Optimal Illiquidity

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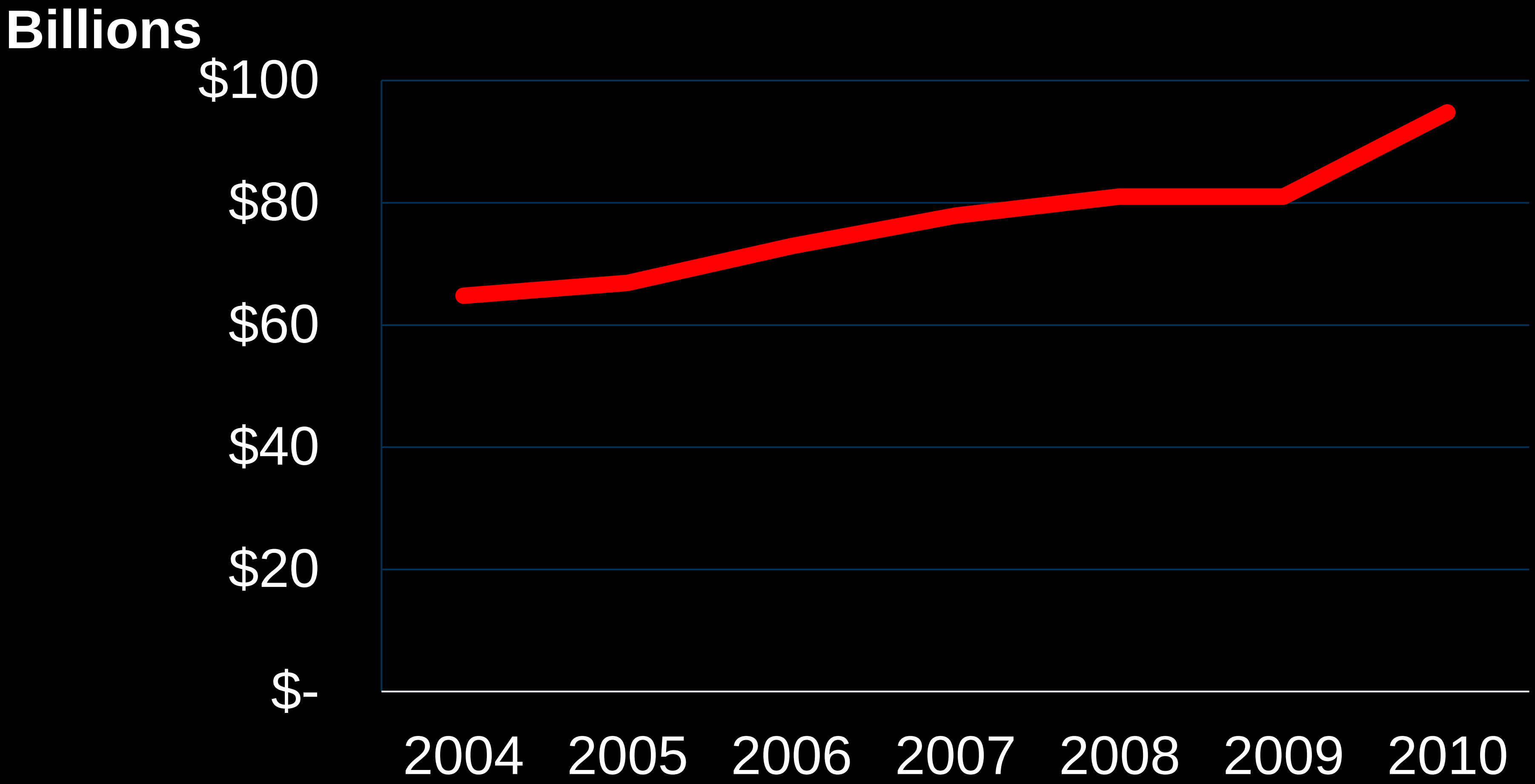
Households <55 make $0.40 of taxable withdrawals from retirement accounts for every $1 of contributions

(Argento, Bryant, and Sabelhaus 2014)



International comparison of employer-based DC accounts

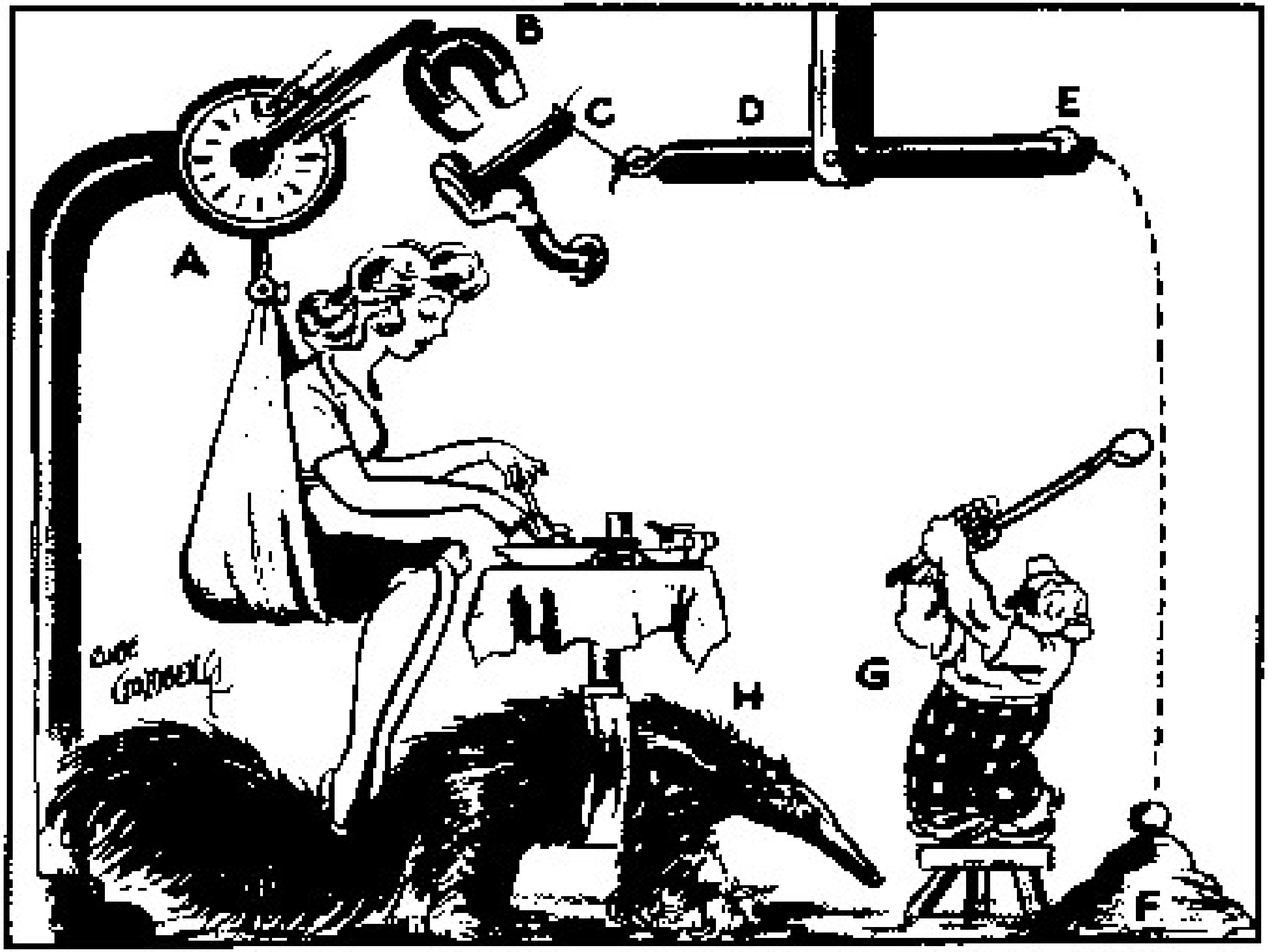
Beshears, Choi, Hurwitz, Laibson, Madrian (forthcoming)

- United States:
  - liquidity (10% penalty or no penalty)
- Canada, Australia:
  - no liquidity, unless long-term unemployed
- Germany, Singapore, UK:
  - no liquidity

What is the socially optimal level of household liquidity?

1. Legitimate unanticipated/uninsurable spending needs
2. Illegitimate overspending
   - self-control problems
   - other types of “mistakes”
3. Externalties (penalties = government revenue)
4. Heterogeneity in preferences (self-control problems)

Socially optimal savings: Behavioral mechanism design



Behavioral mechanism design

1. Specify a positive theory of consumer behavior
   - consumers may or may not behave optimally
2. Specify a normative social welfare function
   - not necessarily based on revealed preference
3. Solve for the institutions that maximize the social welfare function, conditional on the theory of consumer behavior.

Caveats when we’ve worked through 1-3.

Behavioral mechanism design

1. Specify a positive theory of consumer behavior:
   - Quasi-hyperbolic (present-biased) consumers
   - Discount function: $1, \beta\delta, \beta\delta^2$
2. Specify a normative social welfare function
   - Exponential discounting
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1. Specify a theory of consumer behavior

Start with Amador, Werning and Angeletos (2006), hereafter AWA:

1. Present-biased preferences
2. Short-run taste shocks
3. A general non-linear budget set
   - commitment mechanism

Timing

Period 0. An initial period in which a commitment mechanism is set up by self 0 **or** by the planner.

Period 1. A taste shock is realized and privately observed. Consumption (c_1) occurs.

Period 2. Another taste shock is realized and privately observed. Final consumption (c_2) occurs.

