Optimal Income Taxation: Mirrlees Meets Ramsey

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How should we tax income?

- What structure of income taxation offers best trade-off between benefits of public insurance and costs of distortionary taxes?
- Proposals for a flat tax system with universal transfers
  - Friedman (1962)
  - Mirrlees (1971)

This Paper

We compare 3 tax and transfer systems:

1. Affine tax system: $T(y) = \tau_0 + \tau_1 y$
   - constant marginal rates with lump-sum transfers
2. HSV tax system: $T(y) = y - \lambda y^{1-\tau}$
   - functional form introduced by Feldstein (1969), Persson (1983), and Benabou (2000)
   - increasing marginal rates without transfers
   - τ indexes progressivity of the system
3. Optimal tax system
   - fully non-linear

Main Findings

- Best tax and transfer system in the HSV class better than the best affine tax system
- Welfare gains moving from the current tax system to the optimal one are tiny

Mirrlees Approach to Tax Design: Mirrlees (1971), Diamond (1988), Saez (2001)

- Planner only observes earnings = productivity $\times$ effort
- Think of planner choosing earnings x and cons. c for each unobservable productivity type α
- Include incentive constraints, s.t. each type prefers the earnings level intended for their type
- Allocations are constrained efficient
- Trace out tax decentralization $T(x(\alpha)) = x(\alpha) - c(\alpha)$

Novel Elements of Our Analysis

1. Our model has a distinct role for private insurance
   - Standard decentralization of efficient allocations delivers all insurance through tax system $\Rightarrow$ Very progressive taxes
2. We use a SWF that rationalizes amount of redistribution embedded in observed tax system
   - Analyzes typically assume utilitarian social welfare function $\Rightarrow$ Strong desire for redistribution

Environment 1

- Static environment
- Heterogeneous individual labor productivity w
- Log productivity is sum of two independent stochastic components

$$\log w = \alpha + \varepsilon$$

- α no private insurance
- ε private insurance
- planner sees neither component of productivity
    - (later introduce a third productivity component κ that the planner can observe)

Environment 2

- Common preferences

$$u(c,h) = \log(c) - \frac{h^{1+\sigma}}{1+\sigma}$$

- Production linear in aggregate effective hours

$$\int\int \exp(\alpha+\varepsilon) h(\alpha,\varepsilon) dF_\alpha dF_\varepsilon = \int\int c(\alpha,\varepsilon) dF_\alpha dF_\varepsilon + G$$

Planner's Problems

- Seeks to maximize SWF denoted $W(\alpha, \varepsilon)$
- Only observes total income y = earnings plus private insurance income
- First Stage
  - Planner offers menu of contracts $\{c(\widetilde{\alpha}, \widetilde{\varepsilon}), y(\widetilde{\alpha}, \widetilde{\varepsilon})\}$
  - Agents draw idiosyncratic α and report $\widetilde{\alpha}$
- Second Stage
  - Agents buy private insurance against insurable shock ε
  - Draw ε, receive insurance payments and report $\widetilde{\varepsilon}$
  - Work sufficient hours to deliver $y(\widetilde{\alpha}, \widetilde{\varepsilon})$
  - Receive consumption $c(\widetilde{\alpha}, \widetilde{\varepsilon})$

First result: Cannot condition on $\widetilde{\varepsilon}$

- Offered contracts take the form $\{c(\widetilde{\alpha}), y(\widetilde{\alpha})\}$
- Private insurance markets undercut planner's ability to condition allocations on ε
- Planner cannot take over private insurance $\Rightarrow$ Distinct roles for public and private insurance

Planner's Problem: Second Best

$$\max_{c(\alpha),y(\alpha)} \quad \int W(\alpha)U(\alpha,\alpha)dF_\alpha$$

$$\text{s.t.} \quad \int y(\alpha)dF_\alpha \geq \int c(\alpha)dF_\alpha + G$$

$$U(\alpha,\alpha) \geq U(\alpha,\widetilde{\alpha}) \qquad \forall\alpha, \forall\widetilde{\alpha}$$

where $U(\alpha,\widetilde{\alpha}) \equiv$

$$\left\{ \begin{array}{ll} \max_{h(\varepsilon),B(\varepsilon)} & \int \left\{ \log c(\widetilde{\alpha}) - \frac{h(\varepsilon;\alpha,\widetilde{\alpha})^{1+\sigma}}{1+\sigma} \right\} dF_\varepsilon \\ \text{s.t.} & \int Q(\varepsilon)B(\varepsilon;\alpha,\widetilde{\alpha})d\varepsilon = 0 \\ & \exp(\alpha+\varepsilon)h(\varepsilon;\alpha,\widetilde{\alpha}) + B(\varepsilon;\alpha,\widetilde{\alpha}) = y(\widetilde{\alpha}) \quad \forall\varepsilon \end{array} \right.$$

