Partial Solution to Problem 2a of Problem Set 1

Reminder: Model

- Representative consumer maximizing:

$$\mathbb{E}\sum\beta^t\left[\frac{b}{e}\log\left[ac_{mt}^e+(1-a)\,c_{nt}^e\right]+(1-b)\log\left(1-h_{mt}-h_{nt}\right)\right]$$

  - $e\equiv\frac{\sigma-1}{\sigma}$ related to elasticity of sub.

- Production in home and market sectors:

$$\begin{aligned} y_m &= s_m k_m^\theta h_m^{1-\theta} \quad &; \quad y_n = s_n k_n^\eta h_n^{1-\eta} \\ y_m &= c_m + \underbrace{i_m}_{k_{t+1}-(1-\delta)k_t} \quad &; \; y_n = c_n \\ k &= k_n + k_m \end{aligned}$$

- Evolution of productivity:

$$s_i=\rho\log s_{i,t-1}+\varepsilon_{it}$$

  - $\gamma\equiv$ correlation between ε_{mt} and ε_{nt}

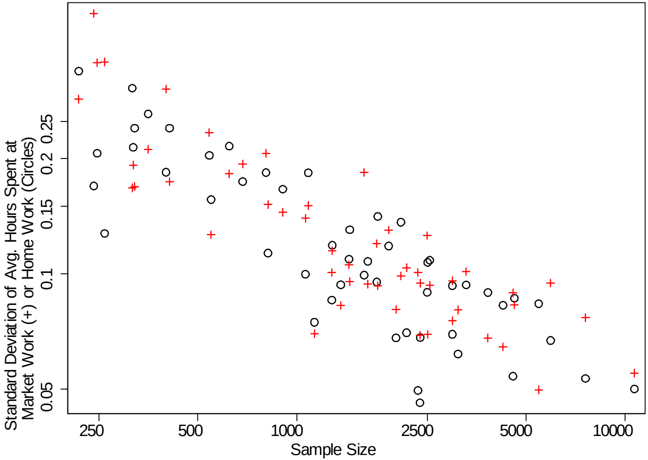
What I did

- Calibrate certain parameters as in Benhabib et al. and Aguiar et al
  - a, b are calibrated to match "Leisure 2" based definitions of average time spent in market work (0.200) and home work (0.115).
  - Use ρ, δ as in Benhabib, adjusted to annual frequency of data.
- Compute home work time and market work time as in Aguiar et al.
  - Residuals from linear national trend in home work time and market work time
- Compute likelihood function of model using the calibrated parameters, plus average time use per state over 2003-2013
  - Parameters to estimate are σ_{ε_n}, σ_{ε_m}, $\gamma_{\varepsilon_m,\varepsilon_n}$, σ.
  - Each state is an independent "closed" economy.
  - Assume: shocks are perfectly independent across states.

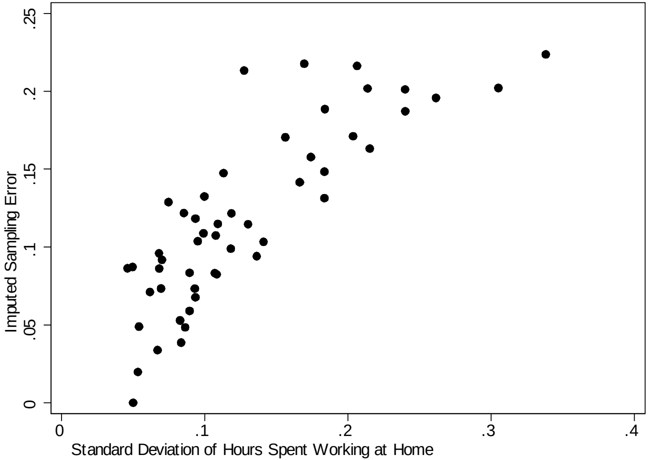
Parameter estimates

	(1)
σ_{ε_n}	0.236
	(0.009)
σ_{ε_m}	0.292
	(0.011)
$\gamma_{\varepsilon_m,\varepsilon_n}$	0.560
	(0.065)
σ	2.661
	(0.164)

Source of variation: Sampling error or true changes?



Imputed sampling error



Parameter estimates

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σ	2.661
	(0.164)

Parameter estimates

	(1)	(2)	(3)
σ_{ε_n}	0.236	0.175	0.090
	(0.009)	(0.008)	(0.007)
σ_{ε_m}	0.292	0.138	0.067
	(0.011)	(0.007)	(0.006)
$\gamma_{\varepsilon_m,\varepsilon_n}$	0.560	0.806	0.849
	(0.065)	(0.047)	(0.058)
σ	2.661	2.515	2.653
	(0.164)	(0.169)	(0.027)

Summary

- Are the parameter estimates reasonable?
  - σ_{ε_n} and σ_{ε_m} are standard deviations of shocks to productivity of individual states.
  - Standard deviation of national productivity:
    $\sigma_{\varepsilon_n}^{\text{National}} = \left(\sum_{i=1}^{51} s_i^2\right)^{\frac{1}{2}} \sigma_{\varepsilon_n}$
  - $\left(\sum_{i=1}^{51} s_i^2\right)^{\frac{1}{2}} = 0.19 \Rightarrow \sigma_{\varepsilon_n}^{\text{National}} \approx 1.7\%$
  - Similarly, $\sigma_{\varepsilon_m}^{\text{National}} \approx 1.3\%$
- Other embellishments
  - Estimate the cross-state covariance of the ε_m and ε_n shocks.
    - Correlation of h_m and h_n, across states, is rather low.
  - National market for capital? National market for certain consumption goods?
  - Calibration to "Leisure 1" time use patterns.