Agent Preferences

$$U_0 = \beta\delta\,\theta_1\,u_1(c_1) + \beta\delta^2\,\theta_2\,u_2(c_2)$$

$$U_1 = \theta_1\,u_1(c_1) + \beta\delta\,\theta_2\,u_2(c_2)$$

$$U_2 = \theta_2\,u_2(c_2)$$

Taste shocks,
with CDF $F(\theta)$

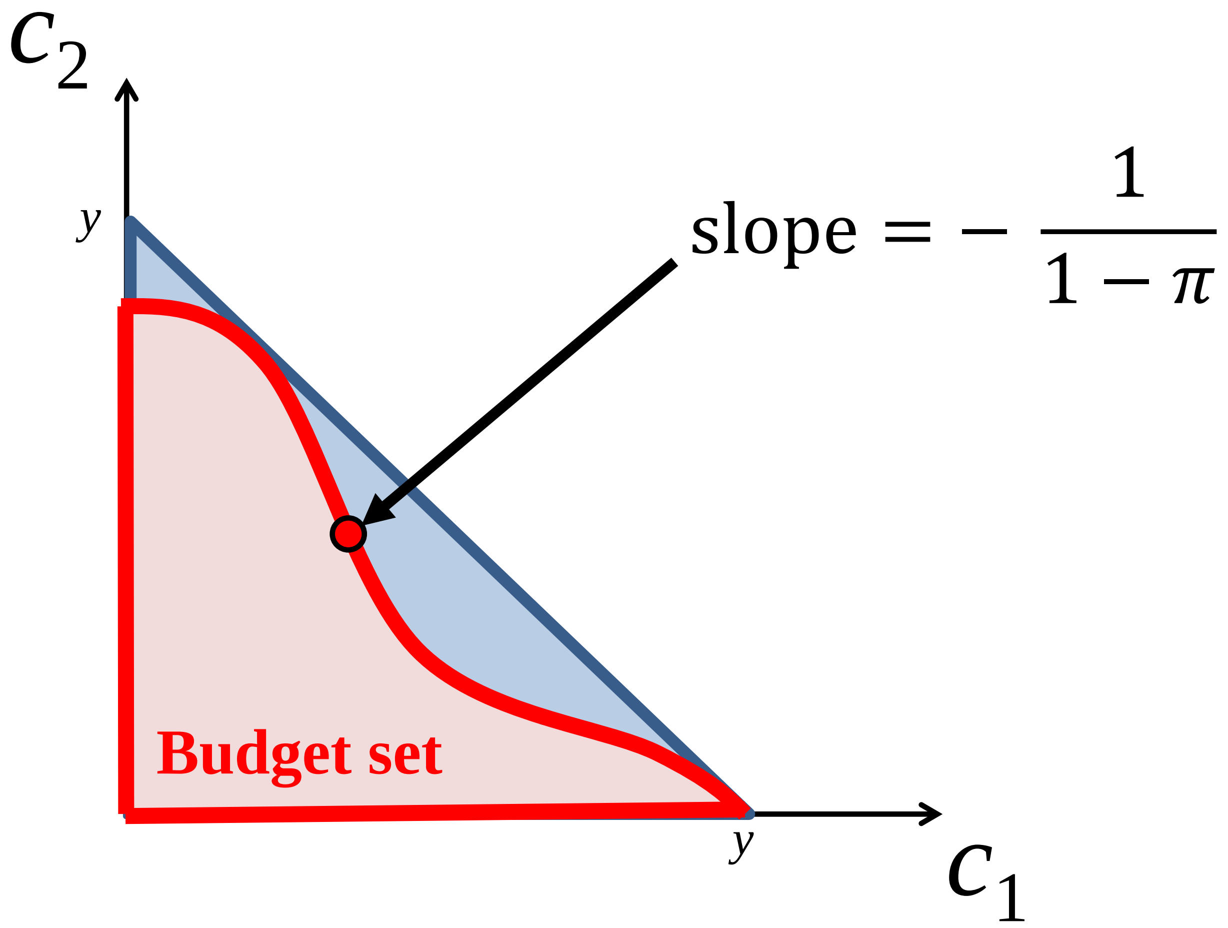
Agent Preferences (simplified)

$$U_0 = \theta_1 u_1(c_1) + \theta_2 u_2(c_2)$$

$$U_1 = \theta_1 u_1(c_1) + \beta\, \theta_2 u_2(c_2)$$

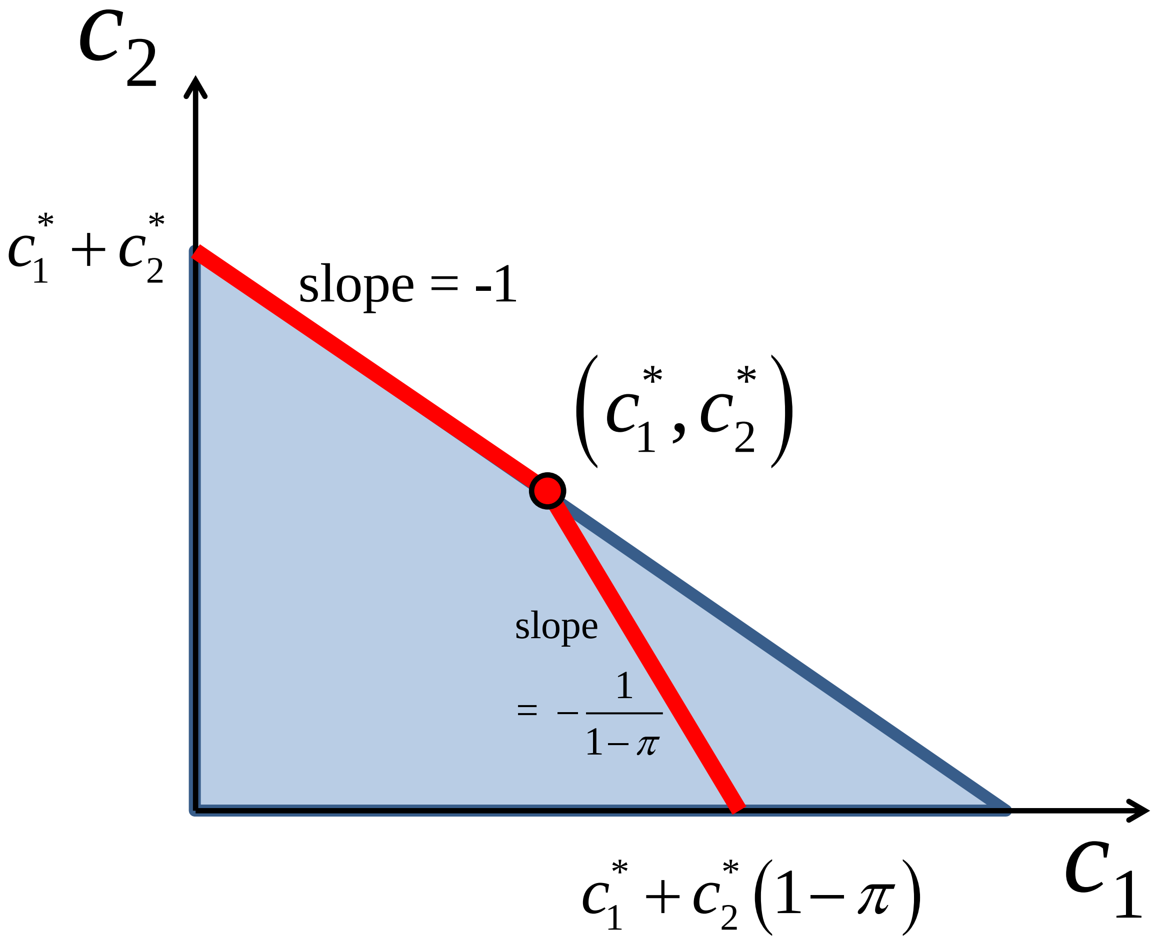
$$U_2 = \theta_2 u_2(c_2)$$

Self 0 hands self 1 a budget set (subset of blue region)

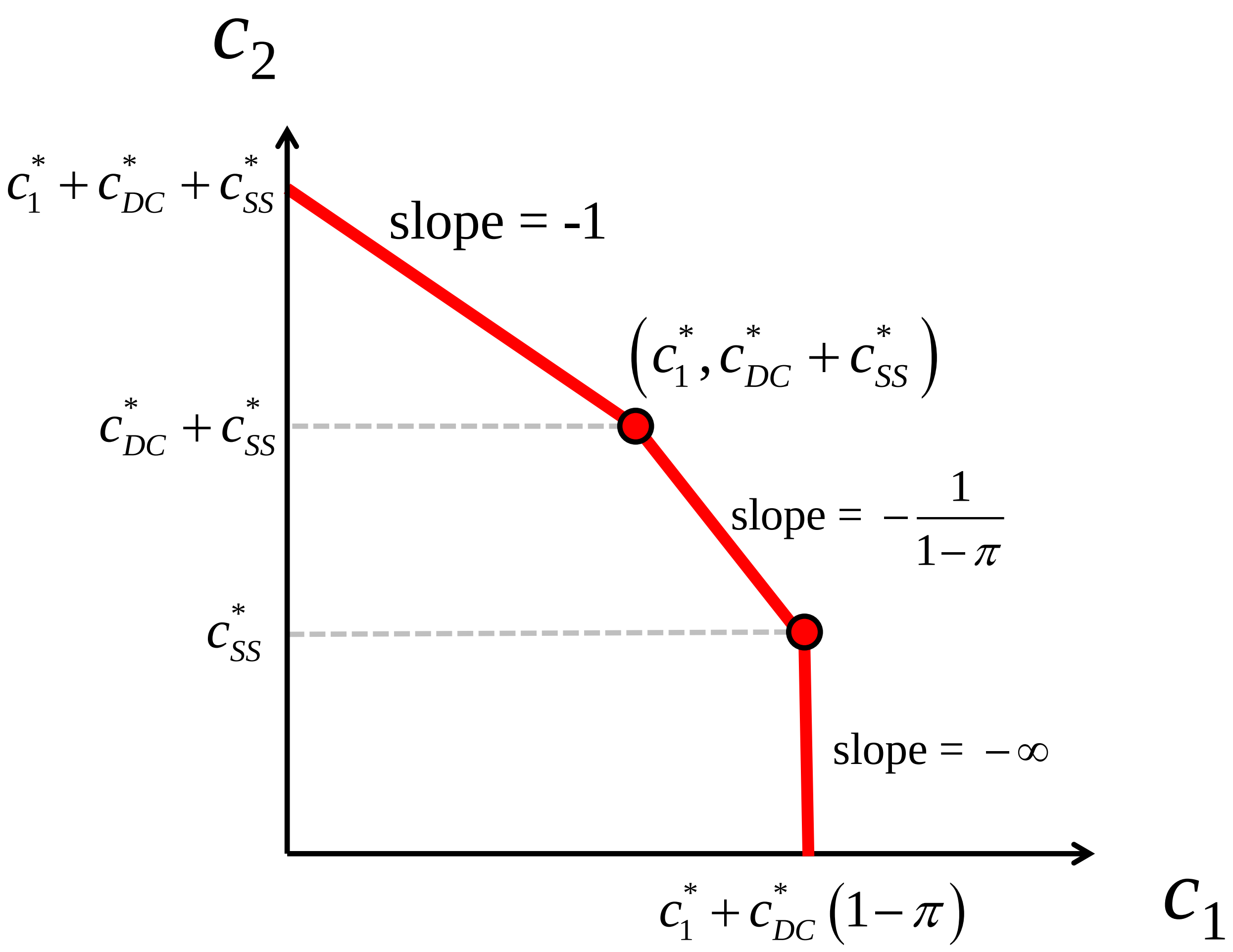


Interpretation: when \$1 is transferred from c_2 to c_1 \$$\pi$ are lost in the exchange.

Two-part budget set



Three-part budget set



Theorem 1 (AWA):

Assume self 0 is sophisticated and can choose any feasible budget set.

Assume self 0 doesn’t care about revenue externality from penalties.

