Household Finance in China

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Outline

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HH Finance relies on:

$$u'(c_t^i) = \beta E_t[R_{t+1}^k u'(c_{t+1}^i)] \tag{1}$$

for agent i, period t, asset k.

Used in

- outcome of HH intertemporal optimization
- asset pricing
- GMM estimation of HH parameters
- channels for monetary and fiscal policy

$$u'(c_t^i) = \beta E_t[R_{t+1}^k u'(c_{t+1}^i)] \tag{2}$$

for agent i, period t, asset k.

BUT

- who is agent i?
  - not all agents participate in asset markets
  - not all agents adjust (stock) portfolios each month or even each year
- what is R^k the return on? only portfolio of adjusted assets for agent i?
- what is a period?
- what are the correct arguments in $u(\cdot)$?

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This talk is about participation and adjustment frictions

- how do we model them?
- how do we estimate parameters?
  - US vs China
  - by education level
  - lifecycle implications
- policy implications (pondering)
  - growth and distribution
  - monetary and fiscal interventions

Approach

- Household Facts
- Dynamic Optimization Model
- Estimation
- Counterfactuals

Outline

Definitions

- stockholding: direct holding + indirect holding (mutual fund, IRA, pension...)
- bondholding: holding of relative safe liquid assets
- stock adjustment (US, PSID):
  - Survey questions about whether a household bought or sold any stock
  - adjustment rate = fraction of stockholders that traded stocks in the past two years
- stock share = stockholding/(stockholding+bondholding)

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CHFS

- China Household Financial Survey, SWUFE, Professor Li Gan
- 2011: 8,438 households and 29,500 individuals
- 2013: bigger sample (in process)
- wide range of questions, focus on financial variables.
- income data from China Health and Nutrition Survey (CHNS)

Table : Household Facts by Education and Age

Age	Pre-retirement		Post-retirement	
Education	Low	High	Low	High
China				
part.	0.055	0.262	0.045	0.192
share	0.492	0.509	0.529	0.522
share(h)	0.133	0.166	0.104	0.194
WI	1.137	1.528	1.051	2.067
WI(h)	12.204	16.011	17.989	17.264
US				
part.	0.174	0.550	0.209	0.646
share	0.522	0.572	0.444	0.551
share(h)	0.258	0.379	0.232	0.364
WI	0.071	0.500	0.377	2.805
WI(h)	0.313	1.260	3.867	6.454

This table displays the participation rate (direct and indirect stock holdings), the share of stocks (for participants), the median wealth income ratio (WI ratio) for Chinese and US households by age and education group. Data for China is from the CHFS. Data for the US is from the SCF.

Role of Inequality

Table : by Total Family Income Group

	part.	share	W/I	share(h)	W/I(h)	home owner-ship rate	age	fraction of high-edu
lower 10%	0.029	0.375	3.70	0.100	52.83	0.86	55.00	0.13
	(0.006)	(0.012)	(0.59)	(0.005)	(7.04)	(0.01)	(0.52)	(0.01)
median	0.088	0.608	0.70	0.118	7.58	0.85	49.11	0.31
	(0.028)	(0.034)	(0.12)	(0.013)	(1.3)	(0.04)	(1.14)	(0.05)
top 10%	0.425	0.490	1.28	0.117	8.67	0.79	44.14	0.71
	(0.019)	(0.011)	(0.09)	(0.006)	(0.38)	(0.02)	(0.45)	(0.02)
top 1%	0.500	0.490	1.33	0.178	4.07	0.69	42.53	0.76
	(0.059)	(0.036)	(0.36)	(0.025)	(0.55)	(0.05)	(1.24)	(0.05)

This table displays household choices by income groups in China. Standard errors are reported in parenthesis. The statistics of median income households are based on 100 households in the sample whose income is closest to sample median income

Top 10% look like US households.

Is there a persistent "iron rice bowl" effect? Location?

Table : Sectors and Regions

	part.	share	W/I	share(h)	W/I(h)	home owner-ship rate	age	fraction of high-ed
public	0.316	0.514	1.22	0.129	11.17	0.86	42.25	0.81
	(0.014)	(0.01)	(0.09)	(0.006)	(0.57)	(0.01)	(0.29)	(0.01)
private	0.145	0.498	0.76	0.124	10.03	0.76	41.73	0.42
	(0.011)	(0.009)	(0.05)	(0.006)	(0.56)	(0.01)	(0.3)	(0.02)
urban	0.185	0.512	1.64	0.125	19.02	0.81	49.10	0.50
	(0.006)	(0.005)	(0.11)	(0.003)	(1.06)	(0.01)	(0.21)	(0.01)
rural	0.027	0.468	0.72	0.118	9.43	0.94	52.25	0.14
	(0.003)	(0.006)	(0.04)	(0.003)	(1.03)	(0.004)	(0.23)	(0.01)

This table displays household finance by employment sector and location of residence.

