

Exler, Florian; Hansak, Alexander

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Naïve Consumers and Financial Mistakes

Florian Exler*

Alexander Hansak†

University of Vienna

Vienna Graduate School of Economics

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(Preliminary and Incomplete)

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 in a market with sophisticated and naïve borrowers who sometimes misunderstand their contracts and make financial mistakes. Naïves are more prone to mistakes without internalizing this fact. When signing debt contracts, we allow agents to trade off interest rates for penalty fees. These fees make financial mistakes costly. Naïves choose inefficiently high penalty fees and cross-subsidize interest rates for sophisticates. We use this framework to analyze two unexplored features of the CARD act: clearer language requirements and a limit on penalty fees in financial contracts. Clearer contract terms lead to fewer financial mistakes by everyone, while limiting fees constrains mostly naïve borrowers. Both policies reduce financial mistakes and increase the welfare of naïve borrowers. The effects on sophisticates differ: clearer language and fewer mistakes benefit sophisticates too. However, limiting fees reduces the cross-subsidization sophisticates receive in equilibrium and consequently makes them worse off.

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

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

*University of Vienna, Oskar-Morgenstern-Platz 1, 1090 Vienna, Austria. ✉ florian.exler@univie.ac.at,
🌐 <https://sites.google.com/site/floexler/>

†University of Vienna, Oskar-Morgenstern-Platz 1, 1090 Vienna, Austria. ✉ alexander.hansak@univie.ac.at, 🌐 <https://homepage.univie.ac.at/alexander.hansak/>

1 Introduction

Financial contracts can be quite complicated. According to the Wall Street Journal, credit contracts in 2013 are up to 50 times longer than in 1980.¹ Complicated contracts are harder to understand. Indeed, many cardholders fail to understand key aspects of their contracts, including when they are charged for late payments (GAO, 2006).²

Consumers who do not understand important aspects of their credit contracts run the risk of committing financial mistakes. For example, they can lose track of financial commitments, misunderstand minimum payments, or forget to pay bills on time. In 2011, nearly 28% of U.S. consumer checking accounts experienced non-sufficient funds or overdraft (CFPB, 2014). A majority of these consumers seems to be making a mistake: 52% of borrowers using overdraft do not recall opting in to overdraft (PEW, 2014).

These mistakes can be quite costly when consumers incur penalty fees for repaying financial obligations too late or for exceeding lines of credit. In 2011, nearly one third of accounts that incurred penalty fees accrued more than 10 penalty items with an average fee of \$225 (CFPB, 2014). 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. Besides leading to potentially high penalty fees, financial mistakes can cause financial distress. According to Himmelstein, Lawless, Thorne, Foohey, and Woolhandler (2019), more than 44% of filers cite “spending/living beyond means” as a contributing factor to their bankruptcy and Warren, Sullivan, and Jacoby (2000) find that “credit card debt out of control” and “trouble in managing money” are the third and fourth most common reasons given for a consumer bankruptcy.³

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 financial mistakes. Secondly, the CARD Act limits penalty fees to reduce the cost of financial mistakes.

Despite the importance of financial mistakes for consumers and policy makers, state-of-the-art quantitative research cannot inform regulators about their costs and consequences. Standard models simply have no roll for financial mistakes; this makes features of the CARD act such as transparency requirements or fee limits seem futile. We close 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

¹400 words in 1980 versus 20,000 words in 2013. See <https://www.wsj.com/articles/SB10001424127887324000704578386652879032748>.

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

³Only job loss and medical reasons rank higher.

act achieve better outcomes? How do these policies influence the interaction between consumers that make more and less mistakes?

