The Optimal Progressivity of Income Tax for Couples

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Progressive Taxation

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  - It measures how strongly marginal tax rates increase between incomes
- What is a progressive tax
  - Tax rate increases with taxable income.

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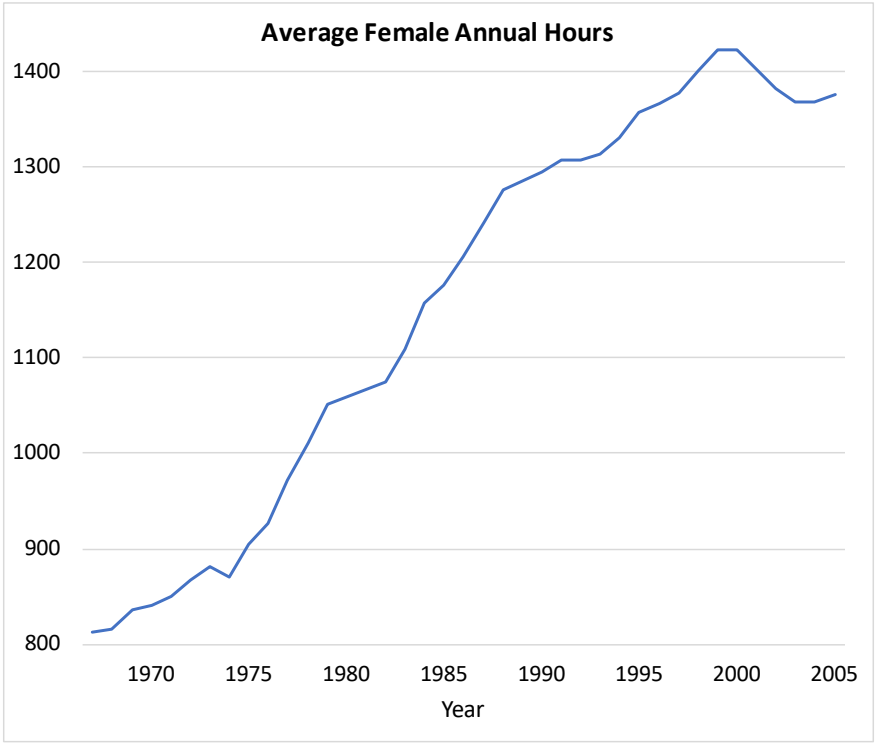
- Purposes
  - Social insurance against ex-ante heterogeneity and earnings uncertainty
  - Promote equality
- Drawback
  - Distortions to labor supply
  - Reduce tax revenue

Literature

- Life-cycle model with incomplete markets and heterogeneous agents
  - Conesa and Krueger (JME '06): numerical solutions
- A tractable equilibrium model shows the welfare trade-off of optimal progressivity
  - Heathcote et al. (QJE'17): analytical solutions
- The main shortcoming of these papers
  - Ignore single female and couples
  - Ignore Institutional feature of the U.S. tax system

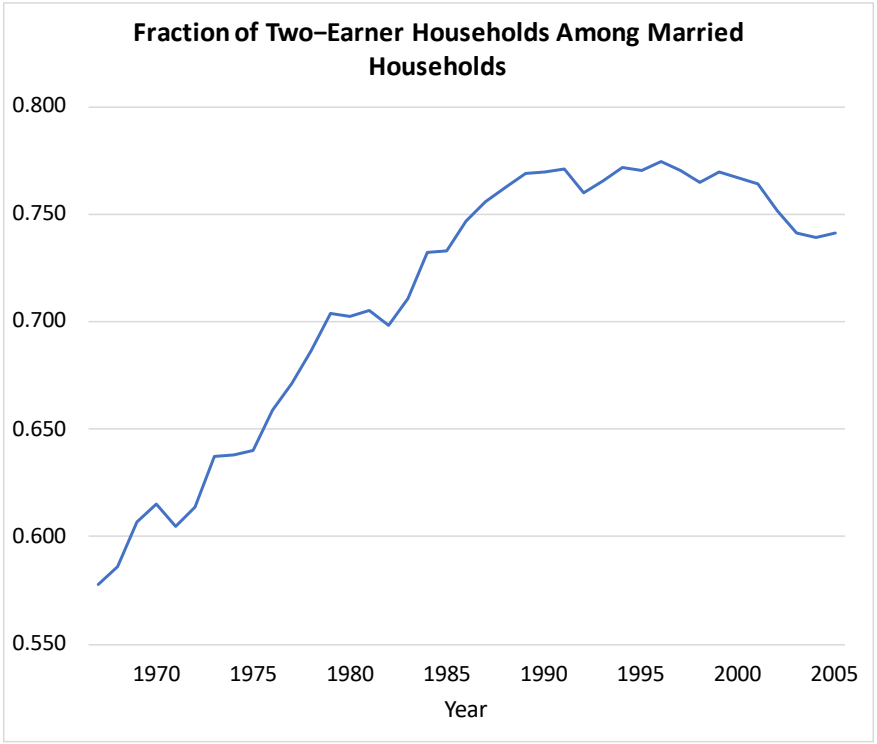
Rise in female labor supply



Source: Heathcote at al. (2010)

- Female plays an increasing role in labor market
- Features of female increase the distortion of progressivity
  - Higher elasticity of labor supply and labor participation cost

Rising fraction of two-earner households



Source: Heathcote at al. (2010)

- Rising fraction of two-earner households
- Institutional feature of the U.S. tax system
  1. Tax systems for singles and couples are different
  2. Couples: tax filing jointly or separately

Questions to answer

- What is the optimal tax progressivity in the presence of females and couples
  1. Females have higher elasticity of labor supply and labor participation cost
  2. Couples are taxed either separately or jointly, which matters to a second earner labor supply decision

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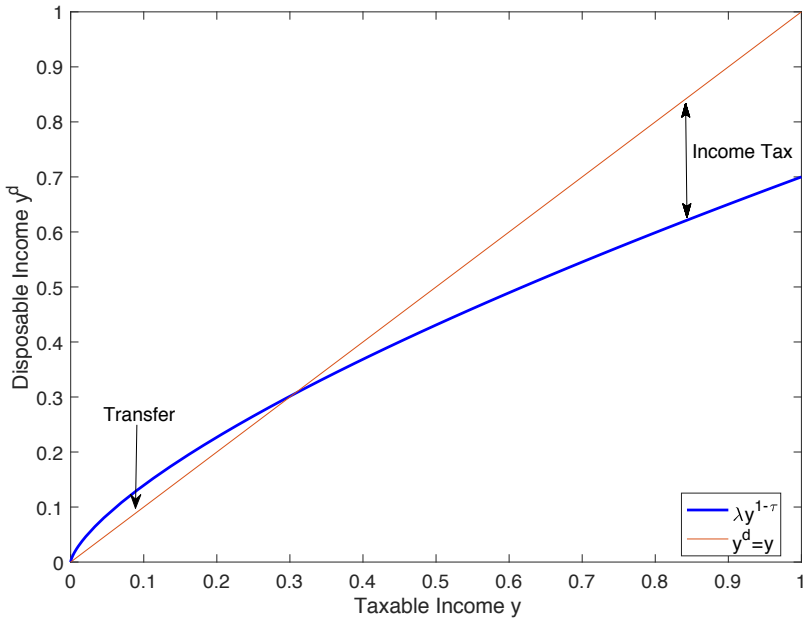
- Study the effects of each introduced features on the level of optimal progressivity
  1. Gender and marital status
  2. Assortative mating on education
  3. Female elasticity labor supply and participation cost
  4. Institutional tax feature for couples: jointly or separately

Overview of Approach

Functional form of tax function



- The U.S. tax schedule depends on marital status.
- Such a tax schedule is characterized by the following functional form:

$$T(y) = \underbrace{y}_{\text{taxable income}} - \underbrace{\lambda_i y^{1-\tau_i}}_{\text{after-tax income}}, \quad i \in \{\text{single}, \text{married}\}$$

  - The parameter τ measures the degree of progressivity progressivity measure
  - λ determines average tax rate

U.S. Tax System

- Parameters λ, τ are estimated by Guner et al. (2014) Def. of Income
- Internal Revenue Service 2000 Public Use Tax File
  - State and local income taxes + federal income taxes
- Tax system for married households is more progressive than that of single households
  - $\tau_S = 0.08$; $\tau_{joint} = 0.092$ Implied tax rates

What is optimal progressivity

- Ramsey approach: planner chooses the welfare-maximizing progressivity within a parameteric class of tax function
- Social welfare function is defined as the total sum of each individual utility

$$\mathcal{W}(\tau_S, \tau_M) = \underbrace{\sum_{m,f} \int V^S(\cdot|\tau_S, \tau_M) d\Gamma}_{\text{single households}} + \underbrace{\int V^M(\cdot|\tau_S, \tau_M) d\Gamma}_{\text{married households}}$$

- Optimal tax progressivity is defined as

$$(\tau_S^*, \tau_M^*) = \arg\max \mathcal{W}(\tau_S, \tau_M)$$

Key findings and contributions

1. The optimal tax system is significantly more progressive than the system currently in place in the United States.
   - Average (population) marginal tax rates: increases from 21.7% to 24.5%
   - In terms of welfare gains: 1.48% increase in lifetime consumption
2. Neglecting the presence of gender and marital status results in
   - A heavily suboptimal level of tax progressivity for singles

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3. Less progressive taxes on married households compared to singles, in contrast to the existing U.S. tax system.
4. Take the first step to show that tax filing separately for couples is quantitatively important to optimal progressivity

