The role of intergenerational transfer in household consumption & portfolio selection

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Microdata users' Workshop

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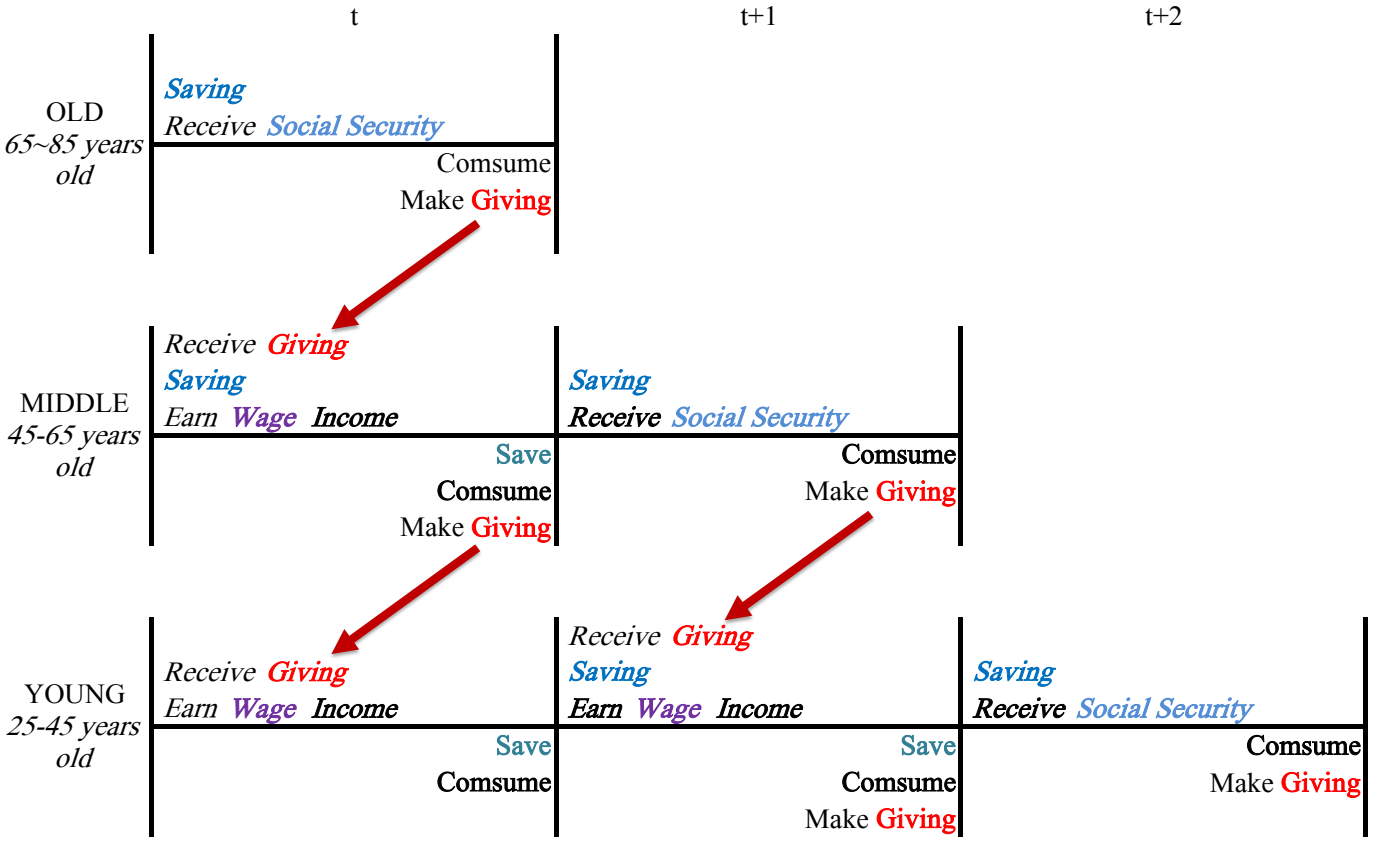
- 70% of inter vivos giving is in financial assets including cash
- **Most of inter vivos support is not explicitly observed but significant**


t
t+1
t+2
OLD
65~85 years old
Saving
Receive Social Security
Comsume
Make Giving
MIDDLE
45-65 years old
Receive Giving
Saving
Earn Wage Income
Save
Comsume
Make Giving
Saving
Receive Social Security
Comsume
Make Giving
YOUNG
25-45 years old
Receive Giving
Earn Wage Income
Save
Comsume
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Save
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Preference: Joy of Giving Utility (Blinder, 1975)

$$\mathbb{E}_0 \sum_{i=1}^{3} \beta^{i-1} \left[\left(\frac{c_i^{1-\sigma}}{1-\sigma} \right) + \Lambda_i \left(\frac{g_i^{1-\eta}}{1-\eta} \right) \right] \tag{1}$$

$\Lambda_1 = 0$ and $\Lambda_2 = \Lambda_3 = \Lambda$: a normalized weight on utility from the inter vivos giving relative to utility based on consumption

- Models of Giving
  - Altruism: Barro(1974), Becker(1974)
  - Uncertain Lifetime: Huggett(1996), De Nardi(2004)
  - Strategic Motive: Bernheim, Shleifer and Summers(1985)
  - **Joy of Giving (A warm glow or Impure Altruism)**: Simple but consistent suggested by Blinder(1975), Andreoni(1989)

Bellman Equation

- The Old Generation's Problem, i=3

$$V_3(a_2, ss) = \max_{\{c_3, g_3\}} [U(c_3, g_3)] \tag{2}$$

$$c_3 = (1 + r(1 - \tau_k))a_2 + ss - \left(\frac{1}{1 - \tau_g}\right) g_3 \tag{3}$$

- The Middle Generation's Problem, i=2

$$V_2(a_1, \hat{g}_3, \varepsilon_2) = \max_{\{c_2, a_2, g_2\}} [U(c_2, g_2) + \beta V_3(a_2)] \tag{4}$$

$$c_2 + a_2 \leq (1 + r(1 - \tau_k))a_1 + (1 - \tau_w)w\bar{h}(\varepsilon) + \widehat{g_3} - \left(\frac{1}{1 - \tau_g}\right) g_2 \tag{5}$$

$$a_2 \geq 0 \tag{6}$$

- The Young Generation's Problem $(i = 1)$

$$V_1(\widehat{g_2}, \varepsilon_1) = \max_{\{c_1, a_1\}} [U(c_1) + \beta \sum_{\varepsilon} \int_{\hat{g}} V_2(a_1, \widehat{g_3}, \varepsilon_2)\pi(\varepsilon_2 \mid \varepsilon_1) d\hat{\Phi}_3] \tag{7}$$

