Assessing Bankruptcy Reform in a Model with Temptation and Equilibrium Default

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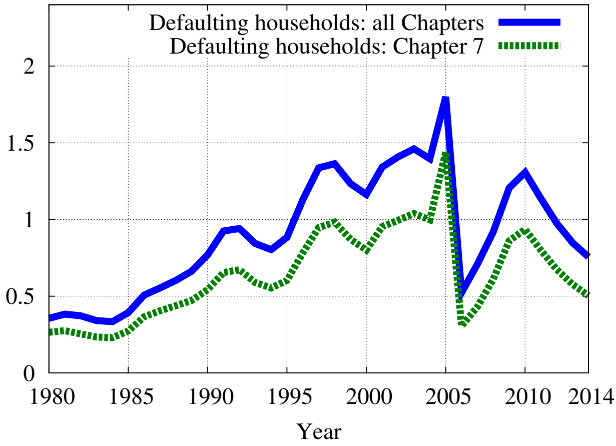
Number of Consumer Bankruptcy Filings



- Rising consistently since early 1980s.
- Seems to be declining as a result of the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) in 2005.

Background

- Models with present bias (hyperbolic-discounting, temptation) have become widely-used in macro/finance.
  - Theoretical foundations (Laibson (1997), Gul and Pesendorfer (2001))
  - Consumers' preferences for illiquid assets (Laibson (1997))
  - Credit card debt with a high interest rate (Laibson et al. (2003))
  - Payday loans (Agarwal et al. (2009))
  - Social Security (İmrohoroğlu et al. (2003), Findley and Caliendo (2008))
  - Optimal taxation (Krusell et al. (2010))
  - Retirement Decision (Feigenbaum and Findley (2015))
  - Mandatory saving Floors (Malin (2008))
  - Rising indebtedness and welfare (Nakajima (2012))

- Models with equilibrium default/bankruptcy have been developed. (Livshits et al. (2007), Chatterjee et al. (2007))

- White (2007) argues that hyperbolic-discounting preference is an important feature in constructing a model of bankruptcies for policy evaluation.

Contribution

- I develop a quantitative model with:
  - Equilibrium default
  - Hyperbolic-discounting / temptation
  - Coexistence of exponential- and hyperbolic-discounting agents.
- And use the model to evaluate the BAPCPA within the model.
  - Does the model replicate what happened after the BAPCPA?
  - What are the welfare implications?
  - Does hyperbolic-discounting matter? How?
  - Can the BAPCPA be improved?
- I also investigate other bankruptcy policy reforms.

Other Issues

- Illiquid assets (housing).
- Simultaneous holding of asset and debt.
- Informal default.
- Chapter 13 bankruptcy.
- Richer heterogeneity (e.g., heterogeneous δ_j and/or β_j).

Model: Overview

- Partial-eqm life-cycle model with uninsured idiosyncratic shocks.
  - Agents work till age I_R and live up to age I.
  - Persistent and transitory labor income shocks.
  - Expenditure shock.
- Two-types of agents
  - Exponential-discounting preferences.
  - Quasi-hyperbolic discounting preferences (sophisticated).
- Equilibrium default.
  - Taking $q(.)$ as given, agents determine $g_h(.)$ (default or not).
  - Taking $g_h(.)$ as given, competitive credit sector determines $q(.)$.

Model: Preferences

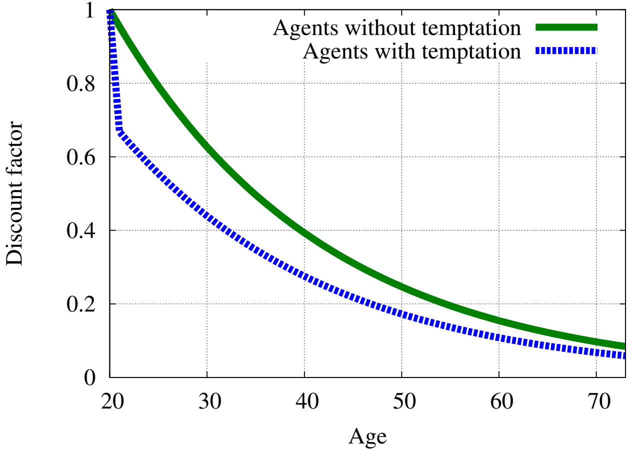
- Two preference types:
  - $j = 1$: Exponential-discounting, measure ϕ.
  - $j = 2$: Quasi-hyperbolic-discounting, measure $1 - \phi$.