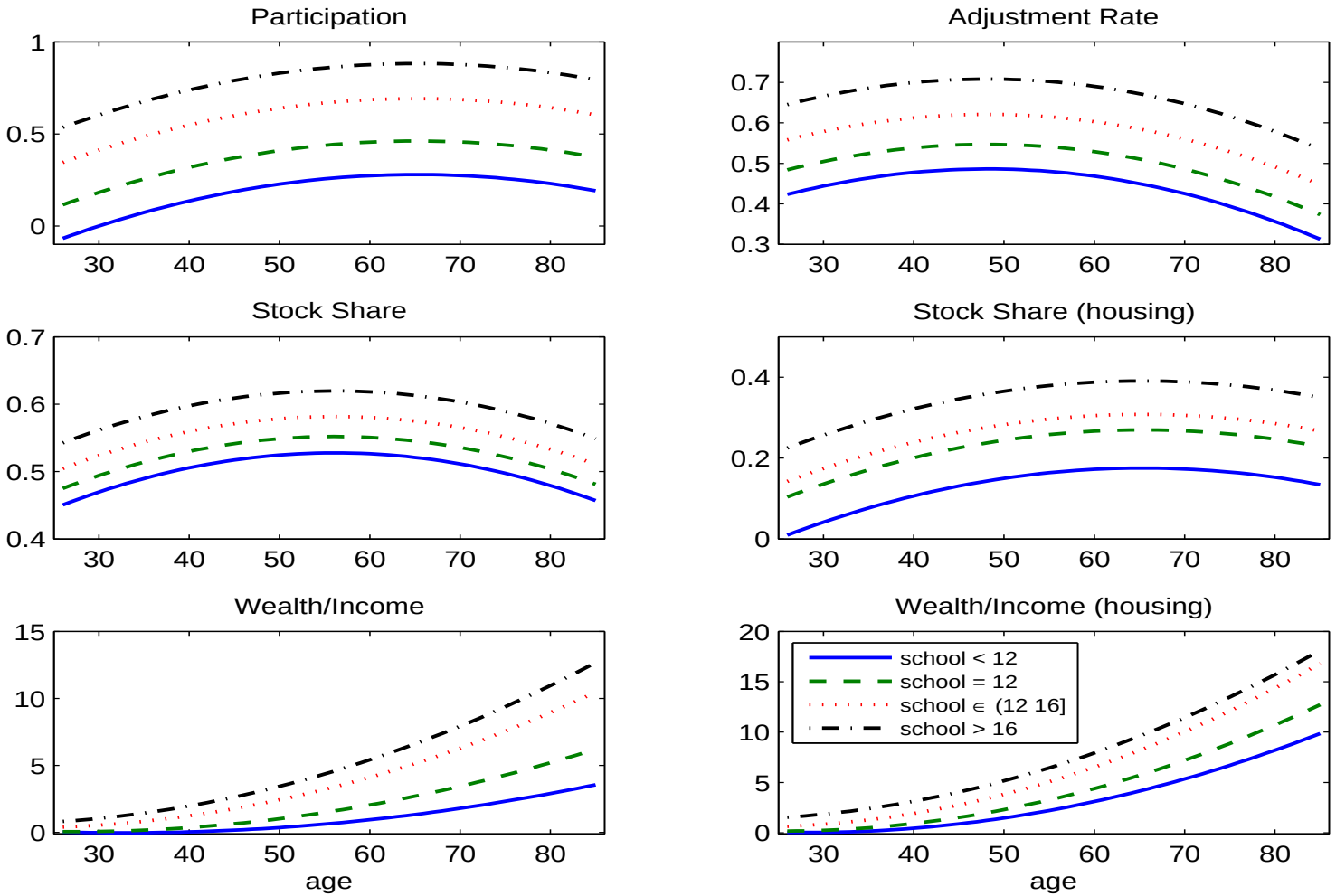

Figure : US: Profiles of Household Financial Decisions

These profiles show the age dependence of household financial decisions. With the exception of the wealth-income equation, these come from a linear regression model with a constant, age, age-squared, time dummies and education dummies as independent variables. For the wealth-income regressions, the independent variables are a constant, age, age-squared, time dummies and education dummies interacted with age and age-squared. For the figures labelled 'housing', home equity is included in the measurement of wealth.

Key Points

- wealth income ratio higher in China
- stock market participation is lower
- education matters, so does sector of employment
- urban HHs participate more than rural HHs
- portfolio share varies much less across groups

What causes these differences?