$$c_1 + a_1 \leq (1 - \tau_w)w\bar{h}(\varepsilon_1) + \widehat{g_2} \tag{8}$$

$$a_1 \geq 0 \tag{9}$$

Summary statistics on a household balance sheet by a transfer type

	Total		General transfer		Bequest		Gift	
	(1)**Mean**	(2)**Median**	(3) No	(4) Yes	(5) No	(6) Yes	(7) No	(8) Yes
Fraction of observations	**100**	**100**	**75.89**	**24.11**	**80.02**	**19.98**	**94.48**	**5.52**
Financial assets	99,163	15,417	75,829	191,725	78,399	203,603	95,037	193,961
The amount in checking accounts	8,743	2,795	7,150	15,072	7,322	15,828	8,546	13,211
Non-financial assets	257,001	181,400	211,068	439,387	218,503	449,518	248,467	452,763
Home, Current cost-based value	160,716	147,070	142,921	231,519	145,557	236,712	157,265	241,224
Net worth	289,128	130,009	219,526	565,446	229,419	587,980	276,503	577,880
Income	75,736	65,317	71,583	100,634	72,667	101,308	76,026	108,974
Wage and salaries	52,908	38,849	51,528	58,449	51,931	57,915	52,358	65,236
Risky asset income	4,568		3,579	9,477	4,290	10,912	3713	10,875
Risk-free asset income	5,817		4,781	10,987	5,550	11,902	4862	12,764
Debt, outstanding	91,355	36,910	87,073	108,726	88,401	106,596	89,708	130,031
Credit limit	17,157	13,092	15,584	23,476	15,835	23,826	16,852	24,349
Consumption								
Durable goods								
Non-durable goods								

Summary statistics on a household balance sheet by a transfer type

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- **In general equilibrium, can we realize the welfare gains by a public reinforcement of inter vivos giving?**

Calibration

Parameters	Values	References
Discount rate	β	0.975
Production elasticity of capital	α	0.36
Coefficient of relative risk aversion for Consumption	σ	1.5
Coefficient of relative risk aversion for Giving	η	1.5
Rate of depreciation	δ	0.048
Replacement Ratio		0.45
Giving Weight	Λ	**20.4%**
Capital tax rate	τ_k	See Text
Gift tax rate	τ_g	**11.30% in effective** **17% in statutory**
Efficiency Scale		Cagetti and De Nardi (2006)
The Transition matrix		Cagetti and De Nardi (2006)

Estimation: 20.4% of an independent CU's annual income

Giving Weight, Λ

- Cash Transfers: The average yearly amount of cash transfers to children in the independent CU, \$1,766 (2.4% of annual household income, SCF) **(Cash attribution of total annual expenditures for all CUs 3.5% of annual CU income, CEX)**
- Real Estate and Financial Assets Transfers: The capitalization rate of the inherited assets (Rental Value/Market Value: Housing and Other Properties) attributed by parent-CU has 2.2 times greater than that of self-obtained properties **(17% of annual income, CEX)**
- Educational Expenses: The CU provides \$1,098.784 for educational spending of a person outside of CU on average, every year **(1% of annual income, CEX)**
  - CEX − EXPN − EEDA(Educational expenses)
  - JEDUCNET: Net amount paid for educational expenses during reference period
  - EDSCHL−A: What kind of school or facility was it?
    1. **College or university**
    2. Elementary through high school
    3. Child day care center
    4. Nursery school or preschool
    5. **Vocational or technical school**
    6. **Other school**
  - EDUCGFTC: Who was the educational expense for?
    1. Person inside the CU
    2. **Person outside the CU**

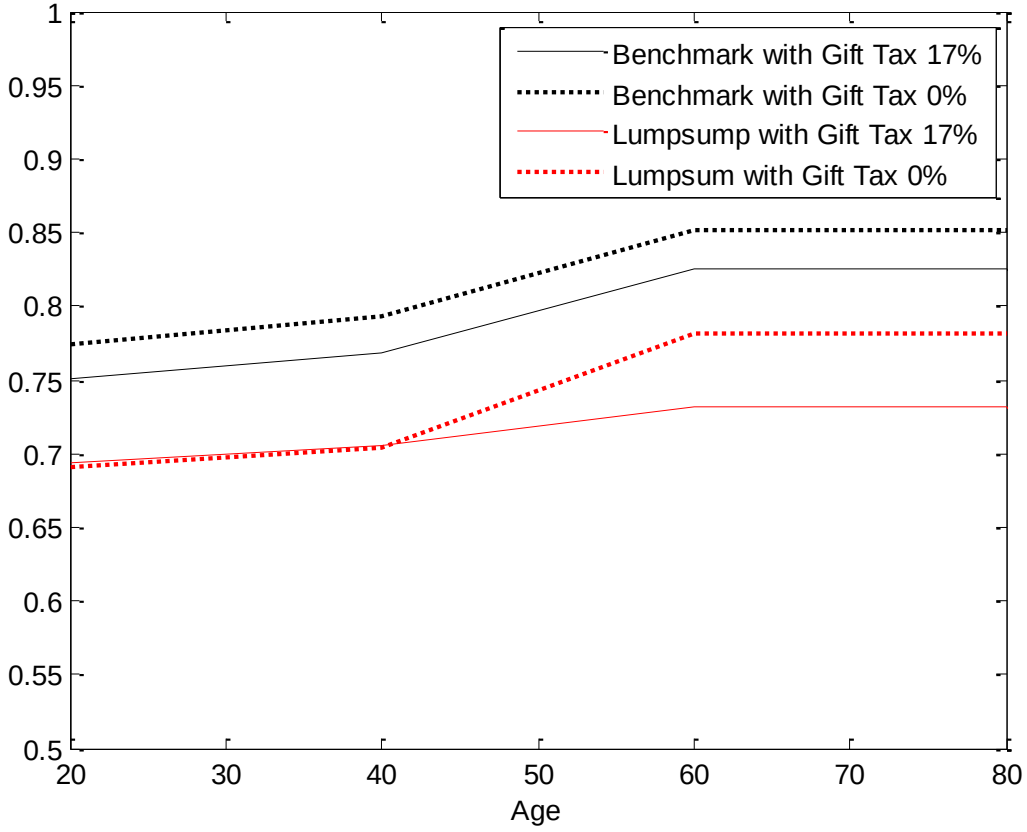
Calibration Target

- Kotlikoff and Summers(1981), Modigliani(1988b), Hurd and Mundaca(1989), Menchik and David(1983), Barlow et al.(1966); Gale and Scholz(1994): **at least 20% of the aggregate wealth**