- Common CRRA period utility function:
  - $\frac{(c_i/\nu_i)^{1-\sigma}}{1-\sigma}$.
  - ν_i: Household equivalent scale for age-i.

- Two type-dependent discount factors:
  - δ_j: Long-term discount factor.
  - β_j: Short-term discount factor.

- Assume:
  - $\beta_1 = 1.0$, $\beta_2 = 0.7$
  - $\delta_1 = \delta_2$.

Model: Discount Factor for Age-20



- Exponential-discounting agents: $\beta_1 = 1.0$ and $\delta_1 = 0.9544$.
- Hyperbolic-discounting agents: $\beta_1 = 0.7$ and $\delta_1 = 0.9544$.

Model: Endowment

- Agents born with $a = 0$.

- Labor income: $e(i,p,t) = e_i \exp(p+t)$
  - e_i: Average labor income for age-i.
  - p: Persistent shock to labor income (Markov).
  - t: Transitory shock to labor income (i.i.d.).

- Social Security benefits: $b(i,p,t) = \psi_e \overline{e} + \psi_p p$
  - Only for age $i > I_R$.
  - $\overline{e}$: Average labor income.
  - p: Persistent shock to labor income at age-I_R.

- OOP expenditure shock x: i.i.d. (Livshits et al. (2007))

- Two paths to bankruptcy:
  - Series of low income shocks $\rightarrow$ Accumulated debt $\rightarrow$ Default.
  - Large medical expense shock $\rightarrow$ Default.

Model: Default

- Based on Chatterjee et al. (2007): Captures salient characteristics of Chapter 7 bankruptcy in the U.S.
- Benefits of defaulting:
  - Existing debt and bills are wiped out.
  - No future obligation to repay: *fresh start*
- Costs of defaulting:
  - Filing cost: $\xi = \$600$.
  - Wage garnishment: Proportion η of the current income.
  - Cannot save in the filing period.
  - Credit history turn bad ($h = 1$).
  - While credit history is bad, excluded from loan market ($a' \geq 0$).
  - With probability of λ, credit history turns good ($h = 0$).
- Agents optimally choose whether to default or not.

Model: Default Decision ($h = 0$)

$$h^* = \begin{cases} 0 \text{ (non-default)} & \text{if } V^*_{non}(.) > V^*_{def}(.) \\ 1 \text{ (default)} & \text{Otherwise} \end{cases} \quad (1)$$

$$V(j, i, 0, p, t, x, a) = \begin{cases} V_{non}(j, i, 0, p, t, x, a) & \text{if } h^* = 0 \\ V_{def}(j, i, 0, p, t, x, a) & \text{if } h^* = 1 \end{cases} \quad (2)$$

- Default decision is made based on the discount factor $\beta_j \delta_j$.
- Value is computed based on δ_j only.

Model: Value Conditional on Non-Defaulting

$$a^* = \underset{a' \in \mathbb{R}}{\text{argmax}} \left\{ u\left(\frac{c}{\nu_i}\right) + \beta_j \delta_j \mathbb{E} V(j, i+1, 0, p', x', t', a') \right\} \quad (3)$$

$$c + a' q(j, i, 0, p, t, x, a') + x = e(i, p, t) + b(i, p, t) + a \quad (4)$$

$$V^*_{non}(j, i, 0, p, t, x, a) = \begin{cases} -\infty & \text{if } B(.) = \emptyset \\ u\left(\frac{c}{\nu_i}\right) + \delta_j \mathbb{E} V(j, i+1, 0, p', t', x', a^*) & \text{if } B(.) \neq \emptyset \end{cases} \quad (5)$$

$$V_{non}(j, i, 0, p, t, x, a) = \begin{cases} -\infty & \text{if } B(.) = \emptyset \\ u\left(\frac{c}{\nu_i}\right) + \delta_j \mathbb{E} V(j, i+1, 0, p', t', x', a^*) & \text{if } B(.) \neq \emptyset \end{cases} \quad (6)$$

- Optimal saving decision is based on $\beta_j \delta_j$, while the value is evaluated with δ_j only.

