From Individual to Aggregate Labor Supply: A Quantitative Analysis Based on a Heterogeneous Agent Macroeconomy

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Introduction

U.S data: Over business cycle, $\sigma(h) >> \sigma(w)$

In micro estimates: $h_{it} = \gamma w_{it} + \epsilon_{it}$, $\gamma \approx 0.4$

For RBC models with separable preferences, $\gamma \approx 0.4$ fails to generate US data.

Hansen (85) and Rogerson (88)

Non-convex labor supply: $h \in \{0, \bar{h}\}$.

Lotteries used to convexify allocations and generate representative agent.

With separable prefs $\rightarrow u(c,h) = u(c) + Bh \rightarrow$ IES of leisure $= \infty$.

Model

$$U = \max_{\{c_t, h_{mt}, h_{ft}\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t u(c_t, h_{mt}, h_{ft})$$

$$u(c_t, h_{mt}, h_{ft}) = 2\ln(0.5c_t) - B_m \frac{h_{mt}^{1+1/\gamma}}{1+1/\gamma} + B_f \frac{h_{ft}^{1+1/\gamma}}{1+1/\gamma}$$

s.t.

$$c_t = w_t(x_{mt}h_{mt} + x_{ft}h_{ft}) + (1+r_t)a_t - a_{t+1}$$

$$a_{t+1} \geq \bar{a}$$

$$h_{it} \in \{0, \bar{h}\}$$

$$V_{ee}(a, x_m, x_f; \lambda, \mu) = \max_{a' \in A} u(c, \bar{h}, \bar{h}) + \beta E[\max\{V'_{ee}, V'_{en}, V'_{ne}, V'_{nn}\} | x_m, x_f, \lambda]$$

s.t.

$$c = w(x_m \bar{h} + x_f \bar{h}) + (1 + r)a - a'$$

$$a' \geq \bar{a}$$

$$\mu' = T(\lambda, \mu)$$

...

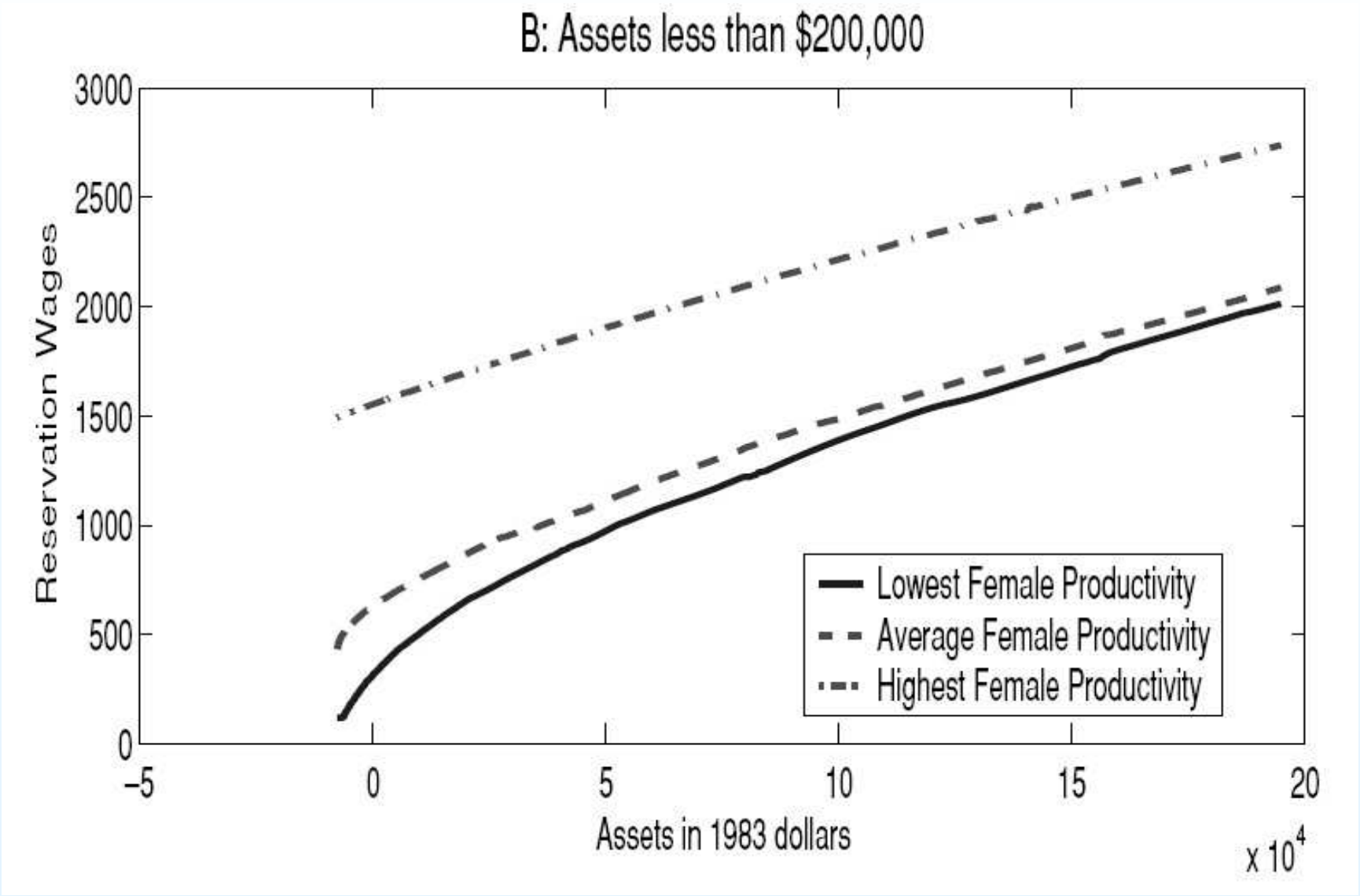
$$V(a, x_m, x_f; \lambda, \mu) = \max\{V'_{ee}, V'_{en}, V'_{ne}, V'_{nn}\}$$