Simulation Results: lowering gift tax rates

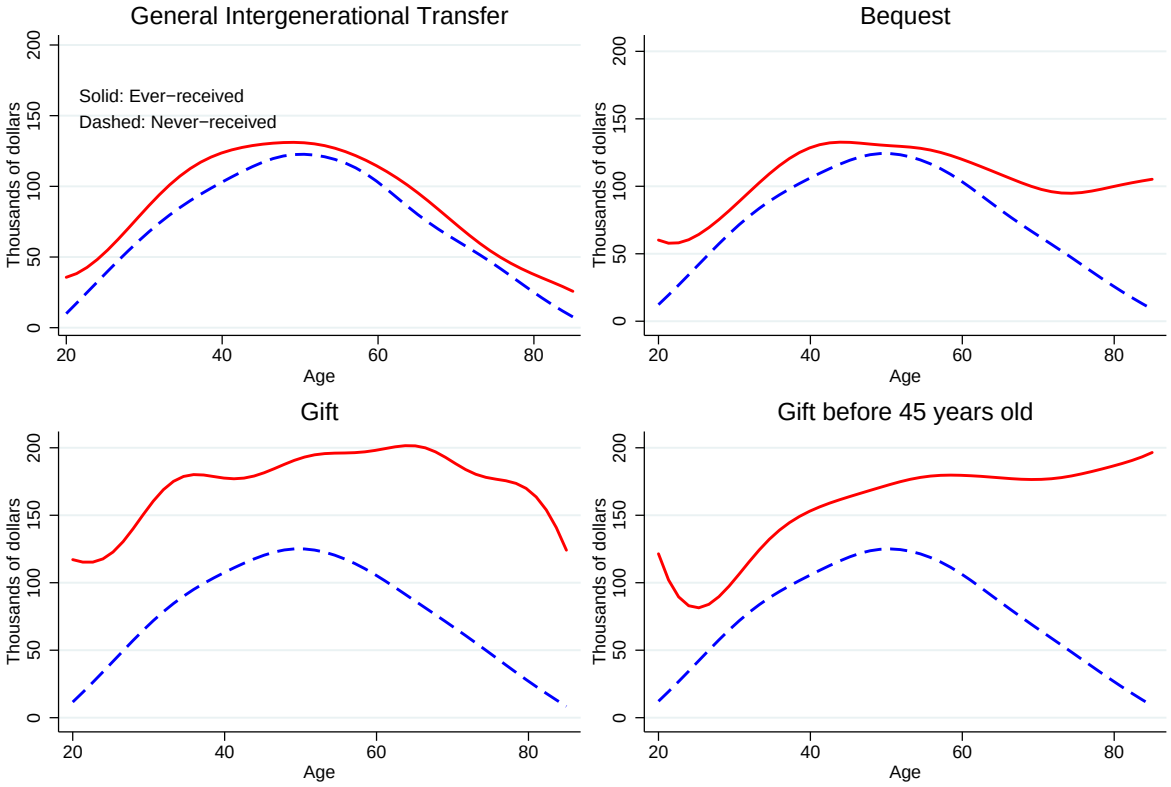
- Changes in Lifetime Giving & **The income effect (Short-term)**:
  - An instant increase in the income during the young period
  - An increase in aggregate saving with the young's higher saving rates and the middle's preparation of gifts
- Changes in Lifetime Asset & **The wealth effect (Long-term)**:
  - Improved wealth accumulation results in higher wages and lower interest rates
  - The old generation receives more social security by the increase in wage

Simulation Results: lowering gift tax rates



Intergenerational Transfer & Debt

Borrowing Constraint is critical to generate Pareto-improving welfare by lowering the gift tax rates: $a_i \geq 0$



Credit Limit, Consumption, Portfolio Selection & Intergenerational Transfer

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  - implications of endogenous credit limits for consumption and investment.
  - implications of intergenerational transfer for endogenous credit limit

Market Setup

In a complete market, a household can generate a portfolio with two securities, a riskless S_t^0 and a risky asset S_t:

- The risk-free asset:
$$\frac{dS_t^0}{S_t^0} = rdt.$$
- The risky asset (or Index):
$$\frac{dS_t}{S_t} = \mu dt + \sigma dB_t$$
.
- B_t is a standard Brownian motion defined on the standard probability space $(\Omega, \mathcal{F}, P)$.
- The pricing kernel is defined by
$$H_t = \exp\left(-(r+\theta)t - \theta B_t\right).$$
with the market price of risk $\theta := (\mu - r)/\sigma$.

Income, Consumption, & Wealth

- Income stream $\{I_t dt\}_{t=0}^{\infty}$ which is an $\mathcal{F}_t-$adapted process.
- The present value of his future income stream $= E[\int_0^{\infty} H_t I_t dt]$
- H_t is the pricing kernel or the stochastic discount factor.
- Consumption rate process c_t and the portfolio process π_t are positive $\mathcal{F}_t$-adapted processes.
- Wealth process by X_t with initial endowment x evolves

$$dX_t = [rX_t + \pi_t X_t(\mu - r) - c_t + I_t]dt + \sigma \pi_t dB_t, \qquad X_0 = x. \tag{10}$$

The following static constraint

$$\mathbb{E}\left[\int_0^{\infty} H_t c_t dt\right] \leq x + \mathbb{E}\left[\int_0^{\infty} H_t I_t dt\right]. \tag{11}$$

The agent's market participant constraints are

$$\mathbb{E}_t\left[\int_t^{\infty} e^{-\beta s} u(c_s) ds\right] \geq \mathbb{E}_t\left[\int_t^{\infty} e^{-\beta s} u((1-\phi)e_s) ds\right], \qquad t > 0. \tag{12}$$

I. Endogenous Default Boundary for the CRRA utility case

We *explicitly* characterize the endogenous default boundary (the endogenous credit limit):

- The endogenous credit limit at time t, denoted by $\bar{X}_t$, can be written as a linear function of the *current* labor income level with some $m^* > 0$ *in equilibrium*:

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  - The debt limit is changing over time.
  - The optimal wealth process never reaches the credit limit boundary thanks to the *liquidity* hedging component in the optimal portfolio:

$$\frac{\pi^*}{I_t} = \text{myopic demand+intertemporal hedging demand+liquidity demand}$$

  since the last term *drastically* decreases whenever the wealth-to-income ratio approaches $-m^*$.

II. Endogenous Default Boundary - Labor Income Growth

- Note $\frac{X_t}{I_t} \geq -m^*$, where

$$m^* = m^*(\mu_I, \sigma_I, \theta, \dots)$$

- If the mean growth rate of labor income increases (higher μ_I) or the labor income has a lower risk (lower σ_I), the borrowing limit increases (higher m^*).

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- Two Opposing Effects:
  - An increase in the expected income growth rate or a decrease in its volatility increases the present value of income.
  - On the other hand, it tightens the endogenous credit constraint (or market participation constraint).
- The former outweighs the latter in the household investment decision while the opposite is true in the limited commitment literature.