- exogenous processes
- parameters

Approach

- dynamic choice model of: consumption/saving, participation, stock share
- estimate parameters for US and China using education split
- examine some counterfactuals

Outline

Key ingredients

- a lifecycle model, partial equilibrium
- Households receives exogenous stochastic income and medical expense.
- In each period, a household makes a number of decisions:
  - consumption-saving decision
  - composition of savings
    - whether enter (stay in or exit) the stock market
    - if in the stock market, whether adjustment
    - if adjustment, allocation between stocks and bonds
- no durables (yet)

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Household's optimization: state variables

$\Omega = (y^e, m^e, R, A)$

- income y^e and medical expense m^e,
- asset holding $A = (A^b, A^s)$
- stochastic stock return: R
- e denotes education group

Household's optimization

For household currently not in the stock market

$$w_{e,t}(\Omega) = \max\{w^n_{e,t}(\Omega), w^p_{e,t}(\Omega)\} \tag{3}$$

- $w^n_{e,t}(\Omega)$=value of not participating
- $w^p_{e,t}(\Omega)$=value of participating

Value of not participating

$$w^n_{e,t}(\Omega) = \max_{A^{b\prime} \geq \underline{A^b}} u(c)$$
$$+\beta E_{y^e_{t+1}, m^e_{t+1} | y^e_t, m^e_t} \left\{ \nu^e_{t+1} w_{e,t+1}(\Omega') + (1 - \nu^e_{t+1}) B(R^b A^{b\prime}) \right\}$$

Consumption is given by

$$c = y^e_t + TR - m^e_t + R^b A^b - A^{b\prime}$$

$$TR = \max\{0, \underline{c} - (y^e_t + R^b A^b - m^e_t)\}$$

Value of participating

$$w^p_{e,t}(\Omega) = \max_{A^{b\prime} \geq \underline{A}^b, A^{s\prime} \geq 0} u(c) +$$
$$\beta E_{y^e_{t+1}, m^e_{t+1}, R^{s\prime} | y^e_t, m^e_t, R^s} \left\{ \nu^e_{t+1} v_{e,t+1}(\Omega') + (1 - \nu^e_{t+1}) B(R^b A^{b\prime} + R^{s\prime} A^{s\prime}) \right\}$$

s.t.

$$c = y^e_t + TR - m^e_t + R^b A^b - A^{b\prime} - A^{s\prime} - \Gamma^e \quad (4)$$
$$TR = \max\{0, \underline{c} - (y^e_t + R^b A^b - m^e_t)\} \quad (5)$$

Value of stock market participants

$$v_{e,t}(\Omega) = \max\{v^a_{e,t}(\Omega), v^n_{e,t}(\Omega), v^x_{e,t}(\Omega)\}$$

for all Ω.

Value of adjusting

$$v^a_{e,t}(\Omega) = \max_{A^{b\prime} \geq \underline{A}^b, A^{s\prime} \geq 0} u(c)$$
$$+\beta E_{y^e_{t+1}, m^e_{t+1}, R^{s\prime} | y^e_t, m^e_t, R^s}$$
$$\left\{ \nu^e_{t+1} v_{e,t+1}(\Omega') + (1 - \nu^e_{t+1}) B(R^b A^{b\prime} + R^{s\prime} A^{s\prime}) \right\}$$

$s.t.$

$$c = y^e_t + TR - m^e_t + \sum_{i=b,s} R^i A^i - \sum_{i=b,s} A^{i\prime} - F^e \quad (6)$$
$$TR = \max\{0, \underline{c} - (y^e_t + \sum_{i=b,s} R^i A^i - m^e_t)\} \quad (7)$$

Value of not adjusting

$$v^n_{e,t}(\Omega) = \max_{A^{b\prime} \geq \underline{A}^b} u(c)$$
$$+\beta E_{y^e_{t+1}, m^e_{t+1}, R^{s\prime} | y^e_t, m^e_t, R^s}$$
$$\left\{ \nu^e_{t+1} v_{e,t+1}(\Omega') + (1 - \nu^e_{t+1}) B(R^b A^{b\prime} + R^{s\prime} A^{s\prime}) \right\}$$

$s.t$

$$c = y^e_t + TR - m^e_t + R^b A^b - A^{b\prime} \tag{8}$$
$$A^{s\prime} = R^s A^s \tag{9}$$
$$TR = \max\{0, \underline{c} - (y^e_t + \textstyle\sum_{i=b,s} R^i A^i - m^e_t)\} \tag{10}$$

