CREDIT LINES

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Old, yet Preliminary

I. Introduction - Objective

General aim:

- To investigate the macroeconomic and distributional implications of unsecured consumer credit (e.g., credit cards).

Specific objectives:

1. To extend the theory of unsecured credit to long term contracts under the restrictions imposed by the *actual* legal environment.
2. Assess how it accounts for U.S. allocations and contracts.
3. The implications of the recent tightening of bank regulation (Regulation AA, to be enforced by mid 2010).

I. The U.S. Legal Environment and transaction costs

1. The Bankruptcy Laws: People can unilaterally ask for debt to be condoned. They cannot save when they file for bankruptcy. Filing for bankruptcy is part of the public record for 10 years which is usually interpreted as a tag that difficults access to credit (here is where the paper about credit scoring came in).

2. Under the current interpretation of the "Consumer Credit Protection Act" and Regulation Z (the Fed's rules that implement it) banks are free to change the terms of an existing credit line
   - Banks can increase or reduce a line of credit but not below the existing loan size.
   - Banks can change the interest rate even in existing balances.

3. It is costly for households and for banks to create, switch and setup credit lines.

I. Eventual question: Is some regulation of commitment desirable?

1. Current policy. The bank can change the interest rate and the credit limit but the bank cannot impose a reduction of the debt.

2. Regulation AA: The Banks cannot increase interest rates on existing debt. We are interpreting it as they cannot increase interest rate on all debt nor impose its reduction.

3. But before we have to learn how the actual legal environment works.

I. - Elements of the Theory

Incorporate bankruptcy code, banks' legal capabilities, and contracting costs:

1. Borrowers cannot commit to repay nor can they commit to stick with current bank.
2. Banks do NOT commit to the initial approved interest rate (although, post-reform, will have to commit)
3. Banks do NOT commit to credit limits (yet must allow to roll on existing debt).
4. Contracts are costly to sign for both borrowers and lenders.

I. Preview of Findings

- All kinds of things can happen (based on simple parameterizations of the model):

1. There are short and long term contracts.
2. Interest rates are revised up and down.
3. Credit limits are often increased (cannot be decreased). Even after bad news.
4. Households borrow, file for bankruptcy and switch lenders.

- Revolving contracts matter:

  - Affect prices and credit
  - Dominate one-period loans (they have a technical advantage, but still)/

Literature

• We extend Eaton and Gersovitz (1981), Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007), Livshits, MacGee, and Tertilt (2007), Mateos-Planas (2007) to multiperiod contracts.

• Big literature on endogenous constraints: Kehoe and Levine (1993), Wang (1995), Kocherlakota (1996), Cole and Kocherlakota (2001), Hopenhayn and Werning (2008). This a different strand.

• A somewhat related (and excellent) paper is Drozd and Nosal (2007): search frictions and full commitment on the part of banks.

A Commercial

- We take the position that the actual forms of contracts are data.

II. MODEL - Households (state)

Many; infinitely-lived; with standard utility over consumption.

State $z = \{e, y, \theta, \varepsilon, \chi, h\}$:

- Public information
  - Observed income type e, Markov or iid
  - Asset position y, positive or negative
  - One contract $\theta \in \Theta$ with a bank, if any
  - A credit history $h \in \{0, 1\}$
- Private Information
  - Endowment/income ε, with type-dependent prob. distribution
  - i.i.d. utility costs shocks χ to defaulting and contracting (Purely technical.) We write $F(\varepsilon, \chi, e)$.

II. Timing

1. State gets realized.
2. Bank chooses interest rates and credit limits for new and existing contracts. Only for existing contracts depends on assets.
3. Households choose whether to default, to switch and how much to save.
4. Households consume and save.

II. Households (contracts)

Credit contracts: θ are associated with observables when signing:

- Initial loan $y'^{\theta} \leq 0$
- Initial (inverse of gross) interest rate $(q^{\theta})^{-1}$
- Initial income type e^{θ}

And continuation plans based on observables for

- Credit limits, $b^{\theta}(e, y)$ so that $y' \geq b^{\theta}(e, y) \leq y$
- (Inverse of gross) Interest rates, $q^{\theta}(e, y)$

II. Households (choices and endog. states)

Decisions:

- default $d \in \{0, 1\}$
- switch line $s \in \{0, 1\}$ and which line θ'. Utility cost ξ_s.
- save/borrow y'

Credit status h' (depends on today's status, default choice, and nature).

With good credit ($h = 0$) if no default ($d = 0$), keep good record $h' = 0$ and repay. If default ($d = 1$), gets bad record $h' = 1$, disutility χ_d, zero line $\theta' = 0$, and debts are discharged ($y' = 0$).

With bad credit ($h = 1$): With prob. $1 - \delta$, keeps bad record $h' = h$ and $\theta' = 0$ With prob. δ, gets good record $h' = 0$ and can switch to $\theta' \in \Theta$.

The credit line θ' is governed by the new credit status and the switching.

II. Household (decision rules)

- For the given set of traded contracts Θ:
  1. Default decision $d(z)$ conditional on state.
  2. Switching decision $s(z)$ and contract $\theta'(z)$.
  3. Saving decision $y'(z)$.

- What would the hhold do for arbitrary one-period deviations in credit terms?
  1. Default decision $\widetilde{d}(z, q, b)$
  2. Switching decision $\widetilde{s}(z, q, b)$
  3. Saving decision $\widetilde{y}'(z, q, b)$

- What would do for alternative contracts not in Θ, furher deviation decision rules. We also solve for

  $\{y'(z, \widehat{\omega}, q, b), \widehat{\omega}'^{s}(z, \widehat{\omega}, q, b), \widehat{d}(z, \widehat{\omega}, q, b), \widehat{s}(z, \widehat{\omega}, q, b)\}$, and
  $\{\widehat{\widehat{d}}(z, \widehat{\omega}, q, b), \widehat{\widehat{s}}(z, \widehat{\omega}, q, b)\}$, alterntv. contract deviation decision rules.

II. Some typical properties of decision rules.

Default $\widetilde{d}(z, q, b)$:

- Default on outstanding balances increases with a higher interest rate and a tighter limit.

Switching $\widetilde{s}(z, q, b)$:

- Switching increases with higher interest rate and tighter limit.

II. Intermediaries (possible contracts)

- A bank issues a contract θ from the potential set Θ^P at fixed cost π.
  - A new contract θ specifies initial loan y'^{θ} and interest q^{θ} for type e^{θ}.
  - If it survives, the bank sets limit and prices based on observables as $b^{\theta}(e,y)$, $q^{\theta}(e,y)$. (It does not matter if it specifies it)

- The space of all possible contracts. Let $\mathcal{C}_b = b : E \times \mathcal{Y}^- \to \mathcal{Y}^-$ and $\mathcal{C}_q = q : E \times \mathcal{Y}^- \to \mathcal{Y}^-$. Then

$$\theta^P = \{E \times \mathcal{Y}^- \times [0,1] \times \mathcal{C} - b \times \mathcal{C}_q\}$$

- The potential set θ^P is very large. Active contracts are a subset.

II. Banks (possible contracts)

- A bank takes deposits at the safe discount price q^*.
- A bank issues a contract θ at fixed cost π
- Active contracts Θ are a subset of a large potential set Θ^P

II. Banks (trade-offs)

The value to an existing line:

$$\begin{aligned}\widetilde{\Psi}(e,y,\theta,q,b) &= \underbrace{-yE[1-d]}_{debt\ repaid} \\ &\quad +E[\underbrace{(1-d)(1-s)}_{survival}\ \underbrace{(-y')}_{new\ debt}\ \underbrace{(q^*(1-d')-q)}_{profit\ margin}] \\ &\quad +[Continuation\ \ value]\end{aligned}$$

where d, s, y' (and so d') depend on bank's choices q and b.

Bank's trade-offs

- Limit: too loose and bad debts; too tight and high default.
- Interest: too low and low return; too high and much default or much switching or little lending.

II. Time-consistency

- Time consistency requires contract policies to solve:

$$\max_{q,b} \ \widetilde{\Psi}(e, y, \theta, q, b).$$

subject to institutional constraints on q and b.

- The continuation value is $\Psi(e, y, \theta)$ which (equilibrium requires that)

$$\Psi(e, y, \theta) = \widetilde{\Psi}(e, y, \theta, q^*, b^*)$$

II. Commitment

We consider two specific models:

- Pre-reform: (The one we discuss today.)
  - q - freely chosen
  - $b \geq y$ - allow revolving existing debt
- Post-reform (price commitment): q cannot fall below initial agreement's

II. Equilibrium

An equilibrium is a set of contracts $\Theta \subset \Theta^P$ and allocations s.t.:

(A) Agents maximize (standard).

(B) Zero profit or free entry in new contracts.

