirements or fee limits as mandated by the CARD act seem futile. We address this gap in the literature and answer the following questions: What are the consequences of financial mistakes for credit market outcomes? Can regulation similar to the CARD act achieve better outcomes? How do these policies influence the interaction between consumers that make more and less mistakes?

In a framework where some borrowers make financial mistakes due to their lack of understanding, we explore the implications on interest rates and welfare when consumers borrow on credit contracts that trade off interest rates and penalty fees. Building on the theory of Naïveté,[4] we set up a heterogeneous agents model of unsecured debt and default that is inhabited by two types of agents: sophisticates and naïves. While all borrowers are subject to financial shocks that trigger penalty fees, naïve borrowers are unaware of their increased exposure to these shocks and the ensuing penalty fees. Being naïve, these consumers behave just like sophisticated consumers (as is standard in the literature) and choose contracts that carry too high penalty fees. This is what we term financial mistakes. Behaving identically, both types of consumers are indistinguishable to lenders. Lenders maximize profit and offer a menu of loan contracts. Conditional on a requested amount and borrower characteristics, lenders offer a continuum of interest rate and penalty fee combinations for both types of borrowers to choose from.

In equilibrium, lenders only offer contracts that yield equal expected revenue. Hence, debt contracts trade off lower interest rates for lower penalty fees. When choosing from the menu of loan contracts, naïve borrowers do not understand the true expected cost of penalty fees and consequently choose contracts that carry too high penalty fees (that they are naïve about) because they prefer low interest rates. Naïve borrowers make financial mistakes: on average, they pay more for credit than they would if they knew their true exposure to financial shocks. Sophisticated consumers are less prone to financial shocks and incur fewer penalty fees. Being pooled with naïve agents, they benefit from the same set of contracts where low interest rates are subsidized by high penalty fees. These high penalty fees are mainly carried by naïve consumers. Thus, sophisticated consumers face cheaper credit in the presence of naïve consumers than if they were by themselves.

We use this framework to analyze two important aspects of the 2009 CARD Act: (1) The CARD Act defines how late fees, interest rates, and minimum payments are to be reported and communicated to consumers. With stringent transparency requirements, standardized language, and clearer reporting standards contracts are easier to understand. More understandable contracts reduce the risk of financial mistakes. (2) The CARD Act limits how lenders can reset interest rates in response to missed payments and restricts the amount of penalty fees to be charged. Limiting penalty fees for borrowers reduces the cost of financial mistakes. We find that both pieces of legislation have a similar impact on credit contracts offered in equilibrium. Revenues from penalty fees shrink, either

[4]Cf. Armstrong and Vickers (2012), Gabaix and Laibson (2006), and Heidhues and Kőszegi (2010).

because (1) consumers make fewer mistakes and thus pay fees less often or because (2) lenders are banned from offering high penalty fees. Consequently, interest rates rise for the equilibrium contracts and cross-subsidization from naïves to sophisticates is reduced under both policies.

Naïve consumers benefit from both reforms. Their lack of understanding become less consequential either (1) because they make fewer mistakes per se due to simpler contracts or (2) because they are protected from choosing too high penalty fees. Naïves pay too much for their credit prior to the reform and both policies reduce their cost of credit. Because sophisticated agents lose cross-subsidization, they stand to lose from these reforms. While inconsequential to their understanding of credit contracts, sophisticates lose out on cross-subsidization as a consequence of (1) transparency requirements. With naïves committing fewer financial mistakes and paying lower penalty fees, sophisticates face higher interest rates. They consequently suffer from transparency requirements. Similarly, (2) limiting penalty fees also reduces sophisticate welfare. Penalty fee limits force naïve borrowers to choose contracts with lower fees, thereby reducing the size of their mistakes. Similar to before, this leads to welfare losses.

1.1 Related Literature

This paper contributes to three strands of literature. First, it relates to empirical studies which try to evaluate the 2009 CARD act. Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015) use panel data to analyze the effects of the 2009 CARD Act and estimate that regulations lead to a decrease in overall borrowing costs. Nelson (2020) also considers the CARD Act and finds that lower markups and limited ability to raise borrowers' interest rates based on new information lead to a fall in average transacted prices. However, he also reports that prices rose in some parts of the market, thereby unveiling possible cross effects which might mitigate the legislator's intent. We add to this literature by proposing a structural model to evaluate two main components of the reform. Besides identifying the importance of financial mistakes, a structural quantitative model allows to identify key mechanisms, gauge effects through equilibrium pricing, and estimate welfare.

Second, our paper extends Naïveté in credit markets to setups with imperfect enforcement and equilibrium default. Furthermore, it quantitatively gauges the relevance of Naïveté in the credit market and for credit market regulation. Naïveté has long been the focus of theoretical contributions. Armstrong and Vickers (2012) show that in markets with sophisticated and naïve consumers a pooling equilibrium may exist and that competition can work to subsidize the sophisticated at the expense of the naïve. This exploitation of naïve consumers is also present in the work by Heidhues and Kőszegi (2015), who study Naïveté-based discrimination and find that firms lend more than is socially optimal to increase unexpected payments of naïve consumers. Heidhues and Kőszegi (2010) develop a model of loan-repayment in competitive credit markets with consumers who value im-

mediate gratification. They show that non-sophisticated consumers take on credit which is cheap in the short term, but would then go on to overborrow and pay large penalties, thereby suffering considerable welfare losses. In Eliaz and Spiegler (2006), agents have dynamically inconsistent preferences and the principal offers a menu of loan contracts in order to screen for sophistication. Gabaix and Laibson (2006) propose a framework in which firms offer cheap baseline contracts in order to hook naïves and earn profits from shrouded prices for additional payments.

Besides constituting an important theoretical tool to study credit markets and contract design, Naïveté also seems to be relevant empirically. DellaVigna and Malmendier (2004) study how firms respond to partially naïve time-inconsistent consumers. They show that contract design targets consumers' misperception of future behavior. Using transaction data of retail funds, Gao, Hu, Kelly, Peng, and Zhu (2020) document that naïve investors cross-subsidize sophisticated investors. Relative to simple non-structured funds, this subsidization is especially pronounced when trading more complex structured funds.

Third, we expand the standard framework of unsecured credit and equilibrium default based on the seminal work by Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007) and Livshits, MacGee, and Tertilt (2007).[5] We introduce naïve agents that misunderstand financial contracts and make financial mistakes. This notion of Naïveté creates a natural role for information requirements and penalty fee limits, which are an integral component of the 2009 CARD Act. To the best of our knowledge, we are the first to quantitatively assess the importance of Naïveté in the credit market. Furthermore, we employ our new framework to investigate central components of the CARD Act that have not been studied before.

There have been other approaches to incorporate behavioral consumers into a model of unsecured credit and equilibrium default. Nakajima (2017) introduces hyperbolic discounters but does not allow for any interactions between consumer types. Exler, Livshits, MacGee, and Tertilt (2020) model over-optimistic consumers that interact with rational consumers through pricing. Chatterjee, Corbae, Rios-Rull, and Dempsey (2018) develop a framework where agents hold heterogeneous discount factors. Both papers focus on how lenders learn about consumer types and do not have a role for information requirements or fee limits. Raveendranathan and Stefanidis (2020) analyze the ability to pay check mandated by the 2009 CARD Act, but also have no role for assessing transparency regulations.

The remainder of this paper is structured as follows: Section 2 presents the framework, Section 3 describes the calibration, Section 4 explores the benchmark properties and mechanisms of the model before Section 5 investigates two important components of the 2009 CARD Act. Section 6 concludes.

[5] See Exler and Tertilt (2020) for a recent survey.

2 The Model Framework

We propose a quantitative theory which allows for the interaction of Naïveté and default and has an explicit role for information requirements and penalty fee limits which are often formulated in credit market legislations. We study an incomplete-market heterogeneous-agent model of unsecured debt and idiosyncratic uncertainty about earnings. Furthermore, the model features equilibrium default and endogenous borrowing interest rates.

2.1 Households

We set up a standard overlapping generations model with an economy which is populated by a continuum of households, with one model period representing one year. Individuals enter the model at age 21 and die with certainty at age 80. They derive utility from consumption in each period, c_t, and maximize expected lifetime utility:

$$\mathbb{E}_0 \left\{ \sum_{j=1}^{J} \beta^t u(c_t) \right\},$$

where $\beta < 1$ is the time discount factor.

Each agent decides on consumption, whether to save or borrow and can file for bankruptcy. The model features equilibrium bankruptcy and abstracts from secured lending like mortgages. Instead, we focus on unsecured credit such as credit card debts. Households face idiosyncratic risk in labor productivity and financial shocks, while wages and the risk-free interest rate are set exogenously.