Optimal Consumption Rate

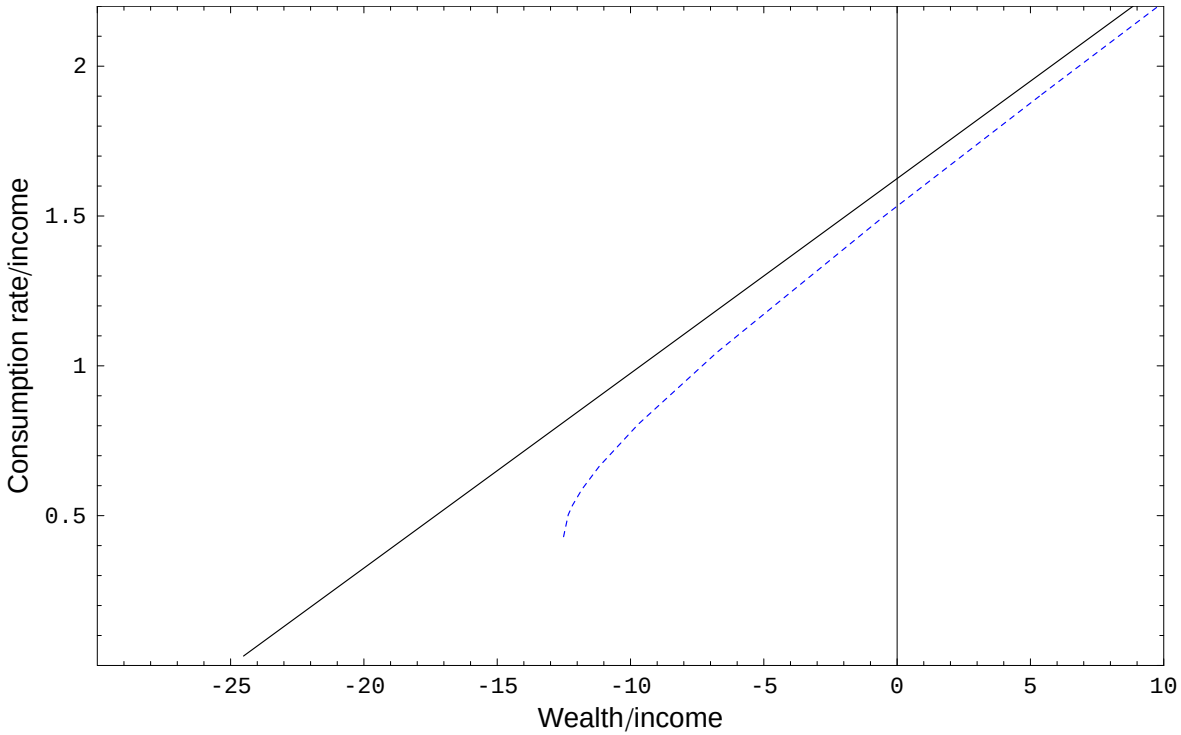
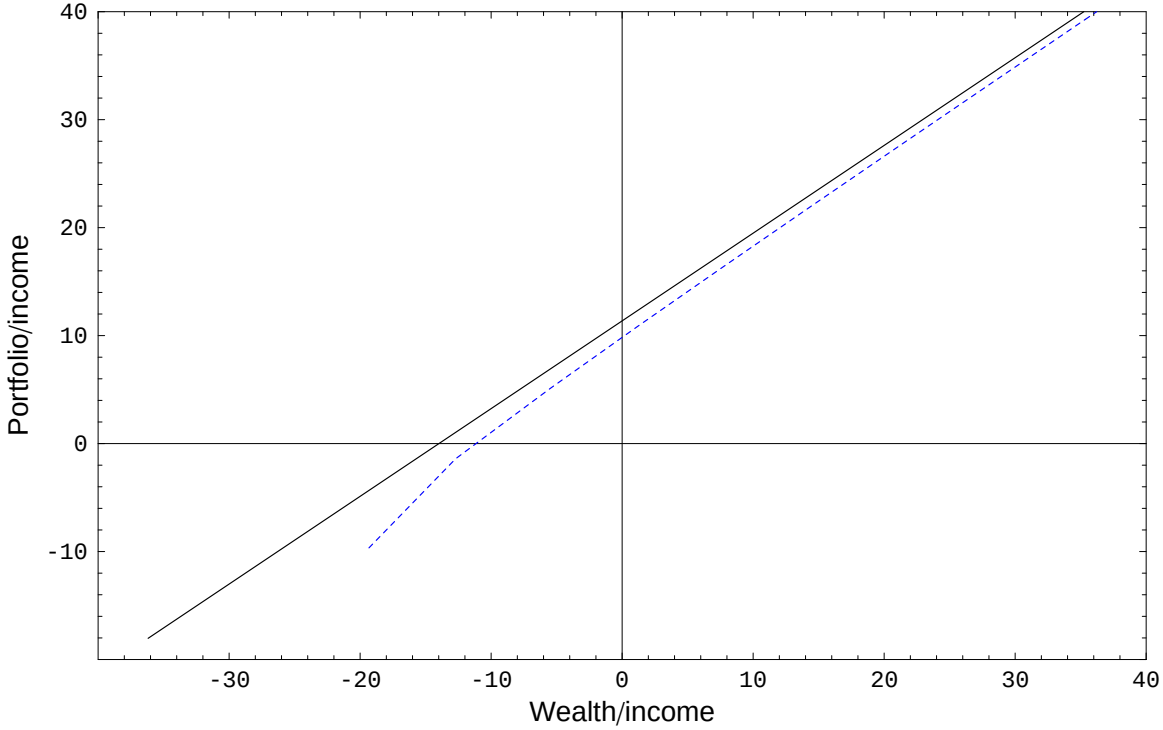


Figure: ($\gamma = 2,\ \beta = 0.07,\ r = 0.015,\ \mu = 0.08,\ \sigma = 0.15,\ \mu_I = 0.02,\ \sigma_I = 0.1$ and $\delta = 0.7$). *The dotted line shows optimal consumption in our model of the endogenous credit constraints and the solid line shows that with no credit constraints (The Merton solution).*

Optimal Risky Portfolio



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III. Business cycle & Credit limit