Model: Value Conditional on Defaulting

$$V_{def}(j,i,h,p,t,x,a) = u\left(\frac{c}{\nu_i}\right) + \delta_j \mathbb{E}V(j,i+1,1,p',t',x',0) \quad (7)$$

$$c + \xi = e(i,p,t)(1-\eta) + b(i,p,t) \quad (8)$$

$$V^*_{def}(j,i,h,p,t,x,a) = u\left(\frac{c}{\nu_i}\right) + \delta_j \mathbb{E}V(j,i+1,1,p',t',x',0) \quad (9)$$

$$c + \xi = e(i,p,t)(1-\eta) + b(i,p,t) \quad (10)$$

- Existing debt a and expenditure x are wiped away.
- Credit history turns bad ($h' = 1$).
- Cannot save in the defaulting period ($a' = 0$).
- ξ: Cost of filing.
- η: Wage garnishment.

Model: Decision of Agent with Bad Credit History ($h = 1$)

$$V(j, i, 1, p, t, x, a) = \begin{cases} V_{def}(j, i, 1, p, t, x, a) & \text{if } B(.) = \emptyset \\ u\left(\frac{c}{\nu_i}\right) + \delta_j \mathbb{E} V(j, i+1, h', p', t', x', a^*) & \text{if } B(.) \neq \emptyset \end{cases} \quad (11)$$

$$a^* = \underset{a' \in \mathbb{R}^+}{\operatorname{argmax}} \left\{ u\left(\frac{c}{\nu_i}\right) + \beta_j \delta_j \mathbb{E} V(j, i+1, h', p', x', t', a') \right\} \quad (12)$$

$$c + a' q(j, i, 1, p, t, x, a') + x = e(i, p, t) + b(i, p, t) + a \quad (13)$$

- Agents can default only if defaulting is the only choice.
- Agents cannot save: $a' \in \mathbb{R}^+$.

Model: Unsecured Credit Sector

- Mass of credit card companies, each of which is a price taker.
- Offers discount bonds of price $q(j, i, h, p, t, x, a')$.
- A credit card company can target any type of agents.
  - Cross-subsidization is impossible in equilibrium.
  - Zero profit for each type in equilibrium.
- Zero profit condition of a credit card company making loans to measure m of type-$(j, i, 0, p, t, x, a')$ agents:

$$m\mathbb{E}\left[\mathbb{1}_{g_h=0}(-a') + \mathbb{1}_{g_h=1}\eta e(i+1, p', t')\frac{-a'}{x'-a'}\right] = m(-a'q(j, i, 0, p, t, x, a'))(1 + r + \iota) \quad (14)$$

Model: Credit Card Sector: $q(.)$ Function

1. Solving the zero profit condition for q:

$$q(j, i, 0, p, t, x, a') = \frac{\mathbb{E}\left[\mathbb{1}_{g_h=0} + \mathbb{1}_{g_h=1}\frac{\eta e(i+1, p', t')}{x' - a'}\right]}{1 + r + \iota} \tag{15}$$

2. In case $\eta = 0$:

$$q(j, i, 0, p, t, x, a') = \frac{\mathbb{1}_{g_h=0}}{1 + r + \iota} \tag{16}$$

3. Special case: no default

$$q(j, i, 0, p, t, x, a') = \frac{1}{1 + r + \iota} \tag{17}$$

4. Special case: all default

$$q(j, i, 0, p, t, x, a') = 0 \tag{18}$$

Model: Credit Card Sector: Remarks

- Default probability is an increasing function of the size of debt.
- Therefore, $q(.)$ (default premium) is a decreasing (increasing) function of the size of debt.
- With $\eta = 0$, at some point, $q(.)$ becomes zero. The corresponding debt level gives the endogenous borrowing constraint.
- When the punishment is very harsh, nobody defaults, and the model becomes the one with the natural borrowing limit.
- When the punishment is very mild, everybody defaults, and the model becomes the one with zero borrowing limit.

Model: Equilibrium

Steady-state recursive equilibrium satisfies:

1. Given $q(.)$, agent's optimize:
   $V(j, i, h, p, t, x, a)$ is the optimal value function and $g_a(j, i, h, p, t, x, a)$ and $g_h(j, i, h, p, t, x, a)$ are associated optimal decision rules.
2. Given $g_h(.)$, zero profit of credit card sector:
   $q(j, i, h, p, t, x, a')$
3. Type distribution of agents, μ, is time-invariant.

Calibration: Parameters [1/2]

Parameter	Value	Description
I	54	Last age is age 73.
I_R	45	Retirement at age 65.
σ	2.0000	Standard in literature.
$\{\nu_i\}$	–	Household size in family equivalence scale.
ϕ	0.5000	Measure of exponential-discounting agents.
β_1	1.0000	Definition of exponential-discounting.
β_2	0.7000	Laibson et al. (2007).
$\delta_1 = \delta_2$	0.9544	Match D/Y=0.09.
λ	0.1000	10 years of punishment.
ξ	0.0280	Cost of filing = 600 dollars
η	0.3064	Match number of bankruptcies = 0.84% p.a.
r	0.0200	Annual interest rate.
ι	0.0600	Transaction cost of loans.
$\overline{r}$	1.0000	Interest rate limit.