Then self 0 will choose a two-part budget set:

- fully liquid account
- fully illiquid account (no withdrawals in period 1)

Theorem 2

Assume there are three accounts:

- one liquid
- one with an intermediate withdrawal penalty
- one completely illiquid

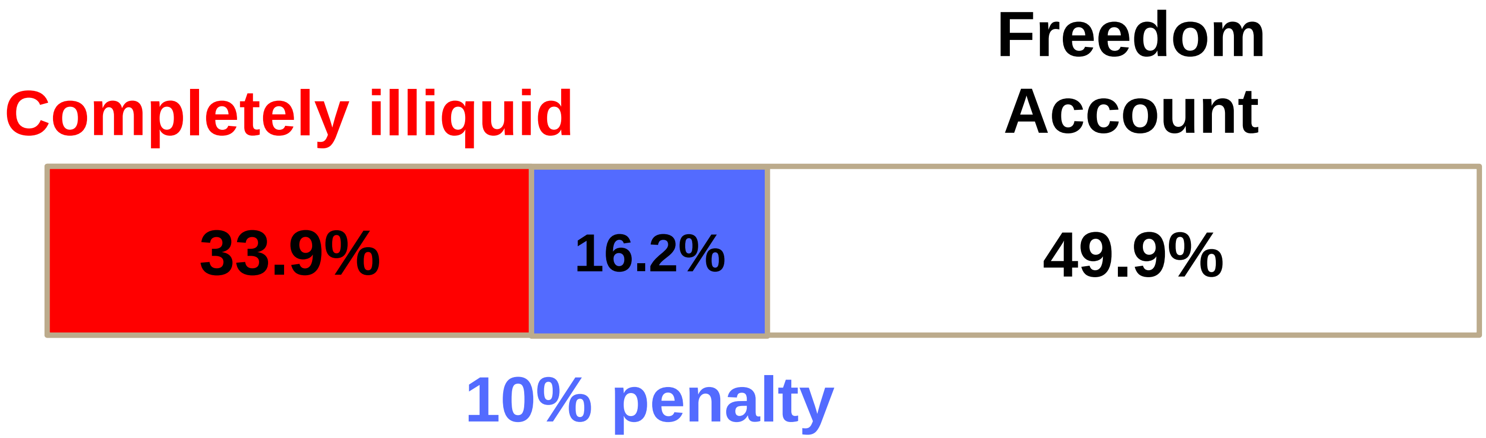
Then self 0 will allocate all assets to the liquid account and the completely illiquid account.

Experimental data

(Beshears, Choi, Harris, Laibson, Madrian, and Sakong 2014)

- Give subjects $100
- Ask them to divide it among three accounts
- All accounts offer a 22% rate of interest
    1. One account is perfectly illiquid
    2. One account has a 10% penalty for early withdrawal
    3. One account is perfectly liquid
- For the first two accounts, set a goal date
- Maximum holding period: 1 year

When three accounts are offered



Theorem 3:

Assume $\ln$ utility.

Assume that self 0 is offered two accounts: one completely liquid and an illiquid account with an early withdrawal penalty of π.

The amount of money deposited in the illiquid account rises with π.

Experimental data

(Beshears, Choi, Harris, Laibson, Madrian, and Sakong 2014)

- Give subjects $100
- Ask them to divide it among two accounts
- Both accounts offer a 22% rate of interest
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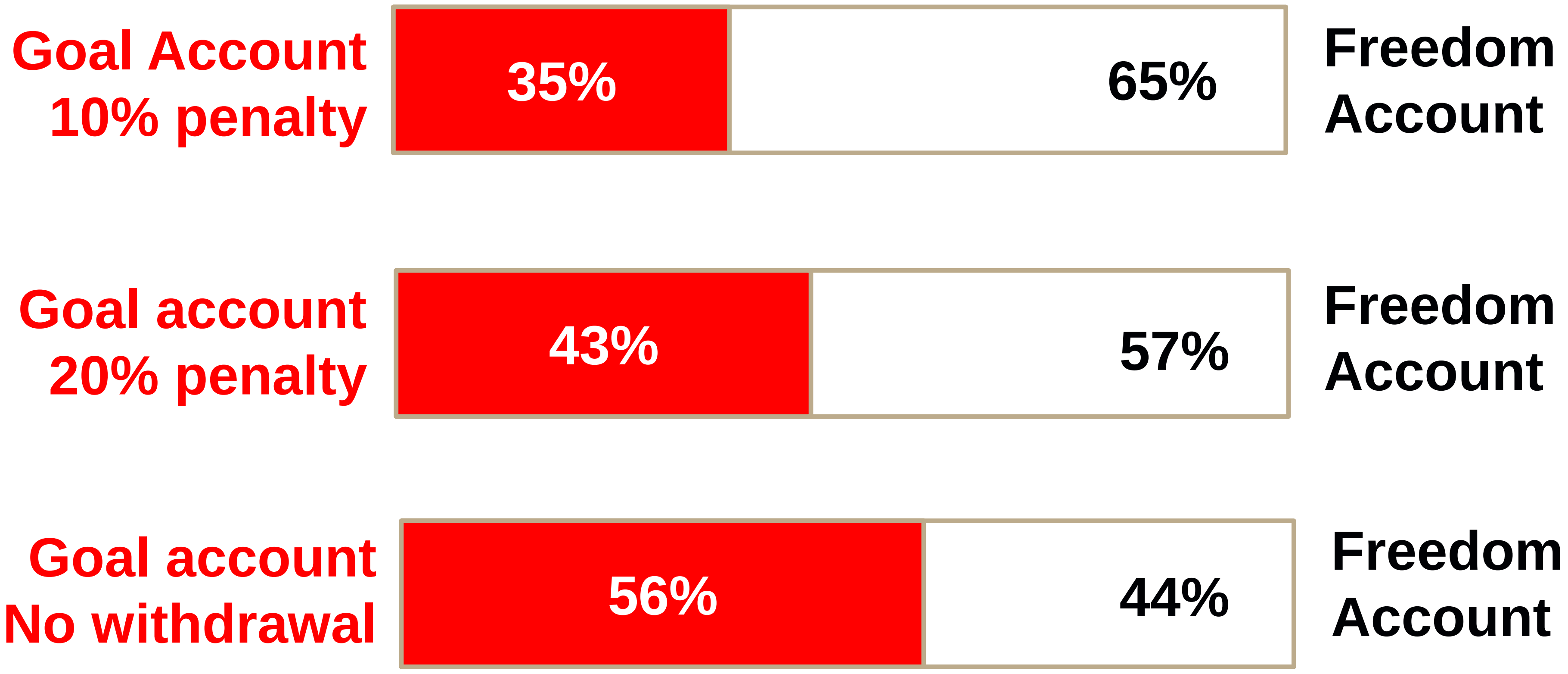
Goal account usage



Summary so far

- Descriptive theory of consumer behavior.
- Theoretical predictions that match experimental data

Behavioral mechanism design

1. Specify a positive theory of consumer behavior:
   - Quasi-hyperbolic (present-biased) consumers
   - Discount function: $1, \beta\delta, \beta\delta^2$
2. Specify a normative social welfare function
   - Exponential discounting
   - Discount function: $1, \delta, \delta^2$
3. Solve for the institutions that maximize the social welfare function, conditional on the theory of consumer behavior.

Why should the planner use a social welfare function with β=1.

- This is the preference of all past selves for today.
- This is the long-run perspective.
- This is the restriction that eliminates present bias.
- For large T, the resulting behavior dominates the unconstrained equilibrium path (Caliendo and Findley 2015)

- However, this is a normative assumption.
- The rest of the paper is only an ‘if, then’ analysis.
- *If* the planner has a social welfare function with $\beta=1$, *then* the following policies are socially optimal.

Planner Preferences

$$U_0 = \delta\, \theta_1\, u_1(c_1) + \delta^2\, \theta_2\, u_2(c_2)$$
$$U_1 = \theta_1\, u_1(c_1) + \delta\, \theta_2\, u_2(c_2)$$
$$U_2 = \theta_2\, u_2(c_2)$$

Planner preferences: $\beta=1$.

These are dynamically consistent preferences.

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3. Institutions that maximize the planner's social welfare function

1. Need to incorporate externalities: when I pay a penalty, the government can use my penalty to increase the consumption of other agents.
2. Heterogeneity in present-bias, β.

Formal problem:

- (Utilitarian) planner picks an optimal policy in period 0:
  - $\{ x, \ (z_1, z_2, \ldots , \ z_N), (\pi_1, \pi_2, \ldots , \ \pi_N) \}$:
  - x is the allocation to the liquid account
  - z_n: allocation to the n'th illiquid account
  - π_n: associated penalty for early withdrawal
- Endogenous withdrawal/consumption behavior generates social budget balance.

$$x + \sum_n z_n = 1 + E \sum_n \pi_n w_n$$

where w_n is the equilibrium quantity of early withdrawals from illiquid account n.

- Agents in the economy are present-biased and naive. They choose consumption in periods 1 and 2, subject to the budget constraint imposed by the government.

Theorem 4:

Assume:

- homogeneous population with $0 < \beta < 1$
- $u(c) = ln(c)$
- Monotone hazard taste shocks on $[0, \overline{\theta}]$

Then, the planner will ***not*** choose a two-part budget set with a fully liquid account and a fully illiquid account.

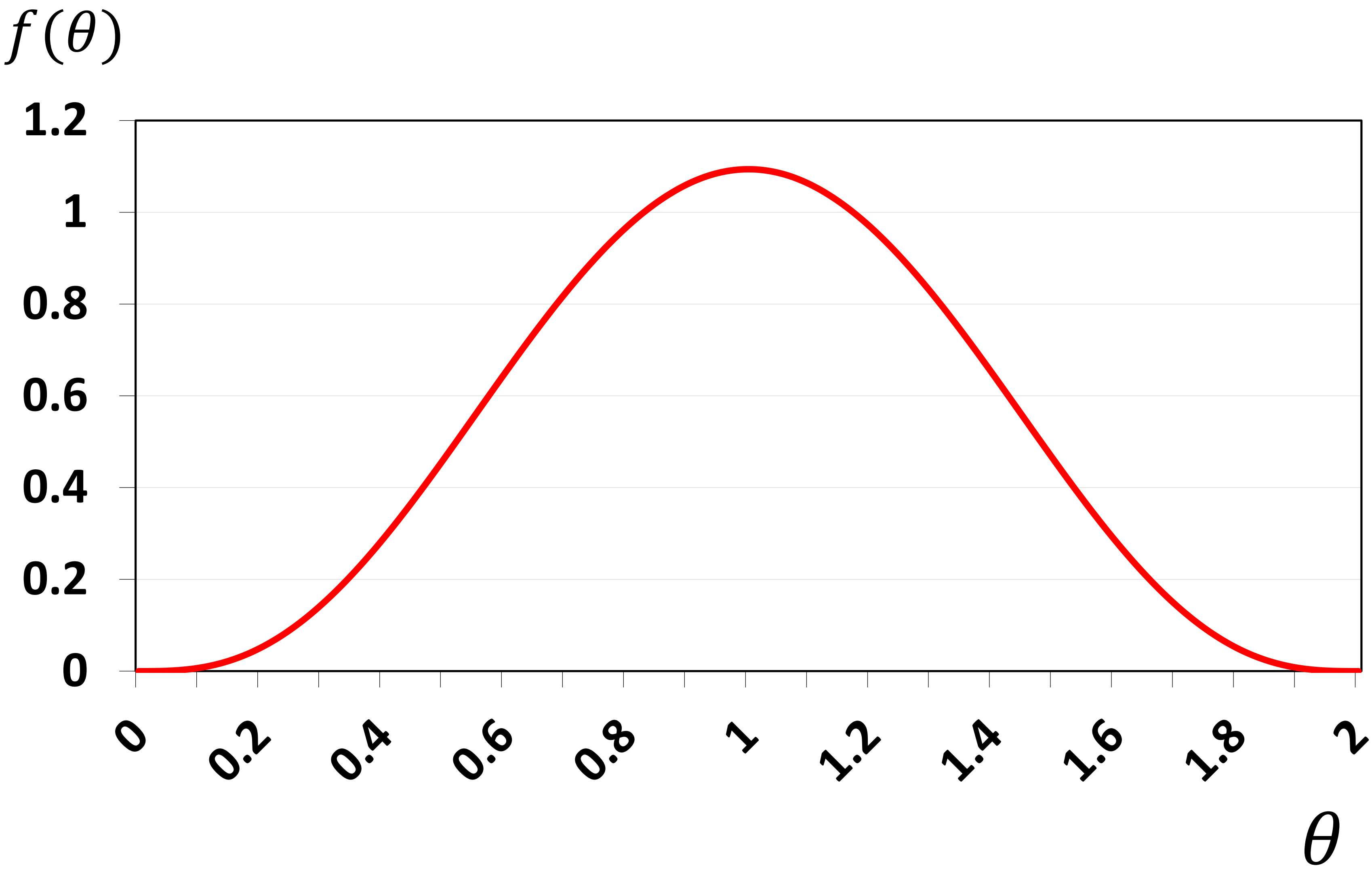
Sketch of Proof

- Consider the class of 2-part budget sets with a liquid account and a 100% penalty account.
- Within this class, find the optimum.
- Perturb this optimum by introducing a 3rd account with a penalty π, such that the agents in a neighborhood of $\overline{\theta}$ are just willing to consume from the third account.
- Use the penalty proceeds to increase the perfectly illiquid account (for all agents).
- This combination raises social welfare.