Labor Productivity. Households are subject to idiosyncratic shocks to their labor productivity p, which represents the wage risk they are facing. Income y_j is given by $y_j = p \cdot e(j)$, with $e(j)$ being an age-dependent efficiency premium as in Livshits, MacGee, and Tertilt (2007). Individual labor productivity is modeled as a persistent AR(1) process $z_{i,t}$ with transitory white noise $\eta_{i,t}$. Hence, for a household i at age j, productivity evolves according to

$$\begin{aligned} \log(p_{i,j}) &= z_{i,j} + \eta_{i,j} \\ z_{i,j} &= \rho z_{i,j-1} + \zeta_{i,j}, \end{aligned} \tag{1}$$

where $\rho \in [0, 1]$, $\eta \sim \mathbb{N}(0, \sigma_\eta^2)$ and $\zeta \sim \mathbb{N}(0, \sigma_\zeta^2)$.

Financial Shocks. Households are prone to unforeseen financial shocks ε. For example, these shocks can be thought of as unanticipated bills or repaying one's credit too late. If a household incurs such a financial shock and does not have the assets to pay for it, a lender will provide them with the funds in exchange for a fee ϕ (e.g.: overdraft fees, late

payment fees, etc.). Thus, for indebted households the costs of a financial shock are given by $\phi \cdot \varepsilon$, while households who are holding assets can pay ε out-of-pocket.

There are two types of households in the economy: Rational, sophisticated consumers (S) and naïve consumers (N), whose shocks share the same support: $\varepsilon \in \Omega_N = \Omega_S$. However, naïve borrowers face higher probabilities that a nonzero shock occurs:

$$p_N(\varepsilon = \omega_i) > p_S(\varepsilon = \omega_i) \quad \text{for all} \quad \omega_i > 0. \tag{2}$$

Sophisticated borrowers know the distribution of their shock and take it into account when making decisions. In contrast, naïve consumers do not understand their higher exposure to financial shocks and expect the same distribution that sophisticates face:

$$\tilde{\mathbb{E}}_N(\varepsilon_N) = \tilde{\mathbb{E}}_S(\varepsilon_S) = \mathbb{E}(\varepsilon_S) \tag{3}$$

where $\tilde{\mathbb{E}}_i(\cdot)$ denotes the perceived expectation of consumers (which might differ from the true expectation in case of a naïve agent).

Consequently, given their perceived expectation over financial shocks, naïve agents behave exactly like sophisticated consumers, conditional on their state. Hence, lenders cannot distinguish between the two types and offer the same loan contract to everyone. Furthermore, we abstract from learning in the sense that even if a consumer keeps experiencing bad shocks, the lenders do not update their belief about the borrower's type - they can only observe the total debt, not the history of shocks which led to that level.[6] This means that we are only analyzing a pooling equilibrium, in which prices depend on the share of naïve and sophisticated consumers in the market, but do not vary between the types. However, in later sections and especially when talking about policy experiments, we compare the results from such a pooling equilibrium to the outcomes in a market where lenders always know the type of their customers.

Financial Mistakes. Due to underestimating their true proneness to financial shocks, naïve borrowers might miscalculate their expected payments resulting from fees, that is $\tilde{\mathbb{E}}_N(\phi \cdot \varepsilon) < \mathbb{E}(\phi \cdot \varepsilon)$. Therefore, naïve borrowers might fail to choose an optimal debt contract and opt for contracts which yield lower interest rates but higher fees. Consequently, their true expected total cost of credit will exceed the optimal costs associated with an optimal contract which a social planner would choose for them. The extent of this over-payment is called a financial mistake.

Bankruptcy. Households can choose to default and not repay their debt and financial mistakes. Bankruptcy is modeled as a Fresh Start according to Chapter 7 meaning that

[6] In subsection 2.3 we discuss how the total debt can hold some information on whether the lender deals with a sophisticate or a naïve and how this is accounted for in equilibrium.

upon default all outstanding debt is discharged and the household enters the next period without any obligations.

However, default is costly since a fraction γ of current income is garnished and distributed to the creditors. Furthermore, the household incurs a utility cost χ which can be thought as stigma costs.

Decision Problem. A household's decision variables are consumption c, debt level d (where $d < 0$ are positive asset holdings) and a financial contract when taking on a loan. A financial contract is a combination of loan prizes q and fees for financial shocks ϕ. Lenders will offer different loan prizes for different fees and the borrowers choose a contract by deciding on a fee level. Note, however, that this fee choice will only be important in the next period, when the borrower might be faced with a financial shock ε and then has to pay $\phi \cdot \varepsilon$.

Let $V(d, \phi; s)$ denote the value function of a consumer in state $s = (z, \eta, j)$, who is holding debts d and chose a fee ϕ last period. If a consumer declares bankruptcy, all debt charges are dismissed ($d = 0$ and $\varepsilon = 0$), but a fraction γ of income is garnished and the household experiences a disutility χ. Also, no saving is allowed for next period, the household simply consumes all income that is not garnished.

With $q(d', \phi'; s)$ being the loan prize for a loan of size d' with fees ϕ' for an individual in state s, the consumer's decision problem reads

$$\begin{aligned} V(d, \phi; s) = \max_{c, d', \phi'} \Big[u(c) + \beta \mathbb{E} \max \Big\{ V(d', \phi'; s'), B(s') \Big\} \Big] \\ \text{s.t. } c + d \leqslant y(s) + q(d', \phi'; s) d' - \phi \cdot \varepsilon \end{aligned} \tag{4}$$

where B is the value of filing for bankruptcy:

$$\begin{aligned} B(s) = u(c) - \chi + \beta \mathbb{E} \Big\{ V(0, \phi'; s') \Big\} \\ \text{s.t. } c = (1 - \gamma) y(s) \end{aligned} \tag{5}$$

Note that this decision problem is the same for both sophisticated and naïve consumers since the latter do not realize their higher proneness to financial shocks. Consequently, the decisions of sophisticates and naïves will be the same based on their observable state.

2.2 Credit Market

Let $s = (z, \eta, j)$ denote a household's current state, with z being the persistent component of labor productivity, η the transitory shock and j age. If an individual seeks out a loan, the lender sets the loan prize depending on loan size and the individual's current state s.

Furthermore, banks offer different loan prizes depending on an additional fee, ϕ. There is no asymmetric information as lenders observe the current state of a household and the loan size. Also, whether a household is naïve or sophisticated is unknown by all. However, lenders know the fraction of naïves μ in the economy.

Loan Contracts. Loans are only sought out for one period and households have a limited commitment to repay. A loan contract consists of the face value of the debt, $d' \in (0, \infty)$, the loan prize, $q \in [0, 1]$, and penalty fees for financial mistakes, $\phi \in [1, \infty)$. Households can choose which contract to take and decide to simply repay their financial shocks without additional fees ($\phi = 1$) or to gamble by accepting higher fees in exchange for lower interest rates ($\phi > 1$). Also, note that in equilibrium the endogenous loan price depends on d', s, and ϕ.

Lenders. When deciding on the bundle of contracts the lenders take as given the exogenous interest rate r. Revenue consists of two components: The expected revenue from the issued loan and the expected revenue from additional payments due to the fee ϕ. If a household is hit by a shock ε, which is interpreted as unexpected financial mishandling, the bank's revenue is simply given by:

$$(\phi - 1) \cdot \varepsilon$$

Furthermore, households can default on their debts. In this case, a fraction γ of the household's current income is garnished to repay parts of outstanding debt. We assume that garnished income is split equally among all creditors and hence, the recovery from a defaulted loan for the bank is given by

$$\rho(d', s, \varepsilon) = \gamma y(s) \cdot \frac{d'}{d' + \varepsilon}$$

Let $\theta(d', s, \varepsilon, \phi)$ denote a household's decision to default depending on loan size d', current state s, financial shock ε and fee ϕ. Then a bank's expected profit is given by:

$$\Pi = -q(d', \phi, s)d' + \frac{1}{1+r} \int \theta(d', s', \varepsilon, \phi)\rho(d', s', \varepsilon) + \Big(1 - \theta(d', s', \varepsilon, \phi)\Big)\Big(d' + (\phi - 1)\varepsilon\Big)\, \mathrm{d}\mu(s', \varepsilon)$$

with $\mu(s', \varepsilon)$ being the probability measure over next period's possible states s' and financial shocks ε.

