The Macro Implications of Gender and Marriage

Margherita Borella[1] Mariacristina De Nardi[2] Fang Yang[3]

[1]University of Torino
[2]University of Minnesota, Federal Reserve Bank of Minneapolis, CEPR, and NBER
[3]Louisiana State University

Facts

- Women and married people make up a large fraction of
  - Labor market participants
  - Total hours worked
  - Total earnings
- Wages, labor market participation, hours worked, and savings differ
  - By gender
  - By marital status
- Yet, most papers, unless studying female labor supply
  - Ignore women and marriage
  - Only use data on men

Questions, matching the aggregates in life cycle models

- Can we match
  - Labor participation
  - Hours worked
  - Labor income
  - Net worth
- By ignoring gender and marriage in both models and data and only considering men?
- Other calibration strategies or relatively simple models of marriage that can do better?

Questions, elasticity implications in life cycle models

- Implications for elasticities of hours and participation for
  - Different calibrations
  - Different versions of the models?

Compare the implications of four life-cycle models

- Economy 1: "No marriage, only men"
  - Model: single decision maker (labor supply and savings)
  - Calibration: data on men only
- Economy 2: "No marriage, men and women together"
  - Model: single decision maker (labor supply and savings)
  - Calibration: individual-level data on men and women

Compare the implications of four life-cycle models

- Economy 3: "No marriage, household-level calibration for couples only"
  - Model: single decision maker (labor supply and savings)
  - Calibration: household level data for couples, per capita
- Economy 4: "Marriage and singles"
  - Model: Married and singles. Everyone chooses labor. Spouses also save and consume jointly
  - Calibration: data for married and single men and women

Key results on matching the aggregates

- Economy 1 cannot match participation, and hours, earnings.
- Economy 2 and 3 better match labor income but still miss participation, and hours.
- Economy 4 matches observed data well.
- $\Rightarrow$ Modeling gender and marriage: important to understand aggregates and thus the economy at a point in time!

Key results on the implied elasticities

- Economy 1 $\Rightarrow$ lowest elasticities
- Economy 2 and 3 $\Rightarrow$ higher elasticities
- Economy 4 $\Rightarrow$ very heterogenous elasticities by gender and marital status
- $\Rightarrow$ Modeling gender and marriage: important to understand elasticities and thus the models' dynamics!

Related literature

- Female labor supply: Attanasio et al. (2005, 2008), Gemici and Laufer (2012), Love (2010), Hong and Rios-Rull (2012), Eckstein et al. (2011 and 2016)...
- Labor supply elasticity: Keane and Rogerson (2012), Meghir and Phillips (2008)...
- Changes in taxation and Social Security rules: Guner, Kaygusuz and Ventura (2012), Kaygusuz (2012), Nishiyama (2012), Low et al. (2016), Blundell et al. (2016)...

Road Map

- Data
- Models
- Calibration
- Results
- Conclusions

Data and Methodology

- Data
  - PSID: Earnings, wages, hours, participation, marital status, gender, and wealth
  - HRS: Survival
- Methodology
  - Pick the 1941-1945 birth cohort and follow it over their life cycle
  - Take its initial conditions and exogenous processes from data (data inputs)
  - Study the evolution of its endogenous variables and match them to data (data outputs)

Fraction of married and single men and women by age

Age Group	25	35	45	55	65
Fraction of married women	0.43	0.42	0.40	0.39	0.37
Fraction of married men	0.43	0.46	0.44	0.43	0.44
Fraction single women	0.07	0.07	0.10	0.12	0.13
Fraction of single men	0.07	0.05	0.06	0.06	0.06

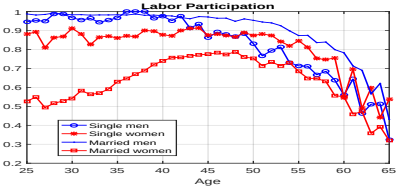
- Single decision makers are a minority in the data.
- Among the working age workers single men are only about 6%.