(C) Time consistency

(D) Unprofitable alternative contracts (When commitment only)

II. Technical Details

- Existence and computability of Equilibrium require some continuity properties of decision rules. Note that households choices are discrete, and that some of the banks' choices are continuous, we want the bank's choices to be continuous.

- Consequently, the model includes various forms of continuous shocks (to the costs of defaulting and switching).

- The exposition mostly abstracts from those costs to zero on the relevant issues.

III. An Unemployment economy: public info. + iid shocks

Simplest settings:

- Two-state income process: employment/unemployment
- Income is i.i.d. and public information

Parameters: 3% risk-free rate; 0.85 discount; 5% unemployment; truncated-normal utility costs; 8 years bankruptcy penalty.

Income for the unemployed is 10% of that of the employed.

Specification of the Model Economy

Table 1. Common parameters

Description	Parameter	value
	Model	
Risk aversion	σ	2.00
Discount	β	0.85
Prob. clear history	δ	0.10
Bank's cost	π	0.01
Risk-free interest	$1/q_0 - 1$	0.03
	Grids	
Lower bound for y		-0.75
Lower bound for q		0.20
Upper bound for q		1.30

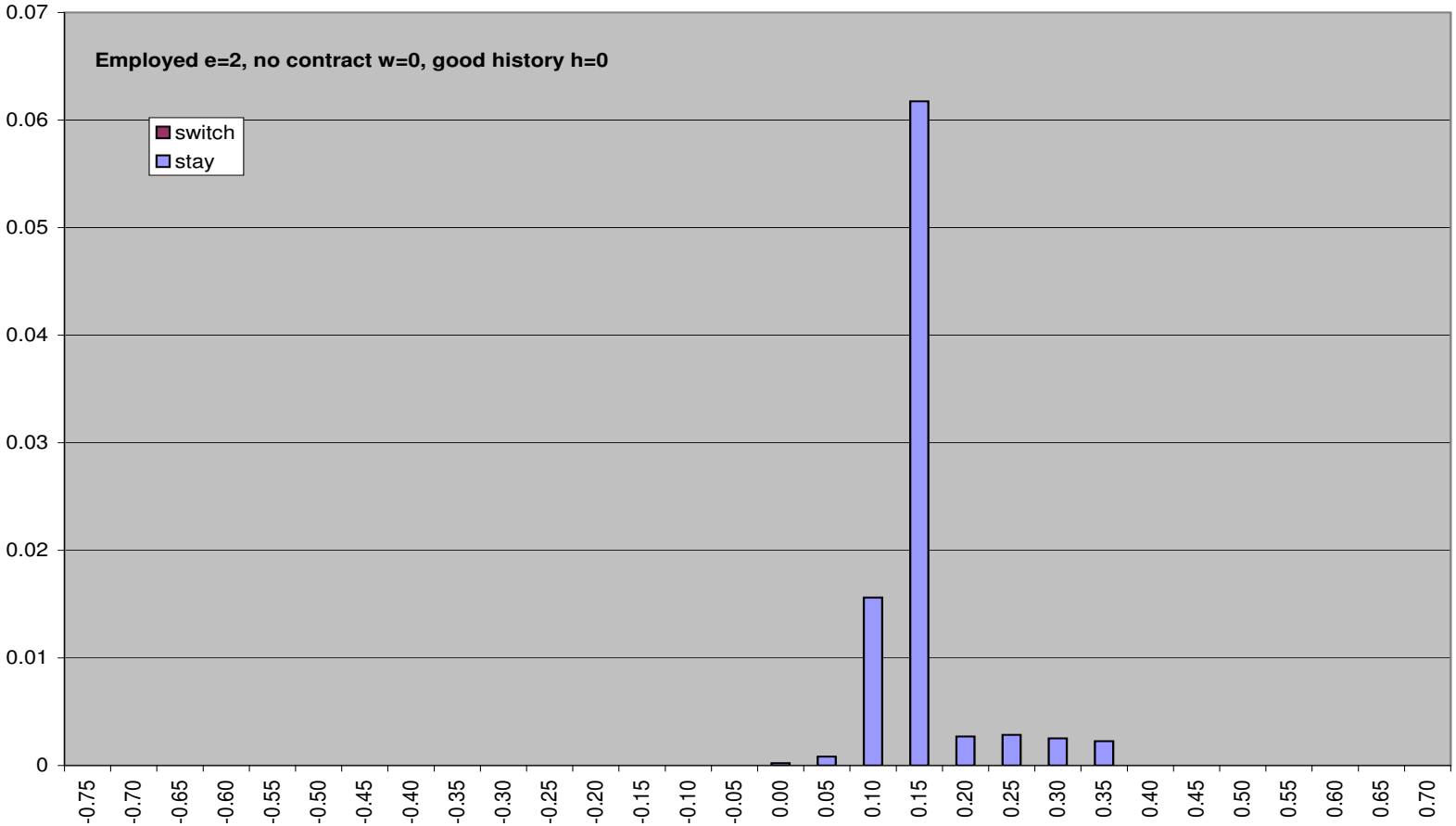
Grid for assets has 100 points (15 negative). Utility costs truncated normal distribution.

Two types of hholds: With and without Contracts

- To Analyze things, it is easier to track household histories. We first look at those struck by bad luck without a contract and after many periods of good luck.

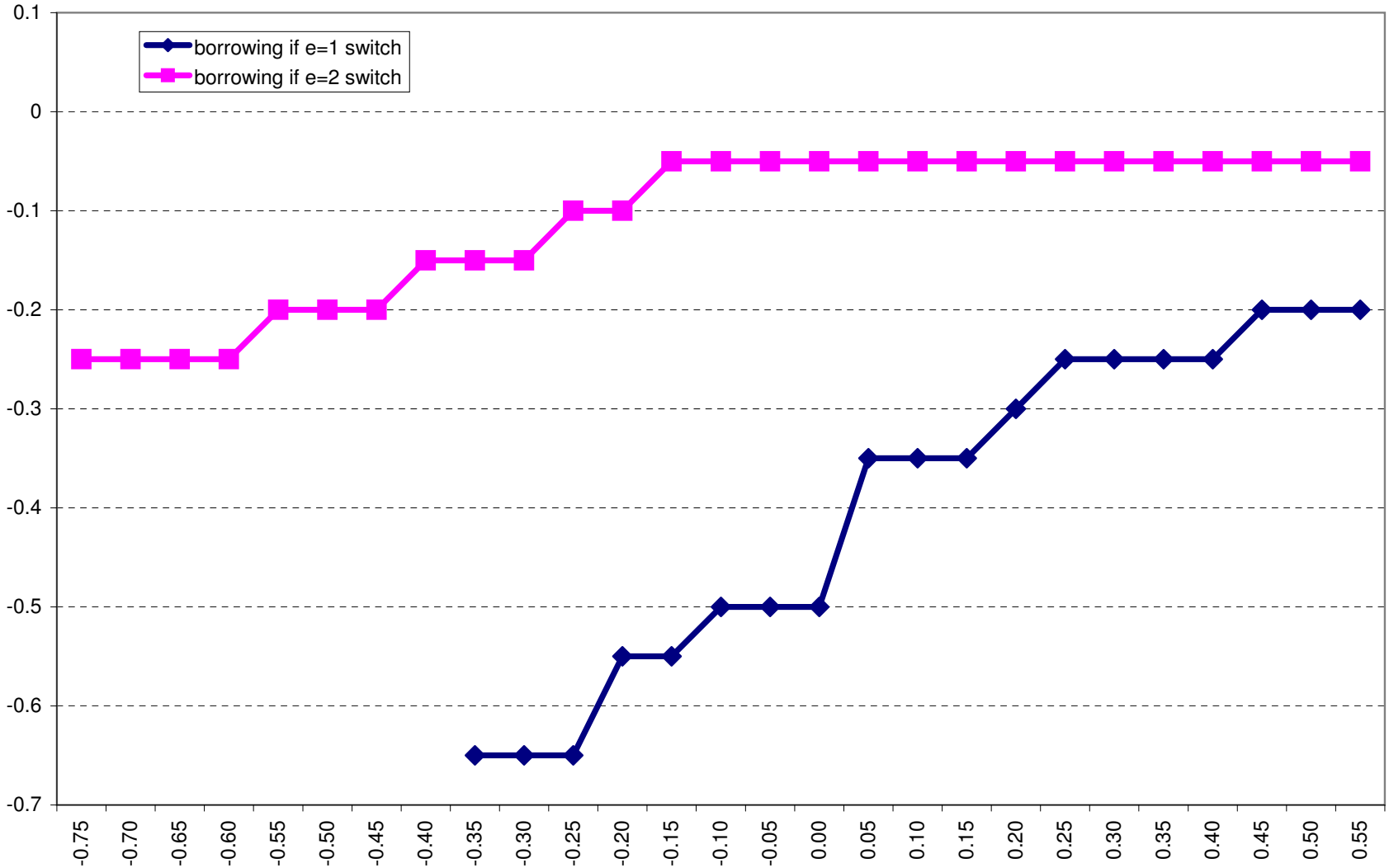
- Then those with a contract that are hit by unemployment.