We assume perfect competition and free entry for lenders, which leads to zero profits

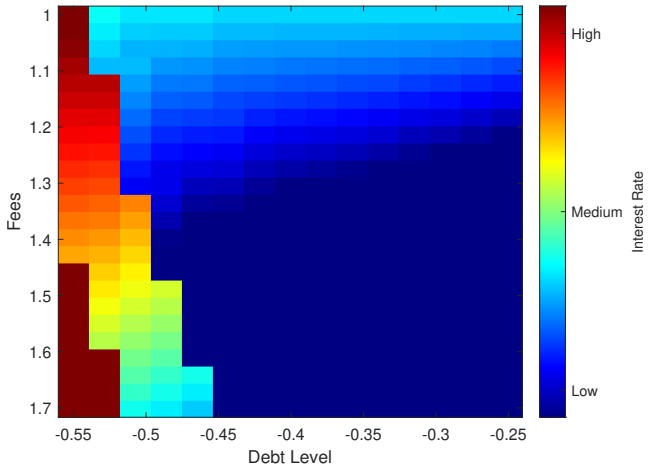


Figure 1: Example contract space

conditional on observables d' and s and hence,

$$q(d', \phi, s) = \frac{1}{1+r} \int \theta(d', s', \varepsilon, \phi) \frac{\rho(d', s', \varepsilon)}{d'} + \Big(1 - \theta(d', s', \varepsilon, \phi)\Big) \left(1 + \frac{(\phi - 1)\varepsilon}{d'}\right) \mathrm{d}\mu(s', \varepsilon). \tag{6}$$

Equation 6 is the implicit functional relationship between $q(\cdot)$ and ϕ, $q = q(\phi, \cdot)$, which holds in equilibrium. Figure 1 shows an example contract space and the relationship between interest rates and fees at different debt levels.

There are two interesting cases to distinguish. If agents choose $\phi = 1$, they decide to fully insure against financial shocks and never have to pay an additional fee if they occur. This comes at the cost of higher interest rates. A choice of $\phi > 1$ relates to positive penalty fees that lenders charge in the case of financial shocks. This choice might lead to lower interest rates as lenders can expect more revenue from fees. Lastly, note that there exists an endogenous limit on penalty fees, since too high fees always cause default: $\exists\ \bar{\phi} \in \mathbb{R}^+$: $\forall\ \phi > \bar{\phi} : \mathbb{E}[\theta(\cdot)] = 1$. Thus, $q(\phi > \bar{\phi}, \cdot) = 0$.

2.3 Distribution of naïve consumers

When creating the bundle of contracts as defined in Equation 6, the lender takes as given the debt level d' without knowing whether the borrower is naïve or sophisticated. However, since naïve agents are more prone to financial shocks, the lender might deem it more likely that they are dealing with a naïve borrower for very high debt levels. In this case, the lender might attribute a probability $\hat{\mu} > \mu$ to the chance of dealing with a naïve agent, where μ again denotes the fraction of naïves in the economy. Figure 2 shows an example of an assumed distribution over asset holdings, where the fraction of naïves might vary for different debt levels. We can see how the expectation of dealing with a

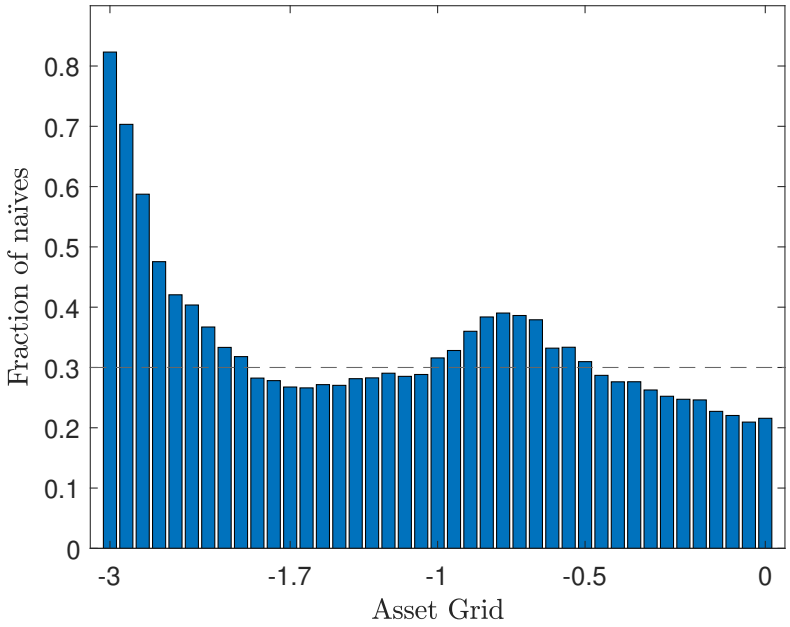


Figure 2: Example of distribution of naïve consumers over different debt levels (share of naïves in whole economy $\mu = 0.3$).

naïve borrower rises for the highest debt levels, while the fraction of naïves at debt levels close to zero is even smaller than the economy wide average.

Hence, when calculating expected repayment and default probabilities for the debt contracts in Equation 6, the lender uses a prior belief of naïves over debt levels d', $\hat{\mu}(d')$. This belief $\hat{\mu}(\cdot)$ might differ from the true ex-post distribution $\mu(\cdot)$, whereupon the lender updates their prior belief. Thus, in equilibrium we have $\hat{\mu} = \mu$ and the lender uses all the information entailed in the debt level d' chosen by the borrower.

3 Calibration

This section presents the parameter values used to numerically solve the benchmark economy. Some parameters are set externally, while others are estimated using a Simulated Method of Moments approach to match important credit market data. We use data of the consumer credit card market from the Consumer Financial Protection Bureau (CFPB, 2014) and credit card account data from the Office of the Comptroller of the Currency in the US (OCC) as reported in Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015). Although the current calibration strategy is limited with respect to variable selection and model outcomes, it still provides a meaningful foundation to solve the model and gauge the importance of our proposed mechanisms. Future versions will include a more intricate simulated methods of moments approach to determine the model's parameters.

Households live for 60 periods and one period represents one year. Individuals enter the model at age 20 and die with certainty at age 80. There is no formal retirement,

Table 1: Directly specified parameters

Economic Parameters		Value
CRRA consumption	σ	2
Persistent Wage Autocorrelation	ϱ	0.95
Persistent Wage Var	σ_ζ^2	0.025
Transitory Wage Var	σ_η^2	0.05
Risk Free Rate	r	1%
Garnishment rate	γ	0.15
Cost of default	χ	1.5
Financial Mistakes		
Size of mistakes	ε	$(0, 0.018, 0.126)$
Sophisticates	$Pr^S(\varepsilon)$	$(0.88, 0.084, 0.036)$
Naïves	$Pr^N(\varepsilon)$	$(0.28, 0.504, 0.216)$
Share of naïves	μ	0.3

but households' age-dependent experience premium drops after the age of 65. Per-period utility takes the form of a CRRA utility function

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma},$$

where the risk-aversion parameter, σ, is set to 2, which is standard in the literature. The discount factor β is chosen to match an average interest to debt ratio of 14.3% and the risk-free rate is set exogenously to 1%.

Persistent labor productivity follows a simple AR(1) process where the autocorrelation parameter is set to $\rho = 0.95$ and the variance of the iid shock chosen to be $\sigma_\zeta^2 = 0.025$. The variance of the transitory shock is $\sigma_\eta^2 = 0.05$. All these values are within the range of standard literature.

A household who decides to file for bankruptcy experiences stigma costs in the form of a disutility of $\chi = 1.5$ in the period of default and a fraction $\gamma = 0.15$ of current income is garnished.

Financial Shocks. Financial shocks are modeled to take on only three different values: $\varepsilon \in \{0, \omega_1, \omega_2\}$. These values are meant to represent no occurrence of a financial shock within a year, only one such occurrence, and repeated occurrences. We use data on overdraft from the CFPB (2014) to estimate that a fraction of 21% of borrowers experiences only one item per year, while 9% of borrowers experience two or more items. Hence, we set $p(\omega_1) = 0.21$ and $p(\omega_2) = 0.09$.

These values represent the economy wide average and have to be split into different

Table 2: Jointly-Targeted Moments

	Data (OCC)	Model
Avg. Interest / Debt	14.30%	13.89%
Avg. Fees / Debt (AFD)	7.10%	4.77%
AFD naïve / AFD sophisticated	6	7.57
	Parameter	Value
Discount factor	β	0.77
Size small financial shock	ω_1	0.57
Relative likelihood of financial shock	ψ	5.46

processes for naïve and sophisticated consumers. The size of these shocks is pinned down by two parameters. First, we look at the data to estimate the average ratio of payments for repeated occurrences in relation to payments for only one occurrence. This means that we are looking at the average ratio of ω_2/ω_1 and estimate a value of 7. By doing so, the value ω_2 is now simply determined by the value of ω_1 which is chosen to match an average ratio of fee payments to debt of 7.1%, as observed in the OCC data. The value to do so is $\omega_1 = 0.018$, with median income normalized to 1.