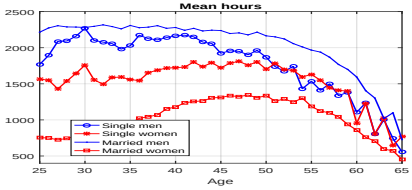
Women and married people as a fraction of workers, hours, or earnings

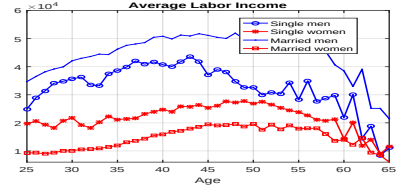
Age Group	25	35	45	55	65
Fract. women among workers	0.37	0.40	0.46	0.46	0.44
Fract. hours worked by women	0.28	0.31	0.39	0.40	0.40
Fract. earnings by women	0.24	0.22	0.30	0.27	0.27
Fract. married among workers	0.86	0.85	0.84	0.82	0.78
Fract. hours worked by married	0.86	0.86	0.84	0.83	0.80
Fract. earnings by married	0.88	0.87	0.86	0.87	0.85

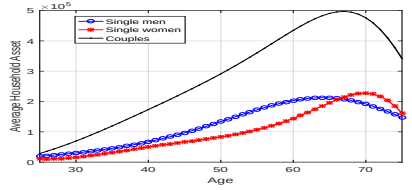
- The aggregates are comprised of large fraction of women and married people.

Single and married men and women over the life cycle









Key data facts, summary

- Single decision makers are a minority in the data
- Aggregates are comprised of large fraction of women and married people
- Married couples' behavior is very different from that of singles

Key model features for the more general model

- Lifecycle model
- Partial equilibrium, cohort level analysis
- Period length: one year
- Working stage (t_0 to t_r)
  - Alive for sure
  - Face shocks to their labor productivity
  - Either are married or single
  - Singles and people in couples can choose to work and hours
  - Fixed cost of working
- Retirement stage (t_r to T)
  - Exogenous probability of death. Thus, married people might lose their spouse.

Household preferences

- Discount factor: β.
- Singles:

$$v(c_t, l_t) = \frac{(c_t^{\omega} l_t^{1-\omega})^{1-\gamma} - 1}{1-\gamma}$$

- Couples:

$$w(c_t, l_t^1, l_t^2) = \frac{((\frac{c_t}{2})^{\omega}(l_t^1)^{1-\omega})^{1-\gamma} - 1}{1-\gamma} + \frac{((\frac{c_t}{2})^{\omega}(l_t^2)^{1-\omega})^{1-\gamma} - 1}{1-\gamma}$$

- Labor participation cost (time cost): $\phi_t^{i,j}$.
- j = marital status, i = gender.

Wage processes for men and women

- Deterministic age-efficiency profile: $e_t^{i,j}$.
- Shocks: AR(1) process

$$\ln \epsilon_{t+1}^i = \rho_\varepsilon^i \ln \epsilon_t^i + \upsilon_t^i, \ \upsilon_t^i \sim N(0, \sigma_\upsilon^2).$$

- Total productivity: $e_t^{i,j} \epsilon_t^i$

Recursive problem for working-age singles

$$W_t^{s,i}(a_t^i, \epsilon_t^i) = \max_{c_t, a_{t+1}, n_t} \left[v(c_t, 1 - n_t - \phi_t^{i,1} I_{n_t}) + \beta E_t W_{t+1}^{s,i}(a_{t+1}^i, \epsilon_{t+1}^i) \right]$$

$$Y_t = e_t^{i,j} \epsilon_t^i n_t \tag{1}$$

$$c_t + a_{t+1}^i = (1 + r) a_t^i + (1 - \tau_{SS}) Y_t \tag{2}$$

$$a_t \geq 0, \quad n_t \geq 0, \quad \forall t \tag{3}$$

Recursive problem for retired singles

$$R_t^{s,i}(a_t) = \max_{c_t, a_{t+1}} \left[v(c_t, 1) + \beta s_t^{s,i} R_{t+1}^{s,i}(a_{t+1}) \right] \tag{4}$$