MODEL

Model

- Demographics
  - Overlapping Generation
  - Start at age 20, retire at age 65, maximum age of 100
  - Fixed proportion of couples at the start of economy and never divorce
  - Single never marry (no marriage decision)
  - Accidental bequest

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- Preferences and Endowments
  - Separable utility function: $U(c,n) = \frac{c^{\mathbf{1}-\sigma_c}}{1-\sigma_c} - \theta \frac{n^{\mathbf{1}+\sigma_l}}{1+\sigma_l}$
  - Equal weighting in joint utility: $U_m + U_f$
  - Fixed time cost of working for female
  - Start wth zero asset or no inheritance

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- Institutions
  - Social security schedule
  - Income and Sales Taxation
  - Exogenous government expenditures

Features of females

- Features different from male
  - earning process
  - survival probability
  - elasticity of labor supply
  - labor participation cost

Features of couples

- Features different from singles
  - Different tax codes: filing jointly or separately
  - Assortative matching on educational attainments Sorting Table
  - Economies of scale in consumption
  - self-insure more productivity risk by saving and by choosing whether to work and how many hours for themselves
  - Insurance device against longevity risk for the surviving partner: inherits her spouse's wealth after his death

Recursive problem of a single person

The Bellman equation for a single worker's problem

$$V^S(j,k,z_g,\tilde{e},g) = \max_{c,k',n}\left\{u(c,n+\phi \mathbf{I}_{g=f,n>0}) + \beta \mathbb{E}\left[V^S(j+1,k',z_g',\tilde{e}',g)|z_g\right]\right\}$$

subject to

$$(1+\tau_c)c + k' = k + y_S^d(wz_g\varepsilon_{g,j}n, rk)$$

The Bellman equation for a single retiree's problem

$$V^S(j,k,\tilde{e},g) = \max_{c,k'}[u(c,0) + \beta s_{g,j} V^S(j+1,k',\tilde{e}',g)]$$

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Recursive problem of the married couples

Married couples derive utility from total consumption and from the leisure of each household member

$$U(c, n_m, n_f + \phi \mathbf{I}_{g=f, n>0}) = u(c/\eta, n_m) + u(c/\eta, n_f + \phi \mathbf{I}_{g=f, n>0})$$

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The Bellman equation for a married worker's problem (household decisions are made cooperatively)

$$V^M(j, k, z_m, z_f, \tilde{e}) = \max_{c,k',n_m,n_f} \{U(c, n_m, n_f + \phi \mathbf{I}_{g=f,n>0}) + \beta \mathbb{E}\left[V^M(j+1, k', z_m', z_f', \tilde{e}')|z_m, z_f\right]\}$$

subject to

$$(1+\tau_c)c + k' = k + \max\{y^d_{joint}(y_m + y_f), y^d_{separate}(y_m) + y^d_{separate}(y_f)\}$$

Recursive problem of the married couples

The Bellman equation for a married retiree's problem

$$V^M(j,k,\tilde{e}) = \max_{c,k'}[U(c,0,0) + \beta s_{m,j} s_{f,j} V^M(j+1,k',\tilde{e}') + \beta s_{m,j}(1-s_{f,j}) V^S(j+1,k',\tilde{e}',m) + \beta s_{f,j}(1-s_{m,j}) V^S(j+1,k',\tilde{e}',f)]$$

subject to

$$(1+\tau_c)c + k' = k + \max\{y^d_{joint}(y_m + y_f), y^d_{separate}(y_m) + y^d_{separate}(y_f)\}$$

Closing the Model

- Firms

$$\begin{aligned} r &= F_K(K, N) - \delta \\ w &= F_N(K, N) \end{aligned}$$

- Markets clear
- Government

$$\text{soc. sec. exp.} + G = \text{Income Tax} + \text{Sales Tax}$$

- Note that G is treated differently in benchmark and optimal cases
  - Benchmark: G is a residual to balance budget, get model implied G/Y.
  - Optimal: set the G/Y as the benchmark level. λ_S balances budget.

CALIBRATION

Tax System

- Married filing separately $\neq$ unmarried single filing
- Assumptions:
  - $\tau_{separate} = \tau_S$ for easier computation
  - Different average tax rates: $\lambda_{separate} \neq \lambda_S$ (justified by U.S. tax codes)
  - Ratio of average tax rates of both system $(\lambda_{separate}/\lambda_S)$ is kept fixed when computing optimal progressivity

Labor Productivity Process

- $\{f_L, f_H\}$ denotes the fix-effect component [ex-ante heter.]
- $\{a_L, a_H\}$ denotes the life-cycle component [ex-post heter.]

Transition matrix:

$$\Pi_Z = \left(\begin{array}{c|cccc} & f_L + a_L & f_L + a_H & f_H + a_L & f_H + a_H \\ \hline f_L + a_L & A_{11} & A_{12} & 0 & 0 \\ f_L + a_H & A_{21} & A_{22} & 0 & 0 \\ f_H + a_L & 0 & 0 & A_{11} & A_{12} \\ f_H + a_H & 0 & 0 & A_{21} & A_{22} \end{array}\right)$$

Estimation detail

Calibration : Calibrated Parameters

Parameter	Description	Value
β	Annual discount rate	0.973
ϕ	Labor participation cost for women	0.1
χ	Labor disutility	2.3
δ	Depreciation rate of capital stock	6.5%
ψ	Social security benefit adjustment factor	0.63
$\lambda_{separate}$	Married filing separately average tax rate	0.827

Preset Parameters

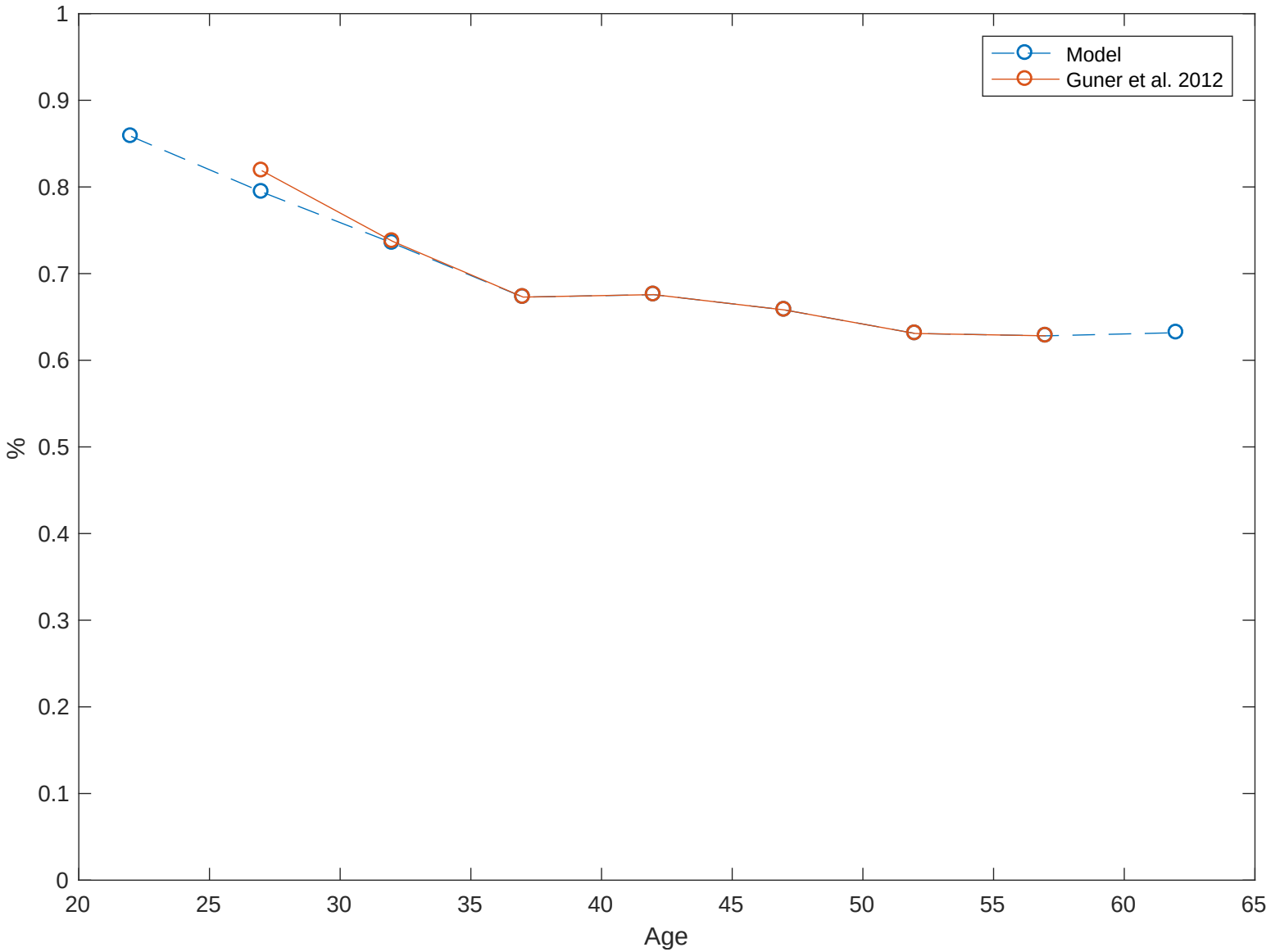
Calibration : Target Moments

Moment	Source	Data Value	Model Fit
Annual Interest rate	McGrattan and Prescott(2010)	4.1%	4.1%
Female (ages 25–54) participation rate 1996	Bureau of Labor Statistics	75.8%	76%
Mean hours worked	Baris,Markus(2016)	35%	34.4%
K/Y		3.0	3.1
Soc. Sec. Pay / GDP	NIPA2000	6.1%	6.0%
Share of couple filing separately	SCF 2001	4.7%	4.7%

