Consumer Credit with Over-Optimistic Borrowers

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Motivation

- Rapid growth of consumer credit and defaults.
- Debate on whether/how to regulate consumer credit products.
- 2009 Credit Card Accountability Responsibility and Disclosure Act.
- Consumer Financial Protection Bureau created in 2010
  $\rightarrow$ mandate to regulate consumer credit products.
- Borrowers' cognitive biases often mentioned:
  - *"Sellers of credit products have learned to exploit the lack of information and cognitive limitations of consumers"*
    (Bar-Gill and Warren 2008)

  - *"Financial regulators face a difficult trade-off between the benefits of regulation to households that make mistakes, and the costs of regulation to other financial market participants."*
    Richard T. Ely Lecture (Campbell 2016)

- Little theoretical (or quantitative) work to assess these arguments.

- Quantitative models of debt and default with risk-based pricing, but no behavioral consumers
  - Chatterjee, Corbae, Nakajima and Rios-Rull (2007), Livshits, MacGee and Tertilt (2007)
- Theoretical papers on behavioral biases and lending, but no default
  - Heidhues and Koszegi (2010, 2017), Eliaz and Spiegler (2006)
- Self-control/temptation preferences in models with borrowing and default
  - Laibson, Repetto and Tobacman (2000) and Nakajima (2012)
- Co-existence of behavioral and rational borrowers
  - Nakajima (2017) – closest to ours, but no interaction between the types

- Focus on particular type of behavioral consumers: **over-optimistic** borrowers.
- Introduce behavioral consumers into structural model of unsecured lending and default.
- Competitive lenders, risk-based pricing.
- Spill-overs between rational and behavioral people arise endogenously.
- Theoretical and quantitative effects of behavioral borrowers.
- Analyze how regulation affects both types of consumers.

Why Over-Optimism?

1. Substantial work documenting some form of over-optimism

- About income (Arabsheibani, de Meza, Maloney, and Pearson, 2000, Dawson and Henley, 2012, Balasuriya and Vasileva, 2014)
- Self-employed particularly over-optimistic (Åstebro 2003 and Arabsheibani et al 2000)
- About survival (Puri and Robinson, 2007)
- Time it takes to complete everyday tasks (Buehler et al 1994)
- People generally underestimate probability of negative events for themselves (Weinstein 1980)
- Evidence of unforeseen expenditures (Gathergood 2012)
- Literature on impulse buying (Beatty and Ferrell 1998, Verplanken and Sato 2011)

2 Over-optimism gives rise to a tractable model of credit scoring and spill-overs between behavioral and rational borrowers.

Standard incomplete market, heterogeneous agent, life-cycle model with bankruptcy (Livshits, MacGee and Tertilt (2007, 2010)

- Stochastic life-cycle model.
- Idiosyncratic uncertainty: about earnings and unforeseen expenses.
- Incomplete markets: non-contingent debt only.
- Consumers decide on saving, borrowing and whether to file for bankruptcy.
- Equilibrium interest rate incorporates default risk.
- Small open economy: risk free rate r^s exogenous.
- NEW: two types of consumers: $T = R, B$. Rational and behavioral.

Maximize discounted expected life-time utility

$$\mathbb{E}^T \sum_{j=1}^{J} \beta^{j-1} u \left(\frac{c_j}{n_j} \right)$$

Risky income

$$y_j^T = \bar{e}_j z_j \eta_j^T$$

$\bar{e}_j$ – Life cycle pattern of effective labor endowment

z – Persistent shock, Markov with finite support

η – Transitory shock, *iid*, finite support

Expense shocks

- Exogenous increase in household's debt
- $\kappa \in K = \{0, \kappa_1, \kappa_2\}$, iid

Budget constraint if not in default:

$$c + d + \kappa \leqslant y_j + q(d', z, j, s)d'$$

- Face different transitory income process (lower mean): $\mathbb{E}\eta^B < \mathbb{E}\eta^R$.
- But they do not realize that. Believe they are just like everyone else, just unlucky: $\mathbb{E}^B\eta^B = \mathbb{E}\eta^R$.
- No Bayesian updating for consumers, as everyone is *convinced* they are realists.
- This naturally leads to pooling. Behavioral consumers behave like (unlucky) rational people.
- Impossible to design screening contracts to separate them. No adverse selection issues.