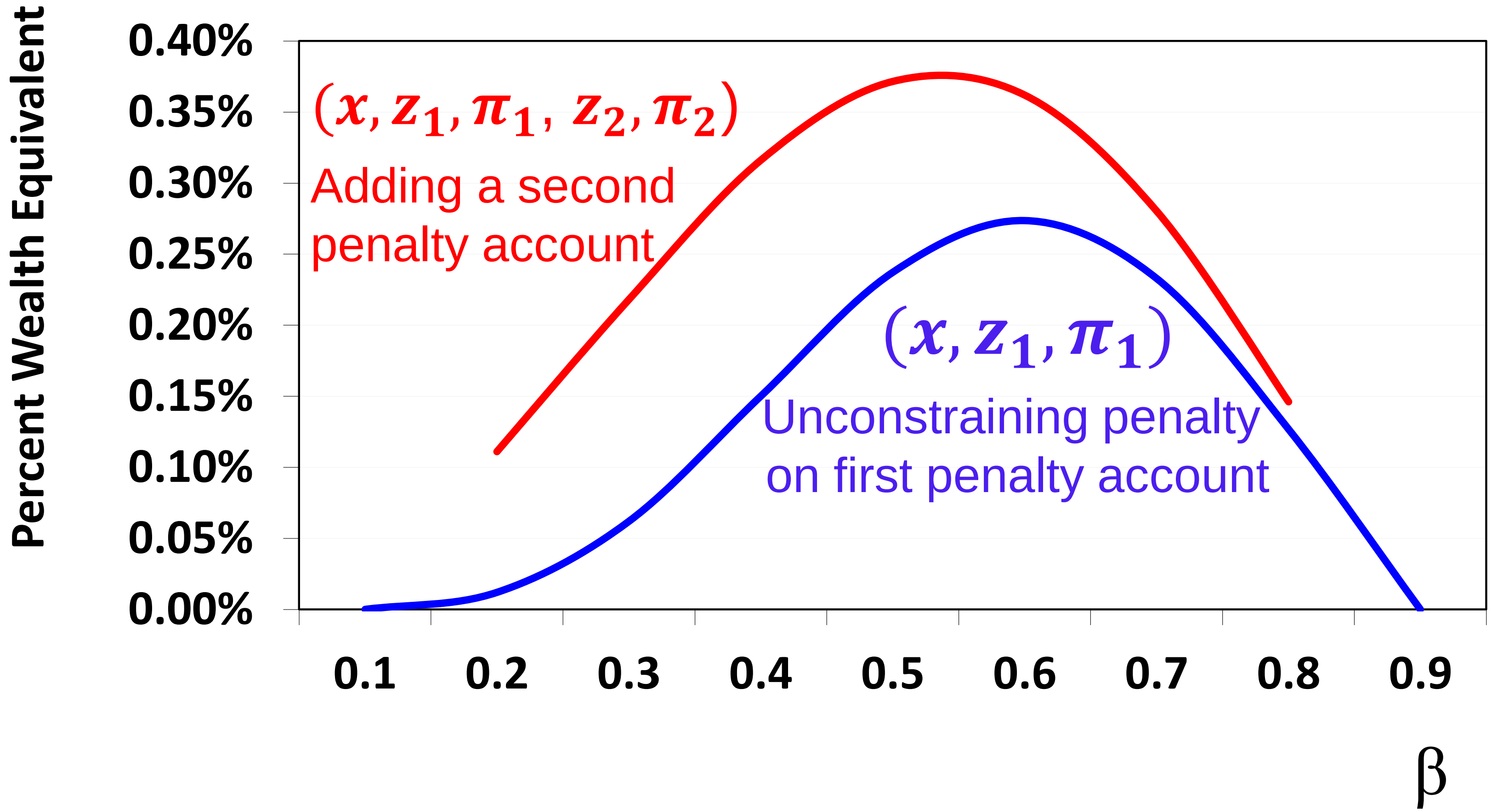
Numerical exploration of optimal policy:

- Bell-shaped distribution of taste shocks on $[0, 2]$.