price of insurance $\int_E Q(\varepsilon)d\varepsilon = \int_E dF_\varepsilon$

Planner's Problem: Ramsey

$$\max_{\tau} \quad \int W(\alpha)\left\{\int u(c(\alpha,\varepsilon),h(\alpha,\varepsilon))dF_\varepsilon\right\}dF_\alpha$$

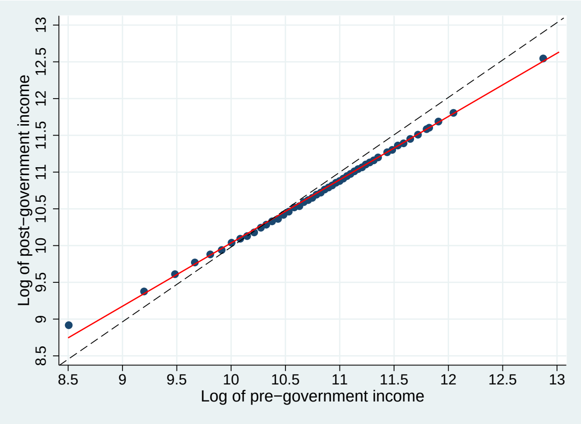
$$\text{s.t.} \quad \int\int y(\alpha,\varepsilon)dF_\alpha dF_\varepsilon \geq \int\int c(\alpha,\varepsilon)dF_\alpha dF_\varepsilon + G$$

where $c(\alpha,\varepsilon)$ and $h(\alpha,\varepsilon)$ are the solutions to

$$\begin{cases} \max\limits_{c(\alpha,\varepsilon),h(\alpha,\varepsilon),B(\alpha,\varepsilon)} & \int \left\{\log(c(\alpha,\varepsilon)) - \frac{h(\alpha,\varepsilon)^{1+\sigma}}{1+\sigma}\right\} dF_\varepsilon \\ \text{s.t.} & \int Q(\varepsilon)B(\alpha,\varepsilon)d\varepsilon = 0 \\ & c(\alpha,\varepsilon) \leq y(\alpha,\varepsilon) - T(y(\alpha,\varepsilon);\tau) \qquad \forall\varepsilon \end{cases}$$

where $y(\alpha,\varepsilon) \equiv \exp(\alpha+\varepsilon)h(\alpha,\varepsilon) + B(\alpha,\varepsilon)$

Baseline HSV Tax System: $T(y; \lambda, \tau) = y - \lambda y^{1-\tau}$

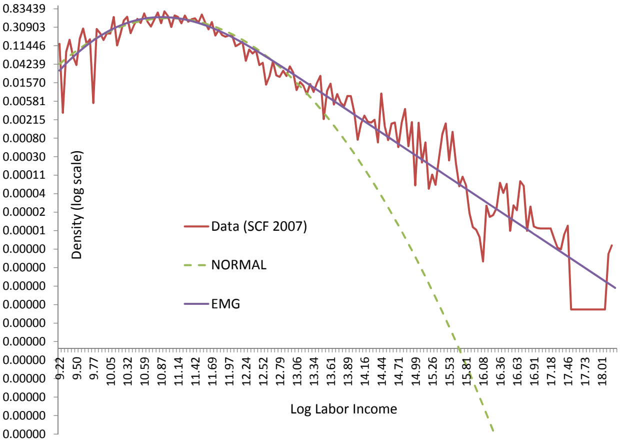


- Estimated on PSID data for 2000-2006
- Households with head / spouse hours $\geq$ 260 per year
- Estimated value for $\tau = 0.151$, $R^2 = 0.96$

Baseline Wage Distribution

- Heavy Pareto-like right tail of labor earnings distribution (Saez, 2001)
- Assume Pareto tail reflects uninsurable wage dispersion
- F_α : Exponentially Modified Gaussian $EMG(\mu, \eta^2, a)$
- F_ε : Normal $N(\frac{-v_\varepsilon}{2}, v_\varepsilon)$
- $\log(w) = \alpha + \varepsilon$ is itself EMG $\Rightarrow w$ is Pareto-Lognormal
- $\log(wh)$ is also EMG, given our utility function, market structure, and HSV tax system