Bankruptcy

- Households can choose to default
- Default as in Chapter 7 (Fresh Start) bankruptcy.

Consequences
- Fraction γ of income garnished
  - Lenders recover (γy_j),
- Cannot file next (model) period
  - Exclusion for 6 years (model period = 3 years)
- All debts discharged $(d' = 0)$

- Financial intermediaries can borrow and save at exogenous rate r^s.
- Accept deposits and make loans.
- Pay proportional transaction costs τ on loans.
- Observe household's debt, income (z, η), expense shock (κ) and age.
- Behavioral consumers not directly observable, but shock history contains information.
- Perfectly competitive financial markets:
  - Zero expected profits on each loan
  - Law of large numbers $\Rightarrow$ zero ex-post profits

- Bankers are smarter than consumers: create type scores.

- Observe shocks, debt & histories.

- Update beliefs about likelihood HH is a rational type.
  Type Score $\equiv$ Pr(Rational)

- Equilibrium interest rate incorporates default risk:
  depends on type score, age, current income, debt.

- Conditional on observables and type scores,
  behavioral and rational people are pooled.

- Type scores become more accurate with age (= longer histories)
  $\rightarrow$ less and less pooling as people get older.

s = probability of being rational. Prior: $s_0 = 1 - \lambda$.

Type scores: Bayesian Updating

$$s'(\eta', j + 1, s) = \frac{Pr^R(\eta') s}{Pr^R(\eta') s + Pr^B(\eta')(1 - s)}$$

Loan price schedule

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

where θ is the equilibrium default probability, and $\overline{q} = \frac{1}{1 + r^s + \tau}$ is the price of a safe loan.

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

where $\bar{V}$ is value of filing for bankruptcy.

$$\overline{V}_j^T(z, \eta, s)$$
$$= u\left(\frac{c}{n_j}\right) + \beta \mathbb{E}^T \max\left\{ V_{j+1}^T(0, z', \eta', \kappa', s'), \bar{W}_{j+1}^T(z', \eta', \kappa', s') \right\}$$
$$\text{s.t. } c = (1 - \gamma)y_j$$

and $\bar{W}$ value of defaulting immediately following bankruptcy.

An equilibrium is a set of value functions, decision rules for consumption $c^T(\cdot)$, debt $d^T(\cdot)$, and default $I^T(\cdot)$ for the consumer, default probabilities $\theta(\cdot)$, and bond price schedules $q^b(\cdot)$, such that

- households optimize, taking the bond price schedule as given.
- bond prices are actuarially fair, given default probabilities.
- default probabilities are consistent with household decision rules.

The model is solved numerically iterating backwards.

Quantitative Analysis

- Use calibration from our previous work.
- Add 20% behavioral consumers.
- Explore implications for
  - Aggregate outcomes
  - Behavioral consumers
  - Policy analysis

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Period Length		3 years
Discount Factor	β	0.94
CRRA Coefficient	σ	2
Wage Autocorrelation	ϱ	0.95
Persistent Wage Var	σ_ε^2	0.025
Transitory Wage Var	σ_η^2	0.05
Risk Free Rate	r^s	3.44%
Roll-over Rate	r^r	20%
Transaction costs	τ	2.56%
Garnishment	γ	0.319

Transitory income shocks

Over-optimists experience negative transitory income shocks more often (and positive ones less often), but are ignorant about it.