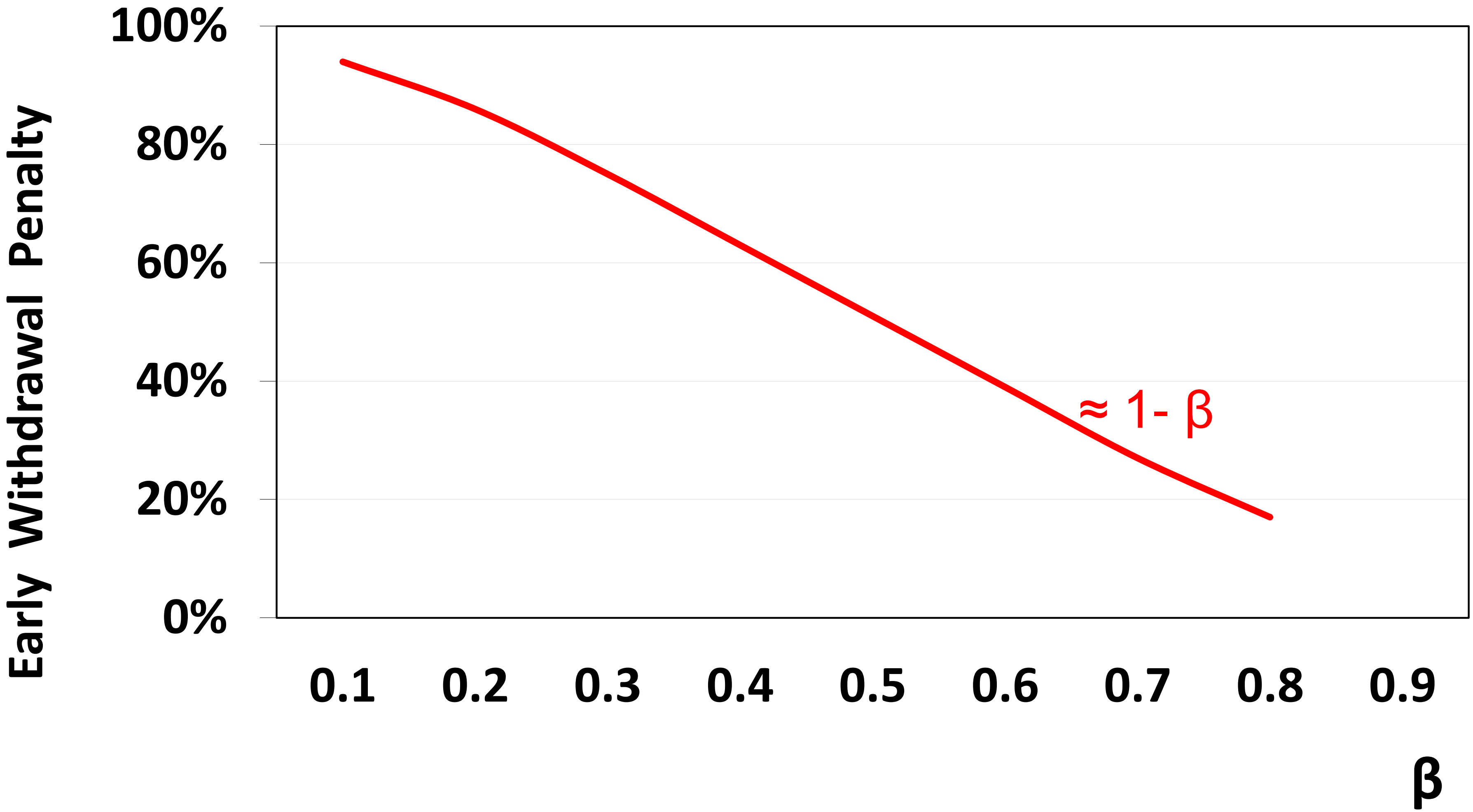
Distribution for taste shocks



Welfare gains relative to $(x, z_1, \pi_1 = 100\%)$

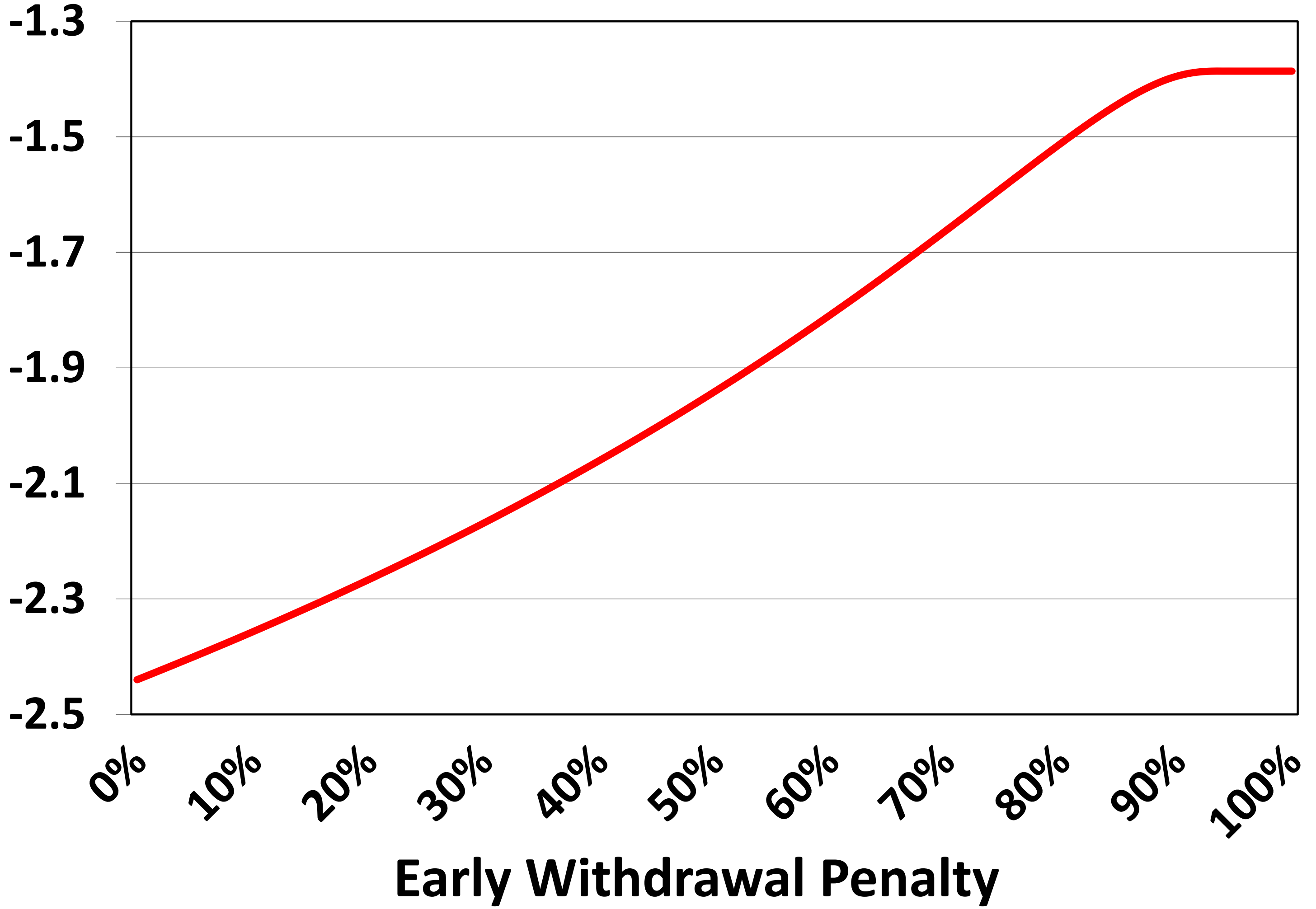


Optimal penalty with one illiquid account



One illiquid account with β=0.7: Expected Utility

One illiquid account with $\beta = 0.1$: Expected Utility



Two key properties

- The optimal penalty engenders an asymmetry: better to set the penalty above its optimum then below its optimum.
- Welfare losses (money metric): $\ln\beta+(1/\beta)-1$.
  - Money metric welfare loss for $\beta=0.1$ is two orders of magnitude higher than for $\beta=0.7$.
  - Getting the penalty "right" for low β agents has vastly greater welfare consequences than getting it right for the rest of us.

To paraphrase Lucas:

Once you start thinking about
low β households,
nothing else matters.

Economy with heterogeneous β

- (Utilitarian) planner picks an optimal policy in period 0:
  - $\{ x, \ (z_1, z_2, \dots, \ z_N), (\pi_1, \pi_2, \dots, \ \pi_N) \}$:
  - x is the allocation to the liquid account
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$$x + \sum_n z_n = 1 + E \sum_n \pi_n w_n$$

where w_n is the equilibrium quantity of early withdrawals from illiquid account n.

- Agents in the economy are present-biased and naïve. They choose consumption in periods 1 and 2, subject to the budget constraint imposed by the government.

Sufficient condition for optimality of two accounts with interpersonal transfers.

Theorem 5:
Let $\beta \in \{0,1\}$, with arbitrary population weights.
Let the utility function have CRRA ≥ 1.
Let the taste shocks be bounded.

Then the social optimum is a two-account system with
(i) a (completely) liquid account, and
(ii) an illiquid account with early withdrawal penalty $\pi = 100\%$.

Intuition:

- Start with liquid account and π =100% account.
- Add an account with $0 < \pi < 1$; this transfers resources due to the penalty payment.
- The transfer is welfare-reducing in two ways.
  - First, marginal utility is weakly greater for β=0 households than β=1 households (with CRRA ≥ 1).
  - Second, the penalty system effectively increases the liquidity of β=0 consumers more than the liquidity of β=1 consumers, which is an additional perverse welfare effect.

Two key properties in this extreme heterogeneous environment

1. You only need one illiquid account to achieve the (second best) social optimum
2. That illiquid account should be completely illiquid

These properties won't hold exactly, as we relax the extreme distributional assumption on β.

But the properties will continue to hold as a good approximation (with heterogeneous β).

β uniform on $\{0,\ .1,\ .2,\ .3,\ .4,\ .5,\ .6,\ .7,\ .8,\ .9,\ 1\}$

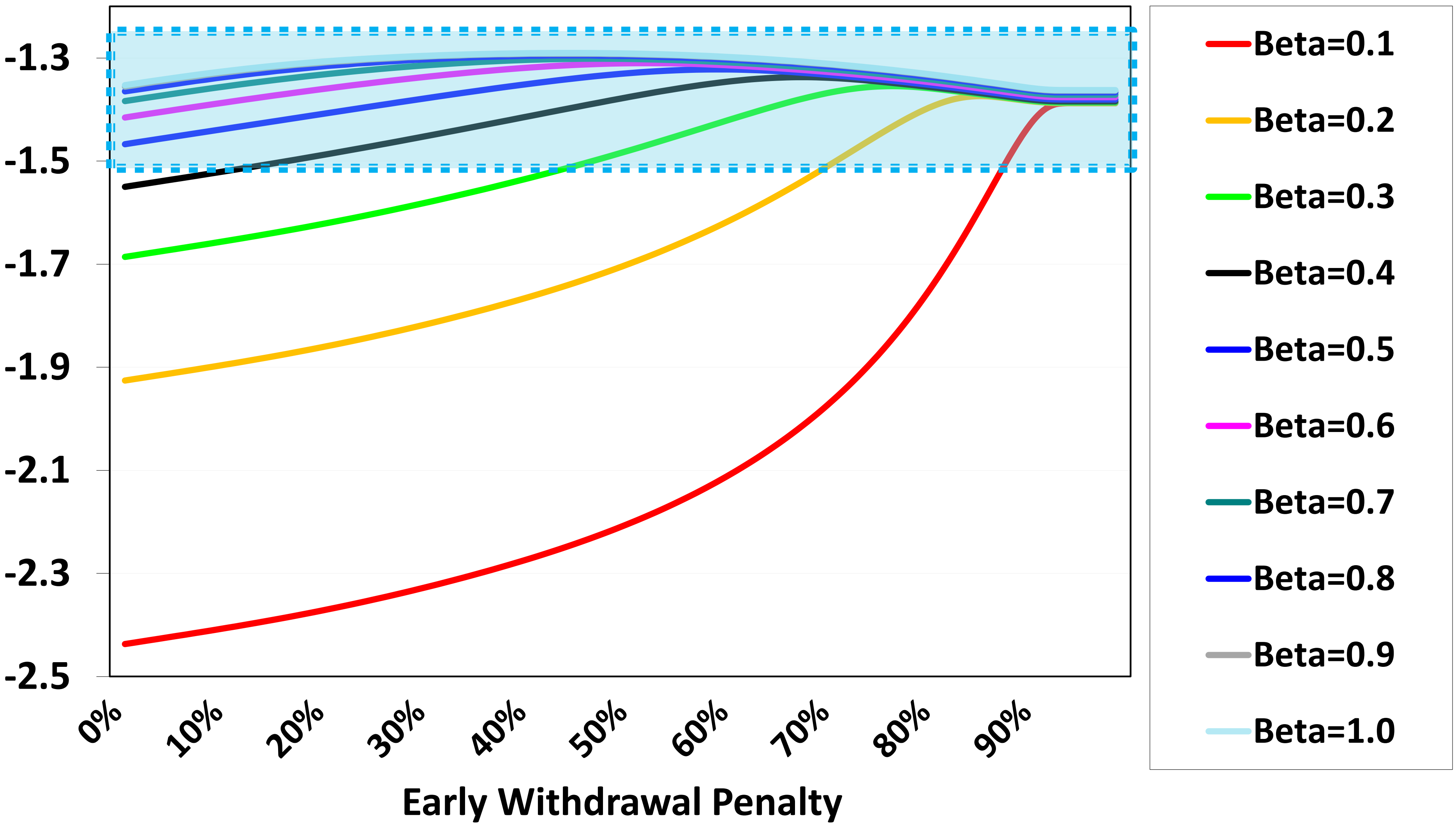
- Start with $x = 1$.
- Welfare gain from adding optimal $(z_1, \pi_1 = 100\%)$: ∞
- Welfare gain from adding optimal $(z_2, \pi_2 = 12\%)$: 0.02% wealth

β uniform on $\{.1, .2, .3, .4, .5, .6, .7, .8, .9, 1\}$

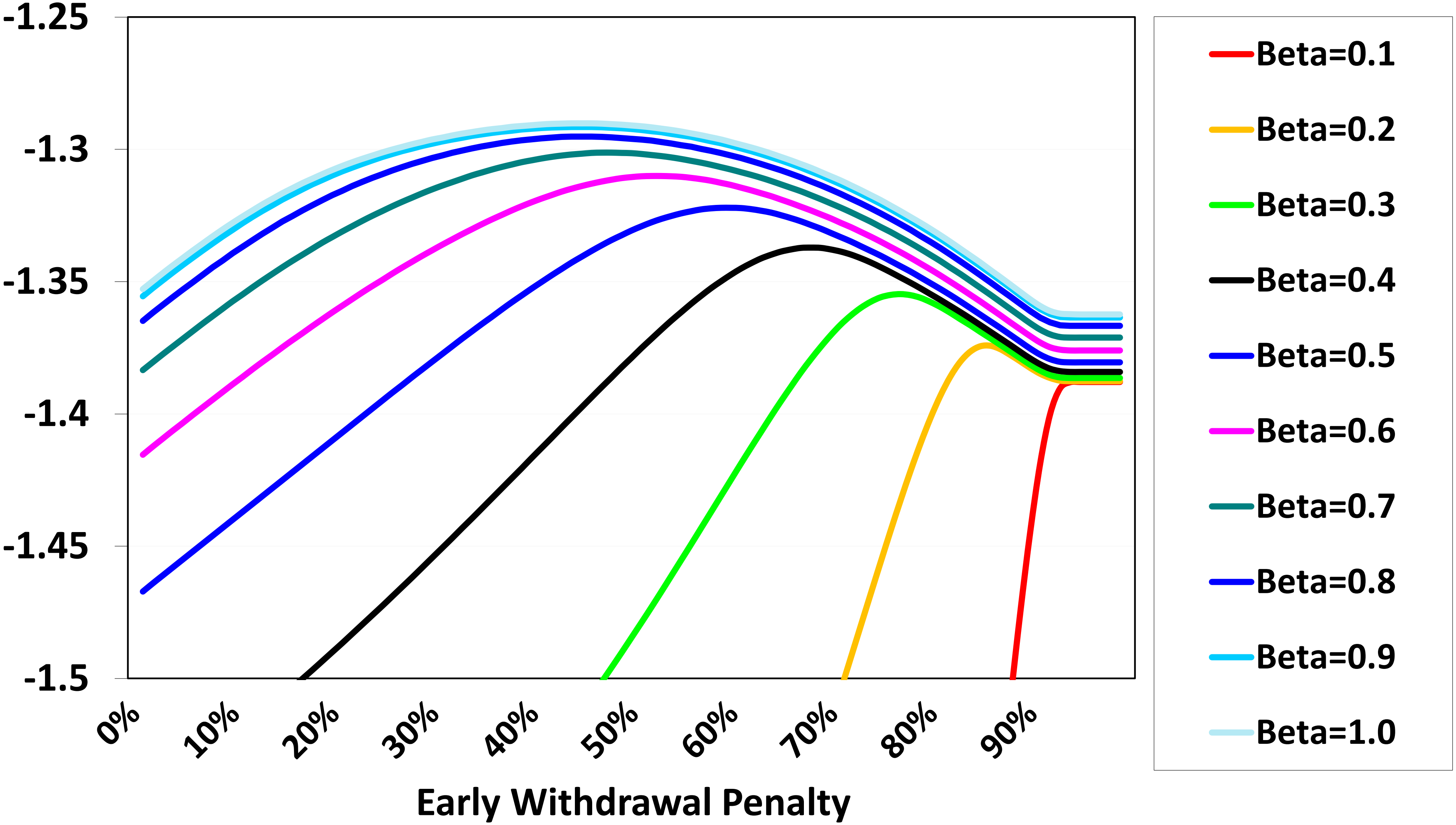
- Start with $x = 1$.
- Welfare gain from adding z_1 with $\pi_1 = 100\%$: 11.01% wealth
- Welfare gain from adding optimal $(z_2, \pi_2 = 13\%)$: 0.02% wealth

To gain more intuition, study the optimal penalty in a system with one illiquid account.