In this paper, we explore the implications on efficiency and welfare when consumers make financial mistakes due to their lack of understanding. 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. Naïve consumers make more financial mistakes and consequently incur higher penalty fees than sophisticated consumers. Being naïve, these consumers are unaware of their increased proneness to mistakes and the implied financial cost. Thus, naïves behave just like sophisticated consumers (as standard in the literature). Consequently, 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 the 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. On average, naïve borrowers end up paying more than they would if they knew their true proneness to mistakes. Sophisticated consumers – being pooled with naïve agents – benefit since they make fewer mistakes. They face the same set of contracts where low interest rates are subsidized by high penalty fees. These 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 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 gain from both reforms. Their mistakes become less consequential

⁴Cf. Armstrong and Vickers (2012), Gabaix and Laibson (2006), and Heidhues and Köszegi (2010).

either (1) because they make fewer mistakes per se due to easier contracts or (2) because they are protected from choosing too high penalty fees. Additionally, naïves pay too much for their credit prior to the reform and both policies reduce cross-subsidization. Even though sophisticated agents lose cross-subsidization, they do not automatically stand to lose from the reforms. Making fewer financial mistakes themselves, sophisticates experience a welfare gain from (1) more understandable contracts. However, (2) limiting fees lets them lose out on cross-subsidized credit contracts without the benefit of better financial decision-making. Sophisticates already chose correct contracts before. Hence, the second reform harms sophisticates.

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 immediate 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.

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, James 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, Jim 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.

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.

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

2.1 Households

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

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

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 labour productivity and expense shocks, while wages and the risk-free interest rate are set exogenously.

Labor Productivity. Households are subject to idiosyncratic shocks to their labor productivity, z_j , which represents the wage risk they are facing. Income y_j is given by $y_j = z_j \cdot e(j)$, with $e(j)$ being an age-dependent efficiency premium as in Livshits, James MacGee, and Tertilt, 2007. Individual labor productivity is modeled as a persistent AR(1) process z_j and given by

$$\log(z_j) = \rho \log(z_{j-1}) + \zeta, \tag{1}$$

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

Financial Mistakes. Households that borrow make financial mistakes. The size of a household's financial mistake is given by a shock ε which can be thought of as mishandling one's credit or paying late, for example. If a household incurs a financial mistake, the costs are given by $\phi \cdot \varepsilon$, with ϕ representing fees that are paid by customers if they mishandle their finances (e.g.: overdraft fees, late payment fees, etc.).

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:

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

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 mistakes and expect to face the same distribution as sophisticates:

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

Consequently, 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 making mistakes, the lender does not update his belief about the borrower's type. 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.

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 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 as stigma costs.

2.2 Credit Market

Let $s = (z, j)$ denote a household's current state, with z being persistent labour productivity 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 η 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, $\phi \in [0, \infty)$. Households can choose which contract to take and decide to perfectly insure against their mistakes ($\phi = 0$), to simply repay their mistakes 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 and the recovery rate is given by

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

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

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

with $\mu(s, \varepsilon)$ being the probability measure over possible states s and ε .

We assume perfect competition and free entry for lenders, which leads to zero profits conditional on observables d' and s and hence

$$q(d', \phi, s) = \frac{1}{1+r} \int \theta(d', s, \varepsilon, \phi) \frac{\rho(d', s, \varepsilon)}{d'} + (1 - \theta(d', s, \varepsilon, \phi)) \left(1 + \frac{(\phi - 1) \varepsilon}{d'} \right) d\mu(s, \varepsilon) \quad (4)$$

Equation 4 is the implicit functional relationship between $q(\cdot)$ and ϕ , $q = q(\phi, \cdot)$, which holds in equilibrium. There are several interesting cases to distinguish. If agents choose $\phi = 0$, they decide to fully insure against financial mistakes and never have to pay for them. This comes at the cost of higher interest rates. $\phi = 1$ is the case of zero penalty fees, whereas $\phi > 1$ are positive penalty fees that lenders charge in the case of financial mistakes. This choice leads to lower interest rates.

Without any cross-subsidization, rational agents will choose $\phi < 1$ contracts to insure against ε . Banks are risk neutral and carry that risk. In the presence of naïve consumers (and $Var(\varepsilon) > 0$), there is cross-subsidization: For any $\phi > 0$, $q(\phi, \cdot) > q_{fair,rational}(\phi, \cdot)$ due to pooling and $Var_{naive}(\varepsilon) > Var_{rational}(\varepsilon)$. However, there needs to be "enough naïve -ness" to overcompensate risk aversion.

