Redistributive Taxation in a Partial Insurance Economy

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Redistributive Taxation

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  1. Social insurance of privately-uninsurable shocks

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Redistributive Taxation

- How progressive should earnings taxation be?

- Arguments in favor of progressivity:

  1. Social insurance of privately-uninsurable shocks
  2. Redistribution from high to low innate ability

- Arguments against progressivity:

  1. Discourages labor supply
  2. Discourages human capital investment
  3. Redistribution from low to high taste for leisure
  4. Complicates financing of govt. spending

Ramsey Approach

Planner takes policy instruments and market structure as given, and chooses the CE that maximizes welfare

- CE of an heterogeneous-agent, incomplete-market economy
- Nonlinear tax/transfer system
- Valued public expenditures also chosen by the government
- Various social welfare functions

Tractable equilibrium framework clarifies economic forces shaping the optimal degree of progressivity

Overview of the model

- Huggett (1994) economy: ∞-lived agents, idiosyncratic productivity risk, and a risk-free bond in zero net-supply, plus:

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- Huggett (1994) economy: ∞-lived agents, idiosyncratic productivity risk, and a risk-free bond in zero net-supply, plus:

1. differential “innate” (learning) ability
2. endogenous skill investment + multiple-skill technology
3. endogenous labor supply
4. heterogeneity in preferences for leisure
5. valued government expenditures
6. additional partial private insurance (other assets, family, etc)

Demographics and preferences

- Perpetual youth demographics with constant survival probability δ
- Preferences over consumption (c), hours (h), publicly-provided goods (G), and skill-investment effort (s):

$$U_i = v_i(s_i) + \mathbb{E}_0 \sum_{t=0}^{\infty} (\beta\delta)^t u_i(c_{it}, h_{it}, G)$$

$$\begin{aligned} v_i(s_i) &= -\frac{1}{\kappa_i}\frac{s_i^2}{2\mu} \\ u_i\left(c_{it}, h_{it}, G\right) &= \log c_{it} - \exp(\varphi_i)\frac{h_{it}^{1+\sigma}}{1+\sigma} + \chi \log G \end{aligned}$$

$$\begin{aligned} \kappa_i &\sim Exp\left(\eta\right) \\ \varphi_i &\sim N\left(\frac{v_\varphi}{2}, v_\varphi\right) \end{aligned}$$

Technology

- Output is CES aggregator over continuum of skill types:

$$Y = \left[\int_0^\infty N(s)^{\frac{\theta-1}{\theta}} \, ds \right]^{\frac{\theta}{\theta-1}}, \quad \theta \in (1, \infty)$$

- Aggregate effective hours by skill type:

$$N(s) = \int_0^1 I_{\{s_i = s\}} \, z_i h_i \, di$$

- Aggregate resource constraint:

$$Y = \int_0^1 c_i \, di + G$$

Individual efficiency units of labor

$$\log z_{it} = \alpha_{it} + \varepsilon_{it}$$

- $\alpha_{it} = \alpha_{i,t-1} + \omega_{it}$ with $\omega_{it} \sim N\left(-\frac{v_\omega}{2}, v_\omega\right)$
  $\alpha_{i0} = 0 \quad \forall i$
- ε_{it} i.i.d. over time with $\varepsilon_{it} \sim N\left(-\frac{v_\varepsilon}{2}, v_\varepsilon\right)$
- $\varphi \perp \kappa \perp \omega \perp \varepsilon$ cross-sectionally and longitudinally

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- Pre-government earnings:

$$y_{it} = \underbrace{p(s_i)}_{\text{skill price}} \times \underbrace{\exp(\alpha_{it} + \varepsilon_{it})}_{\text{efficiency}} \times \underbrace{h_{it}}_{\text{hours}}$$

determined by skill, fortune, and diligence

Government

- Runs a two-parameter tax/transfer function to redistribute and finance publicly-provided goods G

- Disposable (post-government) earnings:

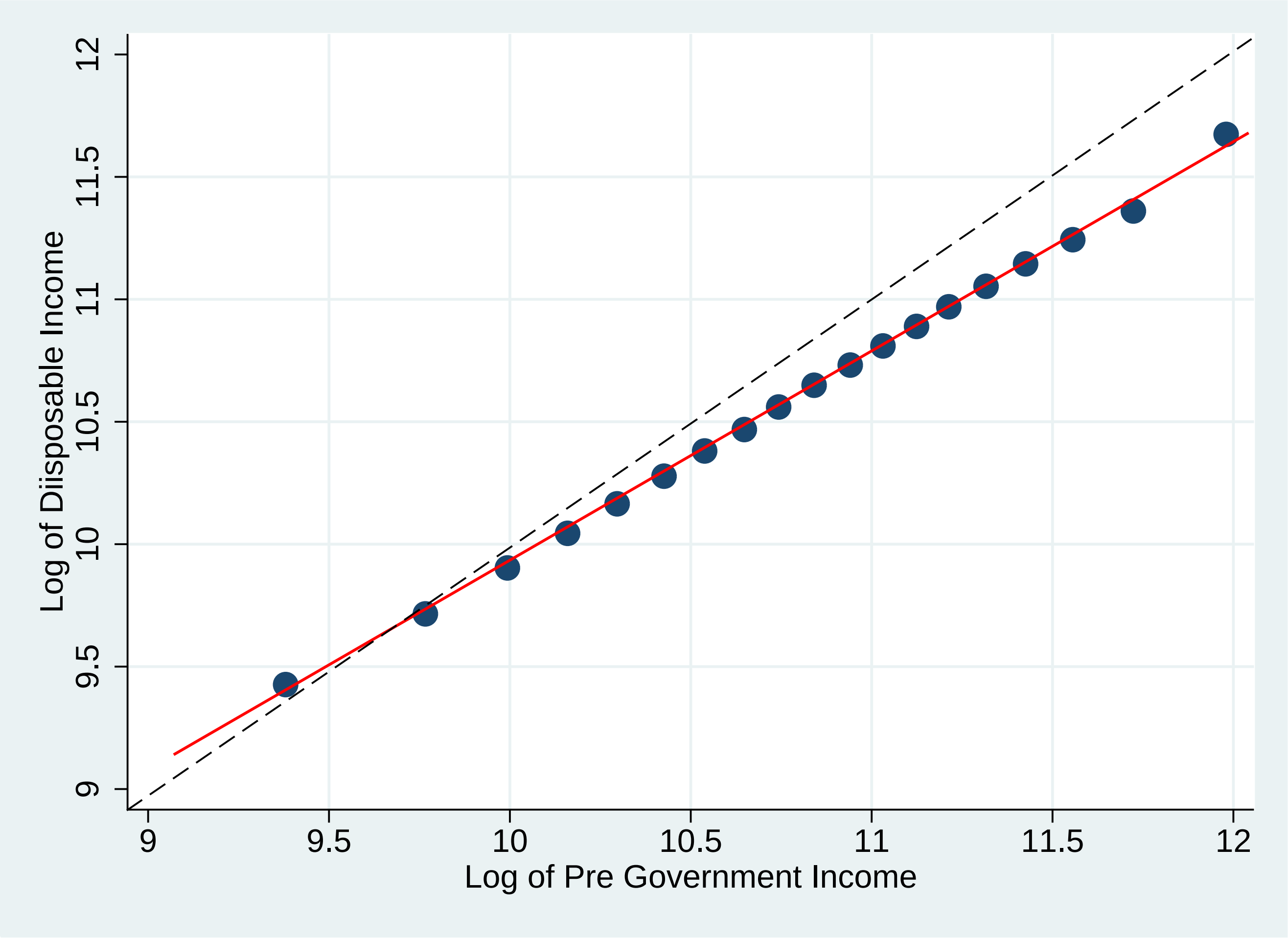
$$\tilde{y}_i = \lambda y_i^{1-\tau}$$

- Government budget constraint (no government debt):

$$G = \int_0^1 \left[y_i - \lambda y_i^{1-\tau} \right] di$$

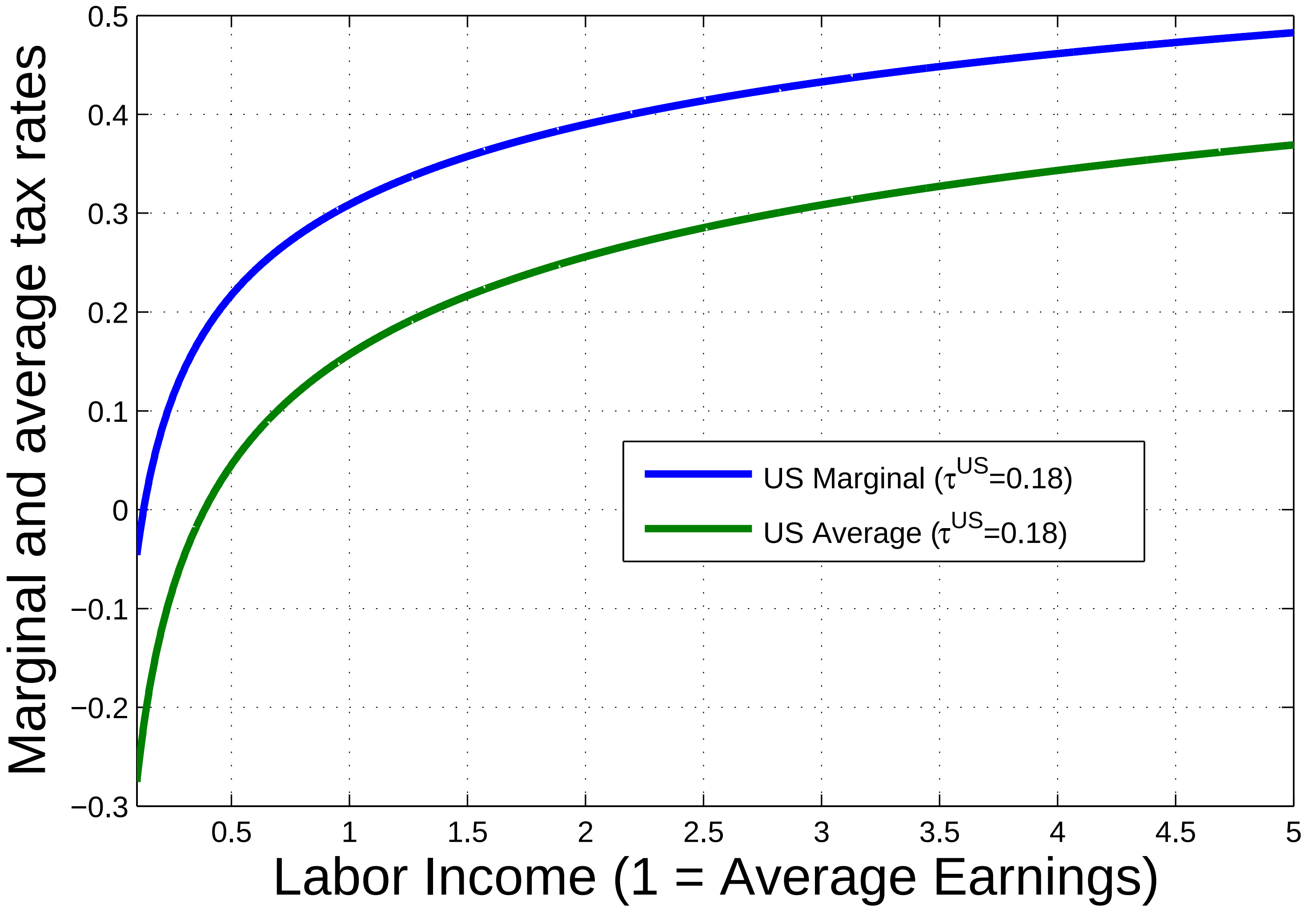
Government chooses (G, τ), and λ balances the budget residually