Distribution for Labor Income



Use micro data from the 2007 SCF to estimate α by maximum likelihood $\Rightarrow$ $a = 2.2$

Baseline Social Welfare Function

- Progressivity built into current tax system informative about society's taste for redistribution
- Assume SWF takes the form

$$W(\alpha) = \exp(-\theta\alpha)$$

- θ controls taste for redistribution (e.g. $\theta = 0$: utilitarian)
- Assume govt choosing a tax system in HSV class

$$T(y) = y - \lambda y^{1-\tau}$$

- What value for θ rationalizes observed choice for τ?
- Empirically-Motivated SWF: θ^{US} that solves $\tau^*(\theta^{US}) = \tau^{US}$

Social Welfare

- θ^{US} solves

$$-\eta^2\theta^{US}+\frac{1}{a+\theta^{US}} = \frac{1}{a-1+\tau^{US}}+\eta^2(1-\tau^{US})+\frac{1}{1+\sigma}\left\{1-\frac{1}{(1-g^{US})(1-\tau^{US})}\right\}$$

  - θ^{US} is increasing in τ and g
  - θ^{US} is decreasing in η^2 and σ

- Special case: If F_α is also Normal ($a \to \infty$),

$$\theta^{US} = -(1-\tau^{US}) + \frac{1}{\eta^2}\frac{1}{1+\sigma}\left\{\frac{1}{(1-g^{US})(1-\tau^{US})}-1\right\}$$

- Use θ^{US} as baseline for welfare comparisons $\Rightarrow$ focus on relative efficiency of alternative tax systems

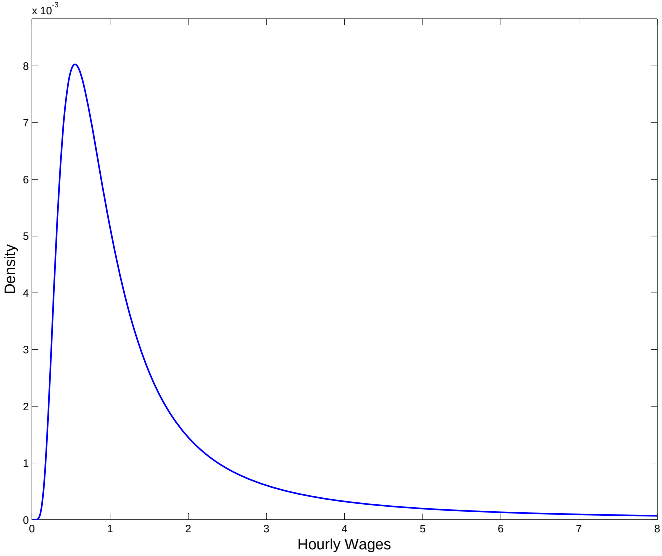
Calibration

- Frisch elasticity $= 0.5 \rightarrow \sigma = 2$
- Progressivity parameter $\tau = 0.151$ (HSV 2014)
- Govt spending G s.t. $G/Y = 0.188$ (US, 2005)
- $var(\varepsilon) = 0.193$: estimated variance of insurable shocks (HSV 2013)
- $var(\alpha) = 0.273$: total variance of wages is 0.466

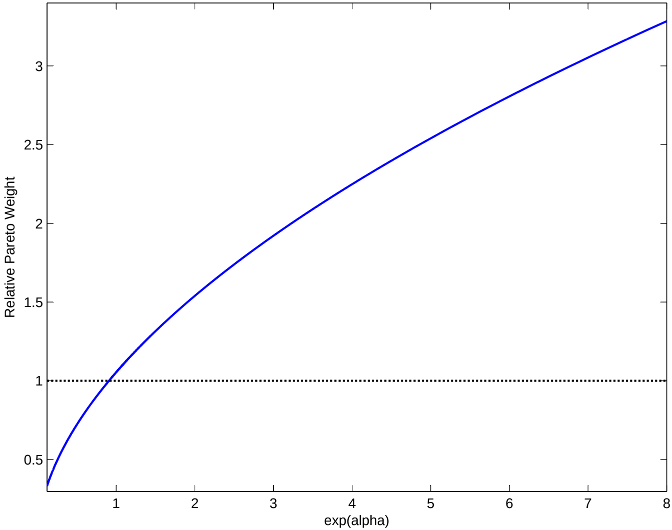
Numerical Implementation

- Maintain continuous distribution for ε
- Assume a discrete distribution for α
- Baseline: 10,000 evenly-spaced grid points
- $\alpha_{\min}$: \$5 per hour (12% of the average $=$ \$41.56)
- $\alpha_{\max}$: \$3,075 per hour (\$6.17m assuming 2,000 hours $=$ 99.99th percentile of SCF earnings distn.)
- Set μ and η^2 to match $E\left[e^{\alpha}\right] = 1$ and target for $var(\alpha)$ given $a = 2.2$