$$c_t + a_{t+1} = (1 + r)a_t + Y_r^{i,j} \tag{5}$$

$$a_t \geq 0, \quad \forall t \tag{6}$$

Recursive problem for working-age couples

$$W_t^c(a_t, \epsilon_t^1, \epsilon_t^2) = \max_{c_t, a_{t+1}, n_t^1, n_t^2} \Big[w(c_t, 1 - n_t^1 - \phi_t^{1,2} I_{n_t^1}, 1 - n_t^2 - \phi_t^{2,2} I_{n_t^2}) + \beta E_t W_{t+1}^c(a_{t+1}, \epsilon_{t+1}^1, \epsilon_{t+1}^2) \Big] \tag{7}$$

$$Y_t^i = e_t^{i,j} \epsilon_t^i n_t^i \quad i = 1, 2 \tag{8}$$

$$c_t + a_{t+1} = (1 + r) a_t + (1 - \tau_{SS})(Y_t^1 + Y_t^2) \tag{9}$$

$$a_t \geq 0, \quad n_t^1, n_t^2 \geq 0, \quad \forall t \tag{10}$$

Recursive problem for retired couples

$$R_t^c(a_t) = \max_{c_t, a_{t+1}} \Big[w(c_t, 1, 1) + \beta s_t^{c,1} s_t^{c,2} R_{t+1}^c(a_{t+1}) + \beta s_t^{c,1}(1 - s_t^{c,2}) R_{t+1}^{s,1}(a_{t+1}) + \beta s_t^{c,2}(1 - s_t^{c,1}) R_{t+1}^{s,2}(a_{t+1}) \Big] \tag{11}$$

$$c_t + a_{t+1} = (1 + r) a_t + (Y_r^{1,c} + Y_r^{2,c}) \tag{12}$$

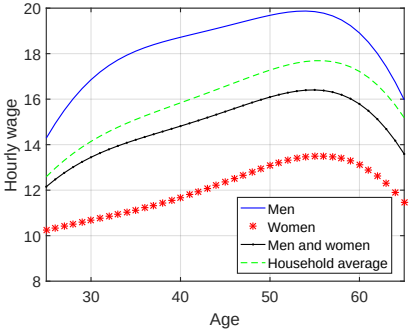
$$a_t \geq 0 \quad \forall t \tag{13}$$

Exogenous parameters common across economies

Parameters		Value
r	Interest rate	4%
γ	risk aversion coefficient	2
τ_{SS}	Social Security tax rate on employees	3.8%

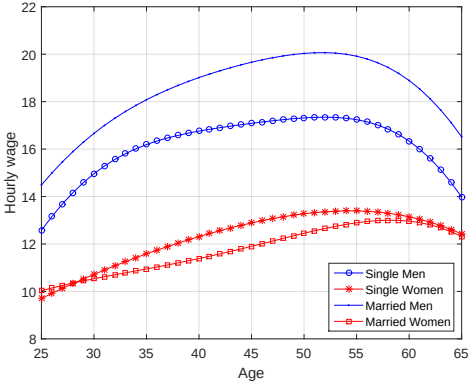
Table: Calibration of the interest rate, risk aversion, and Social Security tax rate

PSID: Wages over the life cycle (in $1998)



- Women's wages are significantly lower than men's wages.

PSID: Wages over the life cycle (in $1998)



- Women's wages are significantly lower than men's wages.
- Single men's wages are significantly lower than married men's wages.