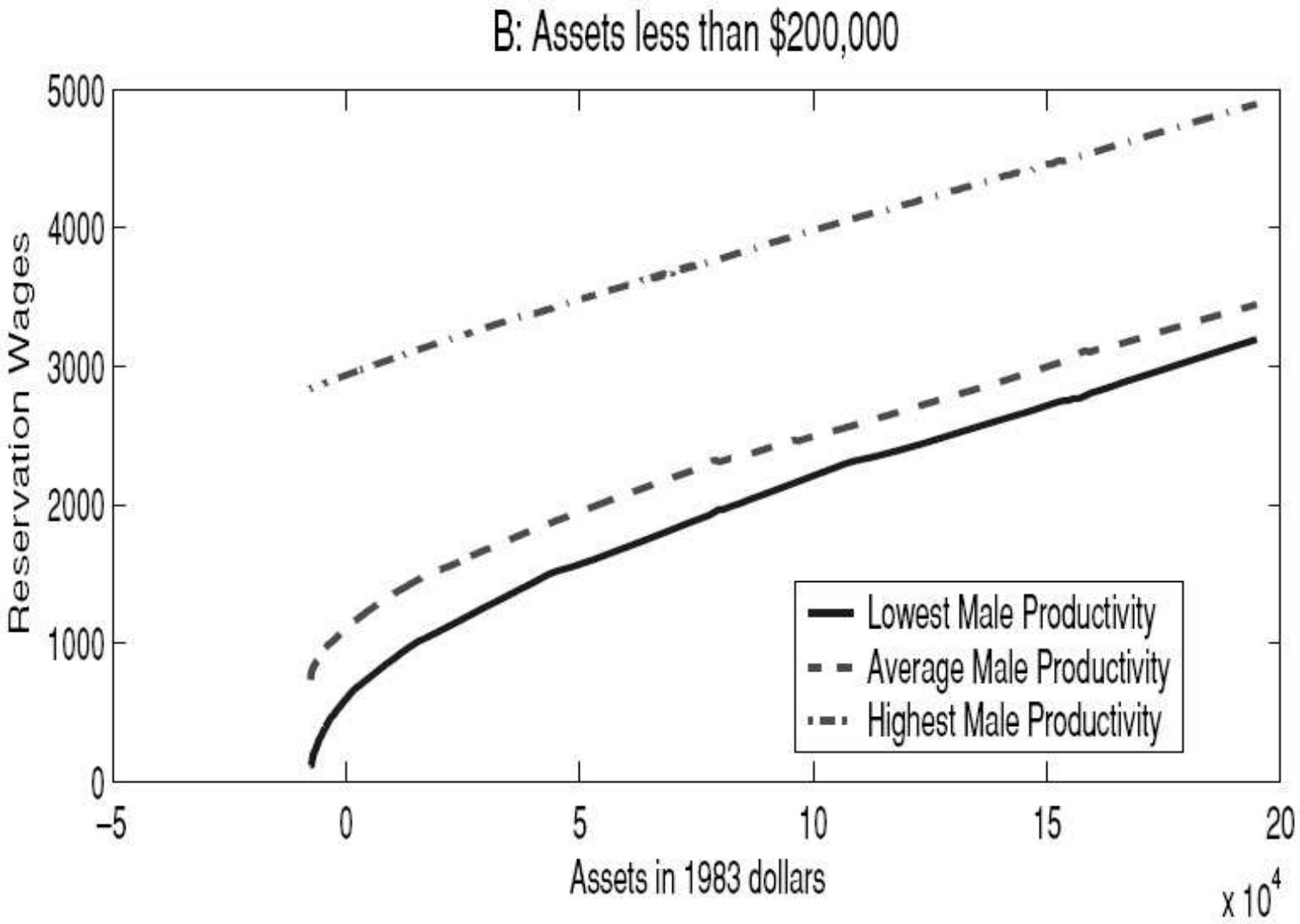
PARAMETERS OF THE BENCHMARK ECONOMY

Parameter	Description
$\alpha = 0.64$	Labor share in production function
$\beta = 0.9807392$	Discount factor
$\gamma = 0.4$	Intertemporal substitution elasticity
$B_m = 93.5$	Utility parameter for male
$B_f = 150.1$	Utility parameter for female
$\bar{h} = 1/3$	Amount of labor supply when working
$\rho_x = 0.948\ (0.925)$	Persistence of productivity x for male (female)
$\sigma_x = 0.269\ (0.319)$	Standard deviation of ϵ_x for male (female)
$\bar{a} = -4.0$	Borrowing constraint

LABOR-MARKET STEADY STATES

	CPS	Model I	Model II
Employment rates			
Male	77.33	77.34	77.36
Female	49.75	49.78	49.75
Aggregate	63.54	63.56	63.56
Fraction of households			
Both members working	43.87	45.35	45.83
Only male working	33.46	31.98	31.52
Only female working	5.88	4.42	3.92
Neither working	16.79	18.23	18.72