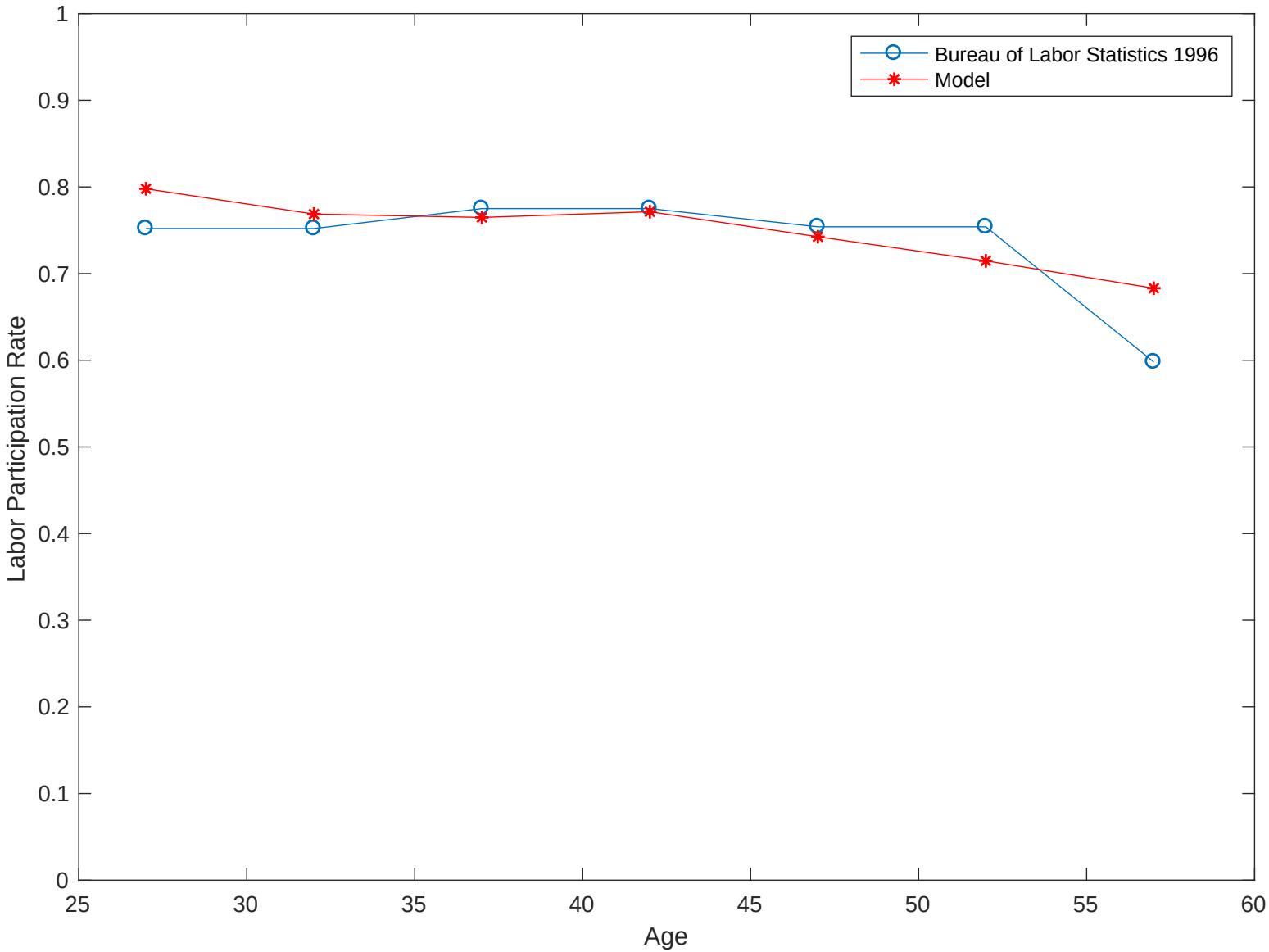
Calibration : Not Targeted Moments

Moment	Source	Data Value	Model Fit
Variance of log earnings (1970-2002)	Heathcote et al. 2010	0.68	0.70
Gini coeff.of pre-tax income (1970-2005)	Heathcote et al. 2010	0.39	0.41
Married Female (ages 25–54) participation rate	Guner et al. 2012	69%	68%
Gov. consumption expenditure/GDP	NIPA2000	14%	13.2%
Difference between average income tax rate for top 1% and 99%	Piketty and Saez (2007)	6.8%	8.5%

Wage gender gap



Female Labor Force Participation



Main Results I
Optimal vs Benchmark

Optimal tax system: Benchmark comparison

	U.S.	Optimal (%change)
Progressivity (τ_S, τ_{joint})	[0.08,0.092]	[0.17,0.12]
Gini coef. for after-tax income	0.404	0.384 (-4.95%)
Gini coef. for wealth	0.569	0.561 (-1.41%)
Gini coef. for consumption	0.322	0.313 (-2.80%)

- Higher progressivity (marginal tax rates increase faster between incomes)
  - Higher tax rates for the rich while lower for the poor Tax
  - $\uparrow$ insurance against uninsurable shocks and ex-ante heterogeneity
  - $\downarrow$ consumption inequality

Optimal tax system: Benchmark comparison

	U.S.	Optimal
Progressivity (τ_S, τ_{joint})	[0.08,0.092]	[0.17,0.12]
Married female labor participation	68.2%	69.5%
% Couples choosing filing separately	4.68%	42.3%

- 42.3% of couples choosing taxing separately Joint vs Sep. Filing
- Households with similar(disparate) income level find it optimal to tax separately(jointly)
  - Reduce tax payments
  - Increase married female labor supply

Optimal tax system: Benchmark comparison

	U.S.	Optimal
Progressivity (τ_S, τ_{joint})	[0.08,0.092]	[0.17,0.12]
Married female labor participation	68.2%	69.5%
Total labor supply N	-	- 2.01%

- The optimal progressivity for couples should be less than that of singles.
  - Self-insurance in marriage partly substitutes for public insurance
  - Different labor supply responses to $\uparrow$ progressivity (τ_S, τ_{joint})
    $\Rightarrow \downarrow$ marginal tax rate to low-income single female; $\uparrow$ labor supply
    $\Rightarrow \uparrow$ marginal tax rate to low-income married female (high-income husband) under joint filing; $\downarrow$ labor supply

Main Results II
Decomposition Exercise

Decomposition Approach

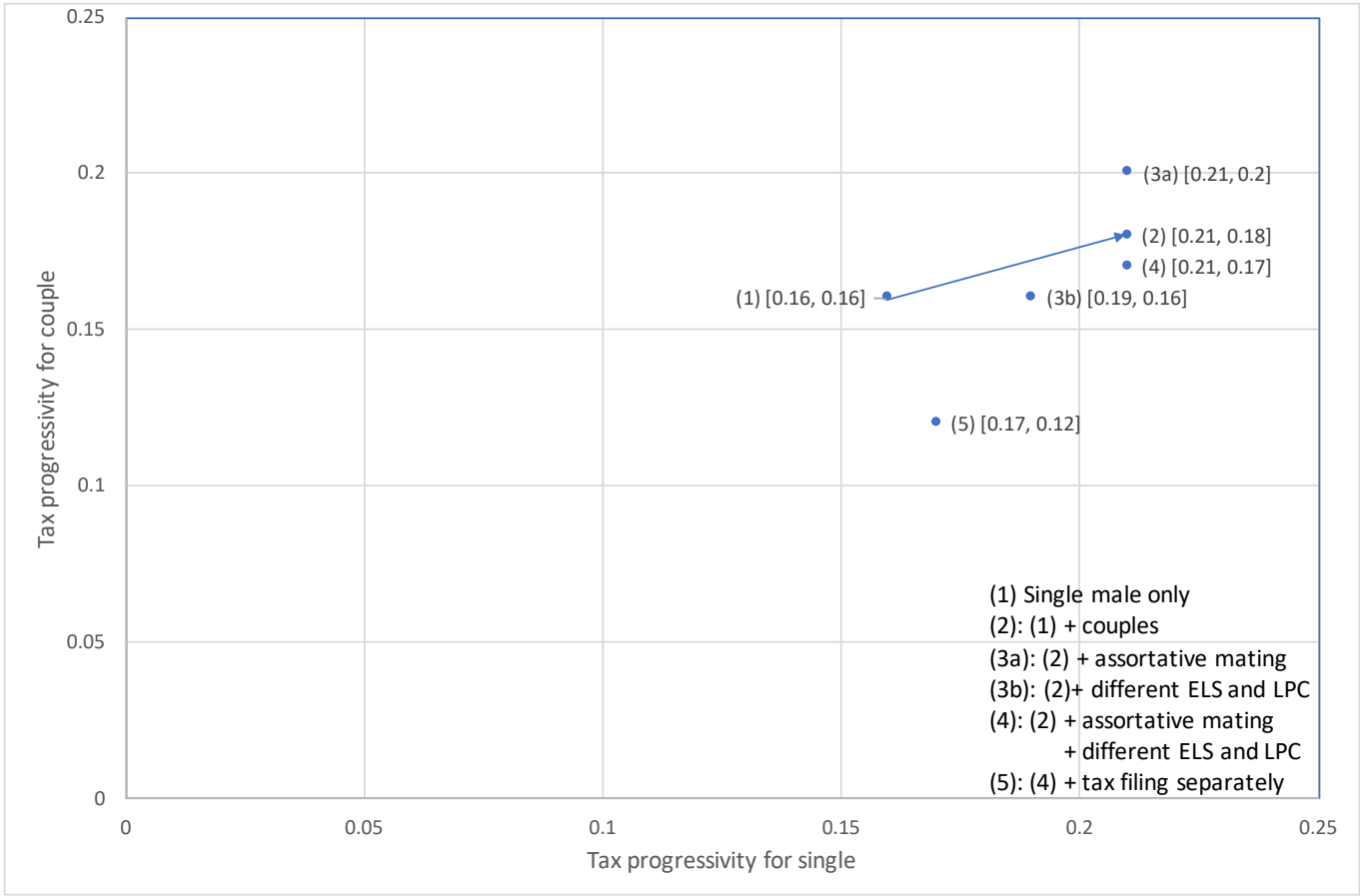
- Decomposing the optimal progressivity to study the impact of each introduced features
  1. Only single male (standard approach in literature)
  2. (1) + Couples