Wage process

Parameter	Men	Women	Men, Women together	Married households
Persistence	0.973	0.963	0.973	0.972
Variance	0.016	0.014	0.021	0.013
Initial variance	0.128	0.122	0.163	0.078
Used in	1, 4	4	2	3

Table: Estimated processes for the wage shocks for men and women (PSID data)

HRS: Survival rates

Gender	U.S. life tables	All	Single	Married
At age 70				
Women	16.4	16.4	15.4	17.5
Men	14.2	13.5	11.5	14.0
At age 80				
Women	9.6	9.7	9.5	10.3
Men	8.2	8.0	7.3	8.2
At age 90				
Women	4.8	4.6	4.6	4.8
Men	4.0	3.8	3.7	3.9

Table: Life expectancy at ages 70, 80 and 90 in years. First column: U.S. life tables from Social Security Administration. Other columns: Our computations based on HRS data

Results

- Economy 1: "No marriage, only men"
  - Only heterogenous by age and realized earnings shocks
  - Only labor supply and saving decisions by (single) men
  - Calibrated using data on men
- Economy 2: "No marriage, men and women together", calibrated using data on both men and women together, as individual-level data.
- Economy 3: "No marriage, household-level calibration for couples only", calibrated by aggregating the data at the household level and we only keep couples.
- A rich life-cycle economy
  - Heterogeneous by gender, marital status, wages, and life expectancy
  - Everyone can choose to supply labor, and spouses also save and consume jointly
  - Calibrated using data for married and single men and women

Results from each model

- Calibrated parameters
- Fit of life cycle profiles being targeted
- Fit of the aggregate life cycle profile for the actual data
- Elasticities of hours and participation by age

Economy 1: The singles economy, calibrated parameters

- Model: single decision maker
- Calibration: data on men only

Parameters		Value
β	Discount factor	0.957
ω	Consumption weight	0.510
$\phi_t^{i=1,j}$	Labor participation cost	0.283
$Y_r^{i=1,s}$	Social Security benefit	\$8023

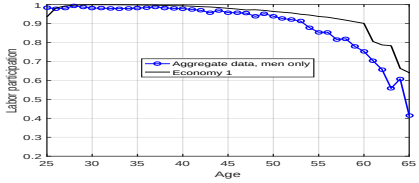
Table: Parameters in the singles economy

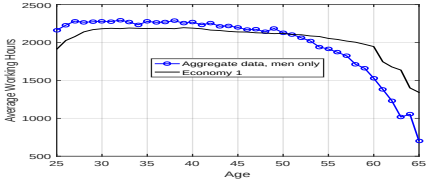
The singles economy, model fit

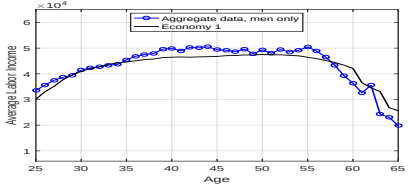
Moments	Data	Model
SS budget deficit	0.000	0.002
Average assets, men at 50	148710	149017
Average hours, men at 50	2129	2120
Participation, men at 50	0.939	0.964

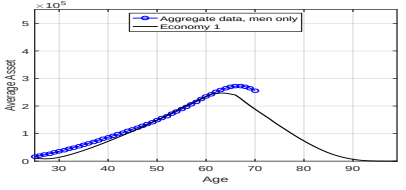
Table: Target moments for the singles economy (from PSID and HRS data) and model fit. The SS budget deficit is expressed as the ratio to SS budget for this cohort