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, $q(\phi > \bar{\phi}, \cdot) = 0$.

Table 1: Benchmark Parameterization

Economic Parameters		Value
CRRA consumption	σ	2
Autocorr. labor efficiency	ρ	0.9
Std. dev. labor efficiency	ζ	0.12
Interest rate	r	4%
Discount factor	β	0.83
Garnishment rate	γ	0.15
Cost of default	χ	1.5
Financial Mistakes		
Size of mistakes	ε	(0, 0.02, 0.05)
Sophisticates	$Pr^S(\varepsilon)$	(0.8, 0.15, 0.05)
Naïves	$Pr^N(\varepsilon)$	(0.5, 0.35, 0.15)
Share of naïves	η	0.5

3 Parameterization

This section presents the parameter values used to numerically solve the benchmark economy. Currently, the model is not calibrated to match actual data but parameters are rather set to standard values. These values allow us to solve the model numerically and gauge the importance of our proposed mechanisms. Future versions will include a proper simulated methods of moments approach to determine the model's parameters.

The specific parameters of our benchmark economy are shown in Table 1. Median income is normalized to 1. The most important part concerns our choice of modelling naïveté. The shocks for financial mistakes are chosen to be less than or equal to 5% of median income and the probability that a shock occurs is higher for naïves than for sophisticates over the whole support. Specifically, the expected value of financial mistakes for a naïve is about 2.5 times the expectation of a sophisticated, with double the variance. For the benchmark economy we chose an equal split of sophisticated and non-sophisticated consumers in the market, setting the share of naïve borrowers, η , to 50%. All other values are standard to the literature and are currently chosen in a way which allows us to focus on the most important mechanisms of our framework. A calibration will follow in future versions.

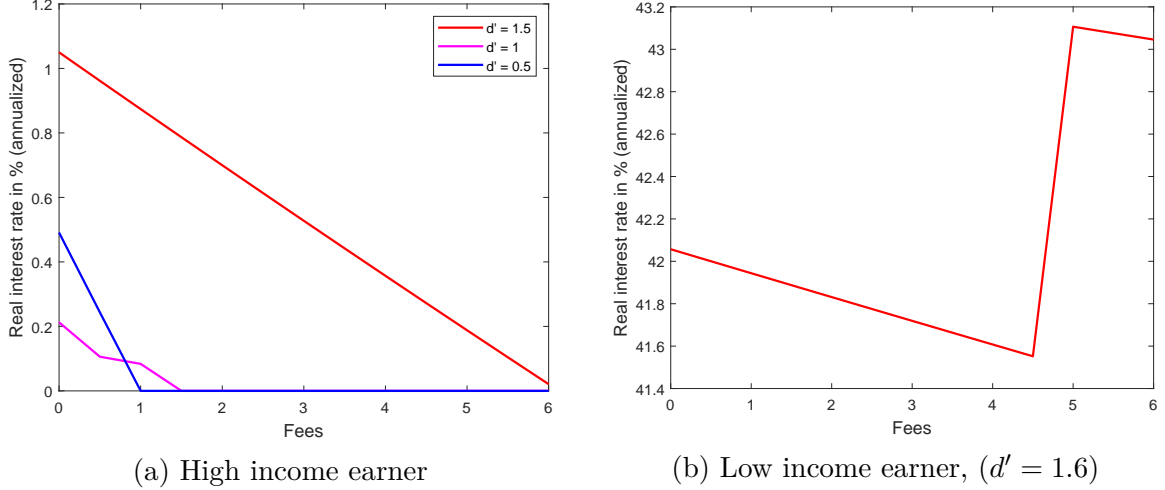


Figure 1: Example of Equilibrium Credit Contracts (q, ϕ) for a high and low income earner, aged 45-50 (median income normalized to 1).