Calibration: Parameters [2/2]

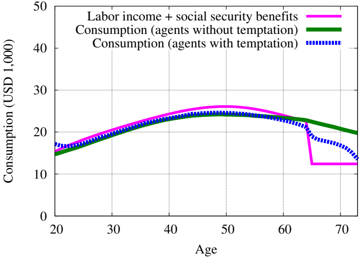
Parameter	Value	Description
$\{e_i\}$	–	From Gourinchas and Parker (2002).
ρ_p	0.9500	From Livshits et al. (2010)
σ_p^2	0.0250	From Livshits et al. (2010)
σ_t^2	0.0500	From Livshits et al. (2010)
ψ_e	0.2000	From Livshits et al. (2010)
ψ_p	0.3500	From Livshits et al. (2010)
x_1	0.3960	Size of small exp. Livshits et al. (2007)
π_1^x	0.0237	Prob of small exp. Livshits et al. (2007)
x_2	1.2327	Size of large exp. Livshits et al. (2007)
π_2^x	0.0015	Prob of large exp. Livshits et al. (2007)

Baseline Model: Aggregate Statistics

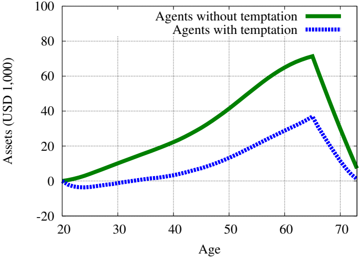
	U.S.	Baseline Model		
	1995-1999	All	Exponential	Hyperbolic
Asset/Income	254-534	97.8	145.4	49.5
% in debt	11.0-48.4	30.8	18.4	43.1
Debt/Income	9.0	9.0	3.9	14.2
Charge-off rate	4.8	4.5	5.7	4.2
Avg borrowing rate	10.9-12.8	10.1	9.9	10.2
Total bankruptcies	0.84	0.84	0.46	1.22
Due to exp shock	–	0.71	0.45	0.98
Due to inc shock	–	0.13	0.01	0.25

- The baseline model replicates U.S. debt-related statistics.
- ...except asset holding.
- Hyperbolic-discounting agents borrow more and default more.
- Hyperbolic-discounting agents default with income shocks as well.

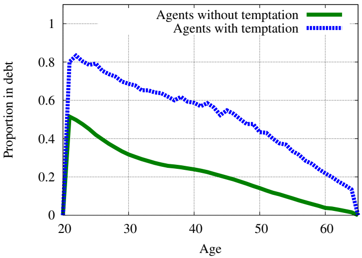
Baseline Model: Average Life-Cycle Profiles



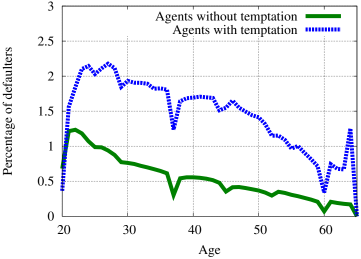
(a) Consumption



(b) Savings



(c) Debtors



(d) Defaults

Evaluating the 2005 Bankruptcy Law Reform

- In 2005, BAPCPA was enacted, in response to increasing defaults.
  - Perception: debtors are abusing the debtor-friendly bankruptcy law.
- Two main components (White (2007)):
  1. Means-testing (income).
  2. Higher cost of filing ($600 $\longrightarrow$ $2500).
- We introduce the two components into our calibrated model.

Comments on Welfare

- Social welfare is measured as ex-ante expected life-time utility.
  - Expectation with respect to all possible initial conditions.
  - Also look at ex-ante expected life-time utility conditional on preference type.
- Experienced utility at the initial age.
  - Value of agents at the initial age with temptation.
- Converted into CEV (consumption equivalent variation).
  - Change in flow consumption due to moving from the baseline economy (without the BAPCPA) to the alternative economy.