Value of exiting

$$v^x_{e,t}(\Omega) = \max_{A^{b\prime} \geq \underline{A}^b} u(c)$$
$$+\beta E_{y^e_{t+1}, m^e_{t+1} | y^e_t, m^e_t} \left\{ \nu^e_{t+1} w_{e,t+1}(\Omega') + (1 - \nu^e_{t+1}) B(R^b A^{b\prime}) \right\}$$

$s.t.$

$$c = y^e_t + TR - m^e_t + \sum_{i=b,s} R^i A^i - A^{b\prime} \tag{11}$$
$$TR = \max\{0, \underline{c} - (y^e_t + \sum_{i=b,s} R^i A^i - m^e_t)\}. \tag{12}$$

Preference

CRRA

$$u(c) = \frac{\gamma}{1-\gamma} c^{1-\gamma}.$$

CARA

$$u(c) = -e^{-\gamma c}.$$

EZW

$$V_{e,t} = \left\{ (1-\beta) c^{1-1/\theta} + \beta W_{e,t+1} \right\}^{\frac{1-\gamma}{1-1/\theta}}$$

where

$$W_{e,t+1} = \nu^e_{t+1} [E_t V^{1-\gamma}_{e,t+1}]^{\frac{1-1/\theta}{1-\gamma}} + (1-\nu^e_{t+1}) E_t [B(R^b A^{b'} + R^{s'} A^{s'})^{1-\gamma}]^{\frac{1-1/\theta}{1-\gamma}}$$

Other Elements

- Mortality: $(1 - \nu_t^e)$ each period
- bequest motive

$$B(Z) = L\frac{(\phi + Z)^{1-\gamma}}{1-\gamma}.$$

Outline

Parameters and moments

- Choose the vector of parameters $\Theta \equiv (\beta_i, \gamma, \Gamma, F, L, \phi, \underline{c}, \theta)$, solve the following problem:

$$\mathcal{L} = min_{\Theta}(M^s(\Theta) - M^d)W(M^s(\Theta) - M^d)' \qquad (13)$$

- W is a weighting matrix
- solve DPP to determine $M^s(\Theta)$

Moments

- US: match lifecycle profiles, coefficients on age and age-squared
- China: match young and old
- control for homeownership and house value in regressions of participation and share
- housing return included in "bonds"
- Euler equations not structural, but could use coefficients as moments

Challenges with Chinese Data

- only a single cross section
- cohort effects: old were born in a different world!
  - participation costs are now lower
  - income processes differ: privatization, return to education
  - consumption floor
- approach
  - simulate regime shift for old
  - match 2 groups, over ten year spans (young, old)