Aggregate	
η	$[0.6, 1, 1.6]$
$Pr(\eta)$	$[10\%, 80\%, 10\%]$
Behavioral	
$Pr(\eta)$	$[15\%, 80\%, 5\%]$
Rational	
$Pr(\eta)$	$[8.75\%, 80\%, 11.25\%]$
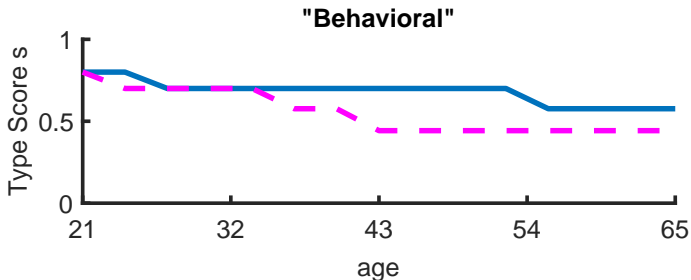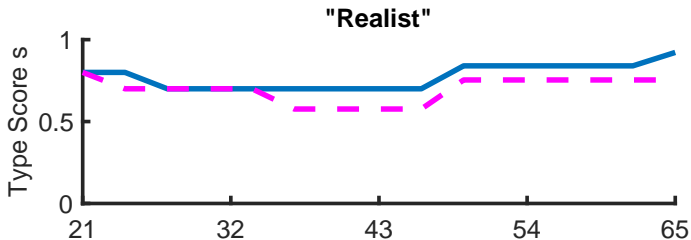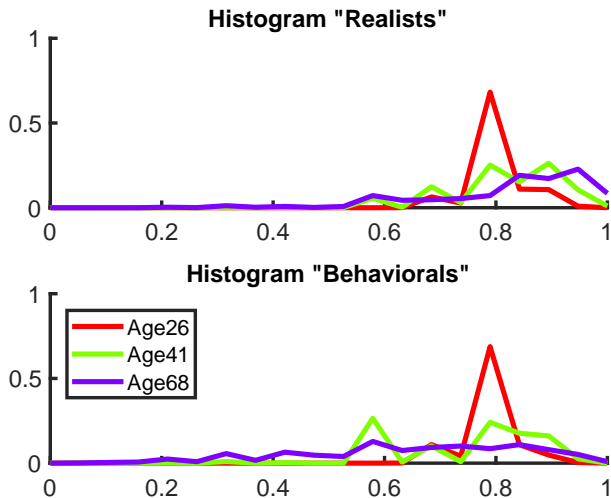
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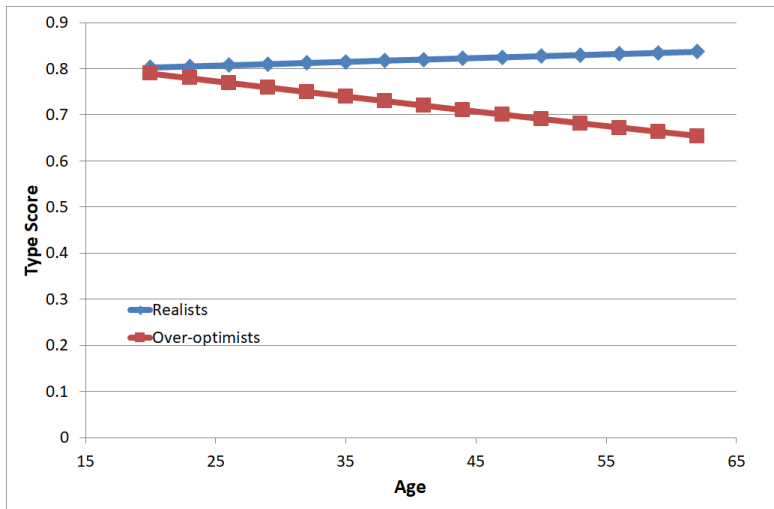
"Behavioral"

Debt-to-income	Rational	9.05%
	Behavioral	13.16%
	Aggregate	9.88%
Filings	Rational	0.79%
	Behavioral	1.11%
	Aggregate	0.86%
Interest Rates	Rational	10.48%
	Behavioral	12.42%
	Aggregate	10.87%
Borrowers	Rational	26.38%
	Behavioral	33.05%
	Aggregate	27.71%

Decomposition: Bias vs. Extra Risk?