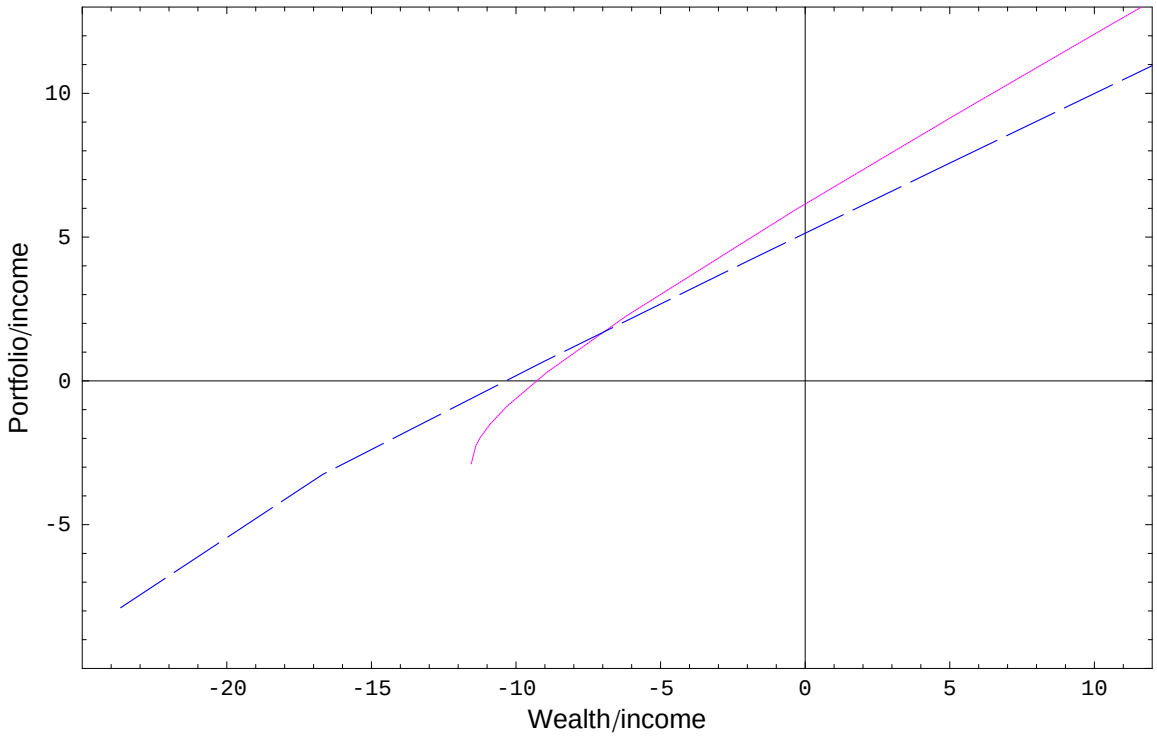


Figure: *The short-dotted line shows the result when the market price of risk is* $\theta = 0.28$ $(\mu = 0.1, r = 0.015, \sigma = 0.3)$ *and the solid line shows the result with* $\theta = 0.45$ $(\mu = 0.2, r = 0.02, \sigma = 0.4)$. *In this case, the endogenous minimum wealth-to-income ratios are given by* $m^* = -23.67$ *and* $m^* = -11.55$, *respectively.*

Stylized Facts & Empirical Implications from

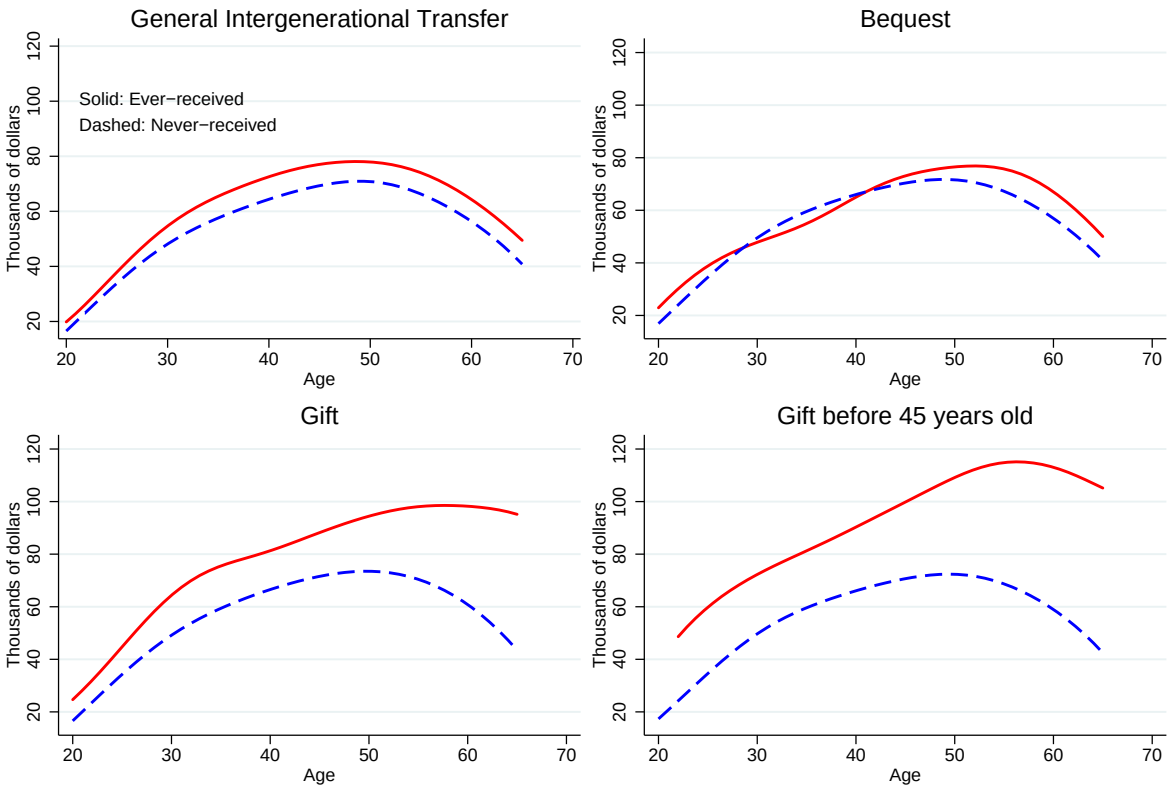
The Survey of Consumer Finance (1995-2010) & Consumer Expenditure Data (2004-2010)

- Credit limit: the maximum amount of loans that a household could borrow
- Using the household finance data from 1995 to 2010, the model's empirical implications are examined including
  1. The marginal effect of wage income on the unsecured credit limit
  2. Changes in unsecured credit limit by the wage growth rates
  3. Changes in unsecured credit limit by the wage volatility & stochastic shocks to wage income
- After estimating the unsecured credit limit,
  1. Unsecured Credit Limit over a Business Cycle: Kernel Density of a Credit Limit
  2. Heterogeneous Portfolio Selection over a Business Cycle
  3. Heterogeneous Consumption over a Business cycle