B: Assets less than $200,000
Reservation Wages
3000
2500
2000
1500
1000
500
0
−5
0
5
10
15
20
Assets in 1983 dollars
x 10^4
Lowest Female Productivity
Average Female Productivity
Highest Female Productivity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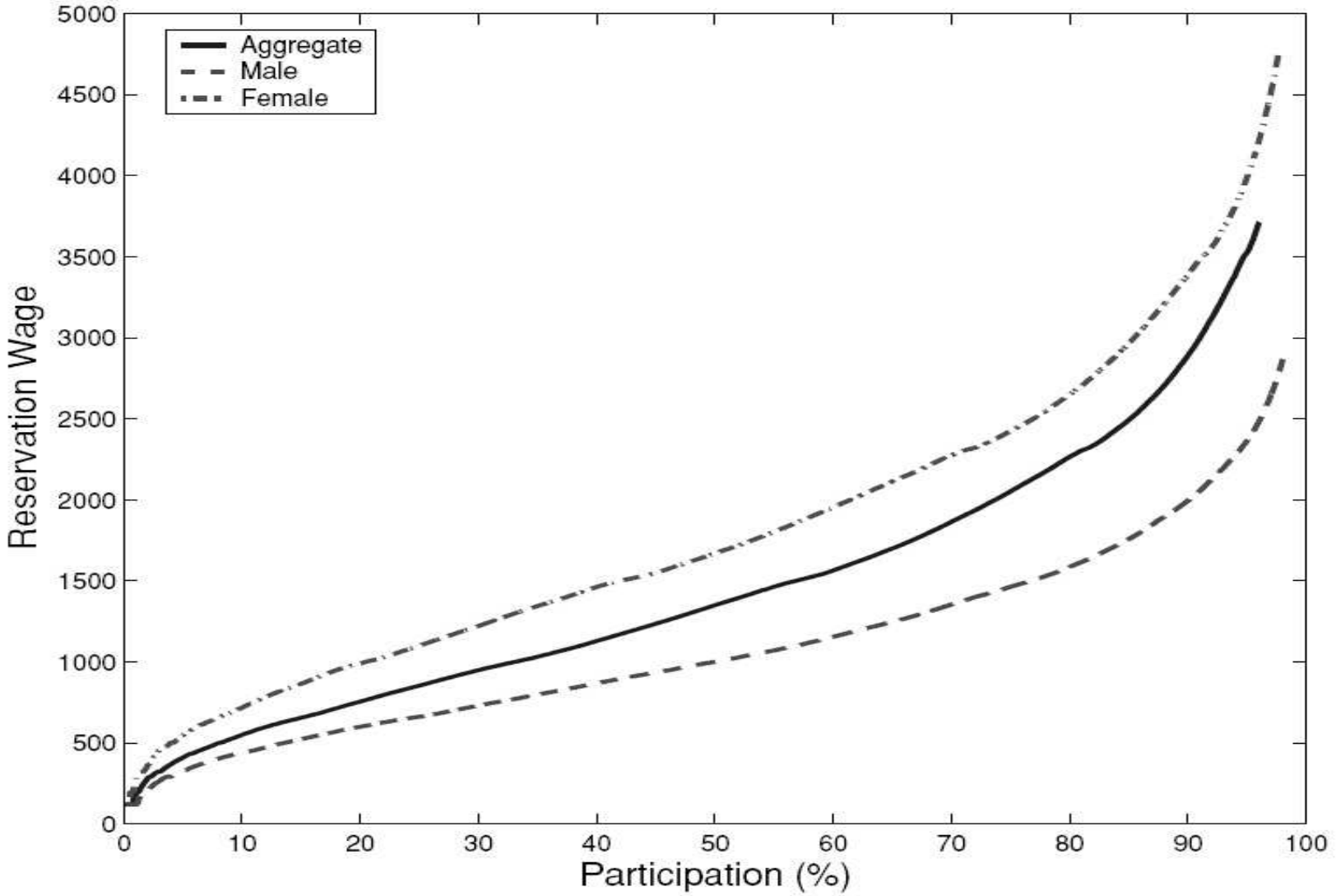
Aggregate
Male
Female
Reservation Wage
Participation (%)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
10
20
30
40
50
60
70
80
90
100

COMPARISON WITH REPRESENTATIVE-AGENT ECONOMIES

			Representative Agent				U.S. Data
	Model I	Model II	$\gamma = 0.4$	$\gamma = 1$	$\gamma = 2$	$\gamma = 4$	1948:I–2000:IV
$\sigma(Y)$	1.53	1.58	1.22	1.38	1.54	1.71	2.22
$\sigma(C)$	0.42	0.40	0.41	0.45	0.49	0.52	0.96
$\sigma(I)$	5.00	5.22	3.72	4.26	4.81	5.39	4.67
$\sigma(N)$	0.72	0.79	0.25	0.50	0.75	1.01	1.78
$\sigma(N)/\sigma(Y)$	0.47	0.50	0.20	0.36	0.49	0.59	0.80
$\sigma(N)/\sigma(Y/N)$	0.82	0.92	0.23	0.55	0.91	1.37	1.61

COMPENSATED LABOR SUPPLY ELASTICITIES
FROM THE MODEL-GENERATED DATA

	Individual Panel		Aggregate
	Male	Female	Time Series
Model I	0.41	0.78	1.08
Model II	0.45	0.89	1.15

NOTES: All estimates are based on the OLS of Equation (13) using model-generated data. The individual labor supply elasticities are based on the annual panel data of 50,000 workers for 30 years. The aggregate estimates are based on the quarterly time series of 3,000 periods.