		Benchmark biased pooled	biased not pooled	not biased not pooled
Debt-to-income	Rational	9.05%	9.08%	9.08%
	Behavioral	13.16%	13.14%	9.05%
Filings	Rational	0.79%	0.82%	0.82%
	Behavioral	1.11%	1.00%	0.86%
Interest Rates	Rational	10.48%	11.16%	11.16%
	Behavioral	12.42%	10.09%	12.08%
Filings per Borrower	Rational	3.01%	3.09%	3.09%
	Behavioral	3.36%	3.00%	3.19%
Borrowers	Rational	26.38%	26.35%	26.35%
	Behavioral	33.05%	33.28%	26.96%

Behavioral Consumers' Mistakes

- Behavioral people make mistakes (compared to a fully aware version of themselves):
  - They over-borrow. Would borrow about 5% less if suddenly made aware.
  - Do not file enough. An additional 1.08% of consumers would file if suddenly made aware.
- Reason: Too optimistic about future ability to repay debt.
- But they benefit from cross-subsidization: interest rate lower than actuarially fair one.

Cross Subsidization
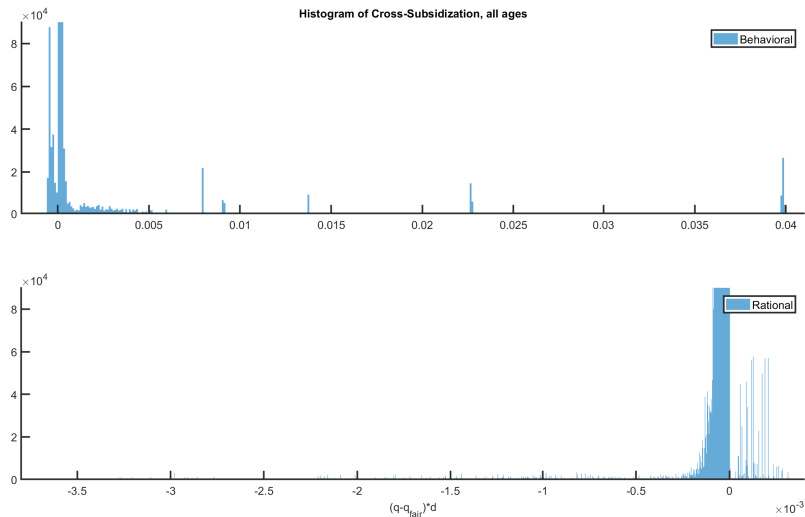
Histogram of Cross-Subsidization, all ages

1. Behavioral people file too little/late, perhaps default should be made easier.
   $\rightarrow$ we lower garnishment γ
2. Behavioral people over-borrow, perhaps borrowing should be taxed
   $\rightarrow$ increase transaction costs of loans τ
3. Behavioral people make financial mistakes, perhaps they should be informed about their type.
   $\rightarrow$ Financial literacy education (caveat: how to implement this?)

Key: policies also affect cross-subsidization!

1. Lower Default Costs

		BM (0.32)	$\gamma = 0.2$
Paternalistic Welfare	Rational		-0.16%
	Behavioral		-0.15%
Bankruptcy filings	Rational	0.79%	1.42%
	Behavioral	1.11%	2.10%
Interest rates	Rational	10.48%	20.16%
	Behavioral	12.42%	24.41%
Debt-to-income	Rational	9.05%	4.98%
	Behavioral	13.16%	7.32%
Financial Mistakes	Filing too late	1.07%	1.12%
	Overborrowing	3.89%	7.42%

Opposite from Nakajima (2017) who finds that borrowers with self-control problems benefit from lower garnishment (they prefer the resulting tighter borrowing constraints).

2. Taxing Loans

		Benchmark	1% tax
Paternalistic Welfare	Rational		-0.41%
	Behavioral		-0.44%
Average interest rates	Rational	10.48%	12.28%
	Behavioral	12.42%	14.59%
Debt-to-income	Rational	9.05%	7.51%
	Behavioral	13.16%	11.14%
Bankruptcy filings	Rational	0.79%	0.75%
	Behavioral	1.11%	1.08%

- Taxing loans lowers over-borrowing. But at a too high cost (deadweight loss). Everyone worse off.

3. Financial Literacy Education

Financial literacy
- Often argued to improve financial outcomes and welfare
- Supposed to prevent financial mistakes
- Education policy, reporting standards, standardized contracts, etc.