Naïveté. Lastly, the most important part concerns our choice of modelling Naïveté. The first parameter to pin down is the fraction of naïves in the economy. Looking at data from the OCC we find that a share of 30% of borrowers have a FICO score of 660 or less. Typically, a FICO score above 660 is considered favorable and since naïve agents in our model are those who experience more financial shocks we relate them to the people with lower FICO scores. Consequently, we set the share of naïves, μ, equal to 30%.

To determine the extent of Naïveté, we define a probability spread ψ which denotes how much more likely a naïve agent is to receive a non-zero financial shock:

$$\psi = \frac{p(\varepsilon_N = \omega_1)}{p(\varepsilon_S = \omega_1)} = \frac{p(\varepsilon_N = \omega_2)}{p(\varepsilon_S = \omega_2)} \tag{7}$$

where $p(\varepsilon_N = \omega_i)$ is the probability that a naïve agent experiences a shock of $\omega_i > 0$ and $p(\varepsilon_S = \omega_i)$ the corresponding probability of a sophisticate.

If $\psi = 1$, there is no naïveté in the economy and all consumers experience the same shocks. If $\psi > 1$, naïve consumers experience financial shocks more often but are not aware of this fact (as discussed in section 2).

We choose $\psi = 5.14$ to obtain a ratio of average fee payments of naïves over average fee payments of sophisticates equal to 6. This ratio corresponds to the differences in fee payments seen in the data from the OCC for borrowers with low and high FICO scores.

The specific probability processes for naïves and sophisticated are then constructed in such a way that their weighted mean (with the share of naïves, μ, used as weight) results in the economy wide probabilities determined above.

Parameters and targets are summarized in tables 1 and 2.

4 Results

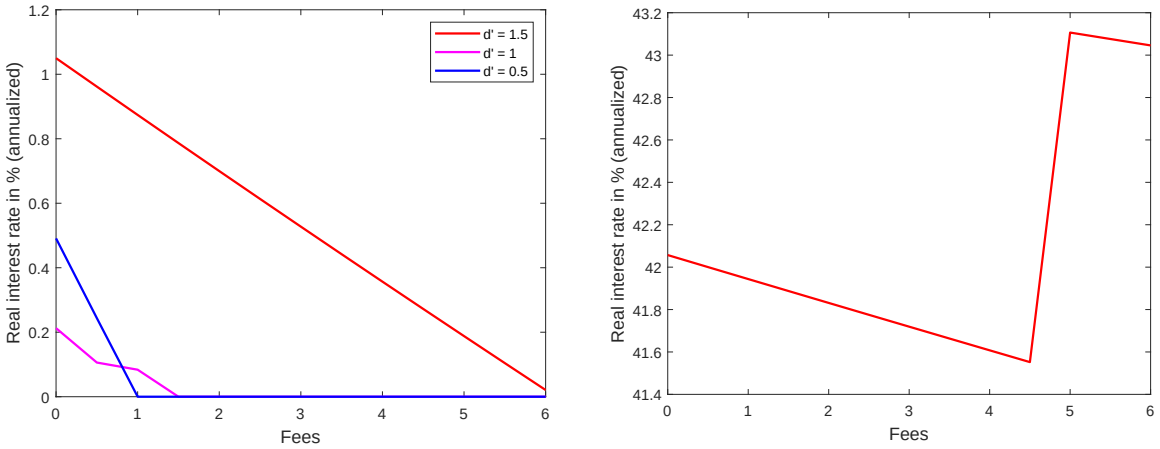
With the previously defined parameters, we solve the model quantitatively by backward iteration on the value function. Before turning to the benchmark outcomes in Section 4.2, Section 4.1 illustrates the effects of naïveté on the design of credit contracts and life cycle outcomes. Section 4.3 discusses cross-subsidization and its welfare effects and Section 4.4 highlights the importance of default for the mechanisms.

4.1 Illustration of Mechanism

Figure 3 shows an example of possible $(q(\phi, \cdot), \phi)$ schedules as defined in Equation 6 for different loan sizes d' with median income being normalized to 1. For the high income earner in Figure 3a we can see how a choice of higher fees can reduce the real interest rate. However, the $(q(\phi, \cdot), \phi)$ schedule does not have to be monotonic as can be seen in Figure 3b. There, the lender faces a low income earner who might default on future debts. Hence, at some point higher fees lead to an increase in default risk. Thus, the lender expects lower profits and consequently increases the interest rates. Note, however, that all the $(q(\phi, \cdot), \phi)$ schedules to the right of the first jump are strictly inferior to all the points to left. They combine higher fees with higher interest rates and would therefore never be chosen by the consumer. This finding ensures that – conditional on a loan size d' and consumer characteristics – the optimal contract is uniquely defined.

These $(q(\phi, \cdot), \phi)$ schedules become important when analyzing a market in which sophisticated and naïve borrowers are pooled together. Since lenders issue one contract for both types, balancing revenue from interest payments and penalty fees, the $(q(\phi, \cdot), \phi)$ schedules become steeper. This means that interest rates are falling more rapidly with the choice of higher fees, since the foregone interest payments are financed by the higher fee payments resulting from naïveté. Later sections will further elaborate on this cross-subsidization effect and show that sophisticates are indeed choosing different contracts in a pooling equilibrium when compared to a separating equilibrium.

To gauge the importance of misunderstanding the risk of financial shocks and fee payments in this framework, Figure 4 shows an example of a naïve consumer's life-time decisions concerning assets, consumption, fees ϕ and bankruptcy. While the red line shows actual decision taken by the naïve consumer, the dotted blue line shows how the optimal behavior would look like if the consumer was aware of the actual probabilities of making financial mistakes but faced the same prices. We call this hypothetical agent



(a) High income earner

(b) Low income earner, ($d' = 1.6$)

Figure 3: Example of Equilibrium Credit Contracts (q,ϕ) for a high and low income earner, aged 45-50 (median income normalized to 1).

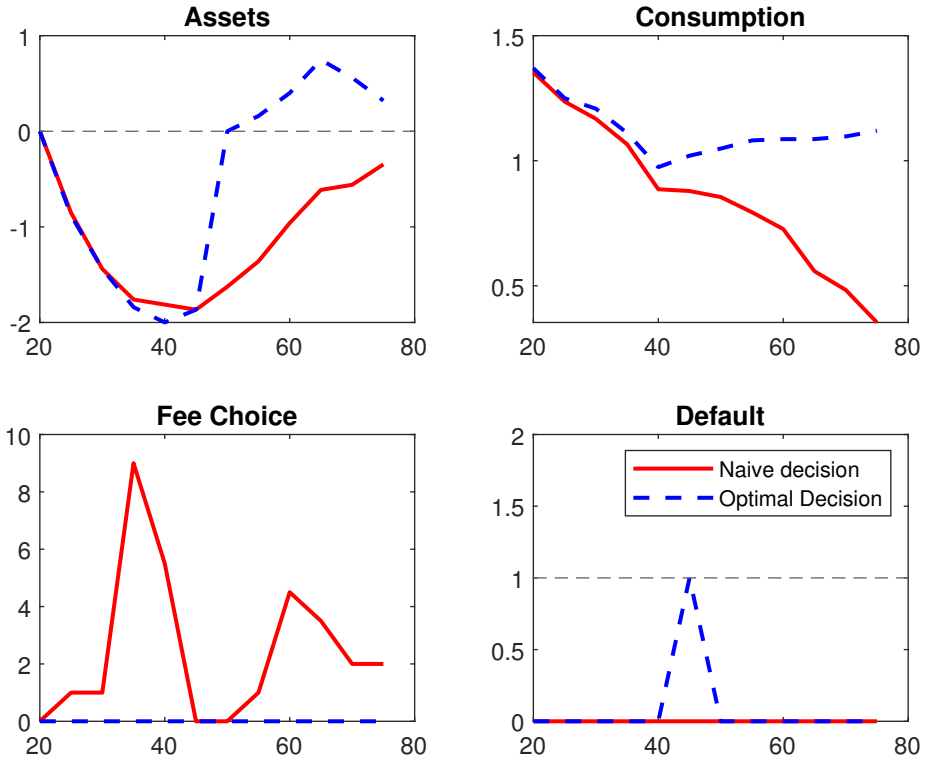
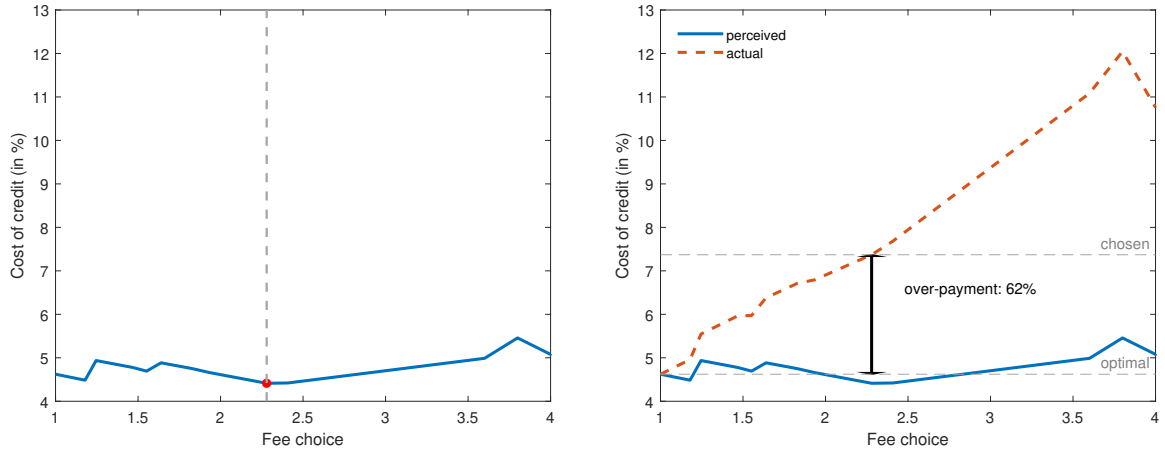