  3a. (2) + Assortative matching on education

  3b. (2) + Different elasticity of labor supply(ELS) and labor participation cost(LPC)

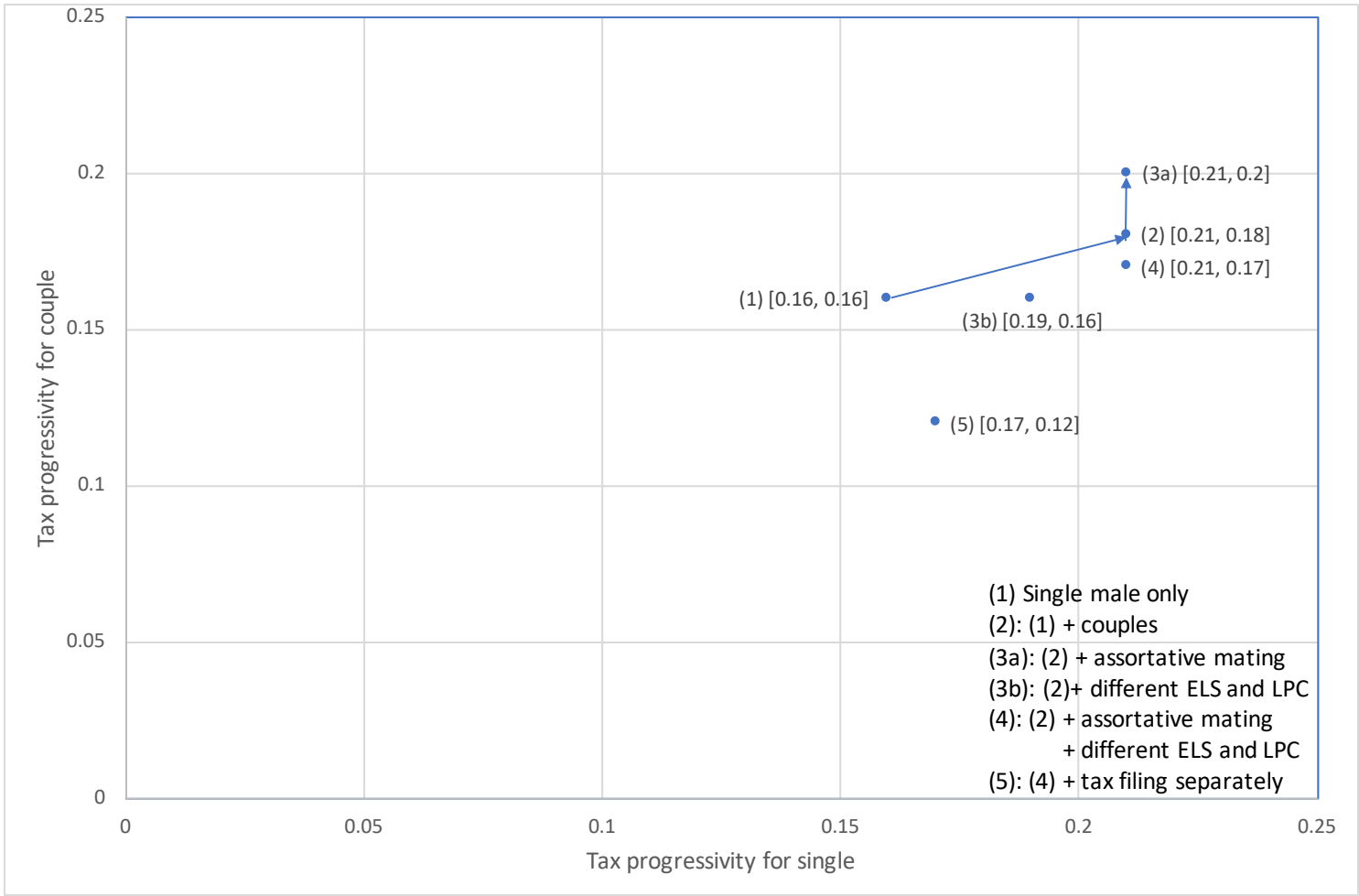
  4. + Assortative matching on education
     +different ELS and LPC
  5. (4) + Option of tax filing separately
- Recalibrate each senario and then compute the corresponding optimal progressivity

Adding Couples



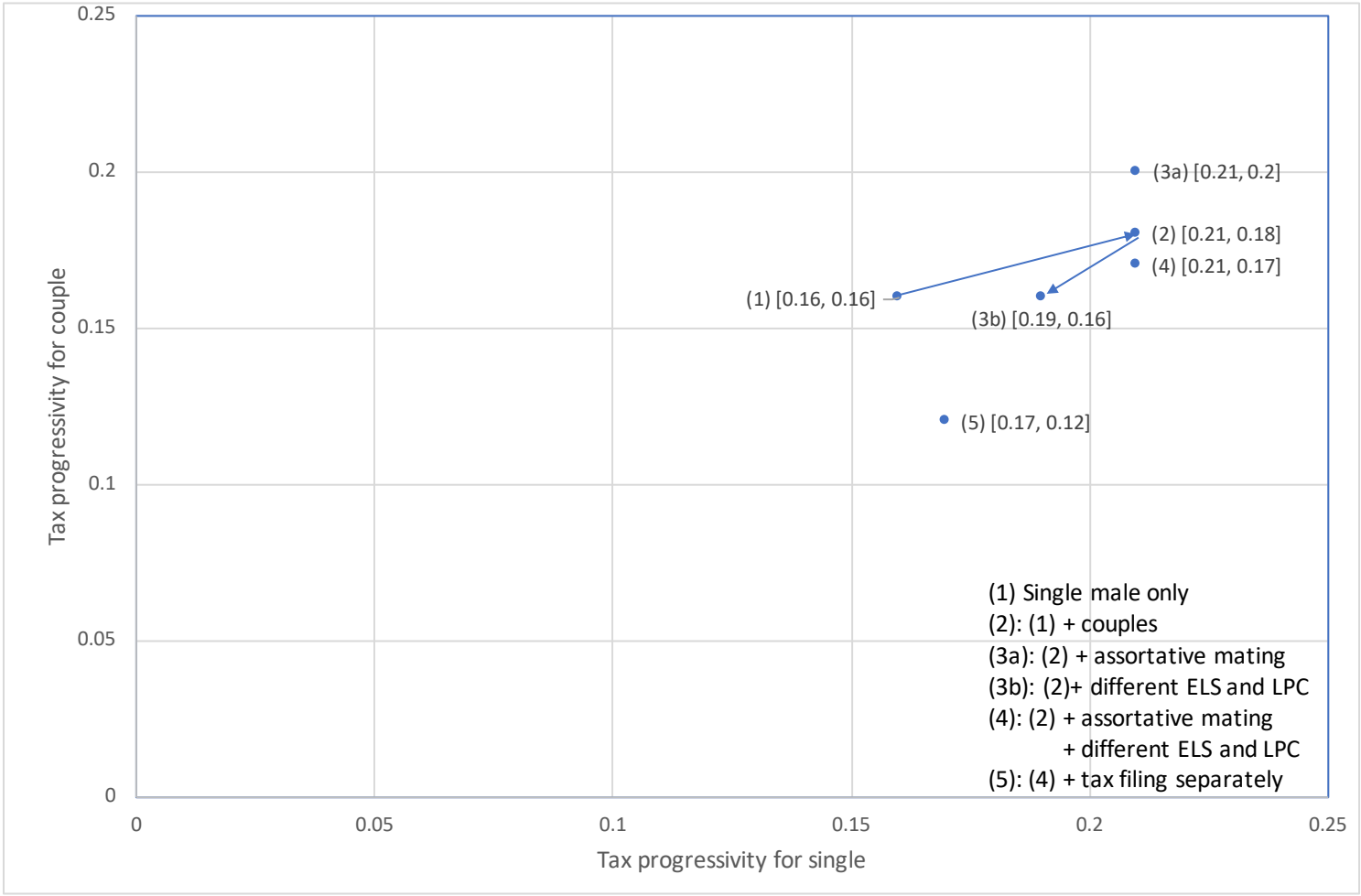
- ↑ consumption inequality due to economies of scale in consumption for couples
  - ↑ progressivity τ_{joint}
- Lower income single females increase inequality among single households
  - ↑ progressivity τ_S

Adding Assortative Mating(AM)



