CONSUMPTION AND INCOME WITH LOTS OF HETEROGENEITY

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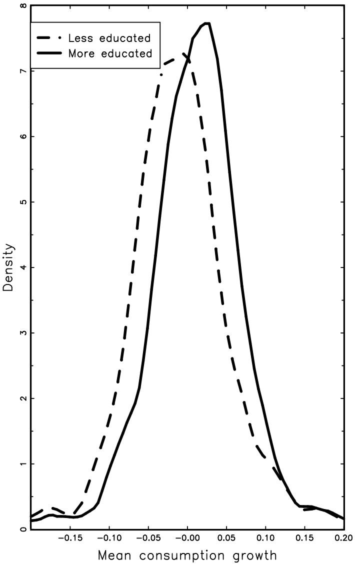
The objective

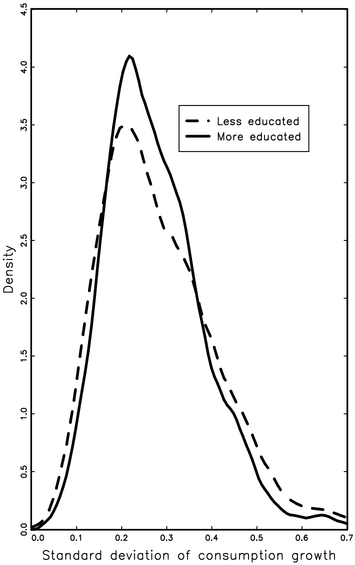
is to provide a framework to estimate "intertemporal allocation parameters (elasticity of intertemporal substitution, discount rate)"
Literature:

- Euler Equation estimation (Hall 1978, Attanasio et al 1999, Alan, Attanasio and Browning (2009)
- Structural estimation, requires assumptions regarding the entire stochastic environment (Gourinchas and Parker (2002), Alan (2006)

Literature assumes a good deal of homogeneity in preferences and underlying stochastic environment.

Evidence of preference heterogeneity





Evidence of income process heterogeneity

- Literature on dynamic models of earnings processes. Large (From Hause 1977) to Meghir and Pistaferi (2004).
- Assumed that everyone has the same process, with different means and variances.
- Likely that different workers have different processes (Some AR(1), some unit root etc)
- Browning and Ejrnaes (2009) adopt a "generalized process" where heterogeneity is conditioned on initial values. (Found a lot of heterogeneity).

What do we do?

We estimate a joint distribution of elasticity of intertemporal substitution and discount rate while taking into account of full income process heterogeneity.

If we have exponential discounting and there are no liquidity constraints, the resulting *exact Euler equation* for consumption growth is (given iso-elastic utility):

$$\left(\frac{C_{t+1}}{C_t}\right)^{-\gamma}(1+r_{t+1})\,\beta = \varepsilon_{t+1}$$

The term ε_{t+1} is a 'surprise' term which satisfies the orthogonality condition:

$$E_t\left(\varepsilon_{t+1}\right) = 1$$

where $E_t\left(.\right)$ denotes the expectation operator conditional on information available at time t.

What do we know about these epsilons?

- We know that they are uncorrelated with past information.
- We know that they depend on contemporaneous income shocks (ignoring interest rate surprises).
- But, we do not know (analytically) how they depend on income shocks.

A good (positive) income shock will result in smaller ε but the magnitude will depend on (among others) : δ, γ, C_0, A_0.

- We also know that they are conditionally heteroskedastic.

A good income shock will increase or decrease the variance in the following period depending on (among others) : δ, γ, C_0, A_0.

Simulated Residual Estimation

- If we knew the distribution of ε, we can define consumption recursively by inverting the exact Euler Equation

$$C_{h,t} = C_{h,t-1}\left[\frac{\varepsilon_{h,t}}{\beta_h(1+r_{h,t})}\right]^{\frac{1}{\gamma_h}}$$

- Of course we need a model for $C_{h,1}$
- Given (panel) data on real interest rates and consumption we can estimate a joint distribution of γ_h and β_h using an indirect estimation approach (like simulated minimum distance).

Unfortunately, we do not know the distribution of ε.

Main observation

Expectation errors of a large range of models with iso-elastic utility can be approximated with a mixture of two-lognormals:

- different income processes
- different impatience levels
- whether agents face binding liquidity constraints or not
- presence of measurement error
- full heterogeneity (preference and income process)

Models (for illustration)

$$U = \frac{C_t^{1-\gamma_h}}{1-\gamma_h}$$

with heterogenous discount rate δ_h.
Income Processes:
Simple iid process : $u_{h,t} \sim N(0, \sigma_u^2)$
Mean reverting process: AR(1): ρ and $u_{h,t} \sim N(0, \sigma_u^2)$
Random walk process: $Y_t = P_t \epsilon_t$ where $\ln \epsilon_t \sim N(-0.5\sigma_\epsilon^2, \sigma_\epsilon^2)$ and $P_t = P_{t-1} Z_t$ where $\ln Z_t \sim N(-0.5\sigma_z^2, \sigma_z^2)$

Parameters:

$\gamma = 2$ and 4
$\delta = 0.02$ and 0.05
$r = 0.02$
$\sigma_u = 0.1$ and 0.2
$\sigma_\epsilon = 0.1$
$\sigma_z = 0.05$ and 0.08

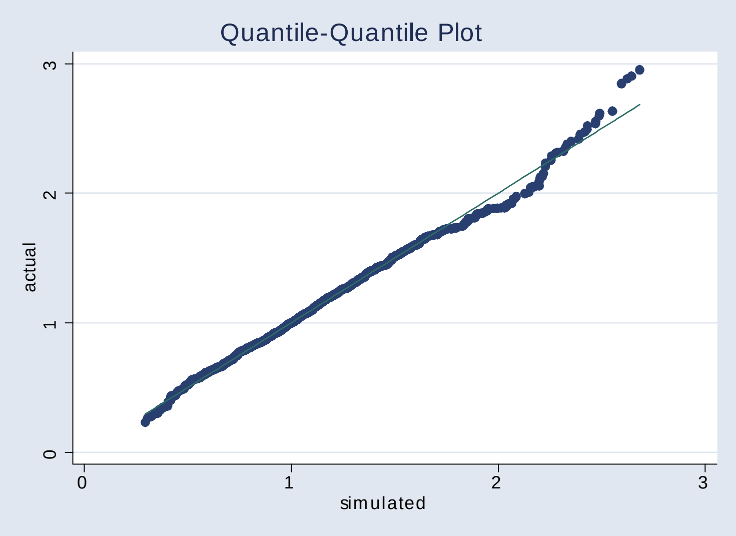
- Combination of all amounts to 24 different (models) types.
- For each model, we generate real expectation errors
- Estimate (via MLE) the parameters of a mixture of two lognormals (two means, two variances and a mixing parameter)
- Test whether the actual errors fit this mixture distribution.

Test for mixture of two-lognormals

critical value for $\chi^2 = 3.89$

	$\gamma = 2$ $\delta = 0.05$ $\sigma = 0.1$	$\gamma = 2$ $\delta = 0.02$ $\sigma = 0.1$	$\gamma = 4$ $\delta = 0.05$ $\sigma = 0.1$	$\gamma = 4$ $\delta = 0.02$ $\sigma = 0.1$
iid	0.06	0.04	0.01	0.02
AR(1)	0.334	0.02	0.01	0.08
RW	0.15	0.07	0.10	0.14
Full heterogeneity		0.1		

Fit for the Fully Heterogenous Model



Conditioning simulated epsilons on Income

Regression of $\ln(\varepsilon_t)$ and $(\varepsilon_t - 1)^2$

	Regression of $\ln(\varepsilon_t)$		Regression of $(\varepsilon_t - 1)^2$
Δy_t	2.24	ε_{t-1}	-1.35
	(0.22)		(0.16)
$\Delta y_t * \gamma$	-0.37	$\varepsilon_{t-1} * \gamma$	0.28
	(0.04)		(0.03)
$\Delta y_t * \delta$	0.66	$\varepsilon_{t-1} * \delta$	-0.41
	(0.06)		(0.04)
$\Delta y_t * C_0$	-3.35	$\varepsilon_{t-1} * C_0$	1.65
	(0.24)		(0.13)
R^2	49%	R^2	

Estimation

- Data PSID 1974-1987, food at home and food at restaurant expenditure.
- No change in marital status, head age 22-60.
- At least two months of assets carried forward.
- More educated (more than 12 years), Less educated (less than 12 years)
- SRE, not using income information.

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	More Educated	Less Educated
Median γ	8.4	6.2
Median β (δ)	0.96 (4.2%)	0.93 (7.5%)
Corr(γ, β)	-0.20	-0.31

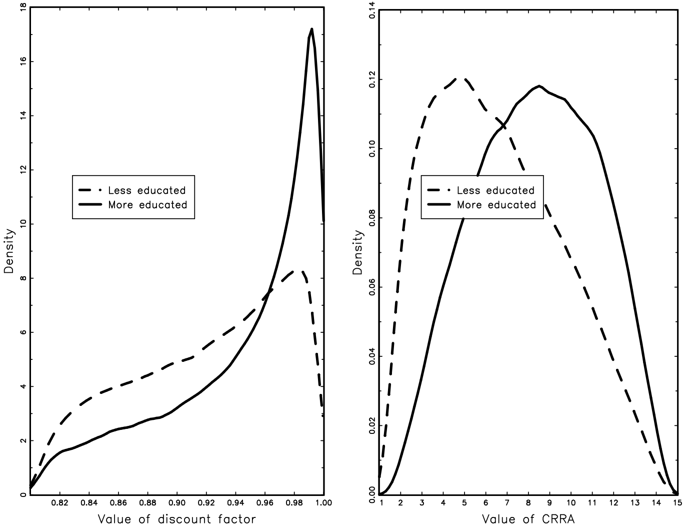

Figure: Marginal distributions of β and γ

Important issues

- modelling initial consumption
- Heterogeneity and uncertainty
- Liquidity constraints
- aggregate shocks