Experiment
- Perfectly inform agents about true transitory income risks
- Behavioral consumers perfectly identified to themselves and lenders

Two effects in model:
1. Avoid financial mistakes
2. Break-down of cross-subsidization

3. Financial Literacy

		Benchmark	Financial Literacy
Paternalistic Welfare	Rational		0.01%
	Behavioral		-0.18%
Financial Mistakes	Filing too late	1.07%	0
	Overborrowing	3.89%	0
Bankruptcy filings	Rational	0.79%	0.82%
	Behavioral	1.11%	0.86%
Interest rates	Rational	10.48%	11.16%
	Behavioral	12.42%	12.08%
Debt-to-income	Rational	9.05%	9.08%
	Behavioral	13.16%	9.05%

Rational consumers benefit from the policy!

Behavioral consumers worse off: Benefit of avoiding mistakes (filing earlier/reduced over-borrowing) does not compensate for losing cross-subsidization.

Predatory Lending?

- Lenders are better informed than borrowers.
- Yet model does not lead to "predatory lending" as defined by Bond, Musto and Yilmaz (2009): *A loan a borrower would decline if he had same information as lender.*
- Over-optimists consider themselves unlucky and their type score unfair.
- However, if made aware, over-optimists would understand that their contracts were actually subsidized by rational types. Hence, they would be more than happy to accept such contracts.

- Explicit treatment of default is critical for model predictions: Behavioral borrowers are cross-subsidized in our model not "taken advantage of" – as in Heidhues and Koszegi (2010, 2017)
- Over-optimists make mistakes: they borrow too much and file too late. Mistakes can be quantitatively large.
- Realists are affected by the presence of behavioral borrowers
  - Not just by mis-pricing (cross-subsidization)
  - Transitory shocks have persistent affects by changing type-score and affecting future prices
- Policies may affect behavioral and rational people in opposite directions.
- Financial literacy benefits rational at expense of behavioral consumers.

Back-up Slides

1. Higher Default Costs

		$\gamma = 0.2$	BM (0.32)	$\gamma = 0.5$
Bankruptcy filings	Realistic	1.42%	0.79%	0.31%
	Behavioral	2.10%	1.11%	0.44%
Interest rates	Realistic	20.16%	10.48%	7.06%
	Behavioral	24.41%	12.42%	7.23%
Debt-to-income	Realistic	4.98%	9.05%	14.78%
	Behavioral	7.32%	13.16%	21.78%
Paternalistic Welfare	Realistic	-0.16%		0.22%
	Behavioral	-0.15%		0.17%
Financial Mistakes	Filing too late	1.12%	1.07%	0.41%
	Overborrowing	7.42%	3.89%	0.39%

Even behavioral consumers benefit from an increase in default costs.

- Suppose instead people were over-optimistic about expense shocks.
- Here behavioral people make fewer mistakes, while cross-subsidization is quite important.
- This leads to somewhat different policy implications:
  - Disagreement between rational and behavioral borrowers on financial literacy continues.
  - Disagreement about optimal bankruptcy law:
    - Rationals want stricter garnishment due to the commitment value.
    - Behaviorals want laxer rules to dispose of expense shocks more easily.

Theoretical Insight

- Explicit treatment of default is critical for model predictions:

- Behavioral borrowers are cross-subsidized in our model
- not "taken advantage of," as in Heidhues Koszegi (2010, 2017)

- Since behavioral agents are more "risky" than realists
  - within any pool, conditional on all other info
- they pay less than actuarially fair risk premia

Quantitative Insights

- Behavioral borrowers borrow too much (relative to aware selves)
  - not too little, as in Hynes (2004)
- and file too little (too late)
- Surprisingly, these "mistakes" are quantitatively large only for income shocks, not for expense shocks confusion

- Aggregates are mostly affected by confusion
- While welfare is affected by pooling

- Realists are affected by the presence of behavioral borrowers
  - Not just by mis-pricing (cross-subsidization)
  - Transitory shocks have persistent affects now
  - by changing type-score and affecting future prices