Figure : Time line and cohorts

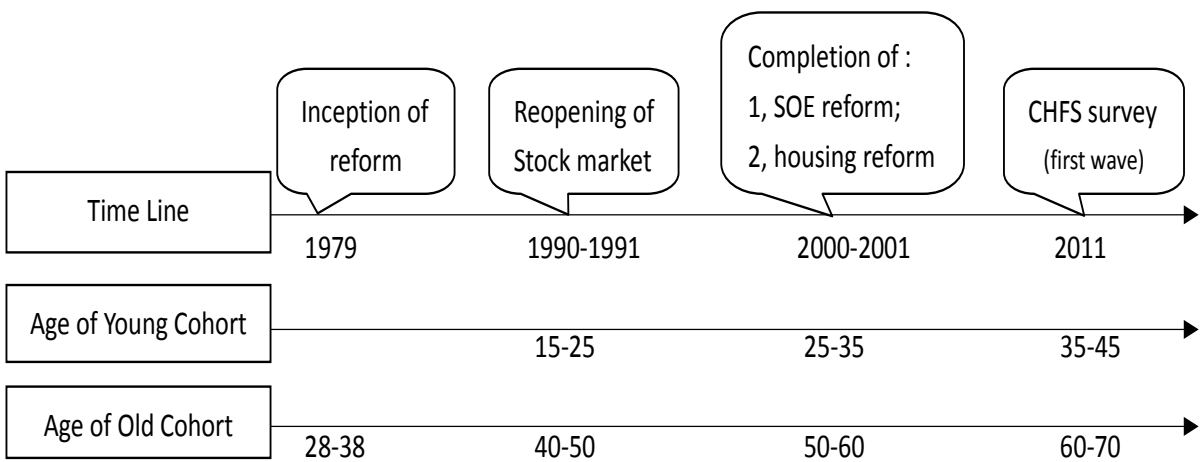
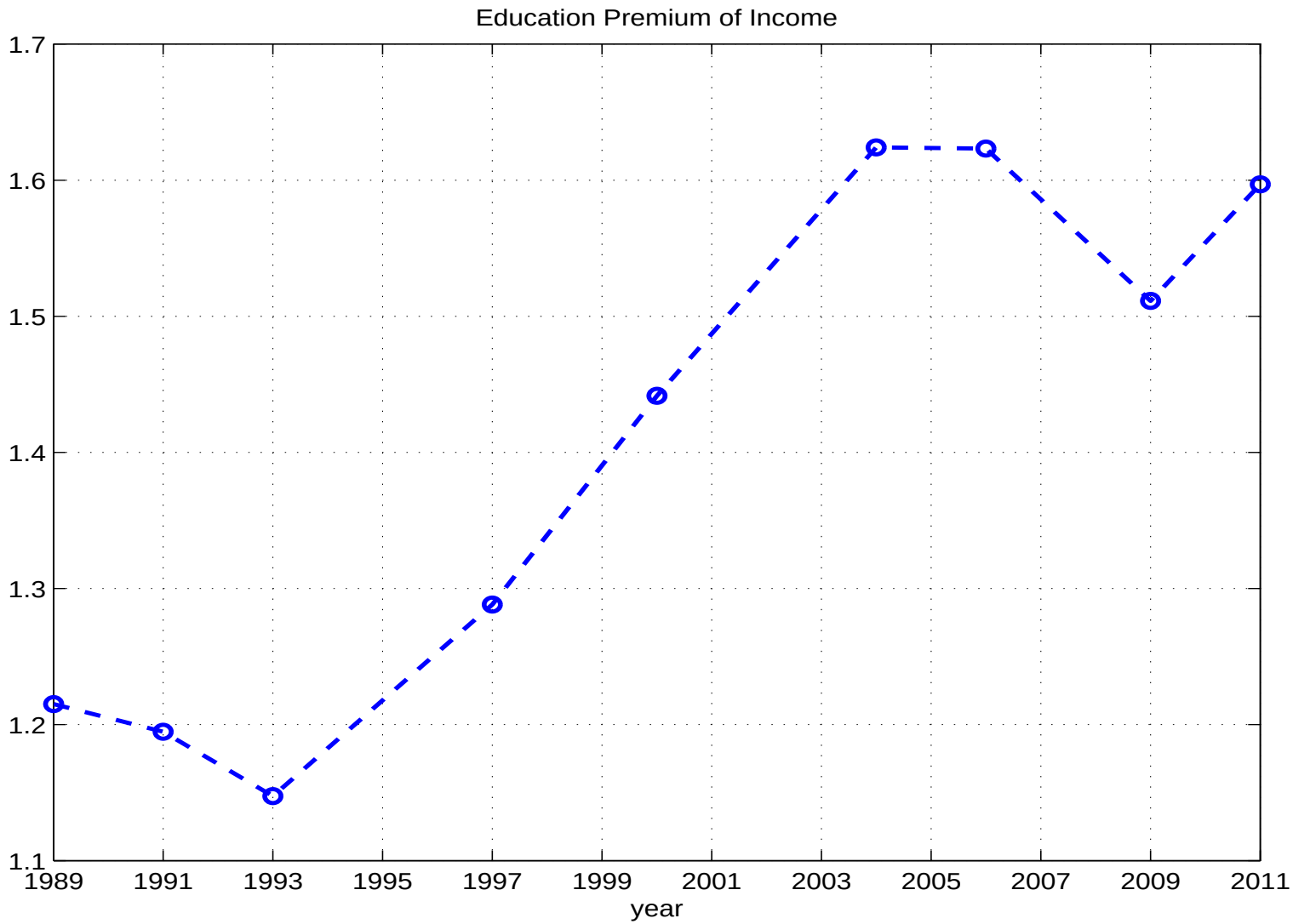