The singles economy, profiles fit

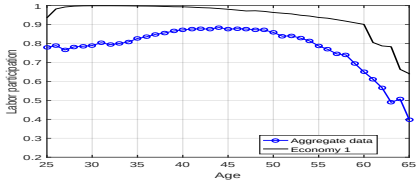


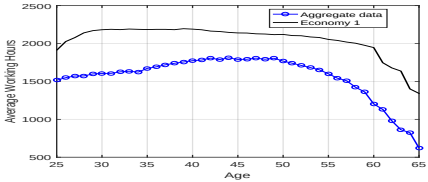


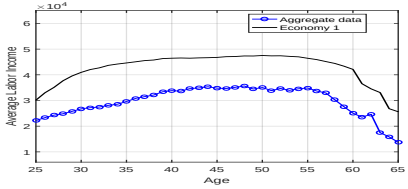


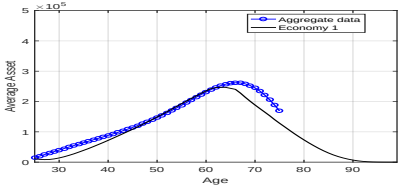


Aggregating up the profiles by gender and marital status









Economy 2, a no marriage economy calibrated to men and women together, calibrated parameters

Parameters		Value
β	Discount factor	0.958
ω	Consumption weight	0.471
$\phi_t^{i=1,j}$	Labor participation cost	0.302
$Y_r^{i=1,s}$	Social Security benefit	\$5006

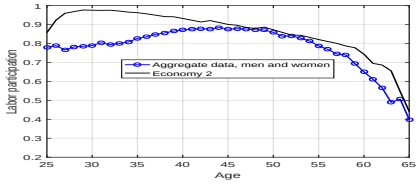
Table: Parameters used in the singles economy

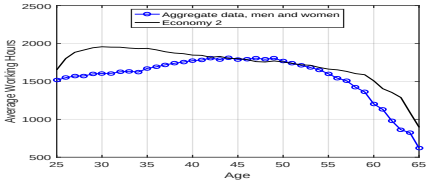
Economy 2, a no marriage economy calibrated to men and women together, model fit

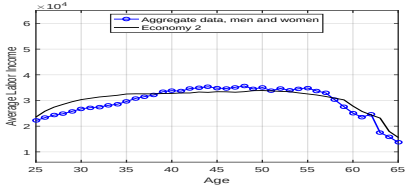
SS budget deficit	0.000	−0.001
Average assets, individuals at 50	147134	147530
Average hours, individuals at 50	1768	1758
Participation, individuals at 50	0.859	0.872

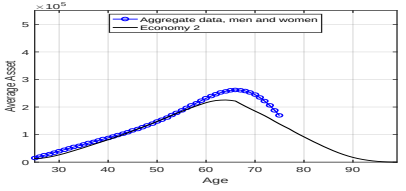
Table: Target moments for the singles economy (from PSID and HRS data) and model fit. The SS budget deficit is expressed as the ratio to SS budget for this cohort

Aggregating up the profiles by gender and marital status









Economy 3, a no marriage, household-level calibration for couples only, calibrated parameters

Parameters		Value
β	Discount factor	0.964
ω	Consumption weight	0.412
$\phi_t^{i=1,j}$	Labor participation cost	0.218
$Y_r^{i=1,s}$	Social Security benefit	\$5070

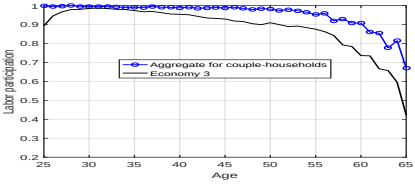
Table: Parameters used in the singles economy

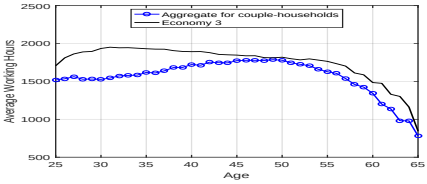
Economy 3, model fit

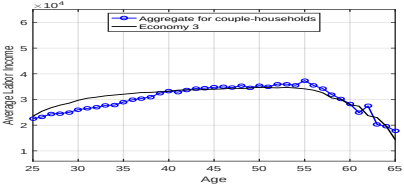
Moments	Data	Model
SS budget deficit	0.000	0.001
Average assets, households at 50	150030	149042
Average hours, households at 50	1780	1819
Participation, households at 50	0.982	0.910