Good credit, no contract, no job, $h = 1, \omega = 0, u$

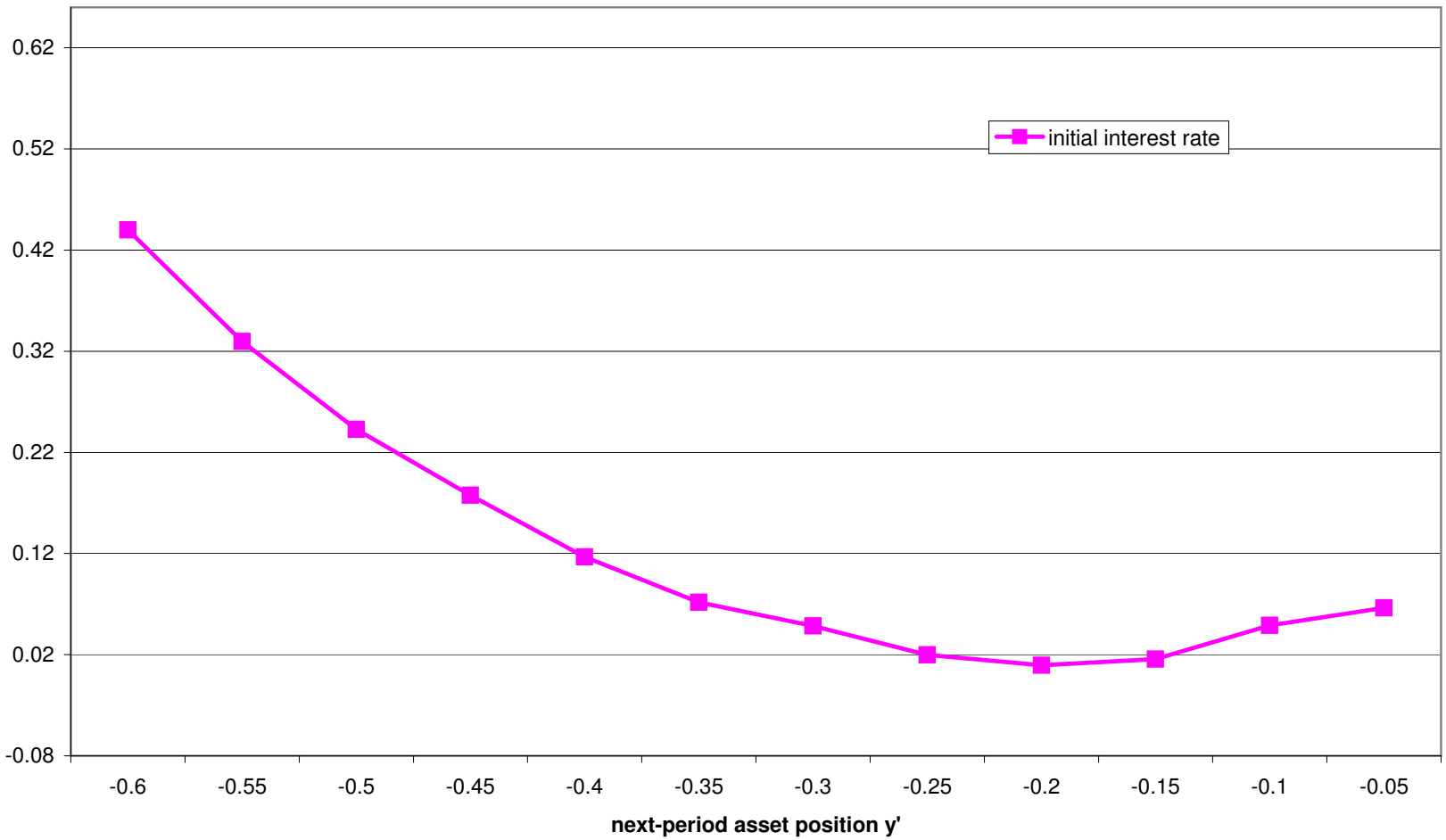


- Start from the absorbing state of always working.

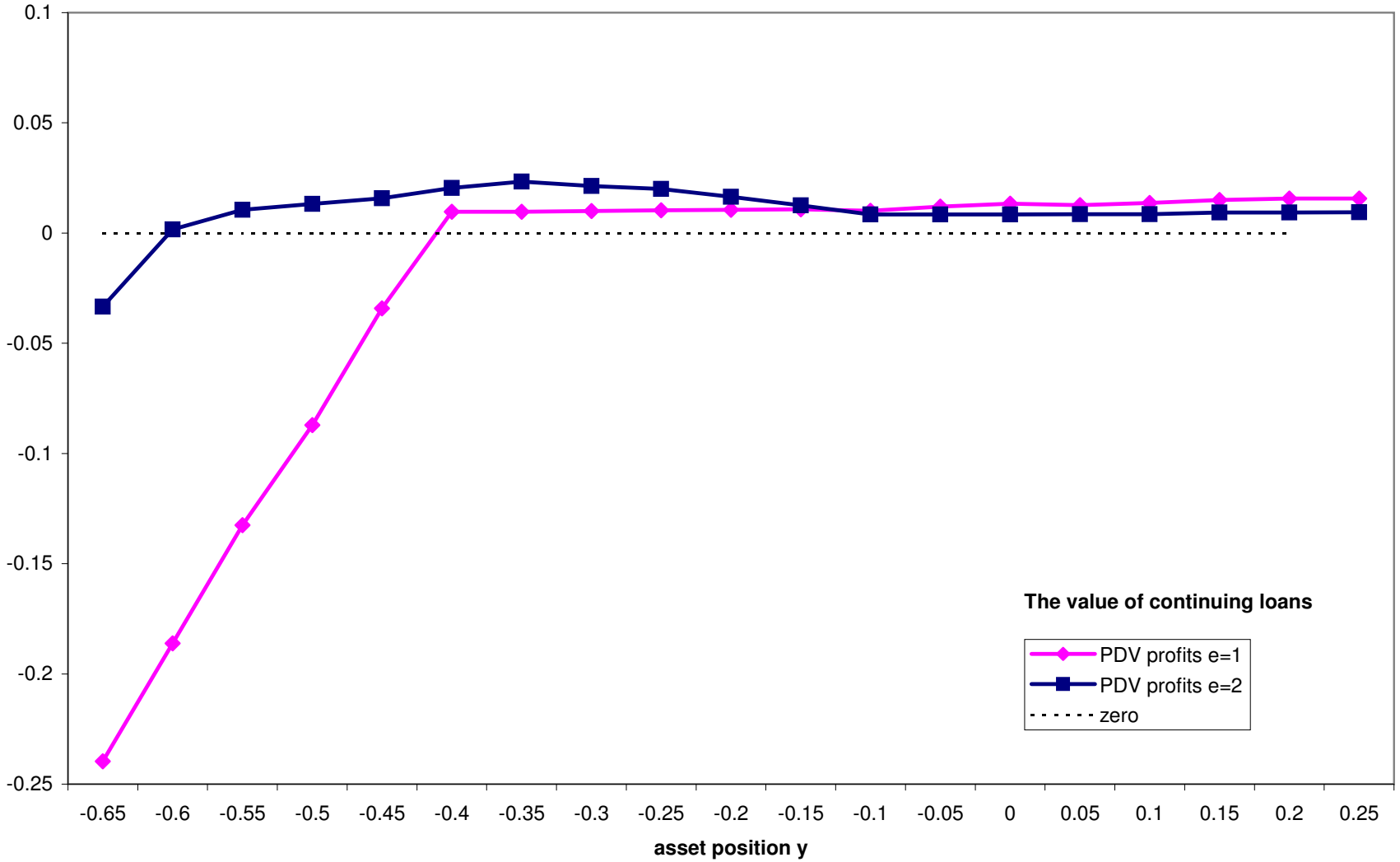
Savings of $h = 0$, $\omega = 0$. Our guy chooses $y = -.35$