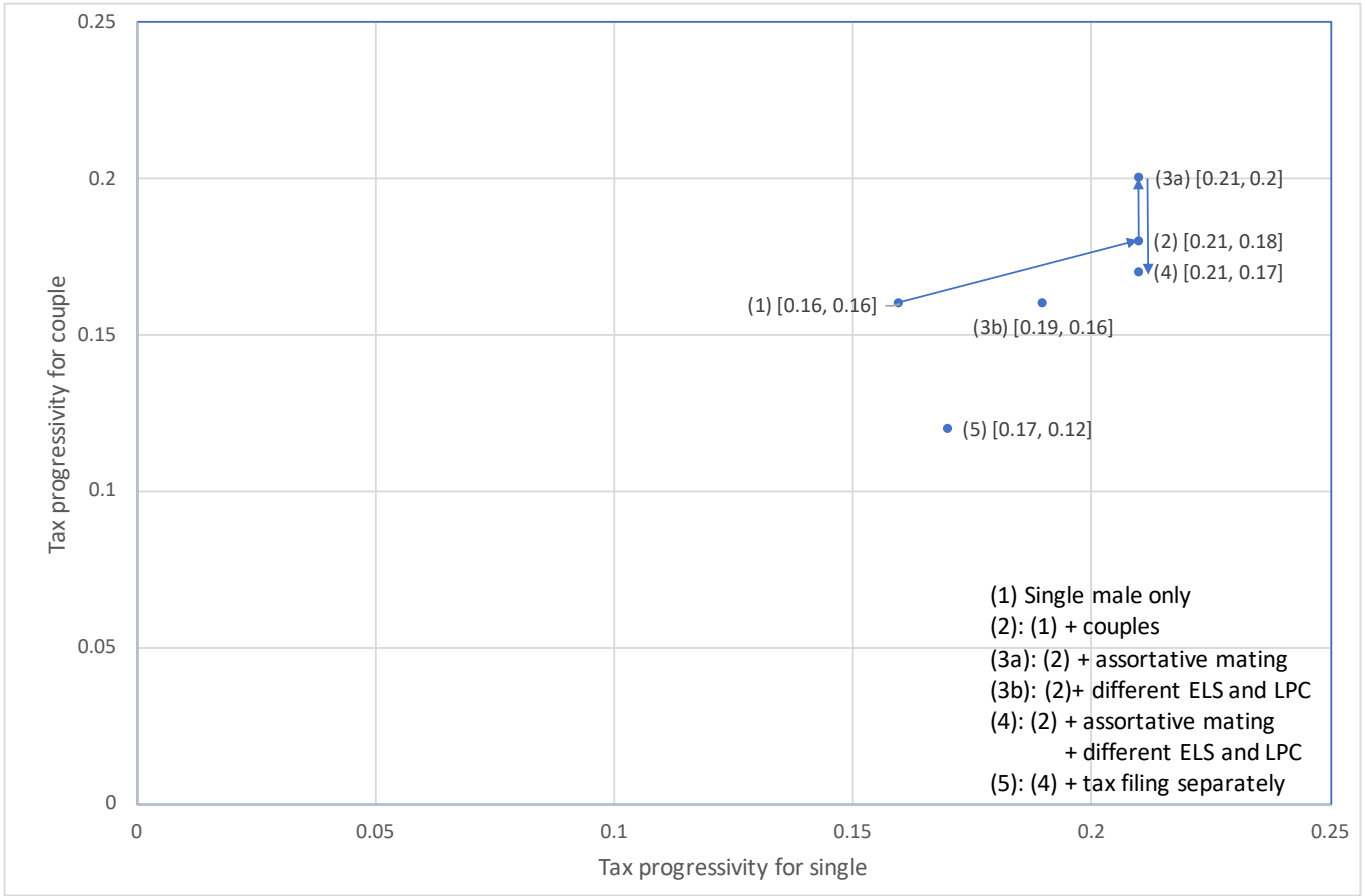
- ↑ income inequality ⇒ ↑ consumption inequality⇒ ↑ progressivity for couples

Adding different ELS and LPC



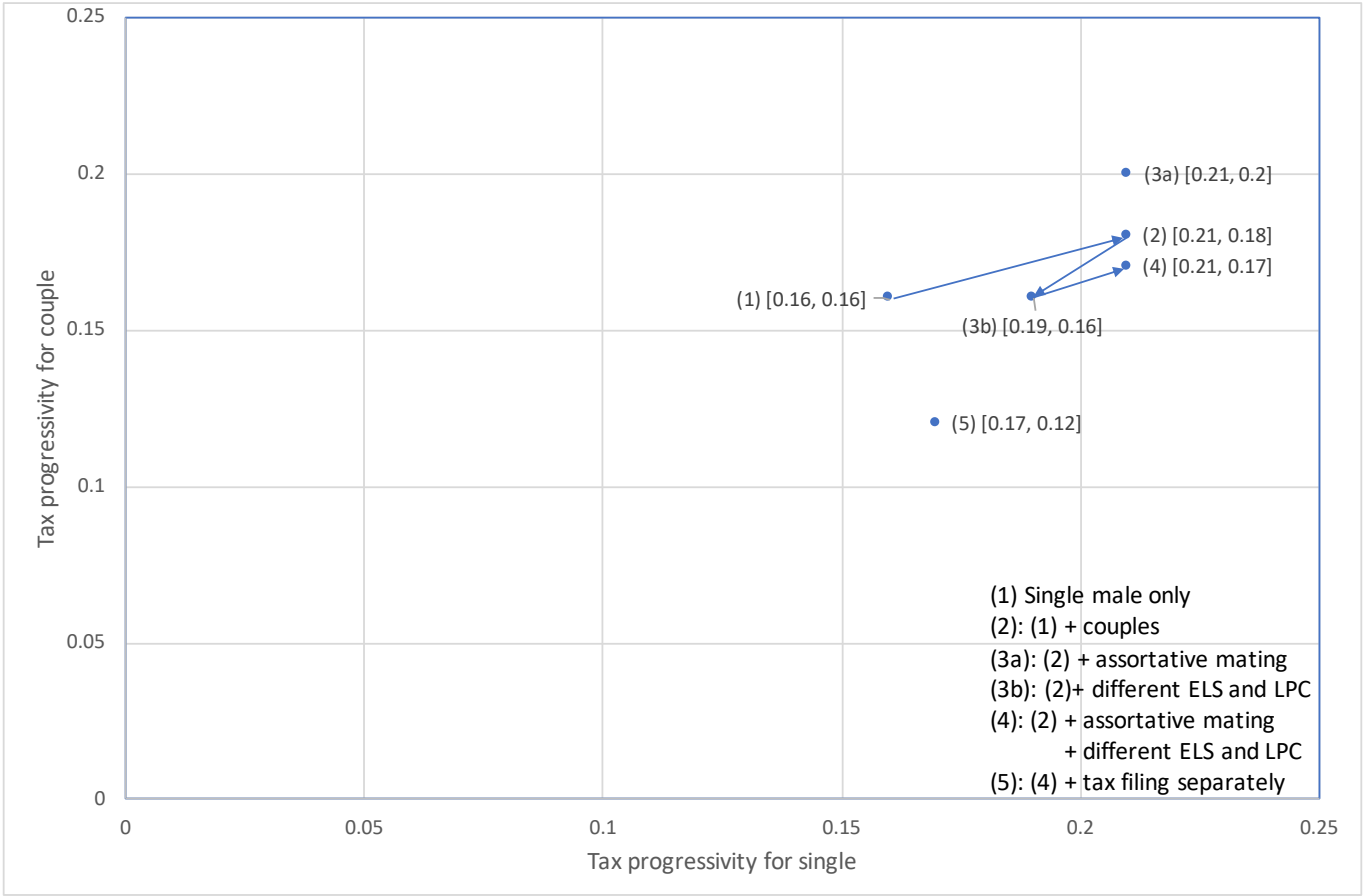
- ↓ progressivity
  - ↓ distortions to family labor supply due to higher elasticity of labor supply and participation cost for female