Wage Distribution



Social Welfare Function



Quantitative Analysis: Benchmark

Tax System	Tax Parameters				Outcomes			
					welfare	Y	mar. tax	TR/Y
HSV^{US}	λ 0.836	τ 0.151			–	–	0.311	0.018
Affine	τ_0 −0.116	τ_1 0.303			−0.58	0.41	0.303	0.089
Cubic	τ_0 −0.032	τ_1 0.126	τ_2 0.064	τ_3 −0.003	0.05	0.79	0.289	0.017
Mirrlees					0.11	0.82	0.287	0.003

Quantitative Analysis: Benchmark

- Moving to affine tax system is walfare reducing

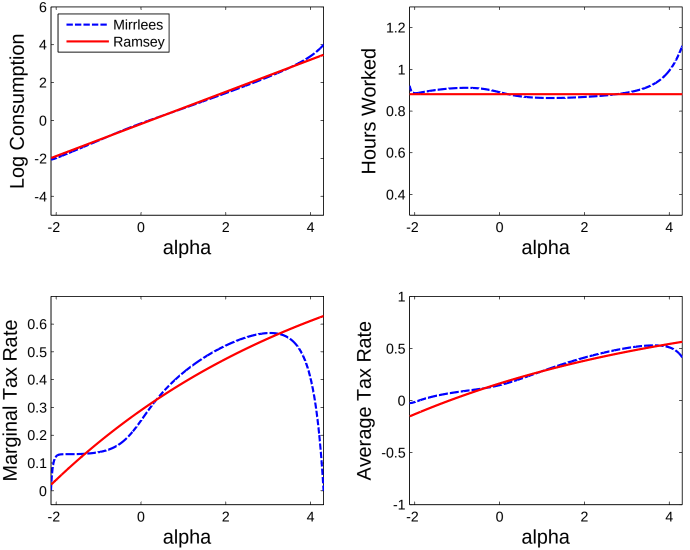
  $\Rightarrow$ Increasing marginal rates more important than lump-sum transfers

- Moving to fully optimal system generates only tiny gains (0.1%)

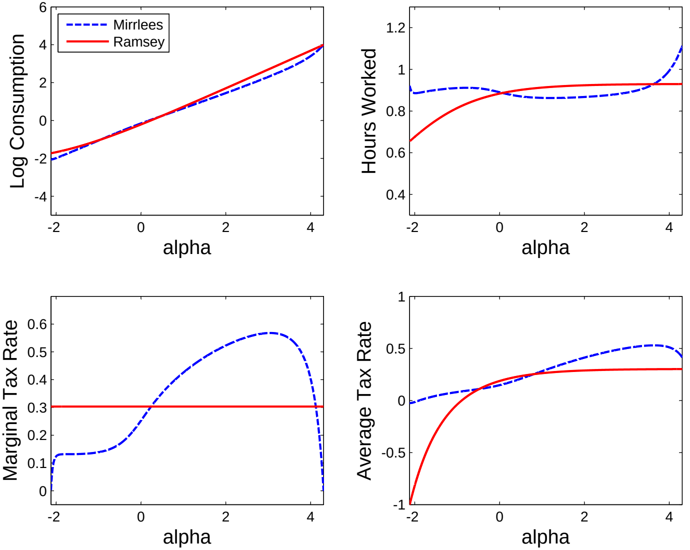
- The optimal marginal tax rate is around 30%