I. The marginal effect of wage on unsecured credit limit

Dependent Variable: Household credit limit in thousand dollars	OLS (1)	OLS(2)	TSLS (1)	TSLS (2)
			(IV for Log Net worth: *Log Bequests, Gifts and other Transfers)*	
Log wage	6.325***		6.167***	
	[0.197]		[0.393]	
Log household income		9.716***		9.530***
		[0.189]		[0.560]
Log household net worth	2.853***	1.892***	5.410***	4.120***
	[0.0707]	[0.0547]	[0.569]	[0.565]
Education (if college educated = 1)	7.687***	6.638***	6.273***	5.306***
	[0.266]	[0.228]	[0.670]	[0.501]
Number of people in a household	0.0866	-0.248***	-0.560**	-0.611**
	[0.101]	[0.0940]	[0.267]	[0.266]
Housing ownership (if yes = 1)	-0.876**	-0.830**	0.0669	-2.667**
	[0.378]	[0.327]	[1.118]	[1.170]
Business ownership (if yes = 1)	6.932***	5.577***	3.675***	2.493***
	[0.473]	[0.417]	[1.091]	[0.916]
Constant	-83.52***	-109.2***	-108.6***	-127.7***
	[2.120]	[1.952]	[5.940]	[4.265]
Age dummies included?	Yes	Yes	Yes	Yes
Year dummies included?	Yes	Yes	Yes	Yes
Observations	81,536	108,401	21,459	30,299
F-statistics	646.1	944.4	145.1	266.3
Adjusted R-square	0.071	0.0892	0.0852	0.103

Intergenerational Transfer & Labor Income



A typical specification for the labor income process is

$$y_{i,a,t} = \sum_t \alpha_t I_t + f(a;\Theta) + g(x_{i,a,t};\Gamma) + u_{i,a,t} \tag{14}$$

where $y_{i,a,t}$ is a natural-log transformed wage income for a household i of a cohort a at period t.

1. We obtain the age-wage profile $f(a;\Theta)$ from the pseudo panel, which is a semiparametric especification.
2. Finally, $g(x_{i,a,t};\Gamma)$ includes variables indicating family composition (marital status, and the size of a household), household head's marital dummies, education, year effects, and potentially household-specific fixed effects.
3. Some of $x_{i,a,t}$, were used for sorting households and then used as a representative characteristic to connect the household of the SCF with the PU of the CEX (FMLY).
   - year of birth
   - sex
   - marital status
   - race(?)

Pseudo Panel Creation

- Developed by Deaton(1985)
- Tracking **'cohorts'** through **time series of survey data drawn a new each year**
- With a fixed membership, find a representative cohort version of the economic relationship corresponding to individual behaviors
- Partial Linear Model in 5 imputations

$$y_{i,t} = \alpha + f(age : \theta) + \beta_{1,t} cohort_i + \beta_{2,t} time_t + \epsilon_{i,t} \tag{15}$$

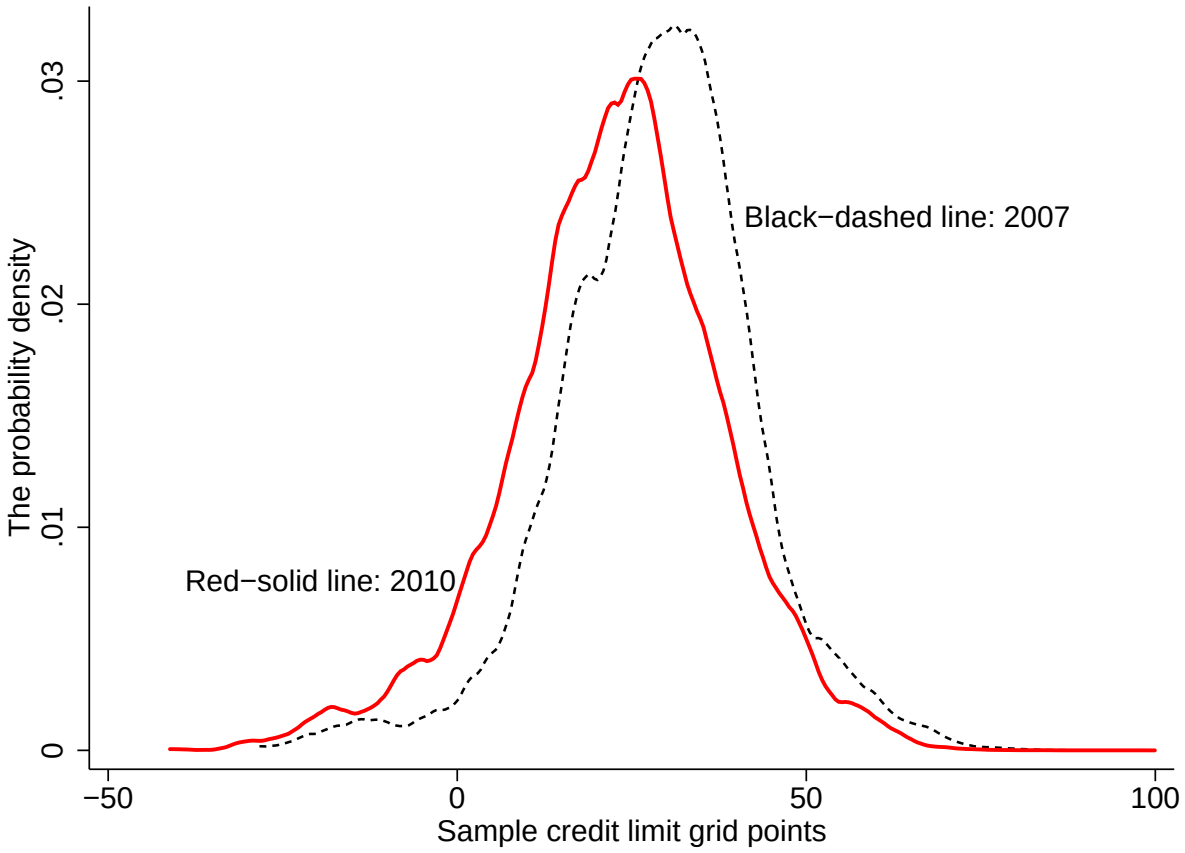
  - Kernel-smooth the variable with bandwidth 5 in each imputation
  - Subtract smoothed data from the original cohort mean to get the residual
  - With the residual, run the regression of residuals ($\eta_{i,t} = y_{i,t} - \epsilon_{i,t}$) on constant ($\alpha$), cohort dummies ($cohort_i$), and time dummies ($time_t$) for each variable $y_{i,t}$
  - Subtract the fitted residual($\hat{\eta}_{i,t}$) after regression from the original cohort mean ($y_{i,t}$)
  - Finally get $\widehat{f}(age : \theta)$