Adding AM,ELS,LPC



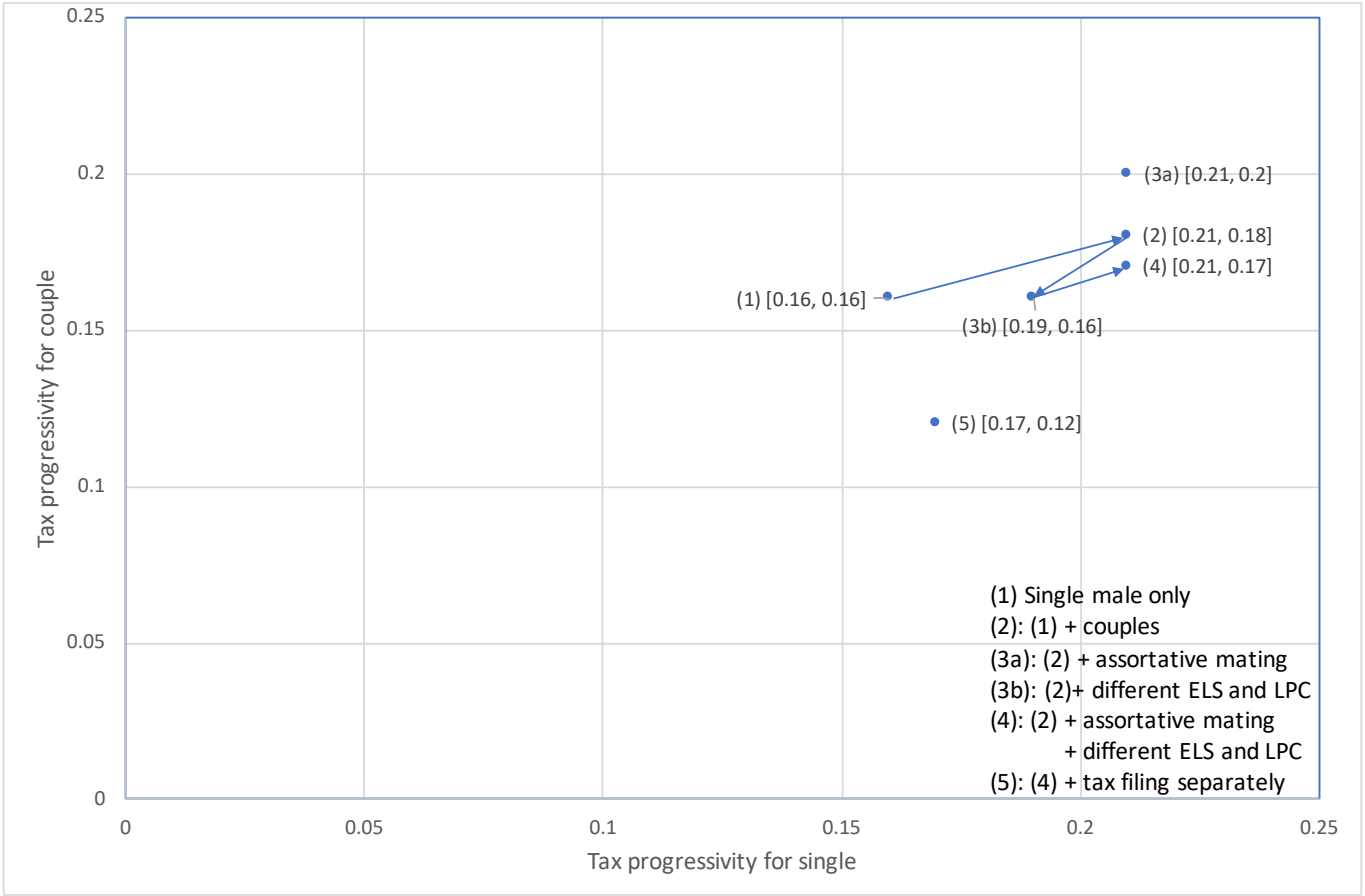
- $\downarrow$ labor supply from female $\Rightarrow \downarrow$ effect of assortative marriage $\Rightarrow \downarrow$ progressivity
- Larger distortion of female labor supply induced from higher elasticity
- Optimal progressivity for married households is further pushed down

Adding ELS,LPC,AM



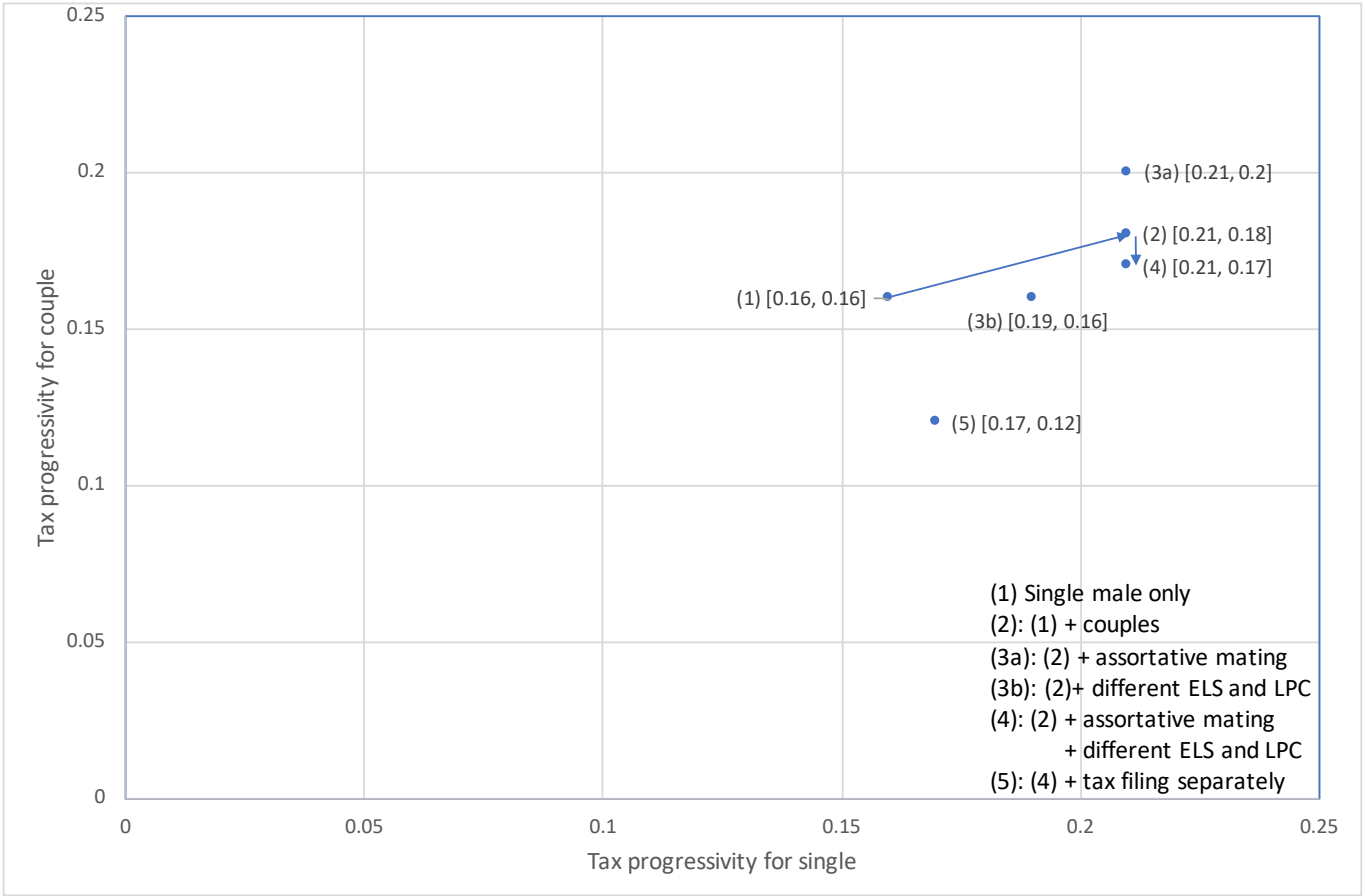
- ↑ Income inequality ⇒ ↑ progressivity
- More households with similar earning members, the distortion of high marginal tax rate on second earner's labor participation decision is alleviated
  ⇒ ↑ progressivity

Adding ELS,LPC,AM



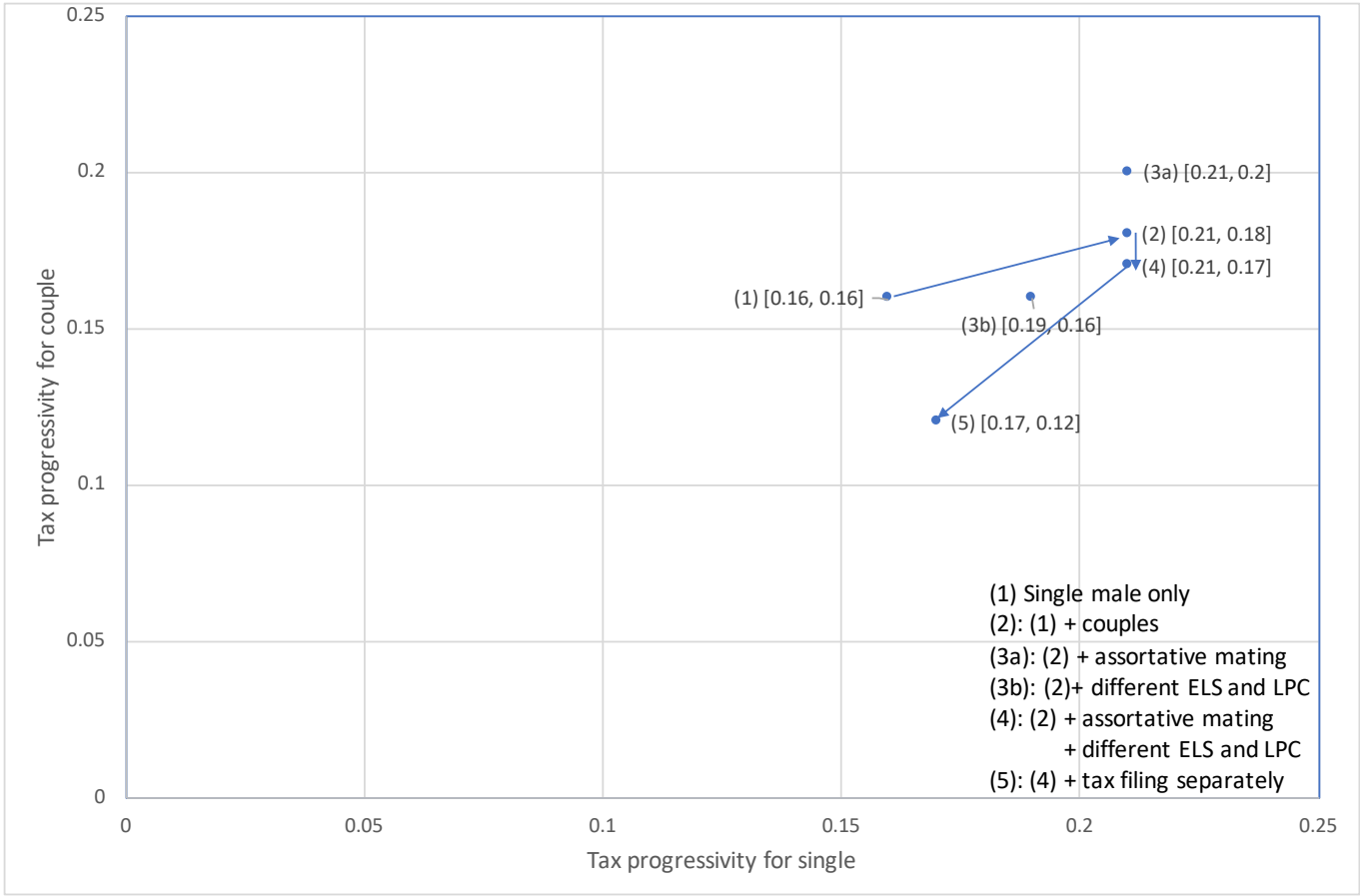
- Assortative mating $\Rightarrow$ better risk-sharing $\Rightarrow$ less precautionary saving motives
  - $\uparrow r \Rightarrow$ favors the weathy singles who have more capital income
  - $\downarrow w \Rightarrow$ harms the poor singles who have more labor income
  - $\uparrow$ income inequality $\Rightarrow \uparrow$ consumption inequality $\Rightarrow \uparrow$ progressivity