Interest faced by $h = 0$, $\omega = 0$. Our guy's is $r = -6.\%$



Value of Contracts for banks



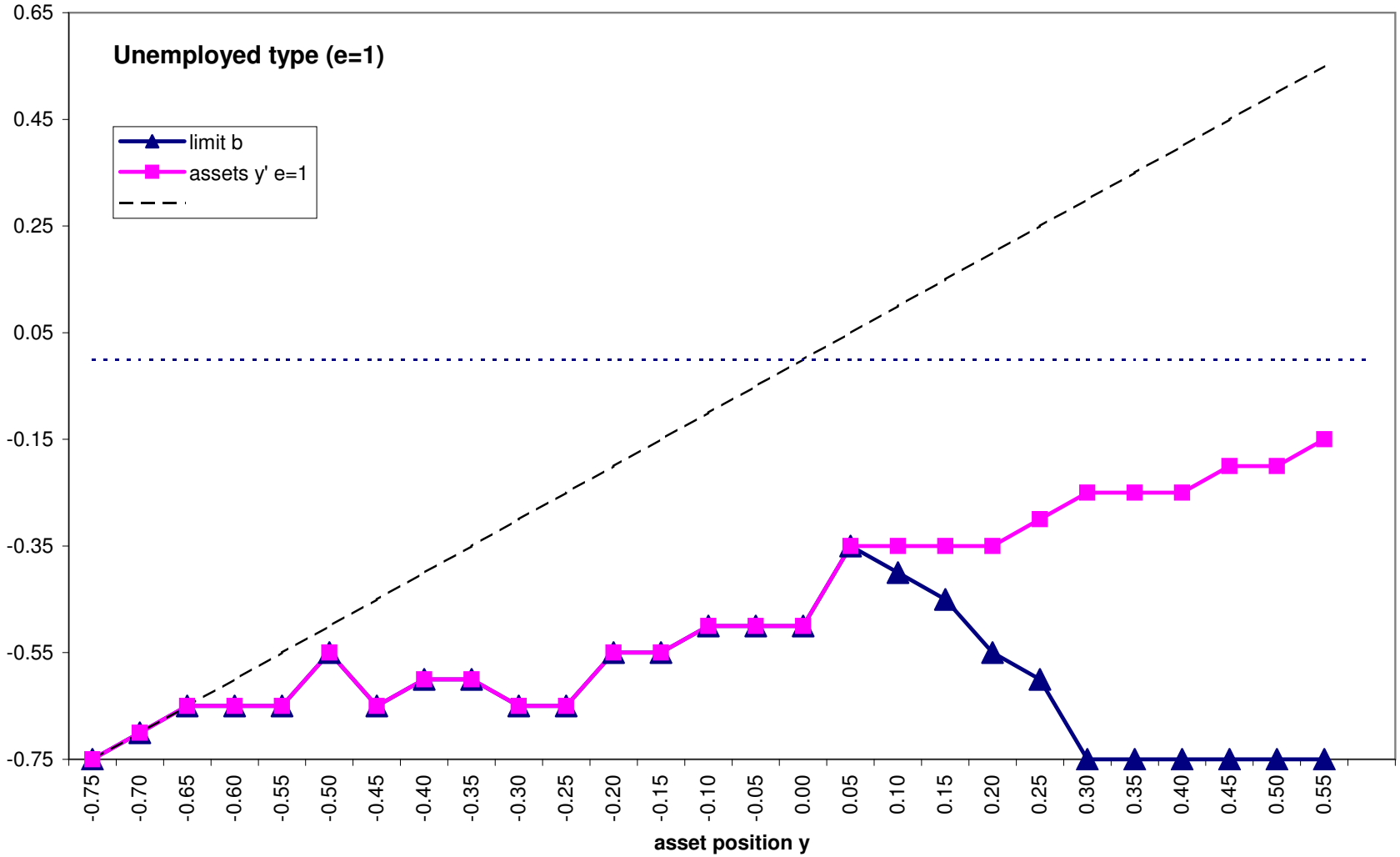
Next period, either employed or unemployed

- At this level of wealth, $y = -.35$, some switch and some default.

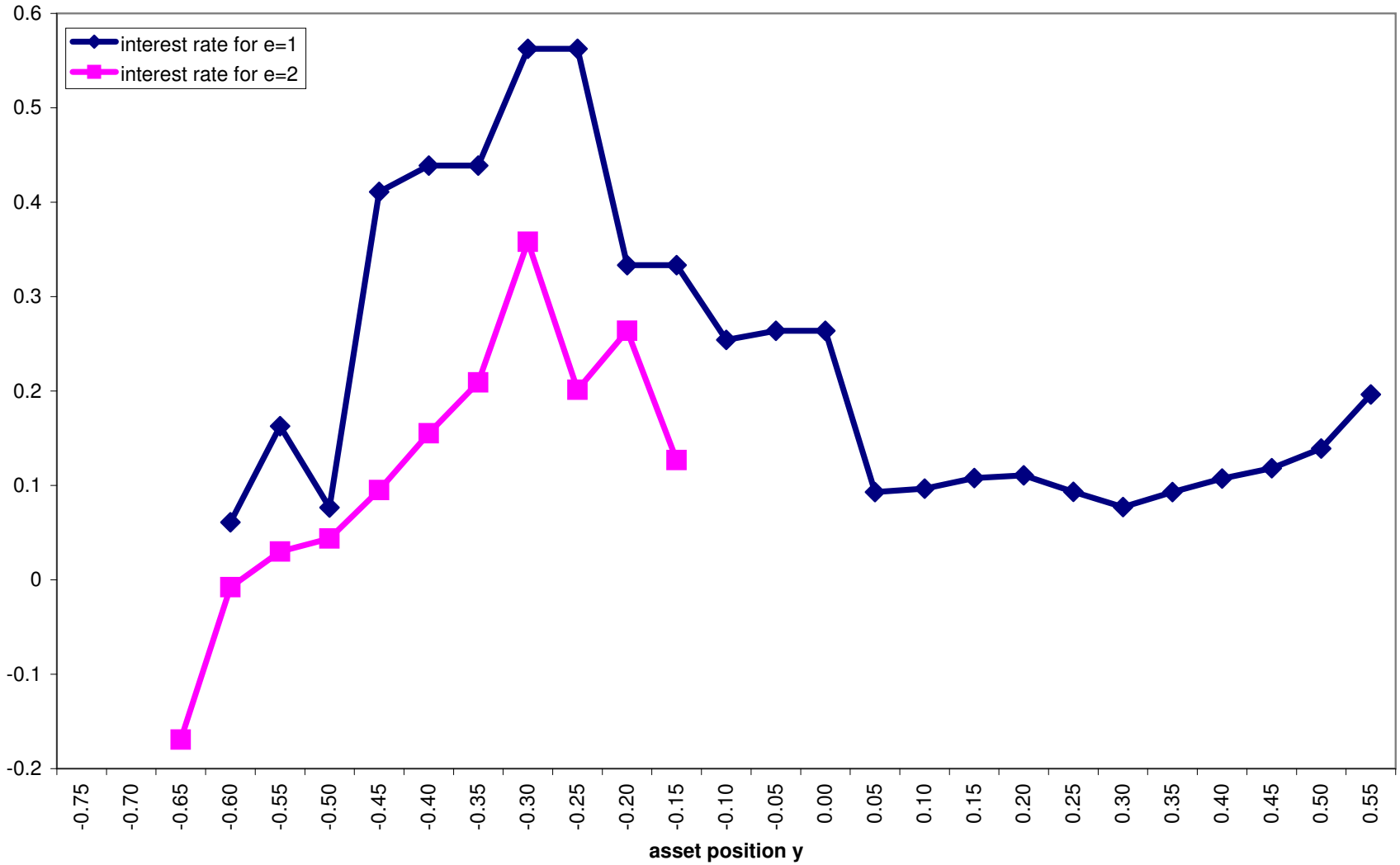
- There is no default among the unemployed and very tiny switch.

- The unemployed prefer to borrow again. And indeed they do. They choose to borrow a lot, $y' = -0.6$, at quite a high interest rate $r > 40\%$.

Twice unemployed: Savings. Credit limit binds



Twice unemployed: Continuation interest rates



Bank makes big profits.

Thrice and more unemployed

- Hholds are at a very high level of debt, $y = -.6$.

- Banks give them a break: they allow households to borrow up to $y' = -.65$, and $(r = 6.1\%$.

- The bank understands that if the household gets out of the hole, it will payback at least some of the debt. Kind of moratorium: the unlikely persistence of unemployment makes it happen.

- Note that the value of this contract for the bank is negative, yet higher than that of a default with probability 1. The bank is managing trouble.

- After this, repeated unemployment is met with subsidies: the debt is constant and the interest rate negative. Nobody defaults.