Subpopulation Expected Utility



Subpopulation Expected Utility



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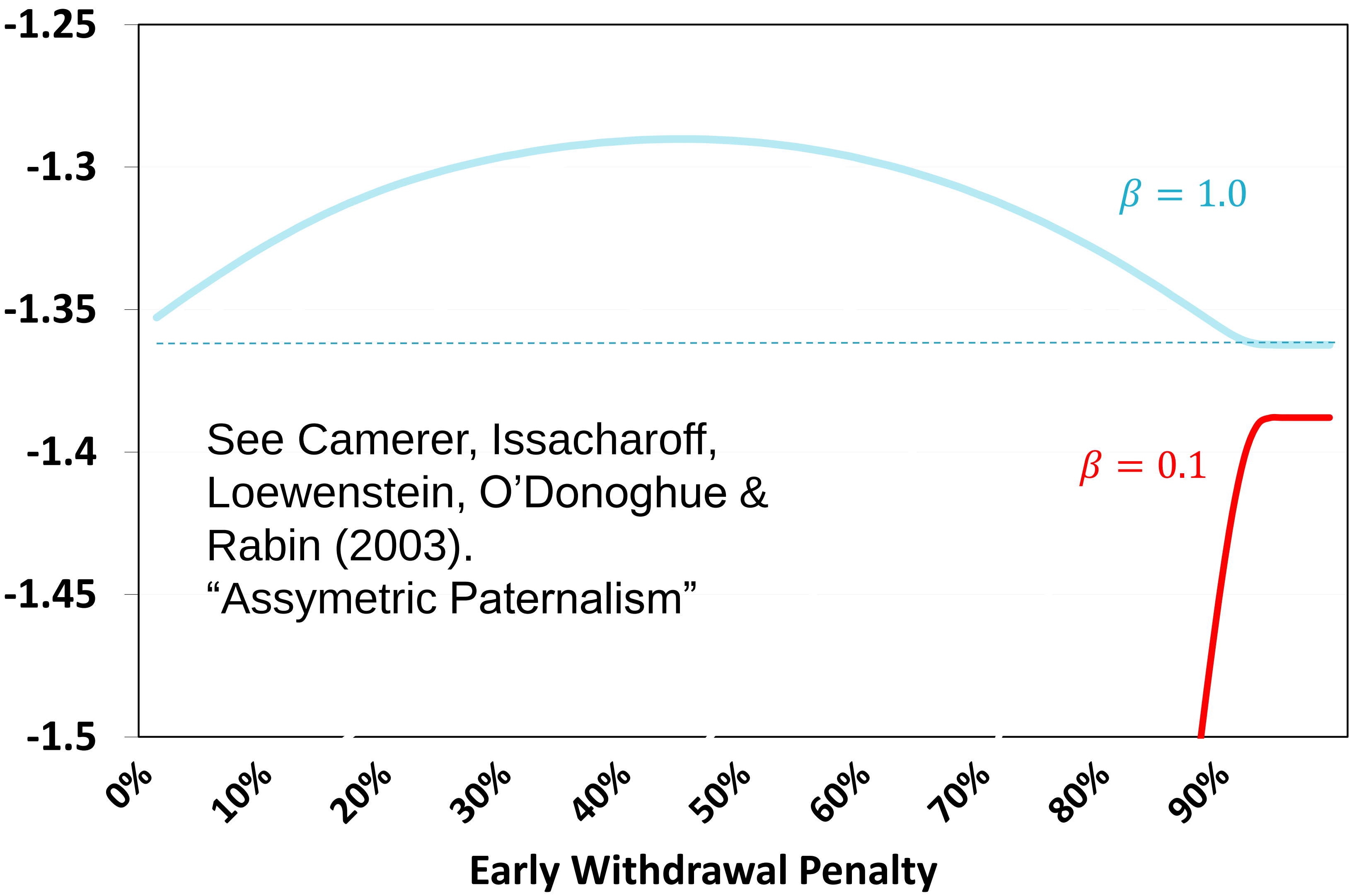

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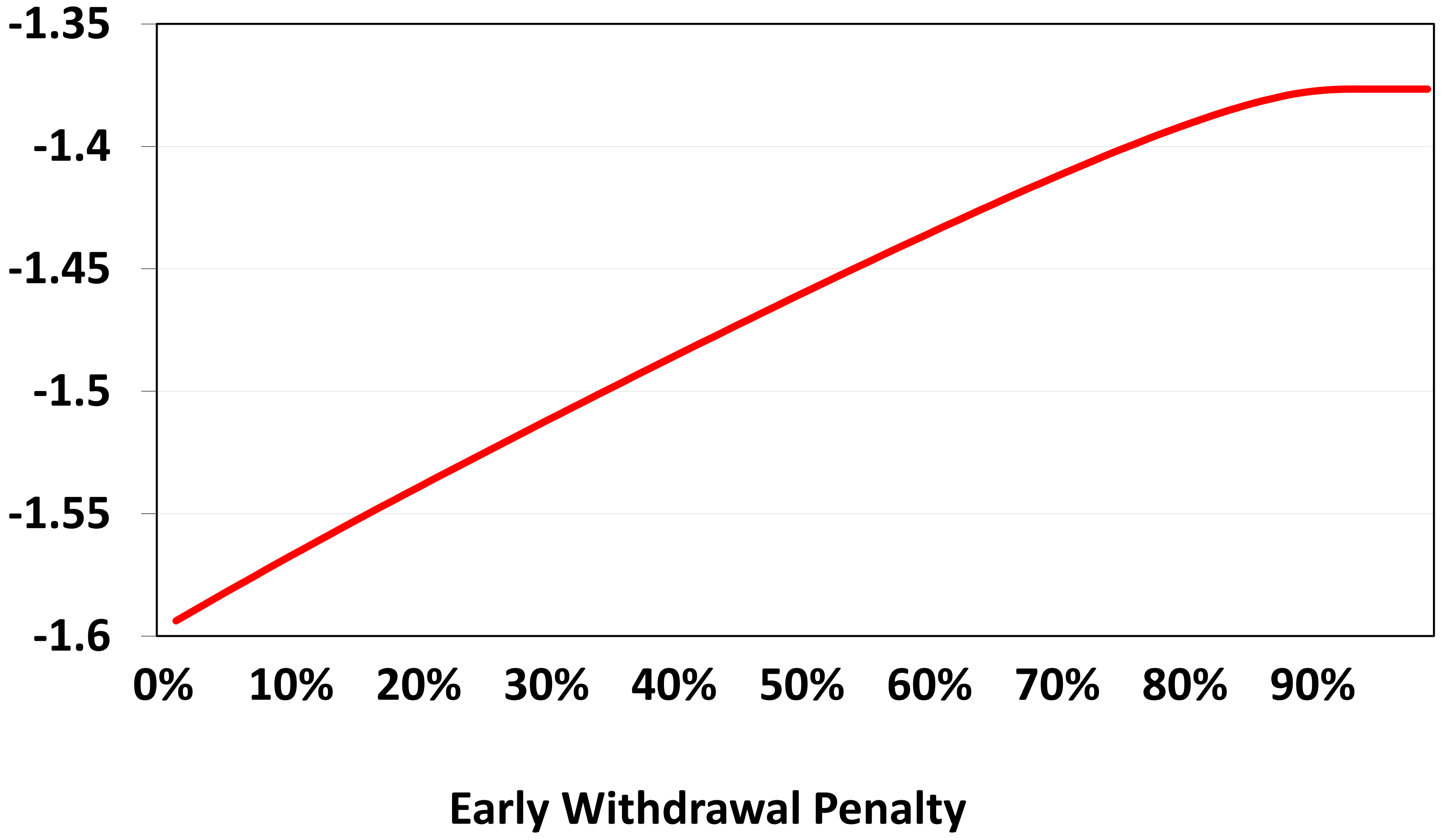
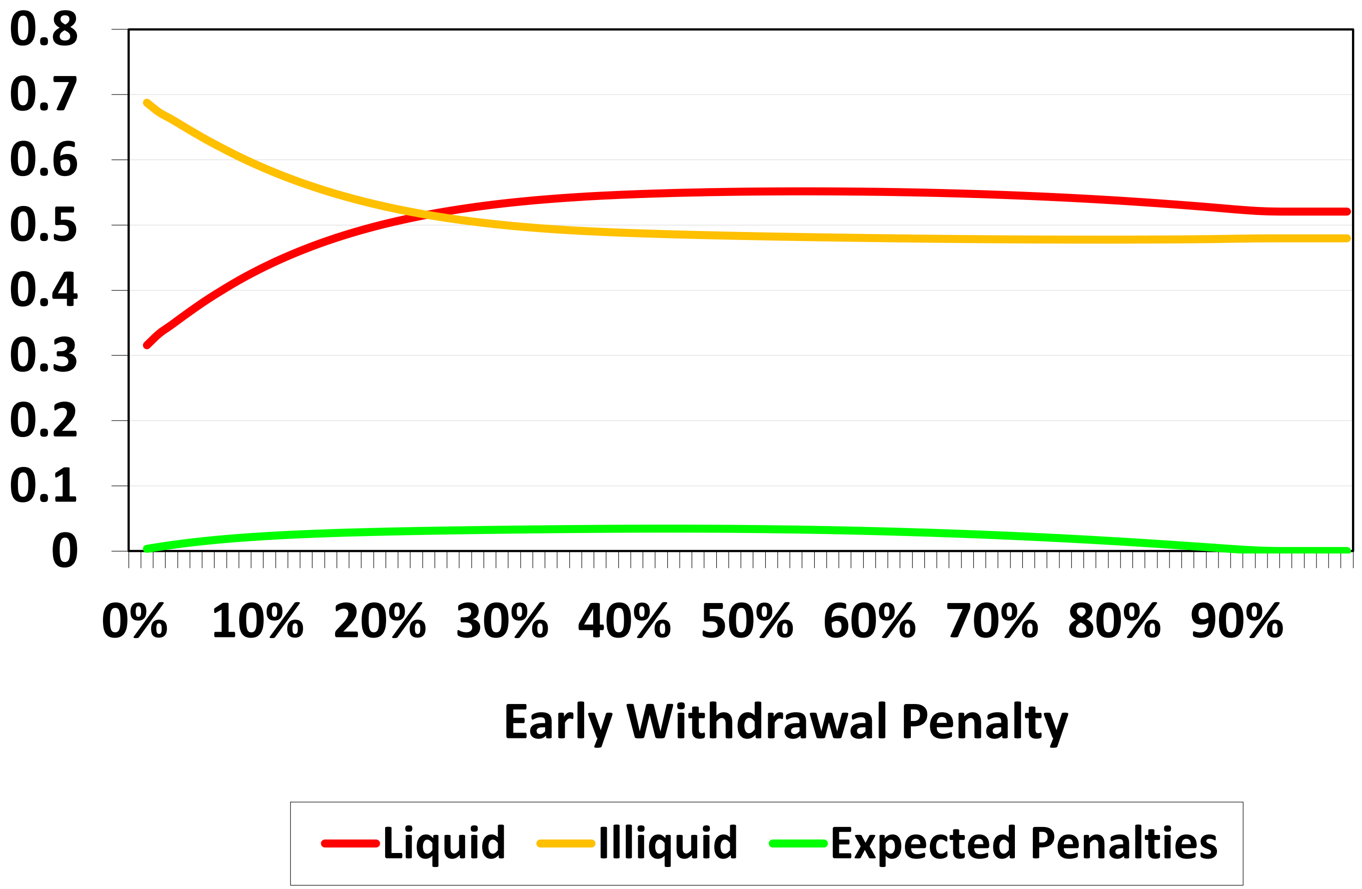
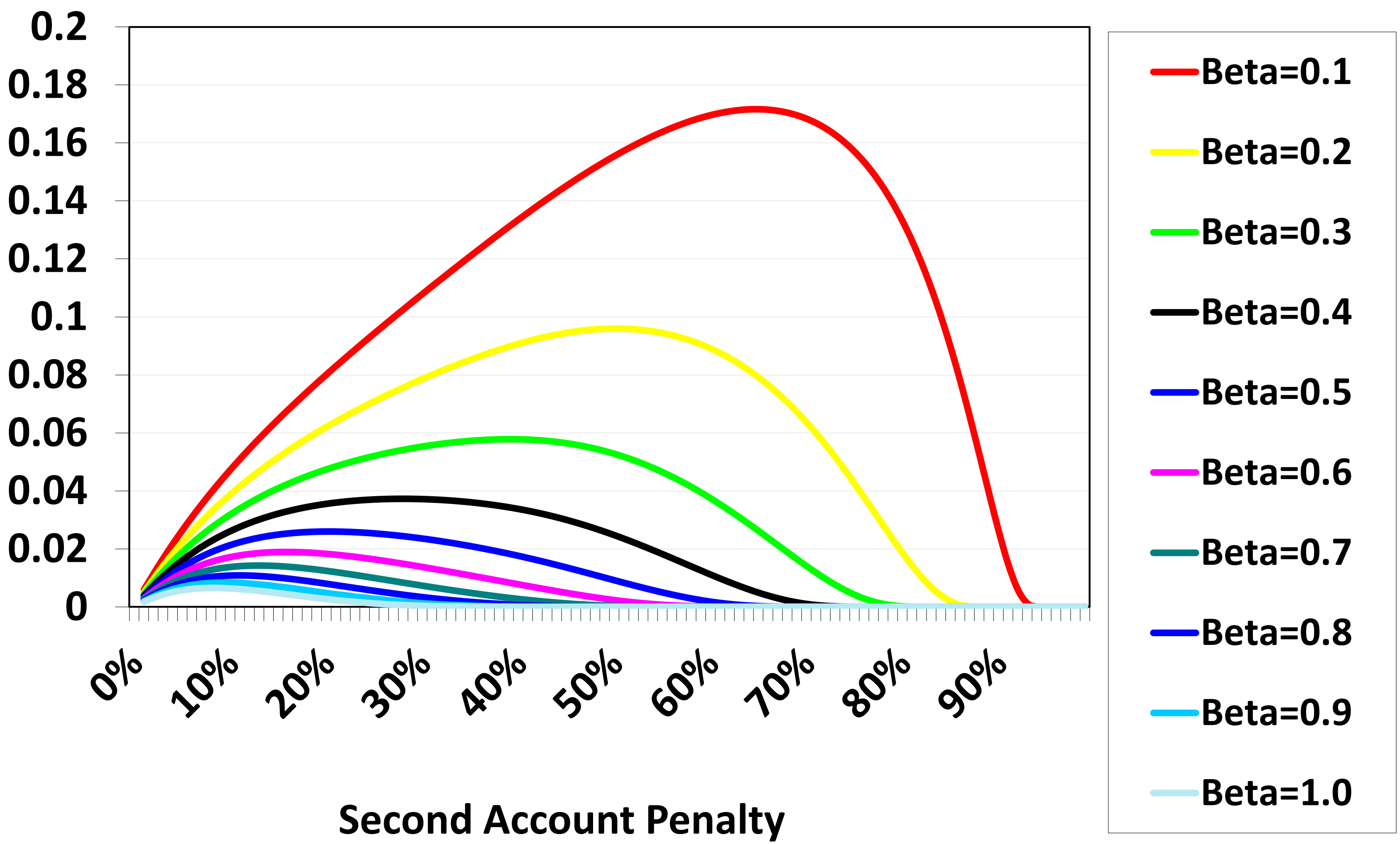