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 1 shows an example of possible $(q(\phi, \cdot), \phi)$ schedules as defined in Equation 4 for different loan sizes d' with median income being normalized to 1. For the high income earner in Figure 1a we can see how a choice of higher fees can reduce the interest rate. However, the $(q(\phi, \cdot), \phi)$ schedule does not have to be monotonic as can be seen in Figure 1b. 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 mistakes

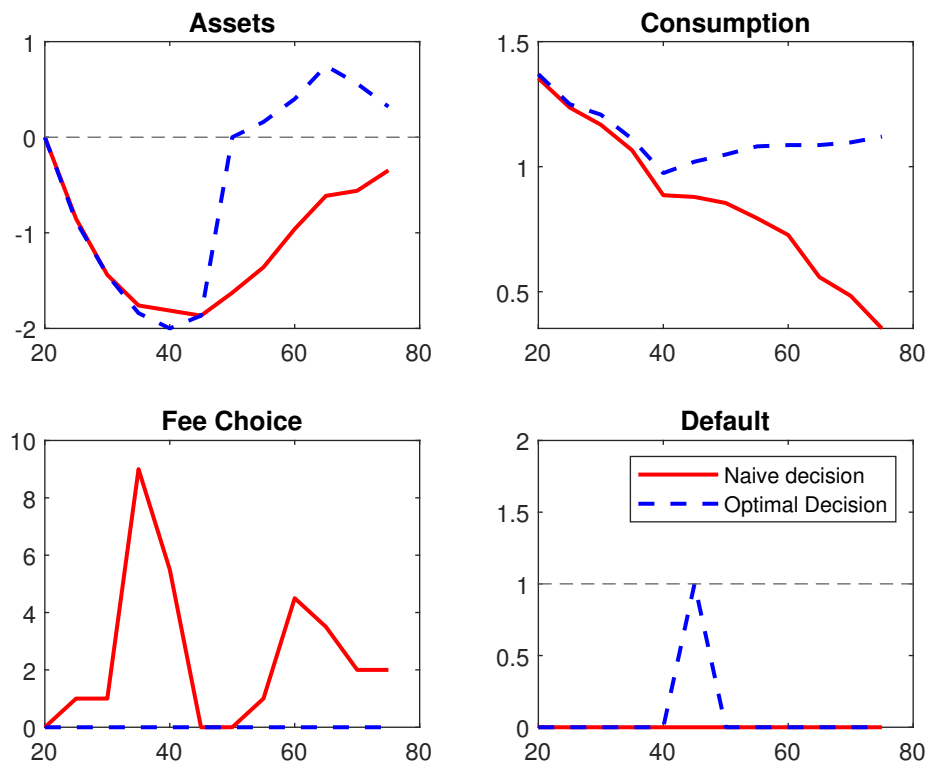


Figure 2: Optimal (dotted blue) and actual decisions (red) of a naïve consumer. Cost of Naïveté 22.5% CEV.

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 one’s credit contracts in this framework, Figure 2 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 *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%.

4.2 Benchmark Outcomes

Table 2 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

Table 2: Benchmark Outcomes

	Sophisticated	Naïve	Average
Debt-to-income ratio	80%	84%	82%
Default Rate	1.1%	1.2%	1.15%
Interest Rates	6.17%	7.16%	6.67%
Fraction Borrowing	78%	79%	78.5%

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 consumers are less prone to mistakes. Furthermore, in equilibrium, sophisticates understand their exposure to financial mistakes 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 make mistakes and incur these fees. Furthermore, naïves underestimate their true proneness to mistakes 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 is represented in Figure 3a, 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 3a depicts welfare for an atomistic *informed naïve* agent, i.e. an agent that faces the same prices and the same risk of mistakes as every naïve but understands her true exposure to mistakes and consequently picks optimal fee levels.