Figure 4: Optimal (dotted blue) and actual decisions (red) of a naïve consumer. Cost of Naïveté 22.5% CEV.



(a) Fee Choice based on perceived costs (b) Actual costs and over-payment

Figure 5: Over-payment of a naïve consumer based on chosen contract compared to optimal contract

informed naïve. One can see how the naïve consumer chooses significantly higher fees than the informed self, resulting in over-accumulation of debts. At age 45, the optimal behavior would be to default, but since the naïve household does not understand his true probabilities, he does not file for bankruptcy. He continues rolling over debt and enjoys significantly lower consumption in all periods thereafter. The difference leads a loss in consumption equivalence of 22.5%.

Financial Mistakes. In our setting a financial mistake is a contract which yields higher expected costs for a given credit than the optimal one. The total costs of a credit, TCC, are all the payments resulting from interest and fees, that is

$$TCC = d' - qd' + (\phi - 1)\varepsilon \tag{8}$$

where $d' - qd'$ are interest payments and $(\phi - 1)\varepsilon$ are fee payments. Note that $\phi = 1$ means that no extra fees have to be paid. Hence, the cost of credit only exceeds interest payments if $\phi > 1$.

Since naïves underestimate their true proneness to financial shocks, they also miscalculate the expected costs of a given credit contract. For a given level of current borrowing let TCC^N denote the costs of a contract chosen by a naïve consumer and let TCC^* denote the costs of a contract chosen by an informed naïve in the same state for the same amount of current borrowing (i.e. both contracts lead to the same consumption in the current period, but might differ in expected costs next period).

A financial mistake is now the relative amount of over-payment, that is the relative amount the naïve consumer has to pay more in expectation than if he had chosen the

Table 3: Benchmark Outcomes

	Sophisticated	Naïve	Average
Debt-to-income ratio	48%	55%	50%
Default Rate	0.78%	2.25%	1.22%
Interest Rates	14.90%	11.54%	13.89%
Fraction Borrowing	11%	6%	9%

optimal contract. Hence, in our setting a financial mistake is defined as

$$Mistake = \frac{\mathbb{E}(TCC^N) - \mathbb{E}(TCC^*)}{\mathbb{E}(TCC^*)}, \tag{9}$$

where the expectation $\mathbb{E}(\cdot)$ is formed with respect to the true risks.

This mechanism is illustrated in Figure 5. Part 5a shows the total costs of a given credit in percent of the amount borrowed as perceived by a representative naïve consumer. The naïve borrower chooses a fee of about 2.3, since this leads to the lowest expected costs for the given borrowing level. However, as shown in Figure 5b the actual expected costs (formed by an informed agent) considerably exceed the naïve expectations. This leads to a situation in which the naïve consumer would have liked to choose a different contract (one with $\phi = 1$), had he known the true underlying risk. In fact, the actual costs of the chosen contract exceed the costs of the optimal contract by 62%, which can be classified as a financial mistake, since both contracts yield the same level of current borrowing and only differ in expected repayment next period. Hence, the naïve borrower could have chosen a cheaper credit contract, had he known about the true underlying risk. Note, however, that this counterfactual is always given in comparison to an atomistic informed agent whose decisions do not affect prices.

4.2 Benchmark Outcomes

Table 3 presents benchmark outcomes in the economy with the parameterization as described in Section 3. Without a full calibration, we do not focus on the levels of these outcomes. However, the differences between sophisticated and naïve consumers are informative: Naïveté leads to higher debt (along the intensive and extensive margin), higher average interest rates, and higher default rates.

4.3 Cross-subsidization and Welfare

Since lenders cannot separate naïve from sophisticated borrowers, they only issue one set of credit contract for both types. Lenders only offer contracts – i.e. interest rate and

penalty fee combinations – that yield the same expected revenue. However, dealing with sophisticates only would lead to contracts with higher interest rates for each level of fees, since sophisticated consumer are less prone to mistakes. Furthermore, in equilibrium, sophisticates understand their exposure to financial shocks and want to insure against this risk, hence they will pick contracts with lower fees.

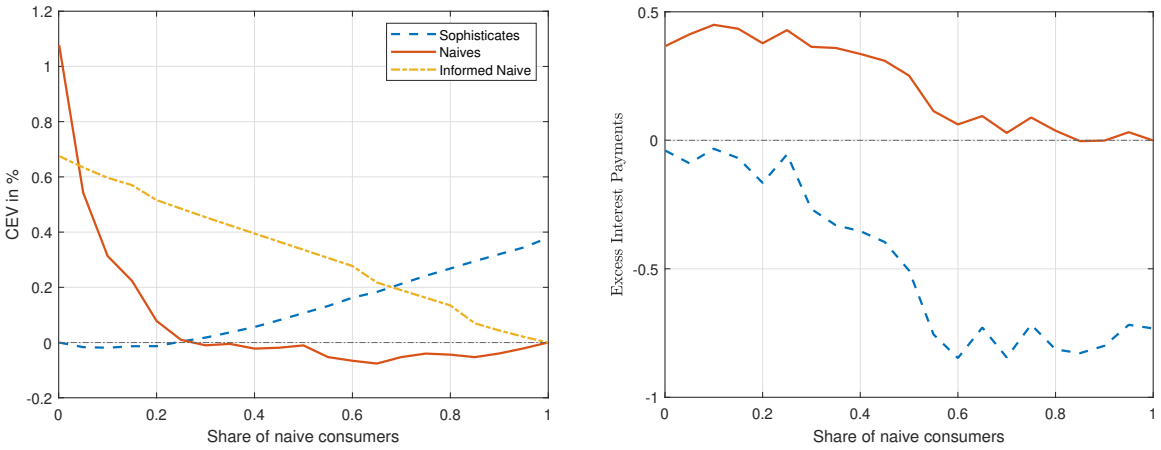
In contrast, dealing with naïve borrowers would lead to lower interest rates for each level of fees, since they are more likely to experience bad financial shocks and incur these fees. Furthermore, naïves underestimate their true proneness to these shocks and thus, in equilibrium they choose contracts with higher fees and lower interest rates than they should were they aware of their risk.

In an economy where sophisticates and naïves are pooled, lenders have to price credit in such a way as to balance those two mechanisms according to the share of naïves in the market. The welfare effects of both types interacting through pooled credit prices are represented in Figure 6a, which plots welfare of sophisticated and naïve agents depending on the share of naïve consumers in the economy. Welfare changes are measured in consumption equivalence variation in percent and computed relative to the separating equilibrium in which banks can offer different contracts to naïve and sophisticated borrowers. In other words, the point of reference for sophisticated (naïve) borrower is on the left (right). The third line in Figure 6a depicts welfare for an atomistic *informed naïve* agent, i.e. an agent that faces the same prices and the same risk of financial shocks as every naïve but understands her true exposure to these shocks and consequently picks optimal fee levels.