- Almost no need for transfers

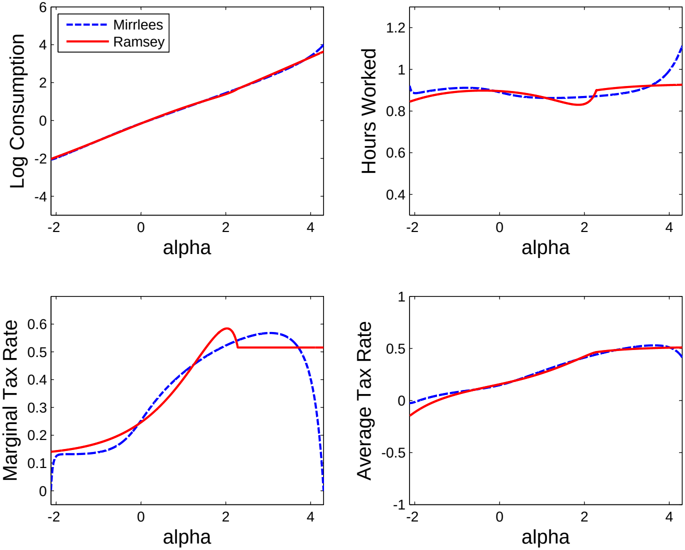
HSV Tax Function



Affine Tax Function



Cubic Tax Function



Quantitative Analysis: Sensitivity

What drives the results?

1. Empirically-motivated SWF $\rightarrow$ Utilitarian SWF: $\theta = 0$
2. Eliminate insurable shocks: $\tilde{v}_\alpha = v_\alpha + v_\varepsilon$ and $\tilde{v}_\varepsilon = 0$
3. Wage distribution has thin Log-Normal right tail: $\alpha \sim N$

Sensitivity: Utilitarian SWF

- Utilitarian SWF $\Rightarrow$ stronger taste for redistribution
- Want higher tax rates and larger transfers
- Optimal HSV still better than optimal affine

Tax System	Tax Parameters		Outcomes			
			welfare	Y	mar. tax	TR/Y
HSV^{US}	$\lambda : 0.836$	$\tau : 0.151$	–	–	0.311	0.018
HSV	$\lambda : 0.821$	$\tau : 0.295$	1.38	−6.02	0.436	0.068
Affine	$\tau_0 : -0.233$	$\tau_1 : 0.452$	0.45	−6.43	0.452	0.220
Mirrlees			1.53	−6.15	0.440	0.122

Sensitivity: No Insurable Shocks

- No insurable shocks $\Rightarrow$ larger role for public redistribution
- Want higher tax rates and larger transfers
- Optimal HSV still better than optimal affine

Tax System	Tax Parameters		Outcomes			
			welfare	Y	mar. tax	TR/Y
HSV^{US}	$\lambda: 0.836$	$\tau: 0.151$	–	–	0.311	0.018
HSV	$\lambda: 0.839$	$\tau: 0.192$	0.12	-1.64	0.346	0.033
Affine	$\tau_0: -0.156$	$\tau_1: 0.360$	-0.21	-1.97	0.360	0.139
Mirrlees			0.23	-2.11	0.361	0.081

- Utilitarian SWF + No insurable shocks
  $\Rightarrow$ Lump-sum transfers more important
  $\Rightarrow$ Optimal HSV worse than optimal affine

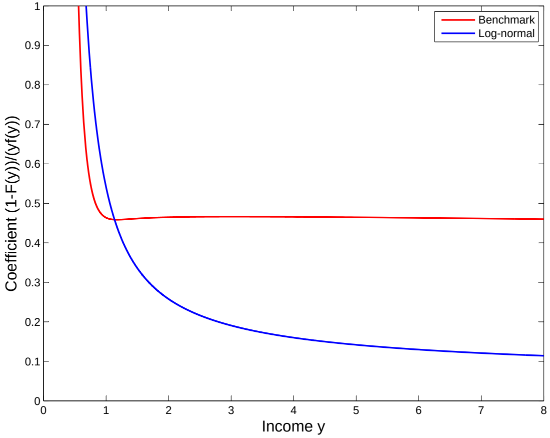
Sensitivity: Log-Normal Wage

- Log-normal distribution ⇒ thin right tail
- Optimal HSV worse than optimal affine
- Optimal affine nearly efficient

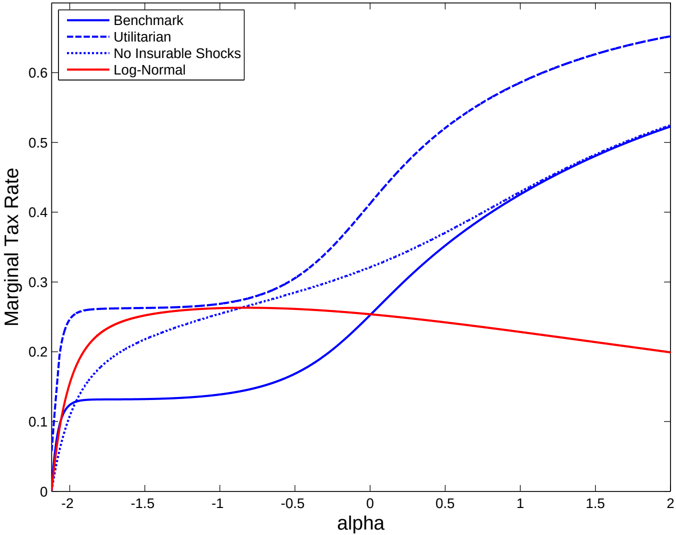
Tax System	Tax Parameters		Outcomes			
			welfare	Y	mar. tax	TR/Y
HSV^{US}	$\lambda : 0.836$	$\tau : 0.151$	–	–	0.311	0.018
HSV	$\lambda : 0.826$	$\tau : 0.070$	0.27	3.10	0.239	-0.005
Affine	$\tau_0 : -0.068$	$\tau_1 : 0.250$	0.34	2.67	0.250	0.042
Mirrlees			0.35	2.71	0.249	0.042