Effects of the 2005 Bankruptcy Law Reform: Model Implications

	% Default	D/Y	Charge-off	Avg r	Welfare
Model					
Baseline	0.84	9.0	4.5	10.1	–
BAPCPA	0.35	11.1	2.4	9.4	−0.34
Means-testing	0.65	9.5	3.8	10.2	−0.05
Higher costs	0.49	10.6	3.2	9.7	−0.31

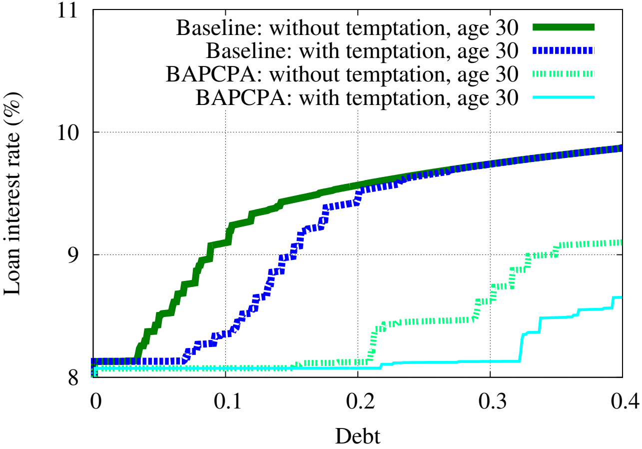
- Lower number of bankruptcies.
- Higher debt.
- Lower average borrowing interest rate.
- Effects of higher filing costs are stronger.

Effects of 2005 Bankruptcy Law Reform: Decomposition

	% Default	D/Y	Charge-off	Avg r	Welfare
Model					
Baseline	0.84	9.0	4.5	10.1	–
BAPCPA	0.35	11.1	2.4	9.4	−0.34
Only $q(.)$	4.45	16.2	45.9	24.3	+1.77
Means-test $\overline{q}(.)$	0.73	8.0	4.0	10.0	−0.08
Higher costs $\overline{q}(.)$	0.49	7.9	3.7	9.9	−0.90

- Means-testing prevents high-income agents from defaulting.
- Higher default costs discourage (lower-income) agents from defaulting.
- Both lower probability of defaulting.
- Stronger commitment to repay leads to lower borrowing rate.
- Agents borrow more in response.

BAPCPA: Response of Default Premium



- Price of discount bonds (default premium) increases (declines) in response to the BAPCPA.

Effects of the 2005 Bankruptcy Law Reform: Model vs Data

	% Default	D/Y	Charge-off	Avg r	Welfare
U.S.					
1999-2004	0.94	9.4	5.3	14.0	–
2007	0.43	9.5	4.0	13.3	–
2007-2014	0.67	7.7	5.6	12.6	–
2014	0.50	6.6	3.2	11.9	–
Model					
Baseline	0.84	9.0	4.5	10.1	–
BAPCPA	0.35	11.1	2.4	9.4	−0.34
Only exponential-discounting agents					
Baseline	0.84	9.0	4.8	9.9	–
BAPCPA	0.38	12.5	2.3	9.2	−0.04
Only hyperbolic-discounting agents					
Baseline	0.84	9.0	4.5	10.1	–
BAPCPA	0.36	10.3	2.5	9.4	−0.31

- Consistent with the U.S. data, especially in 2007.
- Predictions of the baseline model are similar to those of the alternative models with only one type of agents.

Effects of the 2005 Bankruptcy Law Reform: Heterogeneity

	% Default	D/Y	Charge-off	Avg r	Welfare
Model					
Baseline	0.84	9.0	4.5	10.1	–
BAPCPA	0.35	11.1	2.4	9.4	−0.34
Exponential-discounting agents					
Baseline	0.46	3.9	5.7	9.9	–
BAPCPA	0.17	4.4	2.8	9.2	−0.34
Hyperbolic-discounting agents					
Baseline	1.22	14.2	4.2	10.2	–
BAPCPA	0.54	18.0	2.3	9.4	−0.34

- Not surprisingly, similar effects between two types of agents.

Welfare Effects of the 2005 Bankruptcy Law Reform

- Small negative welfare effects: -0.34% in CEV.
  - Negative!
  - Same for both types of agents.
- Not working to screen out the abusers.
  - Small effects of means-testing.
  - Consistent with Albanesi and Nosal (2015).

Welfare Effects of the 2005 Bankruptcy Law Reform

- Various channels of welfare effects:
  1. Some agents cannot default due to means-testing ($\downarrow$)
  2. Higher costs of defaulting ($\downarrow$)
  3. Lower borrowing interest rate and resulting better consumption smoothing ($\uparrow$)
  4. Hyperbolic-discounting agents overborrow ($\downarrow$)

- Hyperbolic-discounting agents:
  - (1)+(2)+(4) > (3).
  - Nakajima (2012) show that (4) is strong.