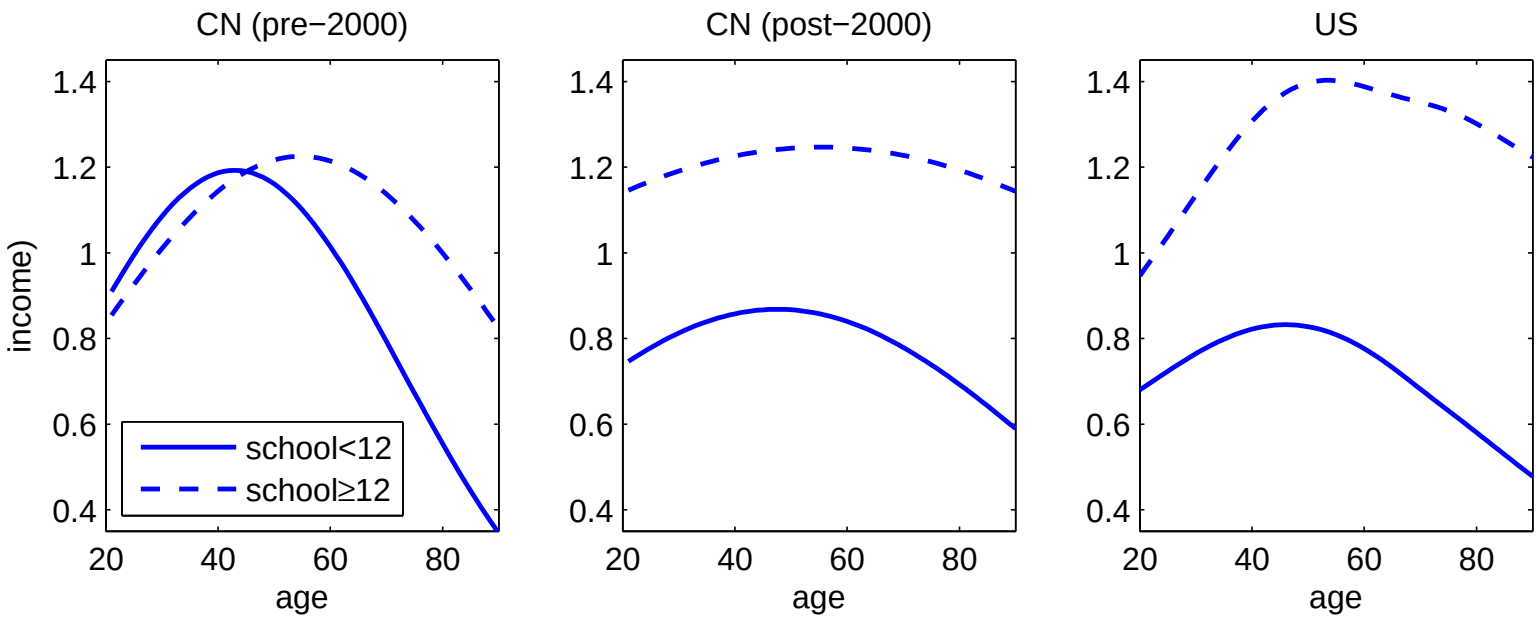
Figure : College Premium



Returns:

- composite bond return is 9%
- stock return is 10.07% on average, std. of 0.47 from 1994 to 2016.
- for US, bond return is 2%, stock return average of 6.33% with std of 0.155

Figure : Age Profile of Income



The figure shows the average profiles of income by education attainment.

Stochastic Income

Table : Stochastic Income Processes

	China pre-2000			China post-2000			US		
Schooling	ρ	var(η)	var(ϵ)	ρ	var(η)	var(ϵ)	ρ	var(η)	var(ϵ)
<12	0.736	0.124	0.382	0.844	0.134	0.329	0.956	0.021	0.152
	(0.023)	(0.023)	(0.035)	(0.012)	(0.013)	(0.026)	(0.010)	(0.005)	(0.026)
≥ 12	0.708	0.059	0.235	0.832	0.076	0.204	0.946	0.028	0.089
	(0.038)	(0.021)	(0.039)	(0.024)	(0.014)	(0.028)	(0.004)	(0.003)	(0.006)

$$\tilde{y}_{i,t} = z_{i,t} + \epsilon_{i,t}$$
$$z_{i,t} = \rho z_{i,t-1} + \eta_{i,t} \quad (14)$$

Stochastic Medical Expense

Table : Stochastic Out-of-pocket Medical Expense Processes

	China pre-2000			US		
	ρ	var(η)	var(ϵ)	ρ	var(η)	var(ϵ)
Overall	0.978	0.077	1.875	0.922	0.0503	0.665
	(0.034)	(0.053)	(0.133)	De Nardi, French and Johes		
Schooling<12	0.987	0.058	1.904	(JPE 2010)		
	(0.029)	(0.038)	(0.134)			
Schooling$\geq$ 12	0.954	0.107	1.825			
	(0.086)	(0.141)	(0.281)			