Overall effect of adding ELS,LPC,AM



- Overall effect
  - τ_{joint} in-between (3a) and (3b)
  - no effects on τ_S

Adding tax filing separately



- Option of separate filing is quantitatively important to optimal progressivity
  - Optimal progressivity for singles drop from 0.21 to 0.17
  - Optimal progressivity for couples drop from 0.17 to 0.12

Effects of Separate Filing on Optimal Progressivity

- Separate filing attracts 90% of couples with similar incomes
- Two opposite forces
  - $\downarrow$ tax revenue ($\downarrow$ progressivity)
  - $\uparrow$ inequality ($\uparrow$ progressivity)
- Balancing the budget is of first order importance to government
  - $\downarrow$ progressivity dominates

Effects of Separate Filing on Optimal Progressivity

	(4) Optimal (without filing sep.)	(5) Optimal (with filing sep.)
Progressivity (τ_s, τ_{joint})	[0.21,0.17]	[0.17,0.12]
Married female labor participation	66.7%	69.5%
Total labor supply N	-	+ 2.0%
GDP Y	-	+ 3.6%
Level of gov. expenditure G	-	+ 3.5%
% Couples choosing filing separately	0.0	42.3%

- $\downarrow$ tax payment $\Rightarrow$ $\downarrow$ Tax revenue collected
- $\uparrow$ GDP $\Rightarrow$ $\uparrow$ Government expenditure G
- $\downarrow$ progressivity $\Rightarrow$ $\uparrow$ labor supply $\Rightarrow$ easier to finance expenditure

Effects of Separate Filing on Optimal Progressivity

- The option of filing separately reduces the cost of labor participation for second earners, and therefore the married female labor participation rate increases by 2.8%.
- Welfare gains from the insurance of highly progressive system is substituted by the efficiency gains from lower marginal tax rates, higher wage rate.

Take home messages

1. Having females and married couples in the model results in a higher optimal level of tax progressivity.
2. The optimal tax schedule for married households should be less progressive than that for singles.
3. Tax filing separately for couples is quantitatively important to optimal progressivity.

End

Appendix

Labor Productivity Estimation

- Method: Baris & Markus (2014)
- Panel data on hourly wages from the PSID (1970-2007)
- Ages 25 to 60
- $\ln w_{it} = \underbrace{\phi_{ig}}_{\text{intergeneration}} + \underbrace{g(age_{it};\Phi) + \varepsilon_{it}}_{\text{life-cycle}} + \underbrace{\mathrm{I}_t}_{\text{time-control}}$
  - $g(age_{it};\Phi)$ captures the deterministic age profile of wages
  - ε_{it} captures the transitory shock

5-year Productivity Transition Matrix

	9.2	19.7	33.5	71.6
9.2	0.493	0.507	0	0
19.7	0.481	0.519	0	0
33.5	0	0	0.493	0.507
71.6	0	0	0.481	0.519

Table 1: Male labor productivity transition matrix

	7.8	18.2	25.2	59.2
7.8	0.476	0.524	0	0
18.2	0.396	0.604	0	0
25.2	0	0	0.476	0.524
59.2	0	0	0.396	0.604

Table 2: Female labor productivity transition matrix

go back

How progressive is the U.S. tax system?

- Define income to include
  - Salaries and wages
  - Interest income
  - Realized capital gains
  - Business income
  - Total pensions and annuities received plus taxable IRA distributions;
  - Social Security benefits
  - State income tax refunds and alimony received

go back

Optimal vs U.S. marginal tax rates

Marginal tax rates (%)	Income Quintiles				
	1st	2nd	3rd	4th	5th
Benchmark					
Single	15.6	19.9	23.2	25.7	29.2
Married	14.5	17.0	20.3	23.8	28.4
Optimal					
Single	15.0	23.9	30.7	35.3	42.1
Married	11.2	15.6	22.0	27.0	32.5

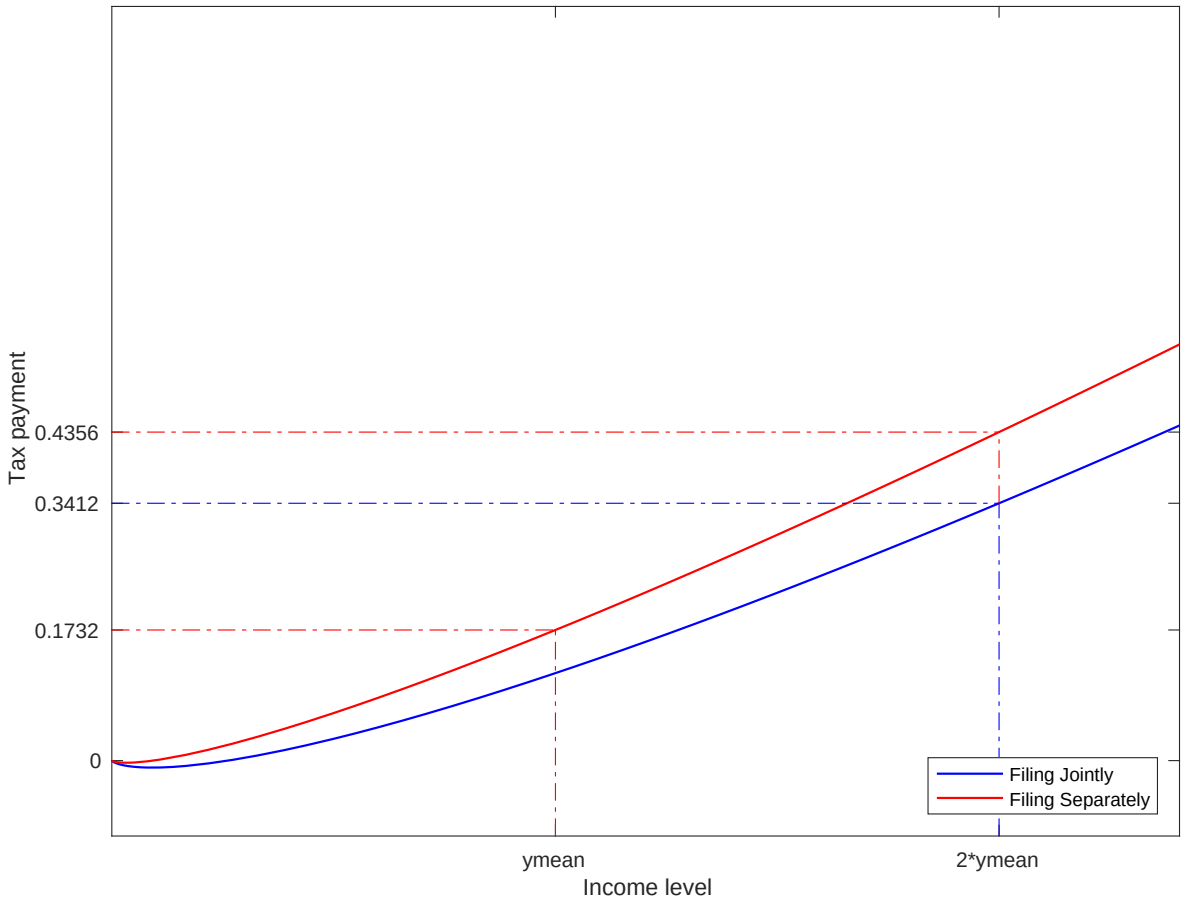
Optimal vs U.S. average tax rates

Average tax rates (%)	Income Quintiles				
	1st	2nd	3rd	4th	5th
Benchmark					
Single	9.0	13.0	16.7	19.3	23.6
Married	5.9	8.7	12.4	16.1	22.3
Optimal					
Single	-0.8	8.5	16.8	22.2	31.2
Married	-5.2	1.0	7.7	15.8	24.4