To gauge the importance of cross-subsidization for the observed welfare patterns, Figure 6b plots excess interest payments of both types of agents. Excess interest payments are defined as the difference in expected interest ($r(\cdot)d'$) paid by an agent in the pooling equilibrium relative to a separating equilibrium.

Sophisticate welfare level increases as the share of naïve consumers increases. Sophisticates profit from the presence of naïve agents in the economy. They profit from cross-subsidization, since pooled interest rates will fall more rapidly as fees increase because more naïves are around. Figure 6b shows that this effect manifests in decreasing average interest rates (or, equivalently, increasingly negative excess interest payments) compared to the absence of naïves. Average interest paid falls as the share of naïves in the pooled market rises. This happens because lenders shift larger parts of their revenue to fees for the financial mistakes made by naïves, thereby increasing fees and lowering interest rates. Since the decisions made by sophisticates are optimal regarding their risk of financial shocks, they benefit relatively more from lower interest rates than being hurt by higher fees.

In contrast, welfare of naïves is highest in an economy where there are only sophisticates and falls sharply as the share of naïves rises. This might seem counter-intuitive



(a) Welfare Change (b) Excess interest paid in pooling economy

Figure 6: The amount of cross-subsidization in dependence of the share of naïve consumers

because excess interest payments drop as the fraction of naïves increase and fewer sophisticates enjoy cross-subsidization (cf. Figure 6b).

However, there is a strong opposing effect reducing naïve welfare. Banks shift their focus from interest payments to punishment fees as the probability of dealing with a naïve agent increases. Abstracting from Naïveté and suboptimal fee choices, we first focus on an informed naïve. Her welfare is highest in an economy with only sophisticates because she can self-insure against her higher risk of mistakes by accepting the loan contracts of sophisticates with relatively low penalty fees. As more naïves enter the market, the set of equilibrium contracts shifts towards higher fees.[7] Thus, insurance for the informed naïve against mistakes gets worse and welfare drops.

These suboptimal fee choices are exacerbated by naïveté. Low interest-high fee contracts are tempting naïves because they underestimate their proneness to financial shocks. Thus, they choose inferior contracts and their welfare drops more steeply than that of an informed naïve. However, at higher shares of naïves in the economy, the cross-subsidization effect dominates for high fee contracts, leading to a small increase of naïve welfare above a share of 60%.

The total welfare effect of ca. 1.1% CEV for naïves that live in an economy with only sophisticates can be attributed to a better set of contracts being available even in the absence of Naïveté (ca. 0.7 percentage points, the gain of an informed naïve) and forced insurance since there are only contracts with lower penalty fees on offer (0.4 percentage points, the difference between naïves and informed naïves). Naïves are forced to insure against their risk, making them ex-post better off, although they themselves would prefer lower interest rates.

Overall, this discussion clearly shows that if the fraction of naïve consumers is high

[7]Both, sophisticates and naïves are happy to accept these contracts. Sophisticates gain cross-subsidization and naïves wrongfully think they gain cross-subsidization but actually pay more.

enough, sophisticated borrowers are being cross-subsidized by the mistakes made by naïve individuals. Naïves suffer from insufficient insurance against their higher risk of mistakes.

4.4 Default Matters

When analyzing credit contracts and the interaction between sophisticated and naïve agents, default is important.[8] Default arises because agents have less than perfect commitment to repay. Agents only repay their debts if it is *ex-post* rational to do so. This limits the amount of late fees a lender can charge and consequently limits cross-subsidization. This has important welfare consequences.

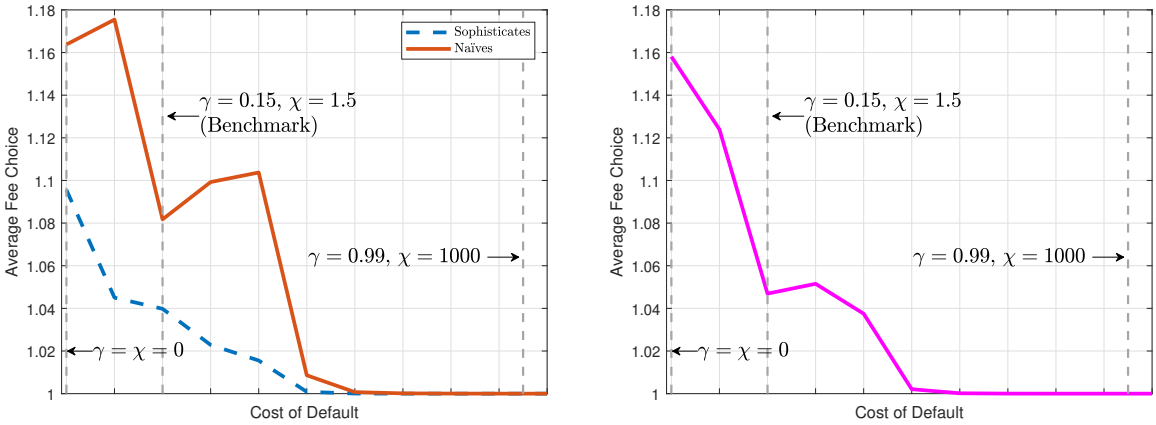
With lower default costs households face less commitment to repay their debts which is taken into account by creditors when pricing the loans. If filing for bankruptcy is completely free, only very low levels of debt can be sustained in equilibrium and lenders will charge high interest rates. In contrast, if bankruptcy is costly enough to ensure nobody ever wants to default, households can take on loans only if they are sure they will be able to repay. This leads to an equilibrium where default is theoretically possible, yet never occurs. Hence, borrowing interest rates are risk-free.

Sophisticates can only profit from lower interest rates due to the presence of naïves if a positive amount of debt can be sustained in equilibrium. Hence, if the costs of default are so high that nobody ever wants to file for bankruptcy, households will always try to insure themselves against possible default risks and thus choose debt contracts without fees ($\phi = 1$). This leads to a situation without cross-subsidization since sophisticates can only profit from the presence of naïves if the lender expects additional revenue from fee payments. If, in contrast, default is costless, only a small amount of debt can be sustained at very high interest rates. Now, sophisticates can profit from higher fee choices to reduce the amount of interest payments.

Figures 7 and 8 show the effects of different levels of default on average fee choice and excess interest payments. To that end, we interpolate between zero default cost and prohibitively high default cost. Default cost have two components: the fraction of garnished income γ and the utility cost χ. Costless default corresponds to $\gamma = \chi = 0$, while in the benchmark we set $\gamma = 0.15$ and $\chi = 1.5$ which leads to an average default rate of 1.15%. Prohibitively high default costs are $\gamma = 1$ and $\chi = 1,000$.

Figure 7a shows the effects of higher defaults costs on average fee choice in an economy without pooling where there is no interaction between sophisticated and naïve households. We can see how both choose contracts with high fees if default is costless. This happens because only a small amount of debt can be sustained in equilibrium and relative to the level of borrowing interest payments are higher than the expectations of possible fee payments. Because of limited commitment to repay debts, lenders can expect to

[8] We extend Heidhues and Kőszegi (2010) to incorporate default and better gauge the magnitude of cross-subsidization and its welfare effects.



(a) No pooling (b) Pooling

Figure 7: Effects of default costs on average fee choice.

sometimes profit from the decisions naïves make and hence offer contracts with low interest rates and high fees. Since naïves underestimate their proneness to mistakes, they choose high fees to benefit from the low interest rates. Sophisticates, in contrast, understand that lower interest rates come with the risk of high penalty fees and thus always accept lower fees than naïve consumers. Since there is no cross-subsidization without pooling, sophisticates don't profit from higher fees chosen by naïves. As the costs of filing for bankruptcy are increasing the average chosen fees decrease, since costly default translates to higher risks associated with higher fees.

Figure 7b again shows the effects of changing default costs, but here sophisticates and naïves are pooled and face the same contracts. One striking difference to Figure 7a is that now sophisticates always choose contracts with higher fees than in the separating economy, exposing themselves to higher costs associated with financial shocks. Due to pooling, however, sophisticates can profit from these contracts. Also, note how higher default costs again lead to a decrease in average fee choice. If default becomes so costly that nobody wants to file for bankruptcy anymore the average chosen fee in the economy even drop to 1, meaning that consumers want to insure against financial shocks. Agents ensure that unexpected financial costs cannot lead to a situation in which they cannot repay and have to default.