To gauge the importance of cross-subsidization for the observed welfare patterns, Figure 3b 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

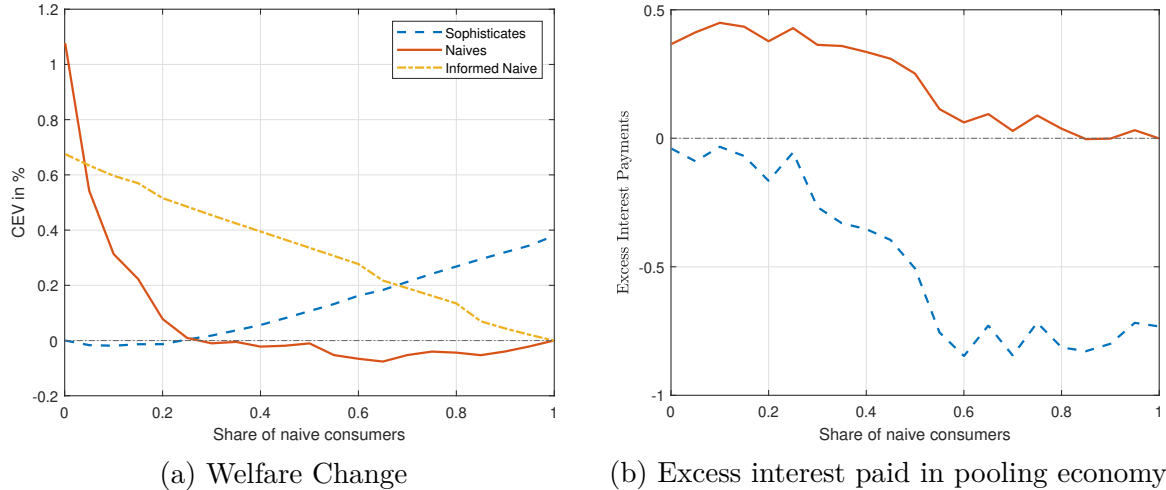


Figure 3: The amount of cross-subsidization in dependence of the share of naïve consumers

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 3b 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 exploiting 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 mistakes, 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 because excess interest payments drop as the fraction of naïves increase and fewer sophisticates enjoy cross-subsidization (cf. Figure 3b).

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.⁶ Thus, insurance for the informed naïve against mistakes gets worse and welfare drops.

⁶Both, sophisticates and naïves are happy to accept these contracts. Sophisticates gain cross-subsidization and naïves wrongly think they gain cross-subsidization but actually pay more.

These suboptimal fee choices are exacerbated by Naïveté . Low interest-high fee contracts are tempting naïves because they underestimate their proneness to financial mistakes. 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 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.⁷ 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, no debt can be sustained in equilibrium, because the lenders always expect default. 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. This allows more debt to be sustained in equilibrium.

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, with costless default and consequently no debt there can be no cross-subsidization. If, in contrast, 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 with low fees. This leads to a situation with very little cross-subsidization since sophisticates

⁷We extend Heidhues and Kőszegi (2010) to incorporate default and better gauge the magnitude of cross-subsidization and its welfare effects.

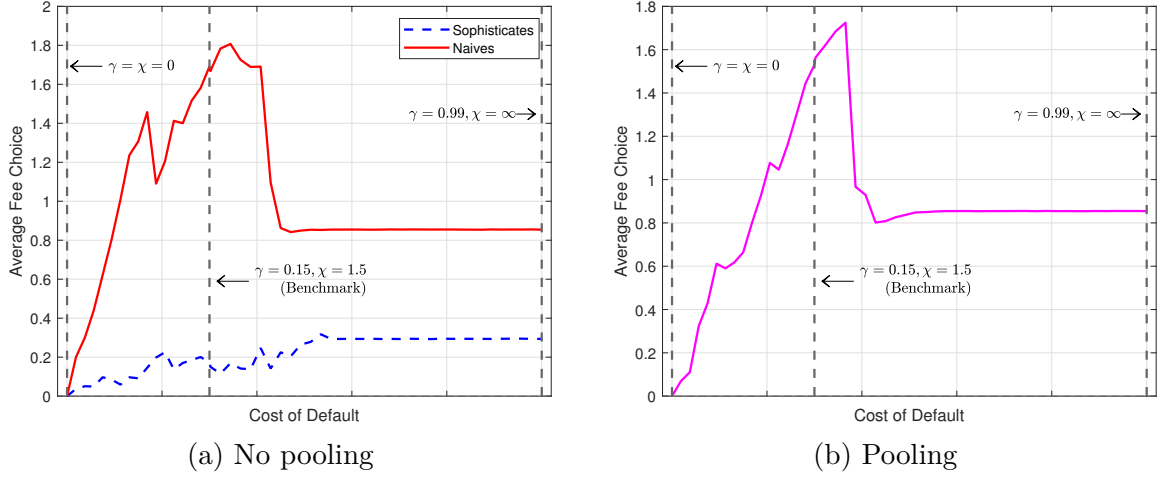


Figure 4: Effects of default costs on average fee choice.

can only profit from the presence of naïves if the lender expects additional revenue from fee payments.