go back

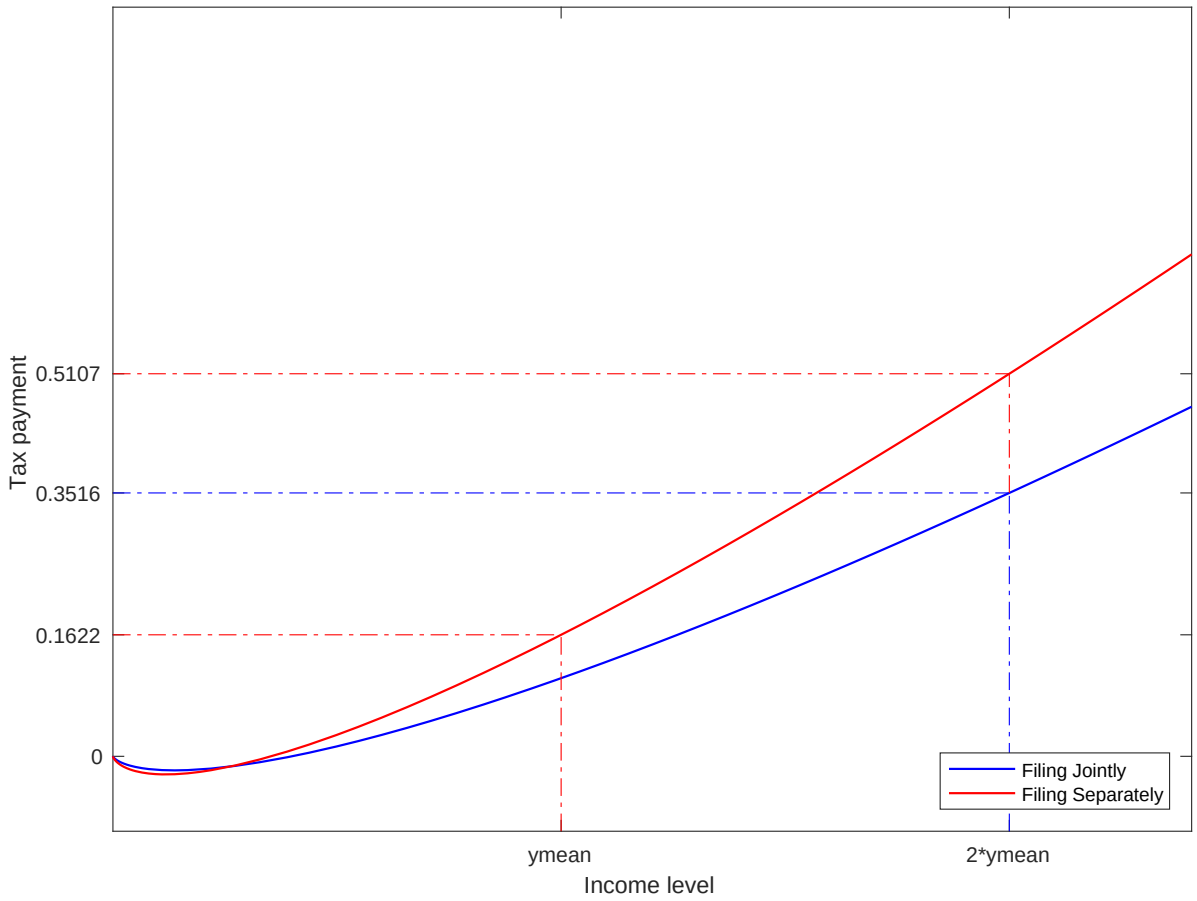
U.S. Taxes: Joint vs Separate Filing

$(\lambda_{joint} = 0.884\ ,\ \tau_{joint} = 0.092);\ (\lambda_{Sep.} = 0.827\ ,\ \tau_{Sep.} = 0.08)$



Optimal Taxes: Joint vs Separate Filing

$$(\lambda_{joint} = 0.896\ ,\ \tau_{joint} = 0.12);\ (\lambda_{Sep.} = 0.838\ ,\ \tau_{Sep.} = 0.17)$$



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Measuring progressivity

- A measure of progressivity commonly used in the literature

$$P(y_1,y_2) = 1 - \frac{1 - T'(y_2)}{1 - T'(y_1)} = 1 - (\frac{y_1}{y_2})^{\tau}$$

  - It measures how strongly marginal tax rates increase between incomes y_1 and $y_2 > y_1$
  - Higher value implies higher progressivity
  - Tax progressivity is determined exclusively by τ

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Calibration : Preset Parameters

Parameter	Description	Value	Source
Demographics			
$\{s_m, s_f\}_{J_r}^{J}$	Survival probability		SSA 2000
κ	Share of married households	60.3%	Kuhn & Rios-Rull (2016)
Preferences			
σ_c	Risk aversion	1.5	
σ_l^m, σ_l^f	Frisch elasticity	2.5,1.25	Blundell et al.(2012)
η	Equivalent scale	1.7	Heathcote et al.(2010)
Labor Productivity			
$\{\varepsilon_j^m, \varepsilon_j^f\}_{j=1}^{J_r-1}$	Gender age-efficiency profile		Conesa et al.(2009) Guner et al.(2012)

Calibration : Preset Parameters

Parameter	Description	Value	Source
Taxes			
$[\lambda_{joint}, \tau_{joint}]$	Married filing jointly tax	[0.884,9.2%]	Guner et al (2014)
$[\lambda_S, \tau_S]$	Single household tax	[0.841,8%]	Guner et al (2014)
τ_c	Consumption tax rate	5%	Krueger et al (2015)
Social Security			
b_1, b_2	Replacement thresholds	0.198,1.195	SSA (2000)
SS^{cap}	Max. Soc. Sec. Benefit	0.54	SSA (2000)

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2005 Assortative mating

	Wife	
Husband	<College	College
<College	0.545 (0.427)	0.108 (0.226)
College	0.109 (0.227)	0.237 (0.120)

Mating matrix (Random sorting)

Source: J. Greenwood et al. (2016 AEJ:Macro)

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Implied Tax Rates

	Income Quintiles				
	1st	2nd	3rd	4th	5th
Marginal tax rates (%)					
Single	15.6	19.9	23.2	25.7	29.2
Married	14.5	17.0	20.3	23.8	28.4
Average tax rates (%)					
Single	9.0	13.0	16.7	19.3	23.6
Married	5.9	8.7	12.4	16.1	22.3

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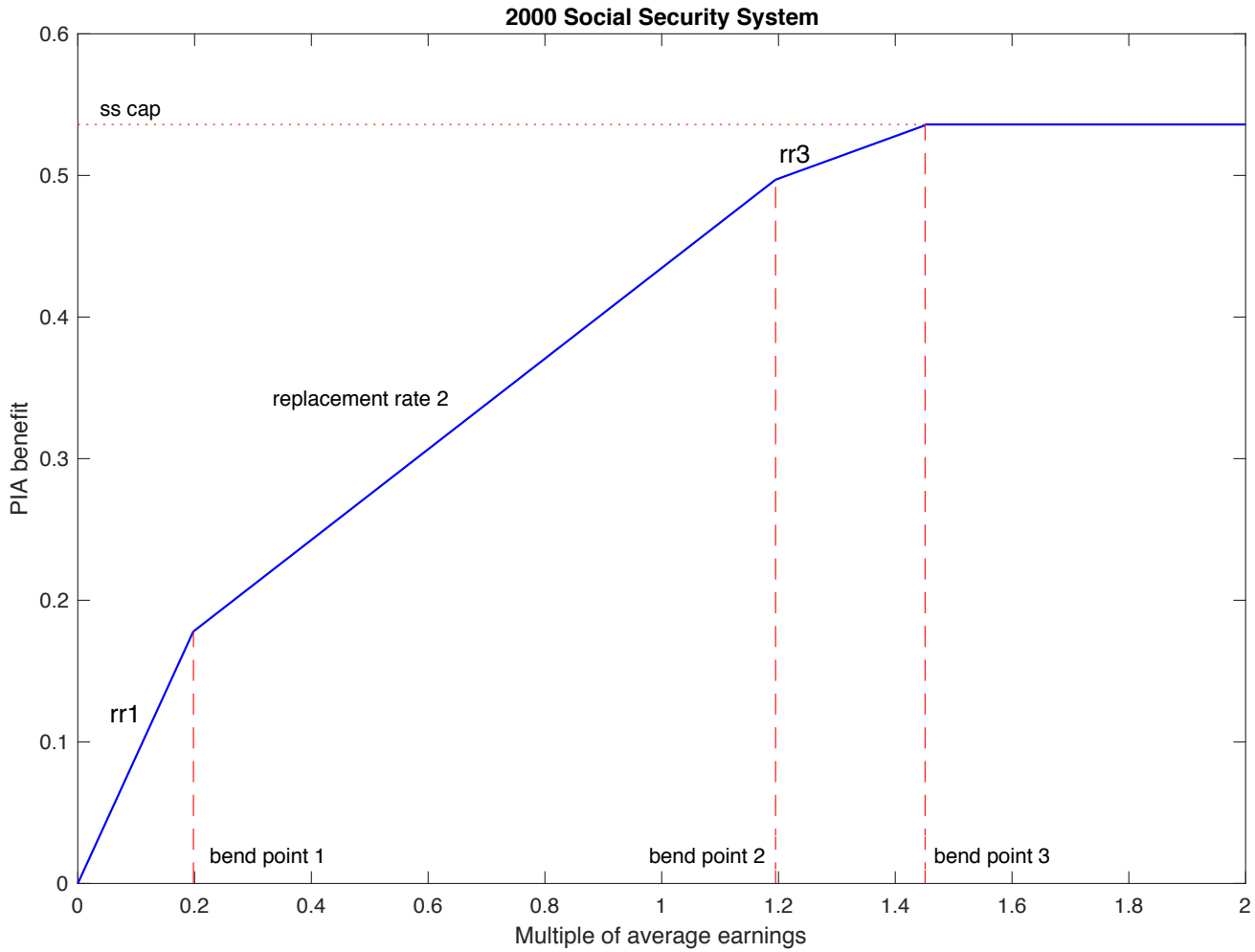
Social Security 2000



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