The effect of default costs on cross-subsidization is depicted in Figure 8. It plots the costs of default against the excess interest payments compared to an economy without pooling, taking as given the penalty fee choices discussed before. We can see that as long as there is default in the economy, naïves cross-subsidize sophisticates. This supports the idea that sophisticates choose higher fees when pooled together with naïves only to profit from the lower interest rates. If default becomes too expensive, average penalty fees drop sharply and cross-subsidization all but vanishes. Thus, cross-subsidization crucially hinges on the occurrence of default in equilibrium. In a model with a continuum of credit contracts that trade off interest rates for penalty fees, naïve agents would otherwise self-

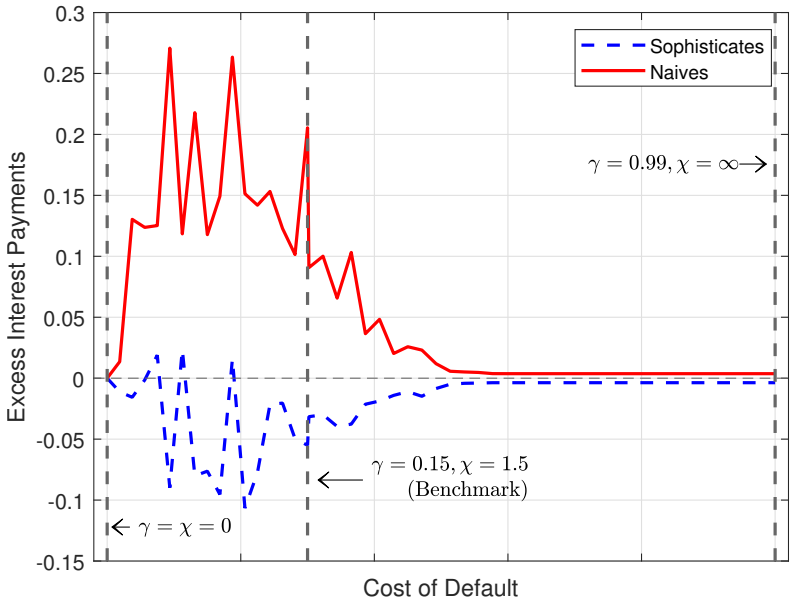


Figure 8: Difference in interest payments between mixed and isolated economy

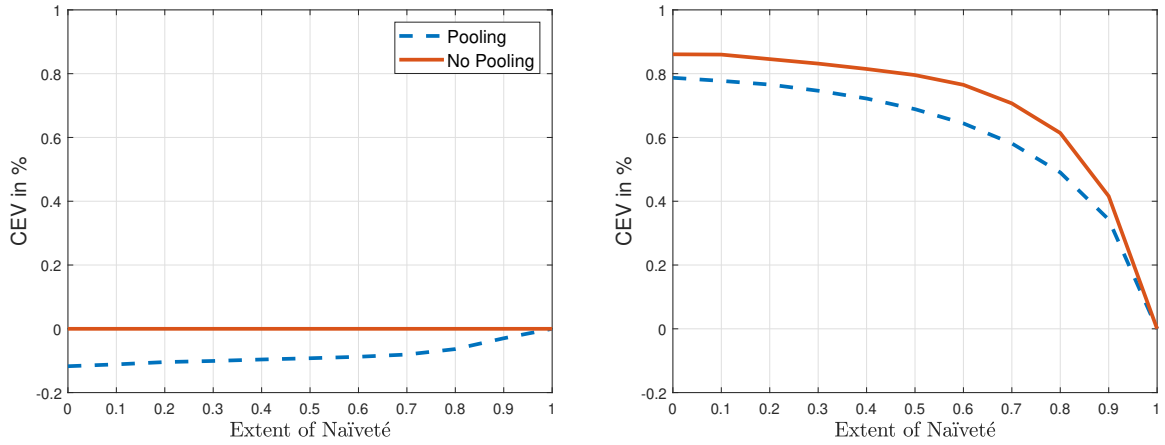
insure against their perceived risk of mistakes and break the cross-subsidization between them and sophisticates.

5 Policy Experiments

Policy makers often pass legislations to reduce the likelihood that financial mistakes occur (e.g. standardized language, information requirements or transparency rules for contracts). Such policies have not been studied in previous quantitative models, because they have no effect on perfectly informed rational agents. In the model, however, we can easily simulate such policies by scaling the extent of naïveté, i.e. reducing the difference between the likelihood of financial shocks of sophisticated and naïve consumers. Another policy which is easily studied within our framework is imposing a limit on possible fee charges. In the following we therefore discuss these two policies and assess them in terms of their effects on welfare which is calculated as consumption equivalence relative to the benchmark. Also, we always compare our benchmark economy, where naïve and sophisticated borrowers are pooled together, with a hypothetical economy in which markets are separated and lenders can offer different contracts to naïve and sophisticated borrowers. This enables us to disentangle the direct effects these policies might have on consumers from the effects on cross-subsidization.

5.1 Transparency Requirements

Credit market regulations and legislations which are aimed at reducing the likelihood of financial shocks by making contracts easier to understand should have an effect on naïve



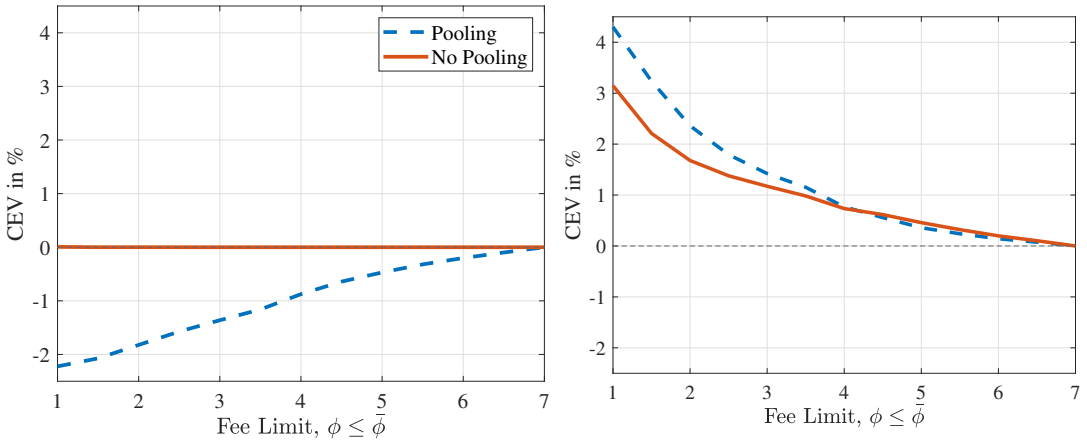
(a) sophisticates (b) naïves

Figure 9: Welfare Effects of Fewer Mistakes.

consumers, since they will become better at understanding the true underlying risks they are facing. Sophisticated consumers, in contrast, will not be affected since they are already aware of the true risks. Hence, we model an improvement in the transparency of financial contracts as a reduction in the spread between the probabilities of financial shocks of sophisticates and naïves. With ψ denoting this spread as defined in Equation 7, we vary the extent of naïveté by scaling down $(\psi - 1)$, such that an economy with 0 naïveté corresponds to a spread of $\psi = 1$, meaning that naïves now face exactly the same shocks as sophisticates. The results of this experiment are shown in Figure 9, where welfare is given as consumption equivalence (CEV) relative to the benchmark in percent.

Focusing first at Figure 9b shows that the effect of improving the transparency of financial contracts is unambiguously positive for naïves, whose welfare in terms of consumption equivalence can be improved up to nearly 1%. Also, note that these welfare gains rise sharply at the beginning, while becoming flatter as transparency reaches the optimal level. Improving transparency by only 30%, for example, already leads to welfare gains between 0.6% and 0.7% in CEV. Further improvements, however, only lead to slightly higher welfare gains. Furthermore, comparing the effects of transparency requirements in the pooling equilibrium to an equilibrium with separated contracts reveals that welfare gains are always higher for naïves when they are operating in separated markets. In the pooling equilibrium some of their welfare gains are counteracted by the cross-subsidization of sophisticates.