Figures 4 and 5 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 cost are $\gamma = 1$ and $\chi = 1,000$.

Figure 4a 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 without fees, if default is costless, since no debt can be sustained in equilibrium. As the costs of filing for bankruptcy are increasing so are the average chosen fees. Because of limited commitment to repay debts, lenders can expect to 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 choose to partly insure against this risk by never accepting fees above 1. Since there is no cross-subsidization without pooling, sophisticates don't profit from higher fees chosen by naïves .

Figure 4b shows the effects of changing default costs, but here sophisticates and naïves are pooled and face the same contracts. One striking difference to Figure 4a is that now sophisticates also choose contracts with high fees, exposing themselves to costly mistakes. Due to pooling, sophisticates can profit from these contracts. Also, note how higher default costs and hence higher commitment to repay leads to higher average fee choices. Only if default becomes so costly that nobody wants to file for bankruptcy anymore does the average chosen fee in the economy drop below 1, partially insuring against financial

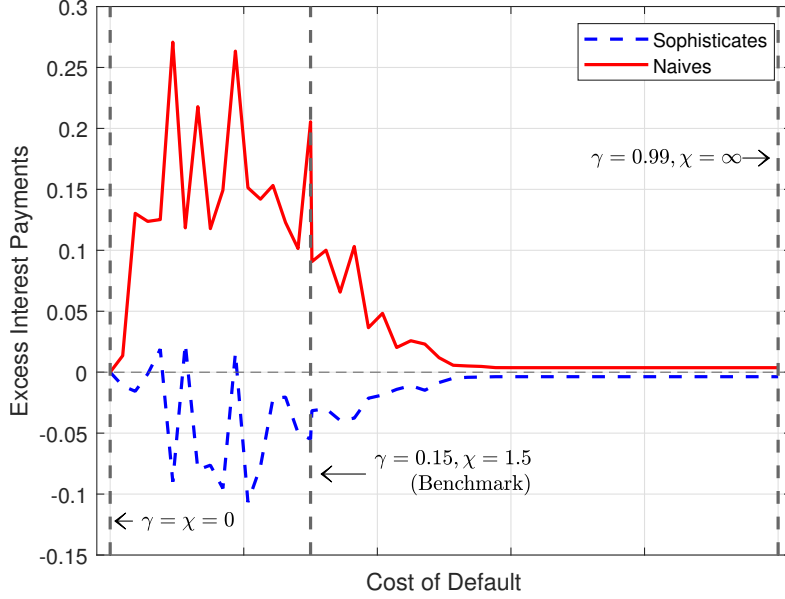


Figure 5: Difference in interest payments between mixed and isolated economy

mistakes. Agents ensure that unexpected financial mistakes cannot lead to a situation in which they cannot repay and have to default.

The effect of fee choices on cross-subsidization is depicted in Figure 5. 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-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). In the model, we can easily simulate such policies by scaling the expected value of a financial shock, i.e. reducing $\mathbb{E}(\varepsilon)$. Figure 6 therefore shows a simulation of the effect of a reduction in $\mathbb{E}(\varepsilon)$ by scaling the shock ε for both sophisticates and naïves until $\mathbb{E}(\varepsilon) = 0$. Welfare was calculated as consumption equivalence relative to the benchmark and is given in percent