Why Distribution Shape Matters

- Want high marginal rates at the top when (i) few agents face those marginal rates, but (ii) can capture lots of revenue from higher-income households



Efficient Marginal Tax Rates: Sensitivity

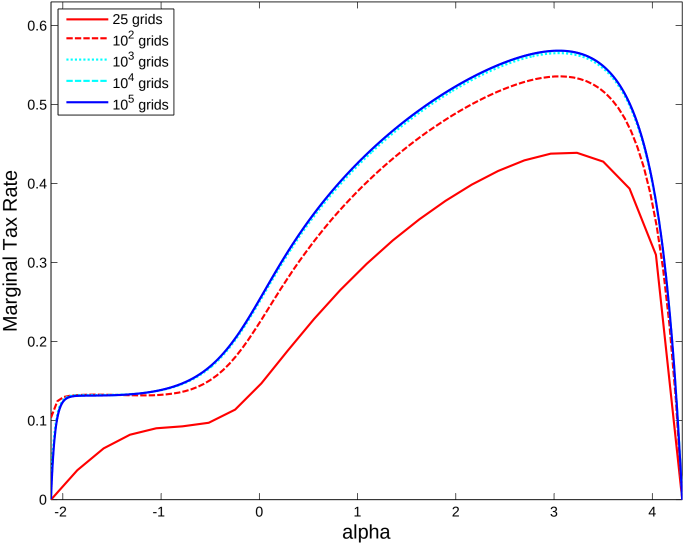


Extension: Coarse Grid

- Coarse grid $\Rightarrow$ Mirrlees Planner can do much better
- Gives Mirrlees planner too much power if true distribution continuous

# of grid points	Welfare (relative to HSV)		
	Affine	Mirrlees	First Best
25	-0.58	3.82	8.80
100	-0.58	1.17	8.79
1,000	-0.58	0.21	8.80
10,000	-0.58	0.11	8.80
100,000	-0.58	0.10	8.80

Extension: Coarse Grid



Extension: Type-Contingent Taxes

- Productivity partially reflects observable characteristics (e.g. education, age, gender)
- Some fraction of uninsurable shocks are observable: $\alpha \to \alpha + \kappa$
- Heathcote, Perri & Violante (2010) estimate variance of cross-sectional wage dispersion attributable to observables, $v_\kappa = 0.108$
- Planner should condition taxes on observables: $T(y; \kappa)$
- Consider two-point distribution for κ (college vs high school)

Extension: Type-Contingent Taxes

- Significant welfare gains relative to non-contingent tax
- Conditioning on observables $\Rightarrow$ marginal tax rates of 20%

System		Outcomes			
		wel.	Y	mar.	TR/Y
HSV^{US}	$\lambda : 0.827, \tau : 0.151$	–	–	0.311	0.017 0.015
HSV	λ^L: 0.988, τ^L: 0.180 λ^H: 0.694, τ^H : −0.059	1.34	4.64	0.212	0.043 −0.061
Affine	τ_0^L: −0.140, τ_1^L: 0.151 τ_0^H: 0.095, τ_1^H : 0.224	1.39	5.20	0.199	0.126 −0.137
Mirrlees		1.46	5.20	0.200	0.103 −0.136

Conclusions

- Moving from current HSV system to optimal affine system is welfare reducing
  - Increasing marginal rates more important than lump-sum transfers
- Moving from current HSV system to fully optimal system generates tiny welfare gains
  - Ramsey and Mirrlees tax schemes not far apart: can approximately decentralize SB with a simple tax scheme
  - Important to measure the gap in terms of allocations and welfare, not in terms of marginal tax rates
- Want to condition both transfers and tax rates on observables