Looking at Figure 9a shows that the effects of higher transparency requirements have vastly different effects on sophisticates depending on being in an economy with or without naïves. The policy has no effect in the economy without pooling, since lenders can perfectly distinguish between sophisticated and naïve borrowers. Sophisticated borrowers have already considered their true risks when deciding on a credit contract and thus, their decisions are unaffected by the extent of naïveté, because banks do not change their



(a) sophisticates (b) naïves

Figure 10: Welfare effect of fee limits. Benchmark: $\bar{\phi} = 7$.

offers to sophisticates. Looking at the pooling equilibrium, in contrast, reveals that sophisticates are hurt by the new policies when they are in an economy with naïves. Since improved transparency of financial contracts reduces the revenue banks can expect from fee payments from naïve borrowers, sophisticates lose some cross-subsidization on their interest payments. Hence, a legislation aimed at reducing the likelihood of financial mistakes will help naïves while hurting sophisticates, meaning that overall welfare effects are ambiguous and depend on the fraction of naïves in the economy.

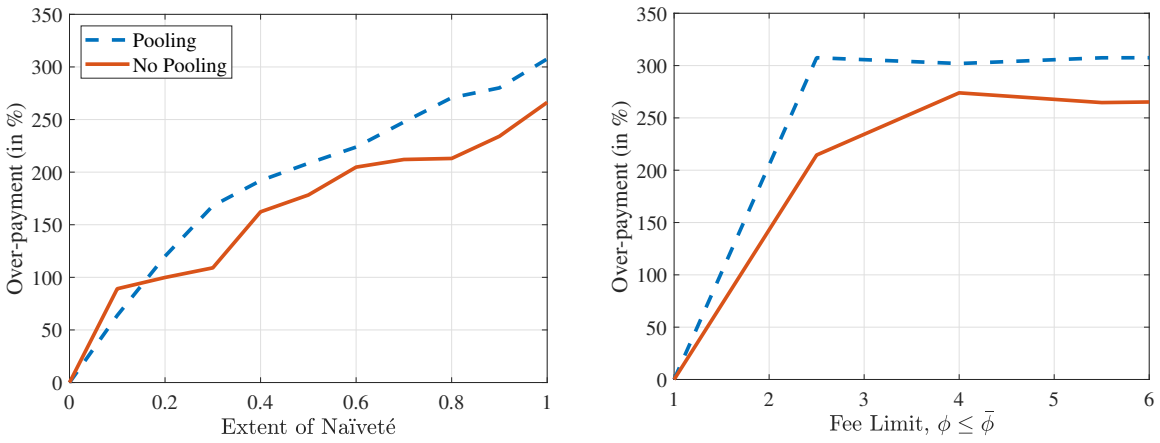
5.2 Limiting Fees

Another possible intervention by policy makers concerns restrictions on the maximum amount of fees which can be charged for financial mistakes. Again, such policies can easily be simulated within our model by imposing an upper bound $\bar{\phi}$ on possible fees ϕ.

The results of such policies are shown in Figure 10 which plots the effects on welfare of a variety of different fee limits, $\bar{\phi}$, on possible credit contracts. Again, the effects are calculated for an economy with and without pooling and measured as consumption equivalence relative to the benchmark in percent.

Focusing first on Figure 10a we can see that a limit on fees has no effects on sophisticated borrowers in an economy without pooling. Since sophisticates already like to insure themselves against the risk of financial mistakes, they are not affected by restrictions. However, if sophisticates are pooled together with naïves, the effects of an upper bound become strongly negative, up to a welfare loss of 2% CEV. This is because lower fees also lower the unexpected payments of naïves and consequently, lenders have to offer higher interest rates when compared to the benchmark economy in order to keep the same expected revenue as before. Hence, sophisticates lose cross-subsidization and end up paying more for their credit then in the benchmark economy.

Turning to Figure 10b we see that while the effects of a fee-limit are unambiguously



(a) Improving transparency requirements

(b) Imposing fee limit

Figure 11: Policy effects on average size of over-payment by naïves.

positive for naïves, they profit relatively more if they are pooled together with sophisticates than if they face separated contracts. This is because in the pooling equilibrium naïve borrowers are also cross-subsidizing lower interest rates for sophisticates. With tighter fees naïves are not only profiting from better insurance against financial shocks, but also from less cross-subsidization. In the separated economy, in contrast, naïves are simply profiting from the fact that upper bounds on fees reduce the size of their potential mistakes. Stricter fee limits force them to choose credit contracts which are closer to the optimal contracts which they would choose if they knew their true risks.

Lastly, comparing Figure 10a and Figure 10b shows that welfare effects are evolving at different rates for sophisticated and naïve consumers. While the loss of welfare for sophisticates is nearly linear in the fee limit, welfare gains for naïves rise slowly at first but very sharply at tighter limits. The overall welfare effects of such a policy therefore crucially depend on the specific choice of the fee limit. For example, prohibiting all contracts with possible fee choices above $\phi = 4$ leads to comparable losses for sophisticates and gains for naïves (about -1% CEV vs $+1\%$ CEV, respectively). When the limit is lowered even further, however, the gains of naïves quickly overtake the losses of sophisticates.

5.3 Policy Interventions and Costs of Mistakes

We have shown that both policies are successful at making naïve borrowers better off. However, policy makers might not only care about improving overall outcomes but also about helping naïve borrowers avoid mistakes. We therefore analyze the effects of different policies on the average size of mistakes of naïve borrowers. Mistakes are measured as the amount by which the expected total costs of a chosen credit contract exceed the expected costs of the optimal contract (cf. Equation 9 and Figure 5 in subsection 4.1).

Figure 11 shows the change in average financial mistakes (i.e. the average over-payment in percent) of naïves for both policies presented in Section 5, reducing the like-

lihood of financial shocks or limiting fees. In the extreme case of completely avoiding mistakes – either by directly abolishing naïveté or by prohibiting lenders to charge any fees – the cost of mistakes is zero.

However, improving transparency of financial contracts and thereby reducing the extent of naïveté in the economy (see Figure 11a) is more effective than limiting fees (see Figure 11b). While the average over-payment falls steadily with the extent of naïveté in the economy, it remains relatively constant with lax fee limits and only decreases if the limit becomes very tight. For example, reducing naïveté in the economy by 40% leads to a decrease in average over-payment of about 30% (from 300% to 200%). To achieve the same improvement in the average mistake through fee limits requires a reduction in the maximum fee of 60%. This suggests that imposing a limit on possible fees is not as effective at reducing mistakes due to Naïveté as is working to reduce the shock itself.

Lastly, note that average mistakes are always lower in the hypothetical separated economy. This does not mean that naïves are necessarily better off if they are not pooled together with sophisticates. It merely shows that the difference between the optimal contract and the contract which was actually chosen is smaller in a separating economy than in a pooling economy. This happens because contracts in the separating economy exhibit higher fees than in the pooling economy, since lenders do not have to account for the choice of sophisticates. Hence, the optimal contract in this separated world will yield higher expected costs than the one in the pooled economy, thereby lowering the difference to the actually paid costs.

6 Conclusion

We propose a novel quantitative theory of Naïveté in the credit market. We incorporate Naïveté in a standard framework of unsecured credit and equilibrium default. The model gives rise to policy interventions as naïve borrowers misunderstand their contracts and make financial mistakes. In equilibrium, they pay high penalty fees that benefit sophisticated borrowers through cross-subsidized interest rates.

We find that the 2009 CARD Act tackles two important dimensions of financial mistakes. Firstly, it makes contracts easier to understand and thereby reduces financial mistakes. Through the lens of our model, the welfare effects of such a policy are ambiguous as sophisticated consumers are hurt by higher interest rates, while naïves make less mistakes. The overall welfare effect therefore crucially hinges on the fraction of naïve consumers in the economy.

Secondly, the CARD Act limits the amount of penalty fees that lenders can charge. This limit has a clear and considerably positive impact on naïve borrowers. They are forced to accept contracts with lower fees, which also lowers the size of potential mistakes from wrong contract choices. Hence, by banning high-fee contracts that naïves might have

otherwise wrongfully chosen, the limit insures them against their future risks, while they themselves would not have done so. Sophisticates, in contrast, are again hurt by such a policy. By reducing the possible size of mistakes made by naïves, cross-subsidization of lower interest rates is also reduced and sophisticates end up paying more for their credit than in the benchmark economy. Also, the welfare gains of naïves and losses of sophisticates rise at different rates. Hence, the overall welfare effects of such a policy can be highly ambiguous and not only depend on the fraction of naïves in the economy, but also on the tightness of the limit.

Lastly, comparing the effects of these two policies on the size of the mistakes made by naïve consumers, we find that transparency requirements are more effective as sizable results are more easily achieved. Also, in light of the welfare effects, transparency requirements seem to have a less strong negative impact on sophisticates. Hence, while limiting fees might be the easier policy, improving the language used in financial contracts and raising standards for transparency and information requirements seems to be the better solution.

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