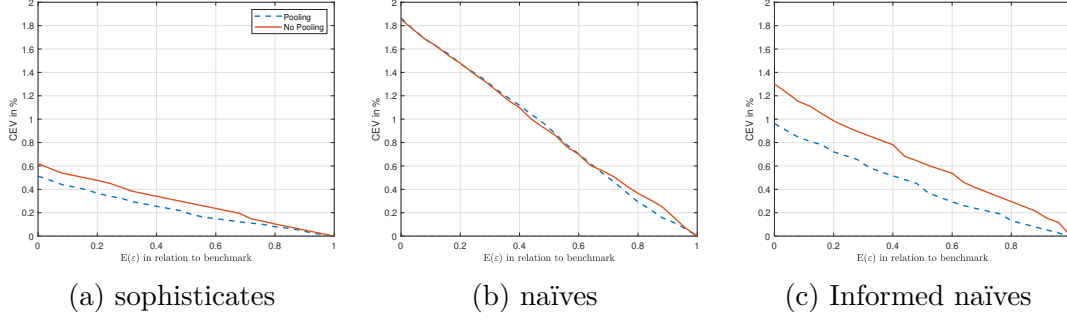


Figure 6: Welfare Effects of Fewer Mistakes.

5.1 Reducing likelihood of mistakes

Focusing first at Figure 6b shows that the effect of reducing the likelihood of mistakes is unambiguously positive for naïves and does not lead to considerable differences between the economies with and without pooling. Looking at Figure 6a, in contrast, shows that sophisticates are effected differently depending on being in an economy with or without naïves. The positive effects of reducing the likelihood of mistakes is stronger in the economy without pooling. This suggests that while sophisticates profit from making less mistakes, they also lose some cross-subsidization as naïves are making less mistakes as well. Hence, if legislations would affect the proneness to mistakes differently for sophisticates and naïves, the overall welfare effects could be ambiguous.

Lastly, looking at Figure 6c which plots the implications for an informed naïve who does not affect prices we see a similar picture as in Figure 6a. A naïve agent who is informed about the true probabilities gains relatively more in a separated economy than compared to a pooled economy. However, here the difference is not due to a loss in cross-subsidization, since the informed agent still faces the same prices as the naïves. Instead, the informed agent profits relatively more in a separated economy, because there she faces contracts with higher fees than in a pooling economy. Therefore, reducing her proneness to mistakes has a larger effect when naïves are not pooled together with sophisticates.

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 7 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 7a 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

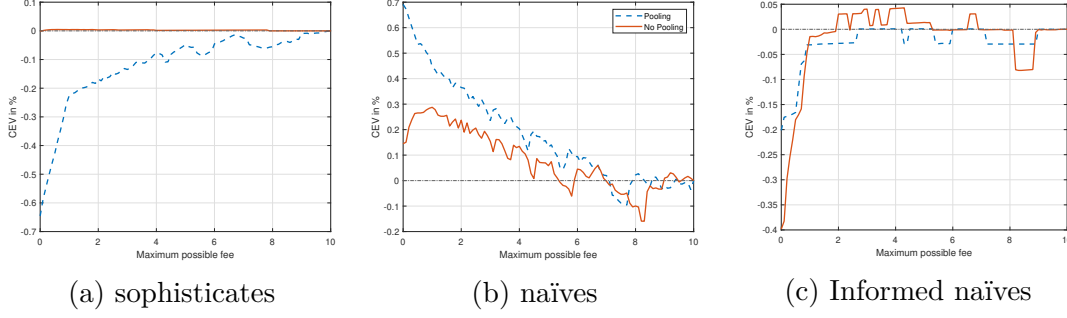


Figure 7: Welfare effect of fee limits. Benchmark: $\bar{\phi} = 10$.

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 is strongly negative. 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.

Turning to Figure 7b we see that while the effects of a fee-limit are unambiguously positive for naïves, they profit relatively more if they are pooled together with sophisticates than if they face separated contracts. This is due to the fact that in the pooling equilibrium the naïves are also cross-subsidizing the sophisticates. When possible fees become limited, however, the extent of cross-subsidization is reduced and consequently, naïves are even better off when compared to the separated economy.