Table : Parameter Estimates

	β_1	β_2	Γ	F	γ	θ	$\underline{c}$	L	Fit
China Baseline	0.834	0.946	0.264	0.012	6.495	0.367	0.139	2.479	53.876
	(0.017)	(0.015)	(0.068)	(0.005)	(1.644)	(0.075)	(0.052)	(0.869)	
US	0.868	0.887	0.011	0.017	8.399	0.580	0.231	0.056	235.842
	(0.012)	(0.011)	(0.002)	(0.004)	(0.371)	(0.039)	(0.035)	(0.018)	
Identity Matrix	0.856	0.933	0.106	0.047	7.763	0.765	0.064	2.720	4.796
	(0.03)	(0.024)	(0.328)	(0.051)	(0.524)	(0.151)	(0.344)	(0.546)	
Earlier Stock Return	0.820	0.919	0.339	0.014	6.107	0.441	0.159	1.853	63.42
	(0.009)	(0.003)	(0.14)	(0.005)	(1.011)	(0.058)	(0.083)	(0.636)	
Lower Housing Return	0.804	0.985	0.478	0.061	6.284	0.349	0.109	2.434	40.01
	(0.013)	(0.001)	(0.162)	(0.019)	(1.849)	(0.041)	(0.025)	(0.165)	
US return	0.853	0.965	0.464	0.170	8.942	0.459	0.117	3.839	216.389
	(0.006)	(0.01)	(0.037)	(0.044)	(1.83)	(0.024)	(0.081)	(3.12)	
Rural-urban	0.834	0.970	0.298	0.015	6.681	0.392	0.144	2.677	95.770
	(0.022)	(0.022)	(0.158)	(0.004)	(1.768)	(0.169)	(0.067)	(2.002)	
Nonstate-state	0.849	0.949	0.234	0.009	6.627	0.351	0.150	2.685	35.395
	(0.013)	(0.014)	(0.067)	(0.005)	(1.618)	(0.092)	(0.1)	(1.076)	

This table reports parameter values from various estimations. The "US return" estimation imposes US stock return to the Chinese market. The "US Economy" represents the estimation based on the US household finance moments and the US exogenous processes. For the first four cases, β_i for $i = 1, 2$ refers to education groups. For the "Rural-urban", β_1 refers to rural households. For the "Nonstate-state" case, β_1 refers to households with jobs in the non-state sector.

- recursive utility fits best
- β_i: discount factor by education group
- γ: risk aversion
- θ: EIS
- Γ: participation cost fraction of pre-retirement average income
- F adjust cost

Table : China: Moments by Education and Age

	con.	Young		Old	
		Low	High	Low	High
Data					
part.	0.120	-0.059	0.206	-0.059	0.100
share	0.124	-0.002	0.009	-0.038	0.048
W/I	12.478	-1.869	4.444	1.967	5.285
Baseline					
part.	0.122	-0.064	0.205	-0.072	0.077
share	0.071	-0.022	-0.034	-0.030	-0.041
W/I	5.318	1.170	2.187	2.039	3.496
Identity Matrix					
part.	0.121	-0.090	0.014	-0.109	0.135
share	0.076	-0.002	0.012	-0.048	-0.0003
W/I	7.258	-0.188	1.920	2.565	6.274
Earlier Stock Return					
part.	0.123	-0.062	0.195	-0.079	0.104
share	0.090	-0.036	-0.035	-0.038	-0.051
W/I	4.713	0.520	1.792	1.342	3.813
Lower Housing Return					
part.	0.080	-0.079	0.207	-0.079	0.071
share	0.105	-0.010	-0.005	-0.029	-0.024
W/I	5.242	-0.714	3.157	-0.449	4.752
US return					
part.	0.081	-0.081	0.062	-0.076	0.035
share	0.225	-0.008	-0.039	-0.071	-0.043
W/I	6.775	1.142	3.290	1.389	4.788

This table reports model moments from various estimations. Housing is included as part of the risk-free assets in data moments.

Table : Moments of the US Economy

		const.	age	age^2	edu_2	
part	data	-0.68	0.029	-0.00023	0.412	
	(s.e.)	(0.037)	(0.001)	(0.00001)	(0.011)	
	model	-0.559	0.033	-0.0003	0.401	
share	data	-0.101	0.01	-0.00007	0.121	
	(s.e.)	(0.042)	(0.001)	(0.00001)	(0.015)	
	model	0.233	0.008	-0.0001	0.433	
adj	data	0.189	0.012	-0.00013	0.135	
	(s.e.)	(0.100)	(0.003)	(0.00003)	(0.031)	
	model	-0.226	0.009	-0.0001	0.028	
	(s.e.)	const	age	age^2	$age \times edu_2$	$age^2 \times edu_2$
W/I	data	2.473	-0.173	0.00305	-0.008	0.001
	(s.e.)	(1.152)	(0.04)	(0.00043)	(0.027)	(0.00038)
	model	4.917	-0.247	0.0033	-0.069	0.002

This table reports model moments from various estimations. Housing status and wealth are covariates in the regressions. High Education is a dummy

- identity matrix: more weight on W/I ratio
- earlier stock return
- lower housing return
- US stock return
- estimates and moments reported in above tables