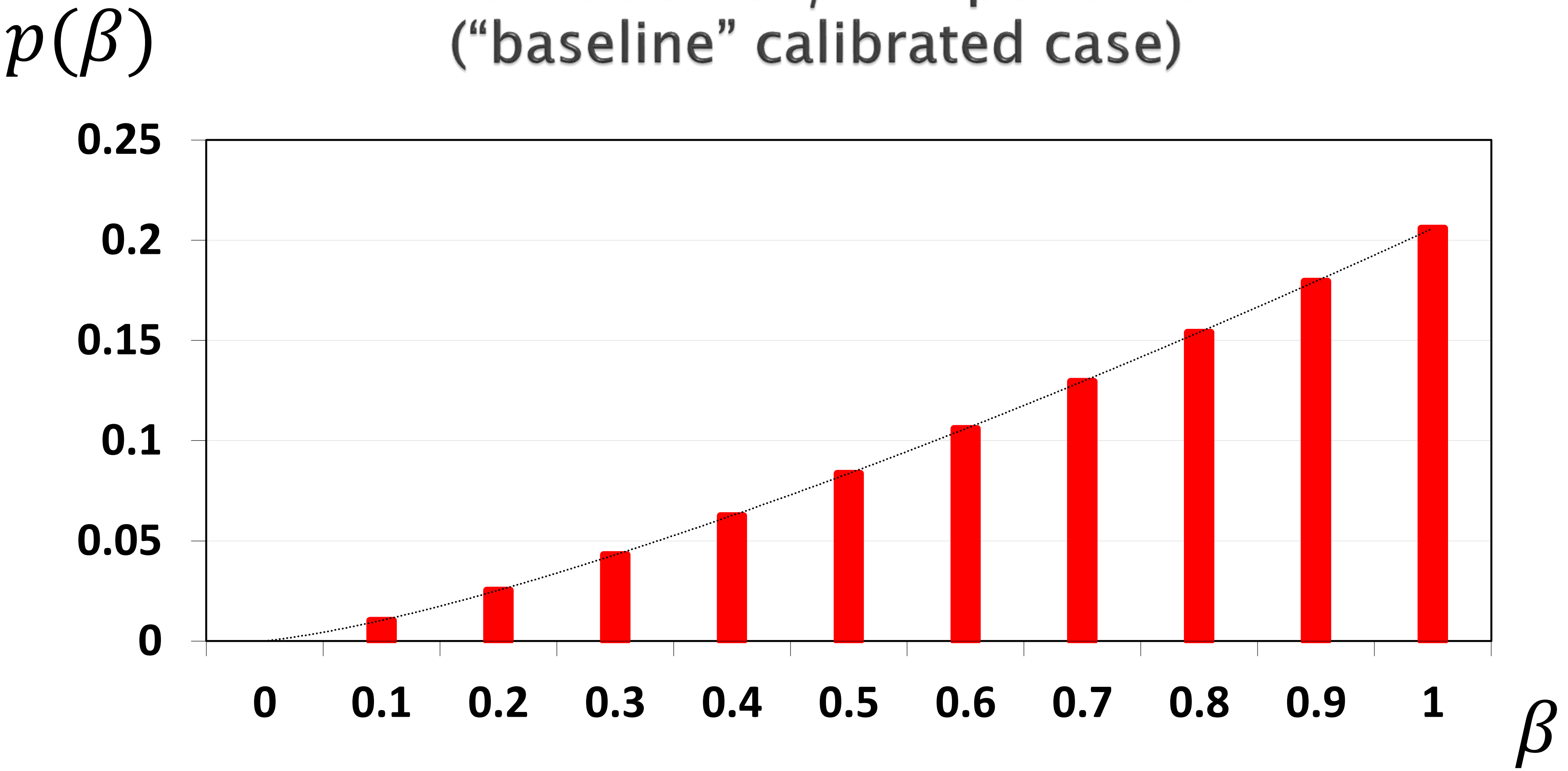
Allocations and Penalties:



Subpopulation Penalties Paid:



Distribution of β: 'Exponential' ("baseline" calibrated case)

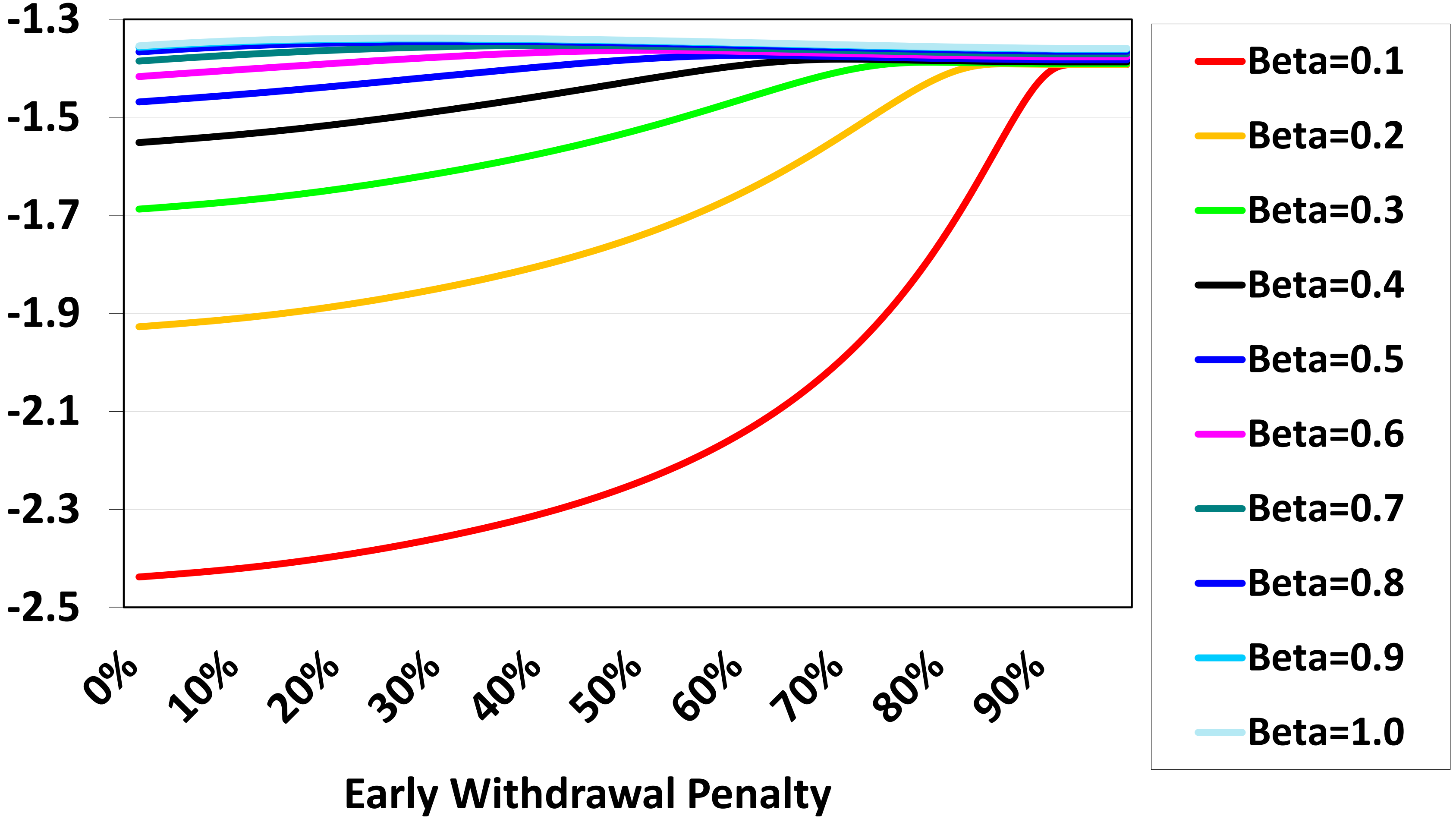


Start with $x = 1$.