Lastly, Figure 7c also shows the effects on a naïve consumer who knows the true probabilities. Since an informed agent behaves similarly to a sophisticated consumer, we again see how limiting fees has an adverse effect on welfare. In contrast to the situation for sophisticates, however, an informed naïve borrower can be hurt in both the separated and the pooling economy. The informed agent knows that she might make mistakes and subsequently have to pay fees and therefore already insures herself against the risk by only accepting contracts with low fees. If a limit on fees is imposed, lenders react by changing the interest rates and while this is beneficial for the naïves whose mistakes becomes less costly, an informed agent might will be hurt by the higher interest rates without benefiting from from additional insurance, since she already insured herself before. Hence, the overall effects of such a policy could be ambiguous, if some naïves also learn about their Naïveté and subsequently change their behaviour.

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. Figure 8 shows the cost of mistakes of naïve borrowers in terms of consumption equivalence variation. It is measured as the

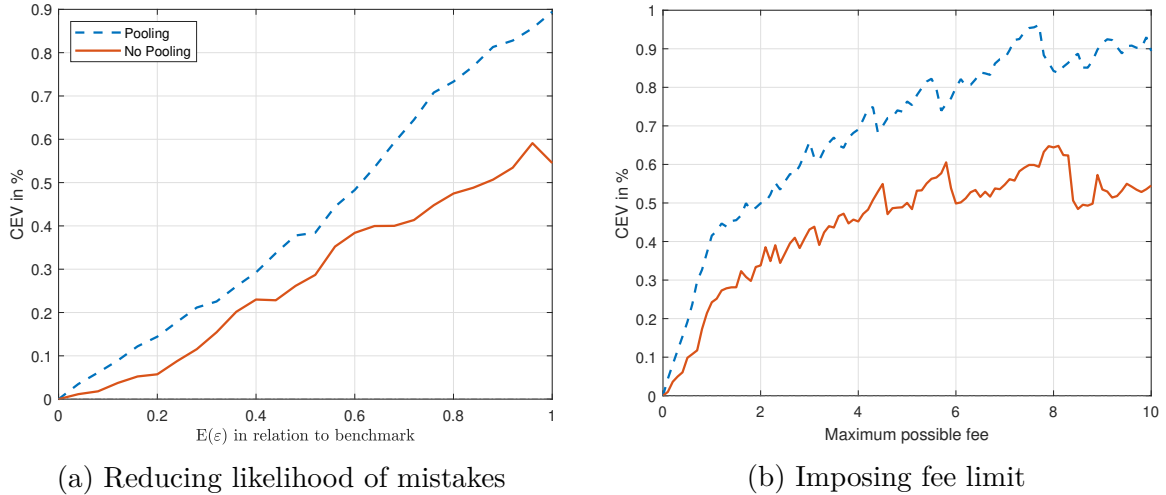


Figure 8: How much an informed agent is better off than the other naïves .

welfare difference between an atomistic informed naïve agent, i.e. an agent that faces the same prices and the same risk of mistakes as every naïve but understands his true exposure to mistakes, relative to the uninformed naïves . In the benchmark economy (on the right of each plot) welfare cost of mistakes are roughly 0.9%.

The welfare cost of mistakes decrease for both policies presented in Section 5, reducing the likelihood of financial shocks or limiting fees. In the extreme case of completely avoiding mistakes – either by directly abolishing them or by prohibiting lenders to charge any fees – the cost of mistakes is zero.

However, reducing the likelihood of mistakes (see Figure 8a) is more effective than limiting fees (see Figure 8b). For example, imposing a limit which reduces the maximum fee by about 80% still yields a welfare cost of mistakes of about 0.5%. The same welfare cost can be achieved by only reducing the likelihood of mistakes by 40%. 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.

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, this yields ubiquitous welfare gains. All consumers avoid mistakes and are consequently better off. Even sophisticated borrowers gain more

through better financial decision making than they lose in the form of cross-subsidization.

Secondly, the CARD Act limits the amount of penalty fees that lenders can charge. This limit has a more differentiated impact: naïve borrowers gain. They avoid mistakes (by banning high-fee contracts they might have otherwise wrongfully chosen) and thereby cross-subsidize sophisticates less. Sophisticates however correctly anticipated their mistakes before and thus cannot benefit from a fee limit. They lose welfare because they lose cross-subsidization.

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