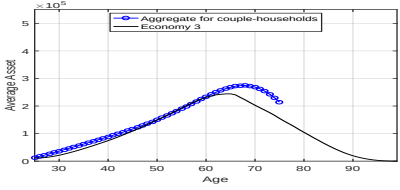
Table: Target moments for the singles economy (from PSID and HRS data) and model fit. The SS budget deficit is expressed as the ratio to SS budget for this cohort

Economy 3, profiles fit

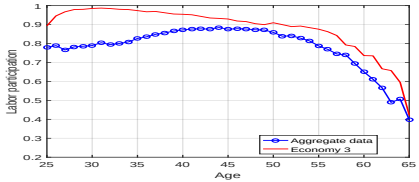


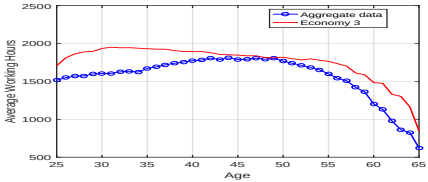


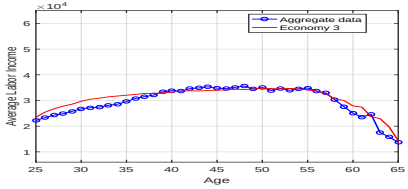


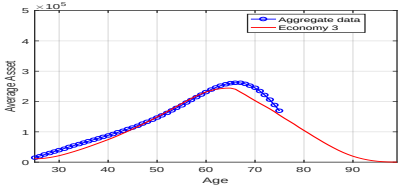


Aggregating up the profiles by gender and marital status









Economy 4: The marriage economy, parameters

Parameters		Value
β	Discount factor	0.959
ω	Consumption weight	0.499
$\phi_t^{i=1,j}$	Men participation cost	0.318
$\phi_t^{i=2,j=1}$	Single women part. cost	0.385
$\phi_t^{i=2,j=2}$	Married women part. cost	See next
$Y_r^{i=1,s}$	Single men SS benefit	$\$6,764$

Table: Parameters used in the marriage economy.

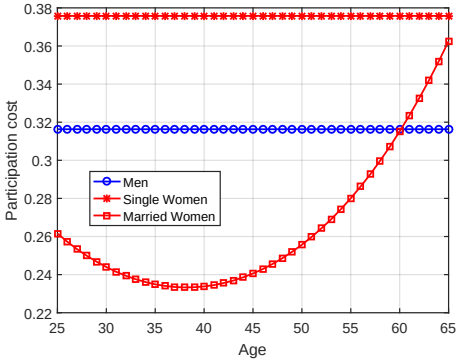
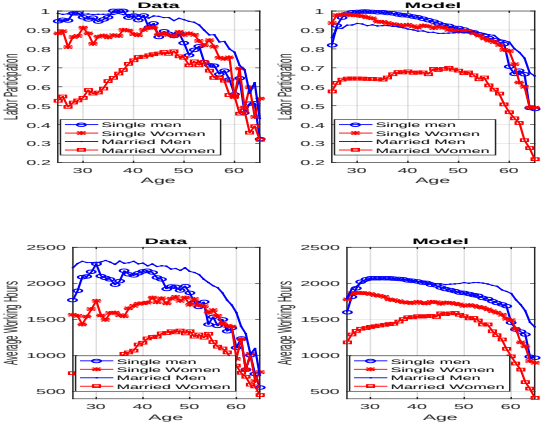