Welfare gain from adding z_1 with $\pi_1 = 100\%$: 3.04% wealth

Welfare gain from adding optimal $(z_2, \pi_2 = 10\%)$: 0.02% wealth

Subpopulation Expected Utility



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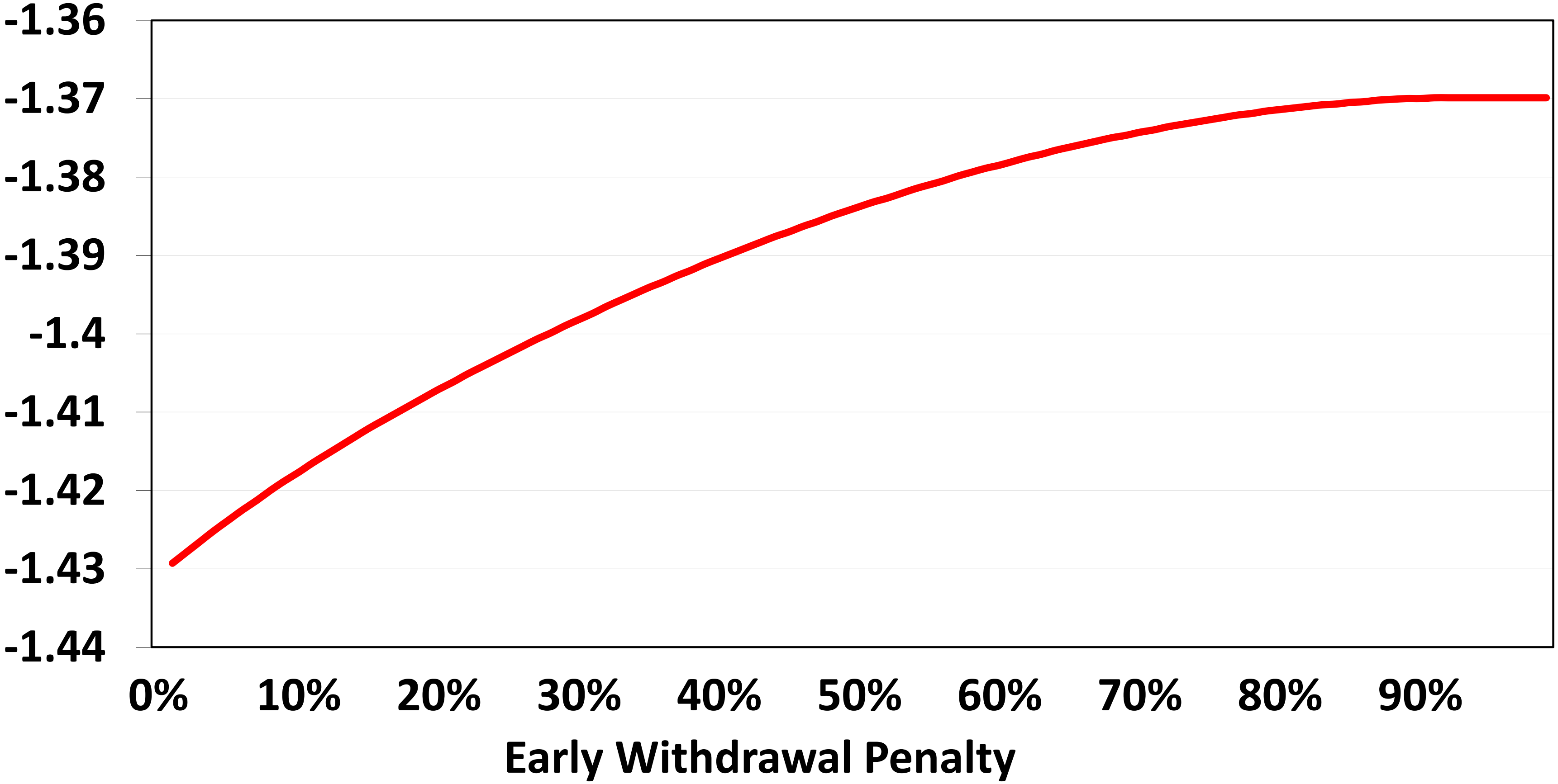
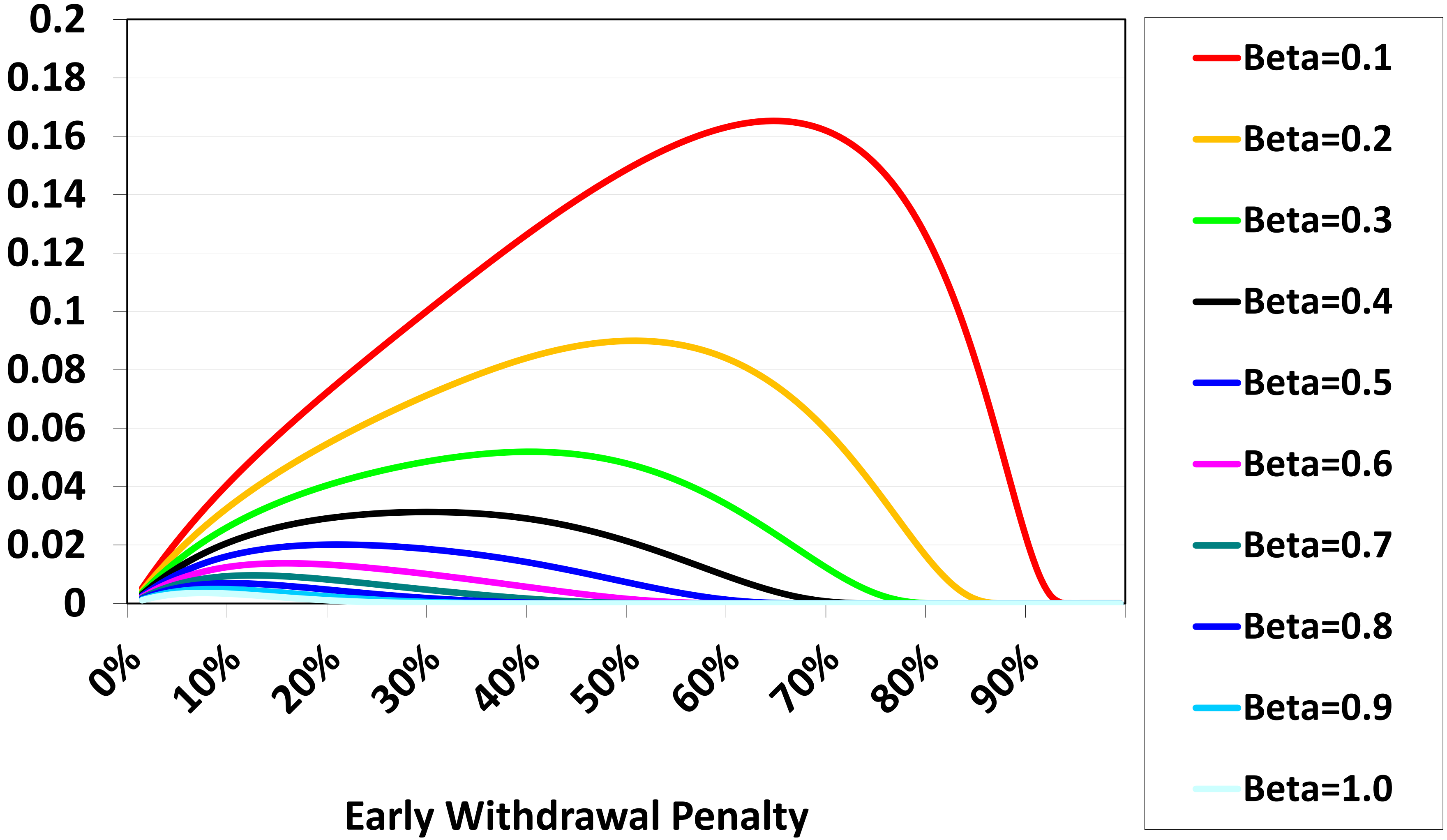


Subpopulation Penalties Paid



Robustness illustrations

	Baseline	Low σ(θ)	High σ(θ)	CRRA = 0.5	CRRA = 2	High E(β)	Low E(β)
σ(θ)	**0.33**	0.26	0.45	0.33	0.33	0.33	0.33
σ(β)	**0.23**	0.23	0.23	0.23	0.23	0.20	0.25
E(β)	**0.73**	0.73	0.73	0.73	0.73	0.79	0.70
Penalty (%)	**10**	**9**	**9**	**10**	**10**	**9**	**10**
Leakage (%)	**57.9**	66.1	48.7	59.4	57.3	51.2	62.1
401(k)/[SS+401(k)]	**15.0**	14.6	11.8	30.9	7.3	14.1	15.9

Some additional questions

- "Number" of accounts: 2 vs. N
- CRRA
- Distribution of β values
- Distribution of taste shocks
- Functional form of taste shock: $\theta u(c)$ vs. $u(c-\theta)$
- Number of periods: 3 vs. T
- Individualization: pooling vs. separation
  - See Galperti (2014)
- Individualization: is income correlated with β?

- And everything else that we did to simplify the problem.

Conclusions

- Using our simple framework with interpersonal transfers and heterogeneous β, we solve for the socially optimal retirement savings system.
- Optimal system should have:
  - A perfectly illiquid account
  - A 10%-penalty account
  - (No more illiquid accounts)
  - 15% of illiquid savings in 10%-penalty account
  - Leakage rate should be 50% from 10%-penalty account
- We studied $\{ x, (z_1, z_2, \ldots, z_N), (\pi_1, \pi_2, \ldots, \pi_N) \}$, which is a subspace of $\mathbb{R}^{2N+1}$, and converged on the point that corresponds to the (U.S.) retirement savings system.

In addition:

- The calibrated model (with heterogeneous β) implies that the 10% penalty account isn't important for welfare
- Explaining why we don't see such accounts outside U.S.
- Partially illiquid accounts are a two-edged sword with both edges almost equally sharp.

- We tried to write a normative paper.
  - "What is the socially optimal retirement savings system?"
- We ended up with a positive paper.
  - "The U.S. system is what you would predict a perfectly rational planner to do."*

*According to the stripped down model presented today.