II. Unsecured Credit Limit by the Moments of the Income Growth Rate

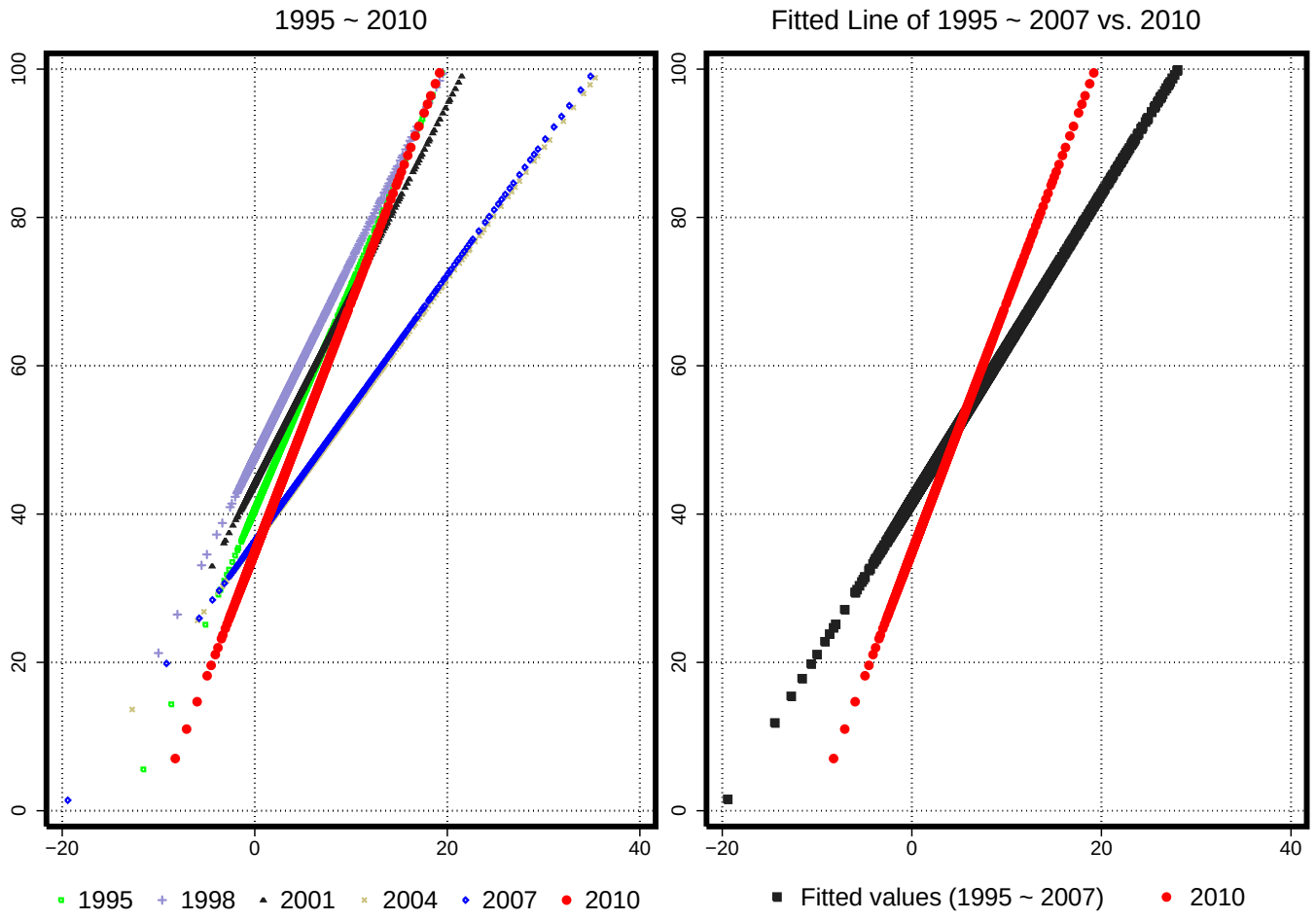
	Mean	Median	Mean	Median
Percentile of three-year-growth rate	**Labor Income** (1st moment)		(2nd moment)	
0% - 25%	12,647.1	11,492.0	14,716.6	13,457.2
25% - 50%	13,380.8	12,279.4	13,665.1	12,389.0
50% - 75%	14,823.9	13,406.8	13,295.1	12,012.4
75% - 100%	15,681.9	14,344.9	14,349.4	13,269.8
Percentile of shocks to income	**Shocks to Labor Income** (Variance)		(Persistent Shock)	
0% - 25%	15,759.2	15,049.0	14,353.2	13,286.8
25% - 50%	15,129.2	14,160.9	15,331.4	14,770.0
50% - 75%	13,358.0	12,417.2	13,766.9	12,722.2
75% - 100%	11,813.7	9,822.6	12,627.3	10,903.8

Note: The results are estimated by the OLS regression with robust standard errors.

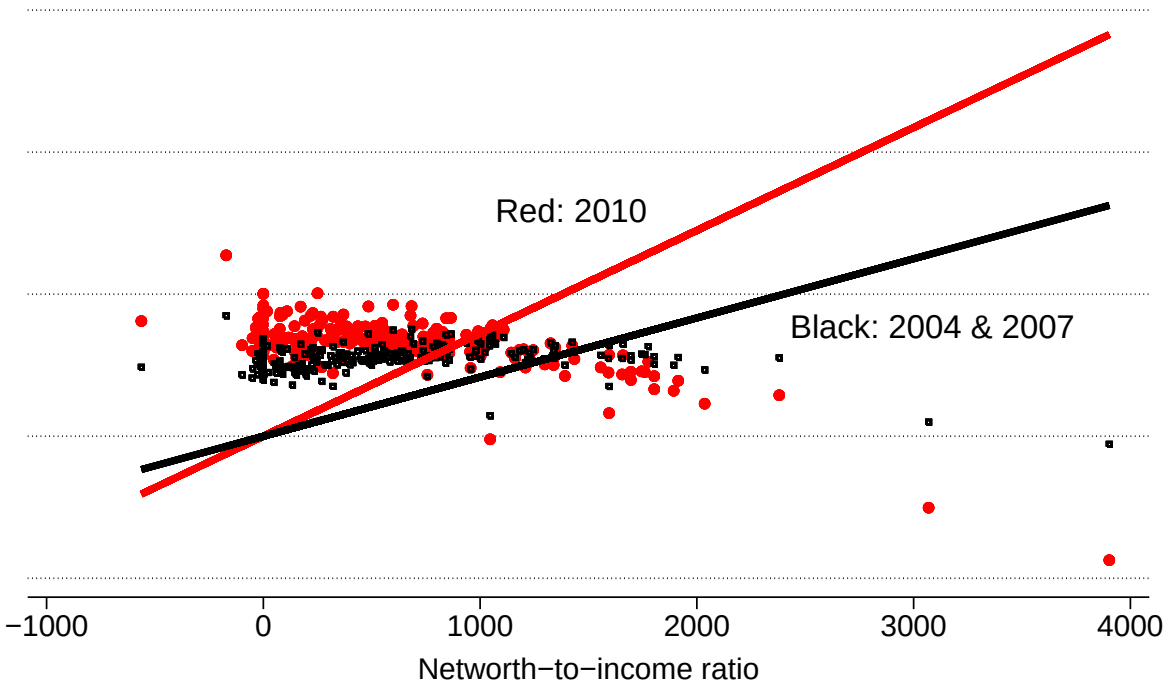
III. Unsecured Credit Limit over a Business Cycle: Kernel Density of a Credit Limit