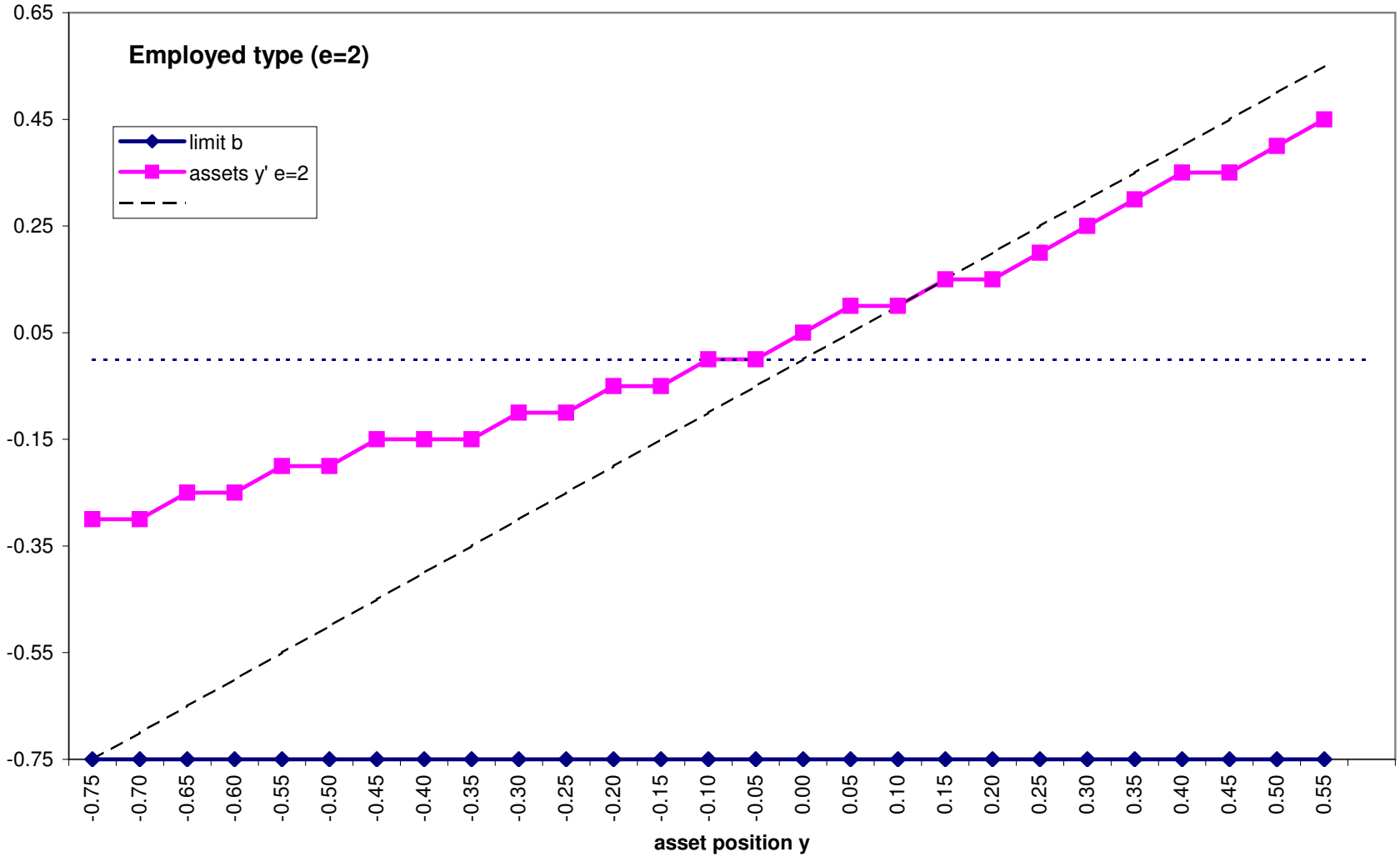
Employment after two or more unemployment periods

- Hholds are at a very high level of debt, $y = -.6$ (next page).
- The bank lures them not to default with a subsidy $r = -1.\%$.
- Still, many choose to default (27%): it is a good time to do so.
- The majority reduce their debt to $y' = -.25$ (Figure in page 27).
- The following (employed) period the interest rate is high $r = 20\%$.

Some will default (3.%), some (6.8%) switch to $y' = -.1$ with $r = 4.9\%$, the rest reduce their debt to $y' = -.1$.

- After this the employed household will finish repaying its debts.
- If a household with $y = -25$ gets unemployed, it borrows $y' = -.6$ and it starts again a similar cycle.

Savings of employed with contract



Finding a job after one period of unemployment

- They have $y = -.35$ and they do all kind of things.

- Some, about 8%, default.

- Many others, about 21%, find the new terms of the bank outregeous and switch to a new contract that offers them a better deal. Such a contract is to choose $y' = -.15$ at quite a convenient subsidized price, $r = 1.5\%$ (they will be profitable for the new bank the following period if employed).

- The rest jump to $y = -.15$ at a hefty interest rate of about 20%. From them on, it goes on like before.

Summary for borrowers that started without a contract

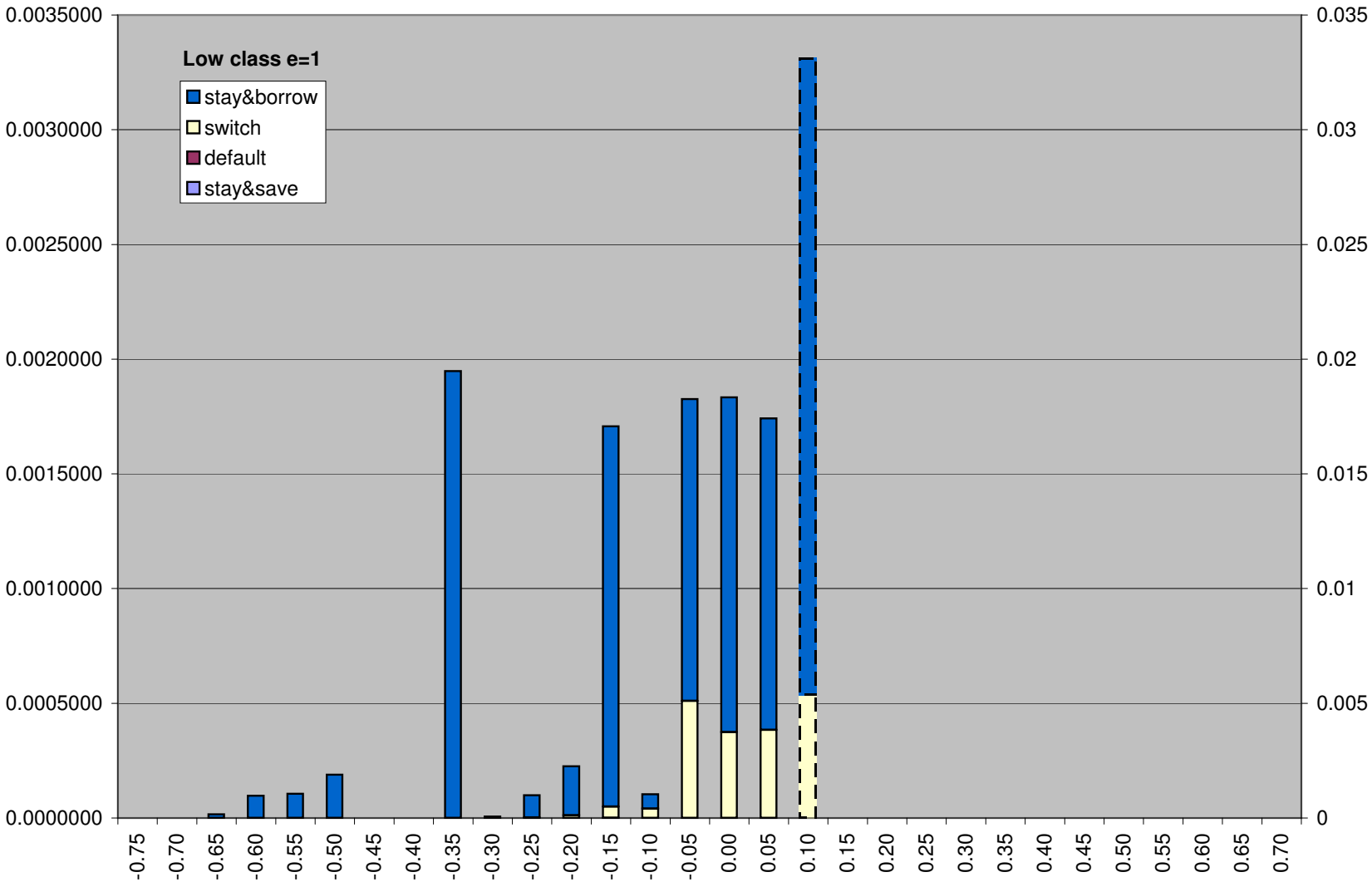
- Banks start subsidizing to attract customers (the payments do not cover the banks' costs).

- Banks make profits in the slow process of customers paying back their debts when they recover employemnt.