Outline

Table : Role of Regime

Age	Pre-retirement		Post-retirement		Distance
Education	Low	High	Low	High	
Baseline					
part	0.070	0.362	0.017	0.078	
share	0.063	0.095	0.038	0.020	
W/I	6.088	7.182	3.571	4.951	
Old Housing Return					8.142
part	0.146	0.682	0.015	0.088	
share	0.104	0.159	0.056	0.057	
W/I	4.157	5.453	1.927	2.681	
Stock Market Always Accessible					0.084
part	0.070	0.362	0.012	0.047	
share	0.063	0.095	0.038	0.026	
W/I	6.088	7.182	3.560	4.919	
Completely New Regime					3.687
part	0.051	0.276	0.000	0.000	
share	0.066	0.082	0.000	0.000	
W/I	6.574	9.276	2.937	5.148	

Other Differences

Table : China: Moments by Type and Age

	con.	Young		Old	
		Rural	Urban	Rural	Urban
Data					
part.	0.117	-0.081	0.224	-0.085	0.134
share	0.121	-0.016	0.016	0.009	0.052
W/I	13.368	-6.792	4.161	-3.653	6.030
Model					
part.	0.114	-0.108	0.219	-0.110	0.103
share	0.077	-0.002	-0.033	-0.033	-0.045
W/I	5.186	0.884	1.988	1.340	4.242
		Non-state	State	Non-state	State
Data					
part.	0.117	-0.015	0.247	-0.028	0.038
share	0.121	-0.001	0.014	0.008	-0.014
W/I	12.312	1.203	-1.151	2.602	3.755
Model					
part.	0.159	-0.015	0.242	-0.035	0.043
share	0.077	-0.025	-0.049	-0.041	-0.036
W/I	5.908	0.774	3.378	2.005	4.781

This table reports model moments from various estimations. Housing is included as part of the risk-free assets in data moments.

Wealth Distribution

Table : Wealth Distribution

	c.v. of wealth	top 5% / *bottom*5%	top 10% / *bottom*10%	top 20% / *bottom*20%	prob. (%) of hitting $\underline{c}$
data	*2.00*	*4117*	*974*	*176*	*n.a.*
Baseline	**1.21**	**4060**	**522**	**91**	**5.9**
Old Income	0.98	1732	388	79	5.4
New Income	1.08	7817	616	93	6
Old Housing Return	1.69	∞	956	227	11.7
New Housing Return	1.05	2513	494	73	5.6
Stock Market Always Accessible	1.21	4064	523	91	5.9
Completely New Regime	0.98	3707	555	76	5.7

This table reports statistics for the wealth distribution from the data, the baseline model and with some counterfactuals.

Outline

Going to the US of A

Key differences

- consumption floor
- participation cost
- income process

Table : US parameters for Chinese Households (with cohort effect)

	Pre-retirement		Post-retirement		Distance
	Low	High	Low	High	
Benchmark	0.070	0.362	0.017	0.078	
	0.063	0.095	0.038	0.020	
	6.088	7.182	3.571	4.951	
US β					7.118
part	0.138	0.048	0.038	0.006	
share	0.067	0.063	0.039	0.021	
W/I	7.382	4.933	4.658	2.977	
US γ					2.015
part	0.046	0.359	0.013	0.059	
share	0.053	0.077	0.019	0.018	
W/I	6.740	7.668	4.026	5.274	
US Γ					1.559
part	0.432	0.636	0.126	0.271	
share	0.066	0.109	0.081	0.031	
W/I	6.217	7.367	3.679	5.077	
US F					0.263
part	0.044	0.258	0.008	0.035	
share	0.070	0.103	0.039	0.020	
W/I	6.075	7.156	3.565	4.930	
US θ					6.596
part	0.023	0.465	0.003	0.182	
share	0.064	0.117	0.019	0.029	
W/I	5.184	8.444	3.366	8.857	
US $\underline{c}$					1.930
part	0.064	0.340	0.008	0.065	
share	0.063	0.098	0.036	0.025	
W/I	5.536	7.014	2.674	4.698	
US stock return					1.598
part	0.104	0.331	0.119	0.271	
share	0.197	0.262	0.192	0.184	
W/I	6.173	7.338	3.719	5.179	

This table reports counterfactuals using US parameters instead of the estimated parameters for Chinese households. In this case, there are cohort effects for Chinese households.

Outline

To Conclude

- approach to estimation when Euler equation does not hold
- Highlight Differences between US and China HH Financial Choices
- To Do
  - Introduce Durables (Housing)
  - Endogenous borrowing constraints
  - Dynamic GE Model to Study
    - Distributions Implications of Asset Market Access
    - Asset pricing