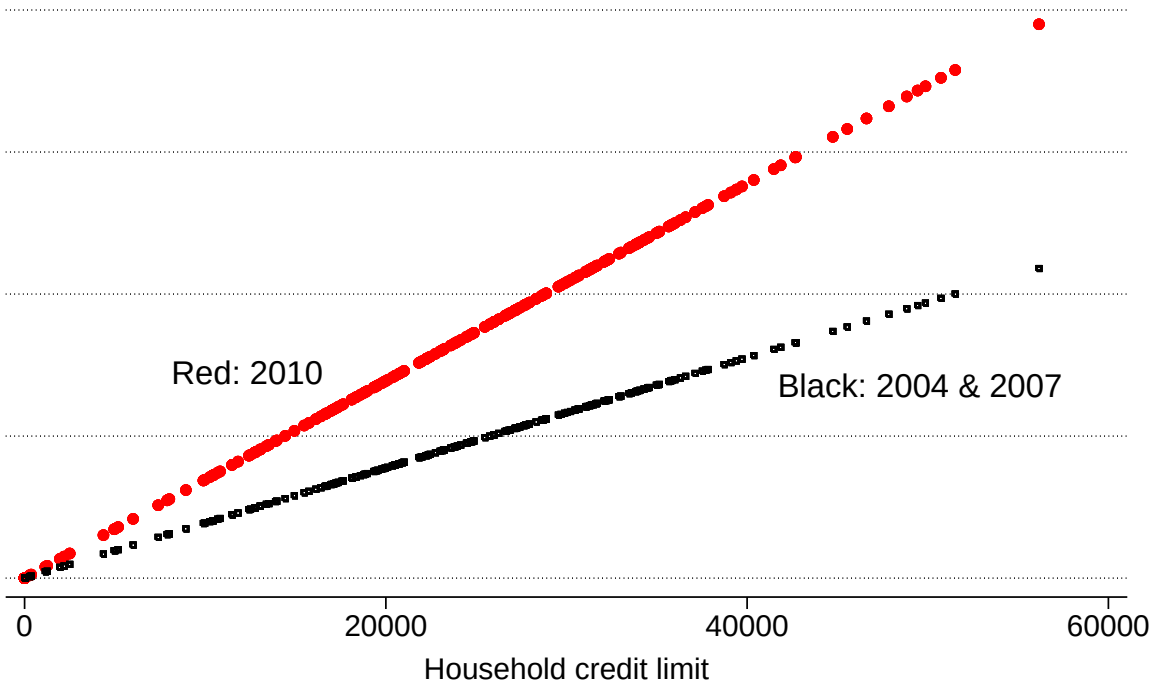
IV. Heterogeneous Portfolio Selection over a Business Cycle: Unsecured Credit Limit over a Business Cycle



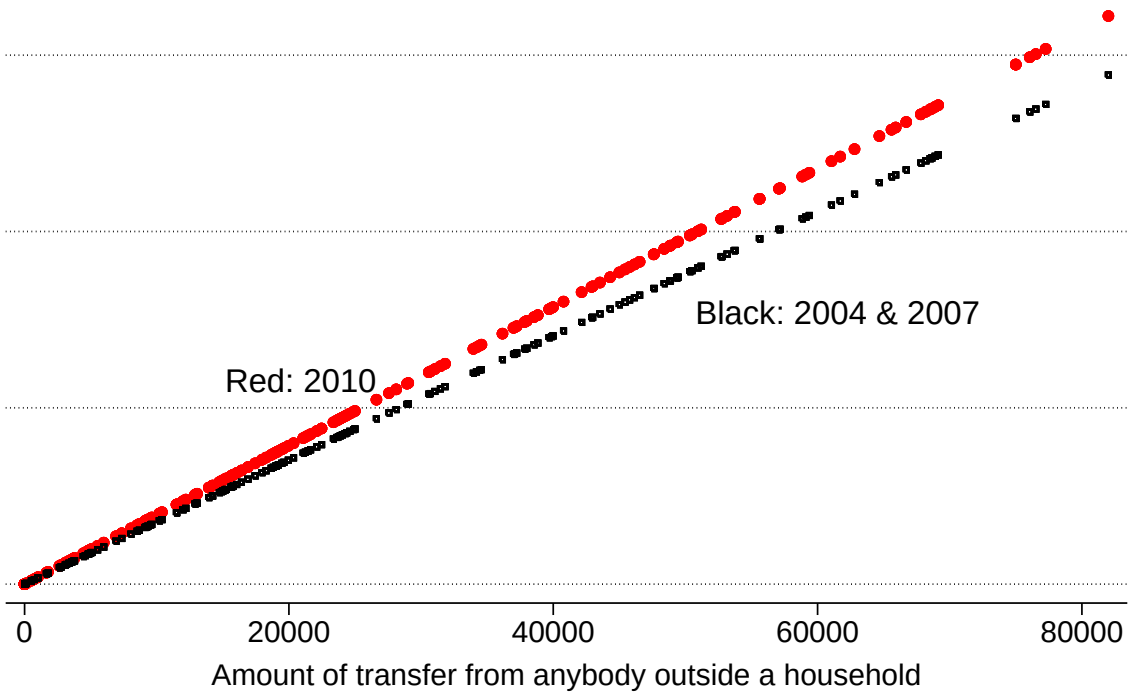
IV. Heterogeneous Consumption over a Business Cycle: Unsecured Credit Limit over a Business Cycle



IV. Credit limit & Consumption over a Business Cycle



IV. Intergenerational Transfer & Consumption over a Business Cycle



Concluding Remarks

This paper presents a continuous-time consumption-investment model for a household without debt enforcement. The empirical implications of closed-form solutions for optimal consumption and portfolio policies and for endogenous credit limit over time:

(1) The household's **current level of labor income** is particularly important for determining **the unsecured borrowing limit**

(2) The unsecured borrowing limit is **greater** for a household with **a higher income growth rate and lower income volatility**.

(3) The unsecured borrowing limit is **greater in a boom** than in a recession.

(4) The portfolio **share of risky assets for the rich** and the poor exhibit **different patterns across booms and recessions.**

(5) The role of intergenerational transfer in

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(5) The role of intergenerational transfer in

- determining the endogenous borrowing constraint
- modeling the public transfer programs
- making an endogenous labor supply decision
- affecting consumption habit