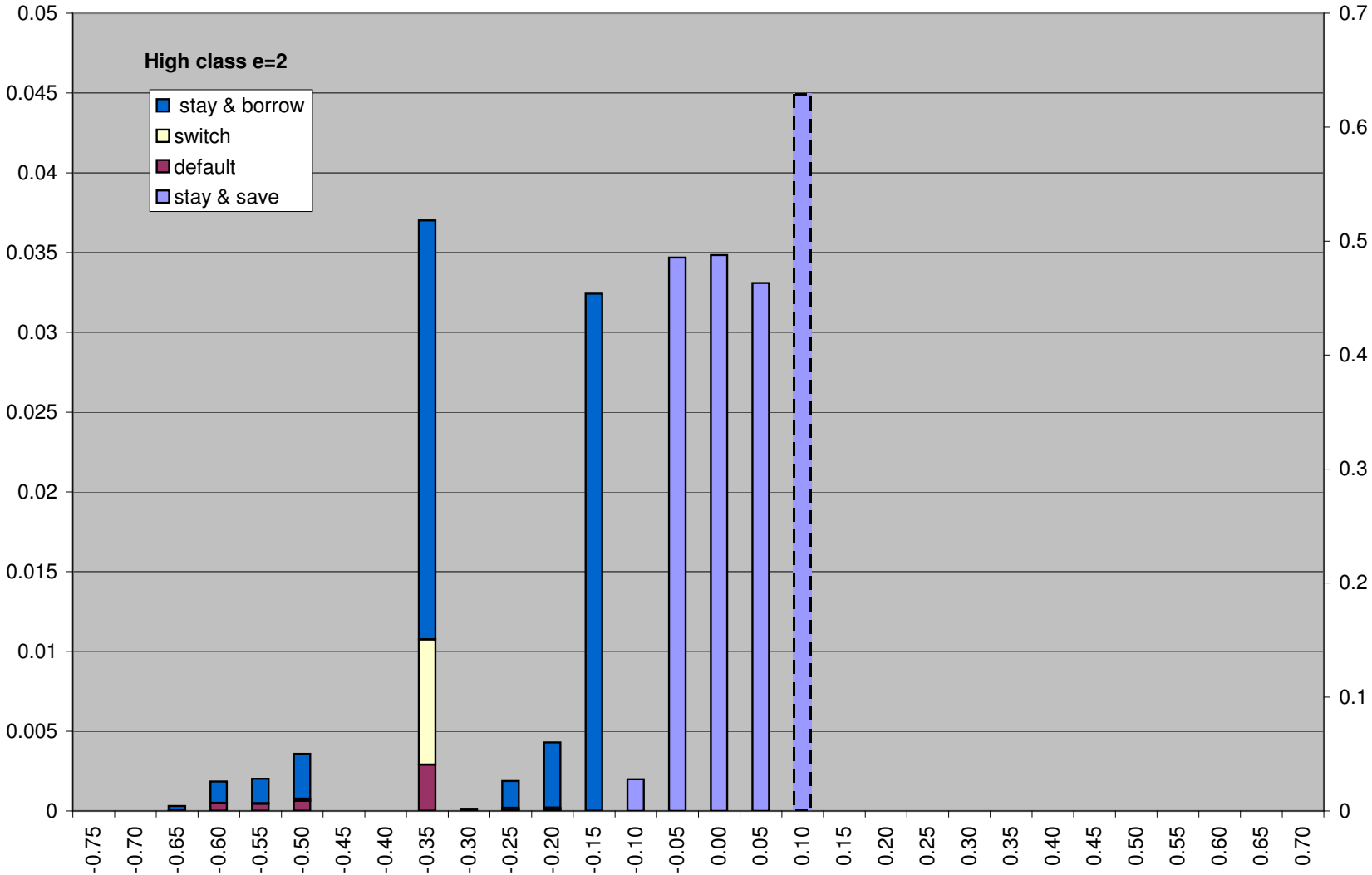
- Banks also extend debt to households that suffer repeated unemployment, first with hefty interest rates.

- Once households are in very high debt and are hit with additional unemployment the banks treat them nicely: they are subsidized.

Dbon with defaulters and switchers ($h = 0$ and $\omega = 1$), u



Dbon with defaulters and switchers ($h = 0$ and $\omega = 1$), e



First unemployment hit to households with contract

- A similar path starting with a worse initial condition $a = .15$.
- The reason is precautionary savings.

Policy Change

- Now let's imagine an implementation of Regulation AA. Banks have to commit to not raise the interest rate (but can temporarily lower it).

- A comparison of steady states yields that with commitment
  - Fewer households with contracts.
  - Fewer borrowers.
  - Similar debt (so more debt per borrower).
  - Initial Interest rates are higher (both initial and continuing).
  - Debt limits are higher.
  - There are fewer switchers.
  - Wealth is lower (precautionary savings, a good sign).

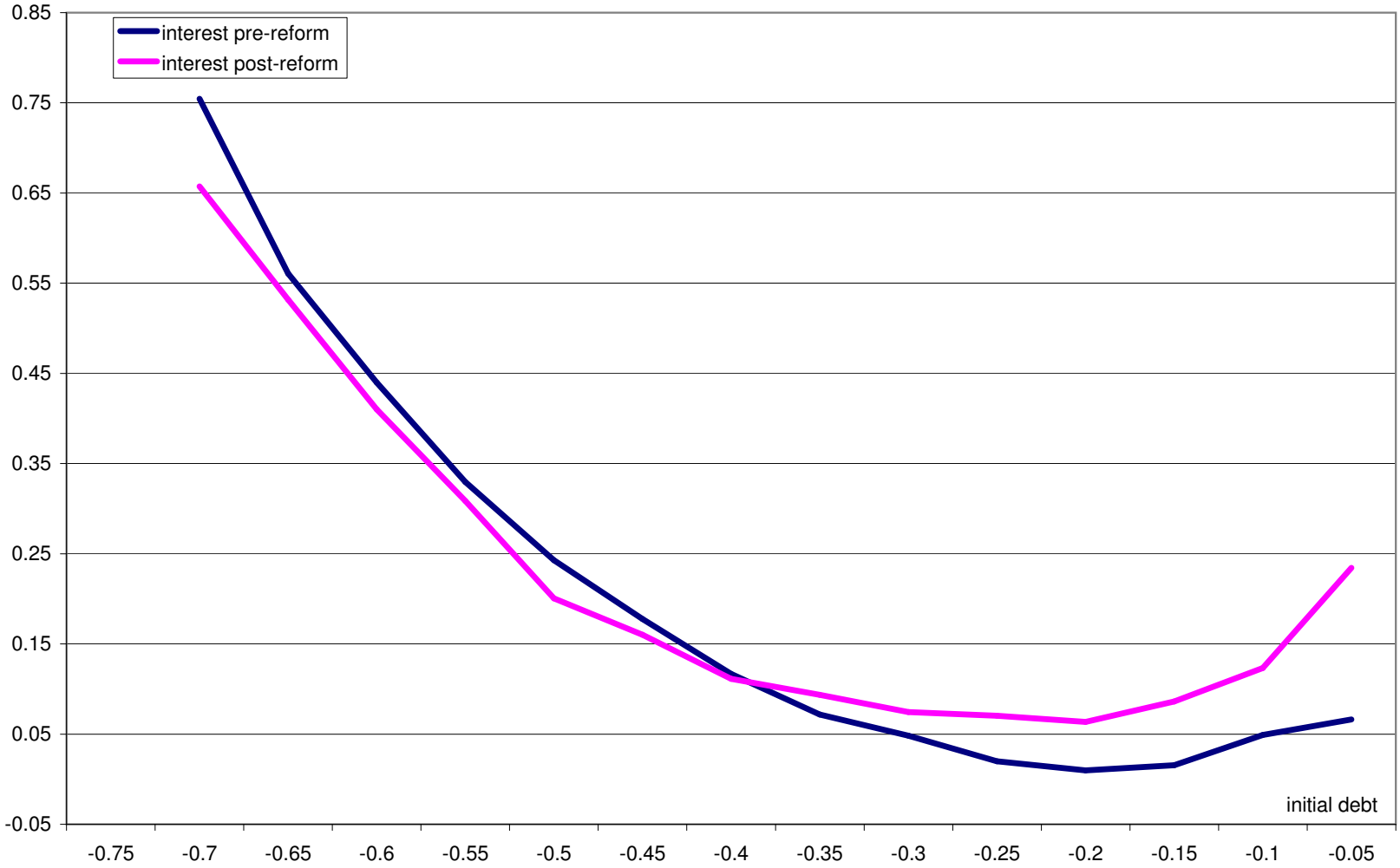
Steady States

	No commitment	Commitment
Mass with a contract	0.860	0.784
Mass no contract but clean h=0	0.093	0.144
Mass in debt	0.126	0.120
Mass of defaulters	0.5%	0.7%
Mass switchers	2.0%	0.9%
Write-off rate	0.073	0.112
Wealth/output	0.066	0.031
Debt/output	0.027	0.031
Loan size (all)	0.211	0.271
Loan price (all)	0.883	0.862
Loan size (initial)	0.271	0.459
Interest rate (initial)	5.4%	17.6%
Loan size (continuing)	0.200	0.255
Interest rate (continuing)	14.8%	19.6%
Debt limit (continuing)	0.306	0.400
Average Consumption	0.951	0.895

Initial Loan Prices

- A comparison of the policies.
  - Initial interest rates girates the right way. The reform induces heaper big loans and more expensive smaller loans.
  - Now the initial loan for first time unemployed is larger. This is associated to the lower average wealth. The interest rate on such loan is smaller than it was before the reform.
  - At this higher level of debt there is more default and less switches.