Figure: Calibrated lifecycle labor participation cost in time

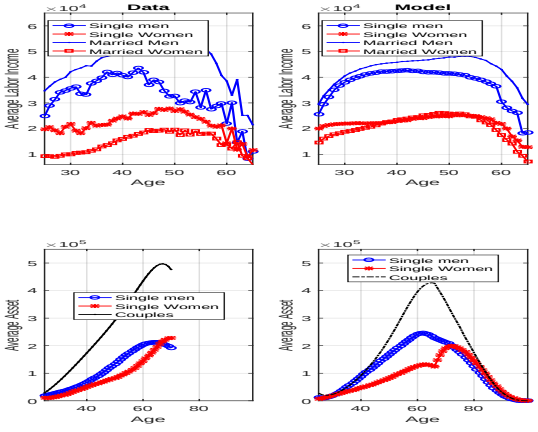
The marriage economy, model fit

Moments	Data	Model
SS budget deficit	0.000	0.009
Avg. assets, single men at 50	133821	157842
Avg. assets, single women at 50	83156	85419
Avg. assets, couples at 50	291433	214084
Avg. hours, single men at 50	1869	1825
Avg. hours, single women at 50	1703	1675
Avg. hours, married men at 50	2165	2053
Avg. hours, married women at 50	1337	1563
Part., single men at 50	0.831	0.883
Part., single women at 50	0.875	0.889
Part., married women at 30	0.542	0.611
Part., married women at 40	0.740	0.716
Part., married women at 50	0.754	0.681
Part., married women at 60	0.551	0.488

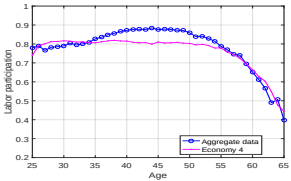
The marriage economy, profiles fit

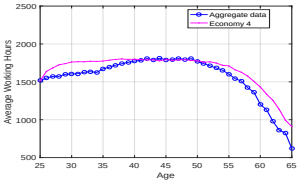


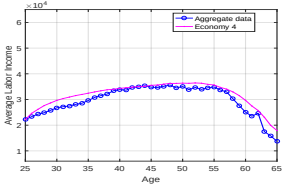
The marriage economy, profiles fit

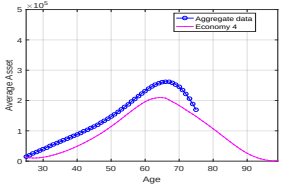


Aggregating up the profiles by gender and marital status









Aggregating up the profiles, what have we learned?

- The economy with only men, calibrated using men
  - Overestimates participation by 10 percentage points
  - Overestimates average hours by about 500 hours
  - Overestimates average earnings by age
- Adding women in the calibration helps in fitting the aggregates.
- The marriage economy does a much better job of fitting aggregate behavior by age

Aggregating up the profiles, what have we learned?

- The economy with only men, calibrated using men
  - Overestimates participation by 10 percentage points
  - Overestimates average hours by about 500 hours
  - Overestimates average earnings by age
- Adding women in the calibration helps in fitting the aggregates.
- The marriage economy does a much better job of fitting aggregate behavior by age

Compensated elasticities by age (singles economies)

	Participation in economy			Hours in economy		
Age	1	2	3	1	2	3
30	0.01	0.37	0.25	0.49	1.13	0.94
40	0.06	0.89	0.58	0.47	1.59	1.29
50	0.24	1.29	0.53	0.73	1.75	1.16
60	0.36	1.32	2.68	0.74	1.87	3.11

- Elasticity increases by age.
- Economy 1 has the lowest elasticity.

Compensated elasticity by age (marriage economy)

	Participation					Hours				
	Single		Married			Single		Married		
	M	W	M	W	All	M	W	M	W	All
30	0.02	0.23	0.07	1.02	0.39	0.11	0.75	0.37	1.01	0.59
40	0.34	0.54	0.22	1.85	0.86	0.67	0.99	0.66	2.26	1.29
50	0.99	1.50	0.49	1.76	1.06	1.40	1.96	0.95	2.14	1.49
60	0.83	3.42	0.91	1.59	1.30	1.68	3.57	1.42	2.14	1.80

- Large heterogenity
- Larger elasticity for women

Conclusions

- Substantial differences by gender and marital status in
  - Labor market outcomes
  - Savings
- Women and marriage matter for
  - The aggregates
  - Labor supply elasticities
- Modeling marriage and gender is important!