- Exponential-discounting agents:
  - (1)+(2) > (3).
  - (3) is weak because not many of them borrow.

Calibrating the Bankruptcy Reform

	% Default	D/Y	Charge-off	Avg r	Welfare
Changing Means-Testing Threshold					
0%	0.02	26.2	0.1	8.1	+0.55
50%	0.29	11.5	1.6	9.3	−0.28
100% (BAPCPA)	0.35	11.1	2.4	9.4	−0.34
∞% (Baseline)	0.84	9.0	4.5	10.1	–
Changing Default Cost					
$0	1.02	8.1	5.1	10.4	+0.11
$600 (Baseline)	0.84	9.0	4.5	10.1	–
$1200	0.72	9.7	4.1	10.0	−0.11
$2500 (BAPCPA)	0.49	10.6	3.2	9.7	−0.31

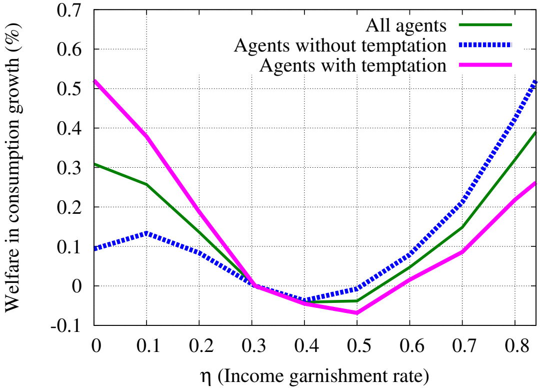
- Tighter means-testing threshold yields welfare gain.
- Lower default cost yields welfare gain (possibly just higher cons).

Effects of Usury Law

	% Default	D/Y	Charge-off	Avg r	Welfare
All Agents					
Baseline (100%)	0.84	9.0	4.5	10.1	–
Usury law (20%)	0.83	9.0	4.5	10.1	+0.02
Usury law (10%)	0.74	4.8	6.0	9.6	−0.98
Exponential-Discounting Agents					
Baseline (100%)	0.46	3.9	5.7	9.9	–
Usury law (20%)	0.46	3.9	5.7	9.9	−0.00
Usury law (10%)	0.46	1.7	10.0	9.5	−1.08
Hyperbolic-Discounting Agents					
Baseline (100%)	1.22	14.2	4.2	10.2	–
Usury law (20%)	1.21	14.1	4.2	10.2	+0.03
Usury law (10%)	1.02	7.9	5.1	9.6	−0.89

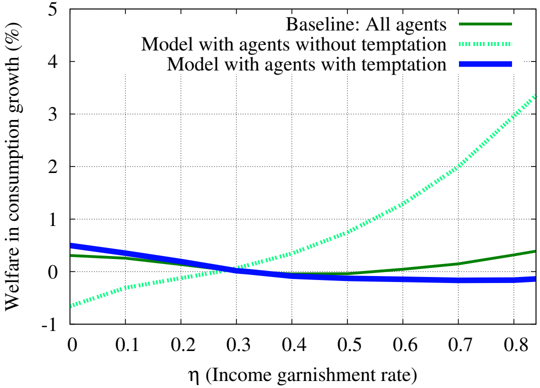
- Not-too-tight usury law improves welfare, for hyperbolic-discounting agents.
- Tighter usury law hurts both types of agents.

Optimal Level of Default Punishment



- The optimal level of income garnishment upon default (η) is 0.84 (highest feasible level).
- Welfare improvement when η is very high or very low.
- Exponential-discounting agents prefer higher η.
- Hyperbolic-discounting agents prefer lower η (overborrowing).

Optimal Level of Default Punishment: Alternative Models



- The model with only exponential-discounting agents imply a large welfare gain from tight η.
- The model with only hyperbolic-discounting agents imply a moderate welfare gain from lax η.

Concluding Remarks

- I develop a quantitative model with:
  - Equilibrium default.
  - Hyperbolic-discounting / temptation
  - Coexistence of exponential- and hyperbolic-discounting agents.
- I evaluate the recent bankruptcy law reform with the model.
  - The model implies that BAPCPA successfully reduces bankruptcies.
  - But with negative welfare effect.
- Effects of changing punishment upon default.
  - Exponential-discounting agents prefer severe punishment of default (stronger commitment to repay).
  - Hyperbolic-discounting agents prefer lax punishment that leads to less credit (stronger commitment not to overborrow).

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