Initial Loan Prices



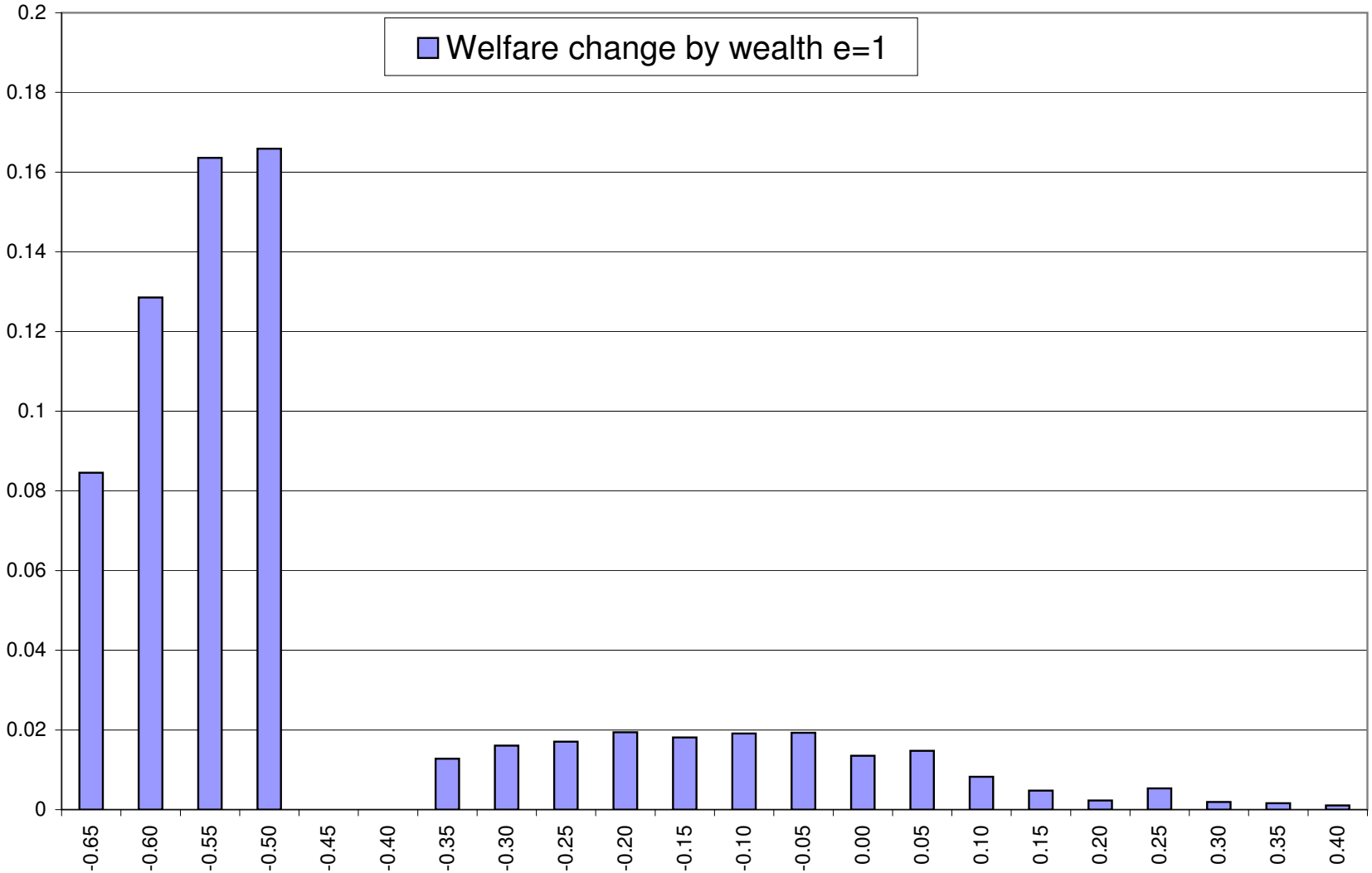
Welfare Analysis

- It is hard to really do welfare analysis since contracts are a state.

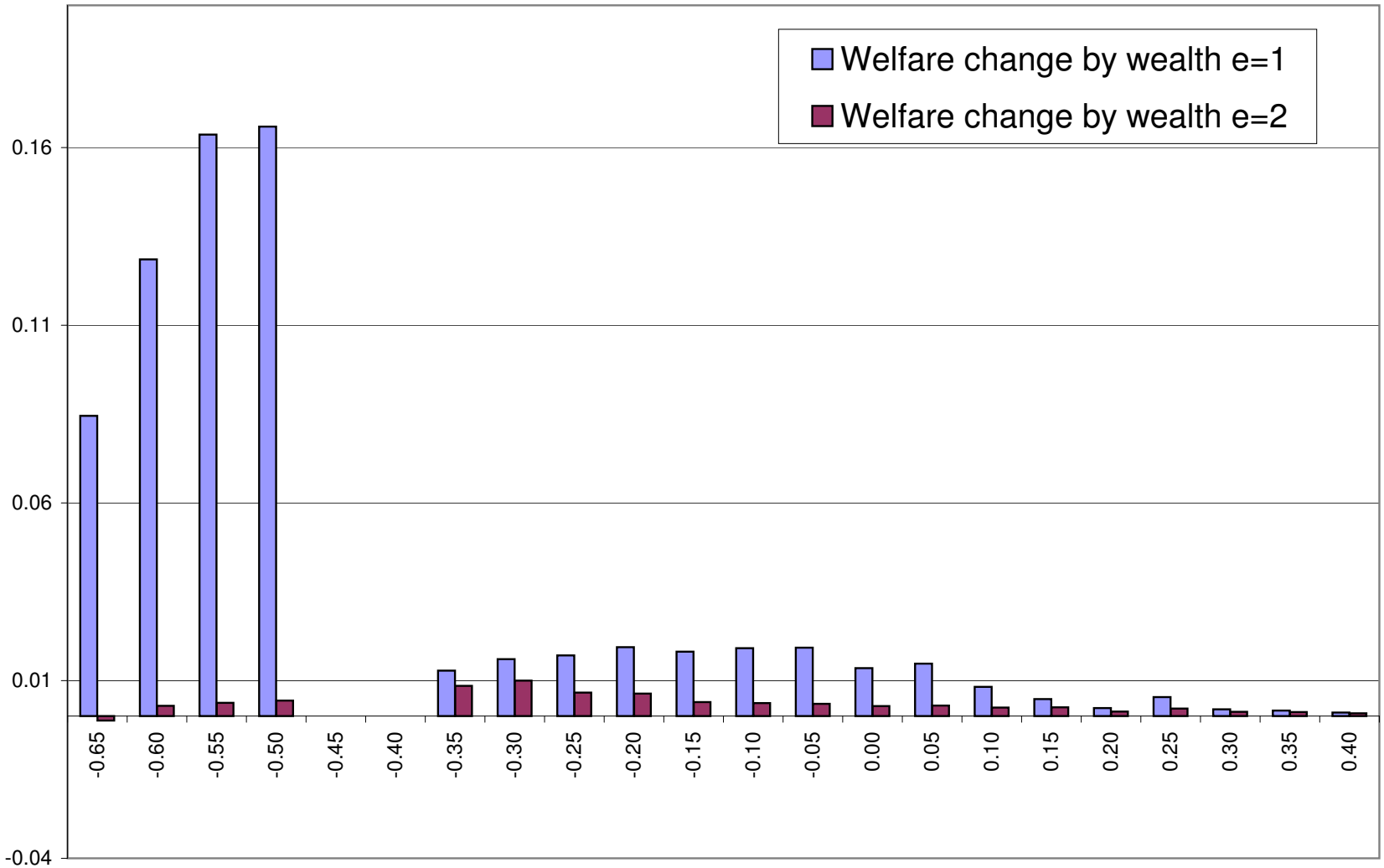
- But we can look at each level of wealth and ask how they would do comparing their initial contract of the new

Welfare Analysis: Properly done as a transition. Looks good

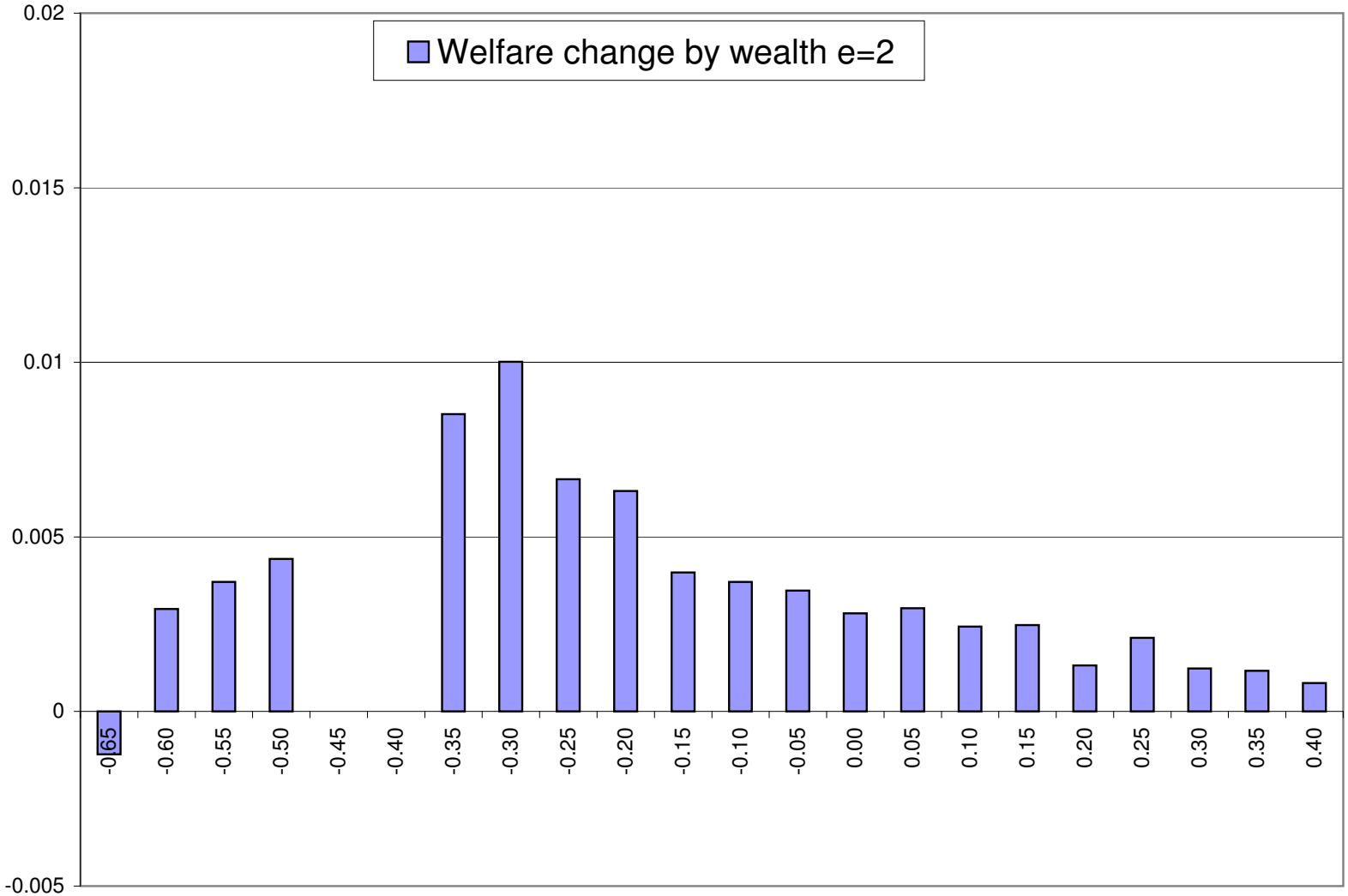
But is it really better for everybody?



No but almost.



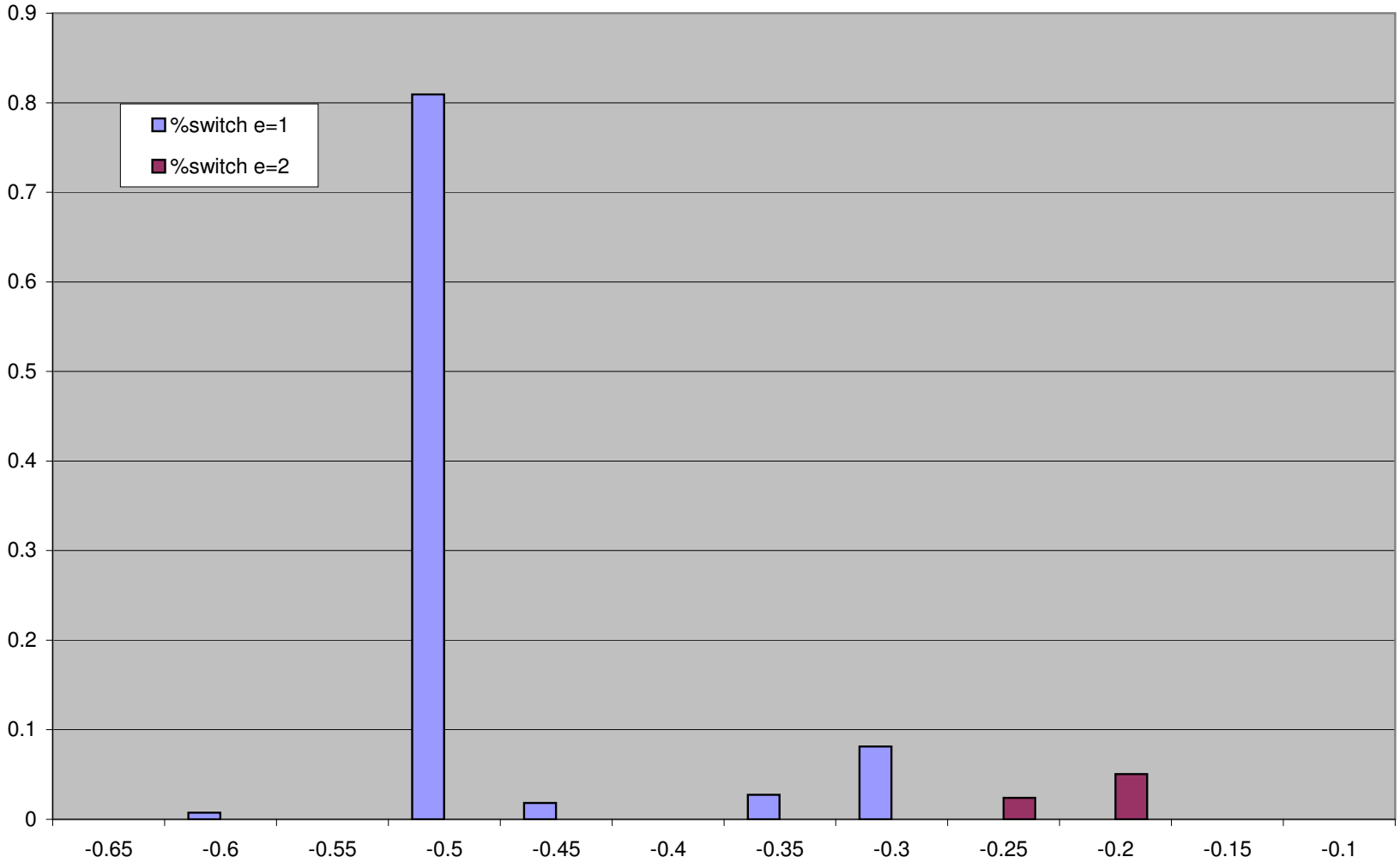
In detail.


Welfare change by wealth e=2
0.02
0.015
0.01
0.005
0
-0.005
-0.65
-0.60
-0.55
-0.50
-0.45
-0.40
-0.35
-0.30
-0.25
-0.20
-0.15
-0.10
-0.05
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40

CONCLUSIONS

- We have developed a positive theory of ongoing credit relationships.
- This theory is built on
  - The U.S. legal framework (what is legal and what is not).
  - The existence of transaction costs on both sides.
  - The realization that some characteristics of households can be private information.
- The theory finds contracts like those that are pervassive in the U.S. and it indicates that there are many possible outcomes.
- The theory can be used to study the likely implications of the type of policy changes that are being implemented as we speak.

Distribution of Contracts.



II. Equilibrium

An equilibrium is a set of contracts $\Theta \subset \Theta^P$ and allocations s.t.:

(A) Agents maximize (standard).

(B) Zero profit or free entry in new contracts: $\Psi_0(\theta) - \pi = 0, \forall \theta \in \Theta$.

(C) Time consistency

$$(q^\theta(y,e), b^\theta(y,e)) = \arg\max_{q,b \leq y} \widetilde{\Psi}(y,e,\theta,q,b), \qquad \theta \in \Theta,$$

with $q = q^\theta$ if price-commitment.

(D) Unprofitable alternative contracts (When commitment only)
$\nexists \theta \in \Theta^P, \theta \notin \Theta$ that satisfies

(i) Profits are non negative;
(ii) It is time consistent;
(iii) Some households choose it.

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