Our model of fiscal redistribution



- CPS 2005, $Nobs = 52,539$: $R^2 = 0.92$ and $\tau = 0.18$

Our model of fiscal redistribution



Representative Agent Warm Up

$$\max_{C,H} \quad U \quad = \quad \log C - \frac{H^{1+\sigma}}{1+\sigma} + \chi \log G$$

$$s.t.$$

$$C \quad = \quad \lambda H^{1-\tau}$$

Market clearing $C + G = H$

Define $g = G/H$

Equilibrium allocations:

$$\log C^{RA}(g,\tau) \quad = \quad \log(1-g) + \frac{1}{(1+\sigma)} \log(1-\tau)$$

$$\log H^{RA}(g,\tau) \quad = \quad \frac{1}{(1+\sigma)} \log(1-\tau)$$

Representative Agent Optimal Policy

- Welfare:

$$\mathcal{W}^{RA}(g,\tau) = \log(1-g) + \chi \log g + (1+\chi)\frac{\log(1-\tau)}{(1+\sigma)} - \frac{1-\tau}{(1+\sigma)}$$

- Welfare maximizing (g,τ) pair:

$$\begin{aligned} g^* &= \frac{\chi}{1+\chi} \\ \tau^* &= -\chi \end{aligned}$$

- Allocations are first best (same as with lump-sum taxes)
- Result for g^* will extend to heterogeneous agent setup

Markets

- Competitive good and labor markets
- Competitive asset markets (all assets in zero net supply)
  - Non-contingent bond
  - Full set of insurance claims against ε shocks
    - If $v_\varepsilon = 0$, it is a bond economy
    - If $v_\omega = 0$, it is a full insurance economy
    - If $v_\omega = v_\varepsilon = v_\varphi = 0 \quad \& \quad \theta = \infty$, it is a RA economy
- Perfect annuity against survival risk

Budget constraints

1. Beginning of period: innovation ω to α shock is realized

2. Middle of period: buy insurance against ε:

$$b = \int_E Q(\varepsilon)B(\varepsilon)d\varepsilon,$$

   where $Q(\cdot)$ is the price of insurance and $B(\cdot)$ is the quantity

3. End of period: ε realized, consumption and hours chosen:

$$c + \delta q b' = \lambda \left[p(s)\exp(\alpha+\varepsilon)h\right]^{1-\tau} + B(\varepsilon)$$

Recursive stationary equilibrium

- Given (g, τ), a stationary RCE is a value λ^*, asset prices $\{Q(\cdot), q\}$, skill prices $p(s)$, decision rules $s(\varphi, \kappa, 0)$, $c(\alpha, \varepsilon, \varphi, s, b)$, $h(\alpha, \varepsilon, \varphi, s, b)$, and aggregate quantities $N(s)$ such that:
  - households optimize
  - markets clear
  - the government budget constraint is balanced

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  - households optimize
  - markets clear
  - the government budget constraint is balanced
- The equilibrium features no bond-trading
  - $b = 0 \rightarrow$ allocations depend only on exogenous states
  - α shocks remain uninsured, ε shocks fully insured

Equilibrium skill choice and skill price

- Skill price has Mincerian shape: $\log p(s) = \pi_0 + \pi_1 s$

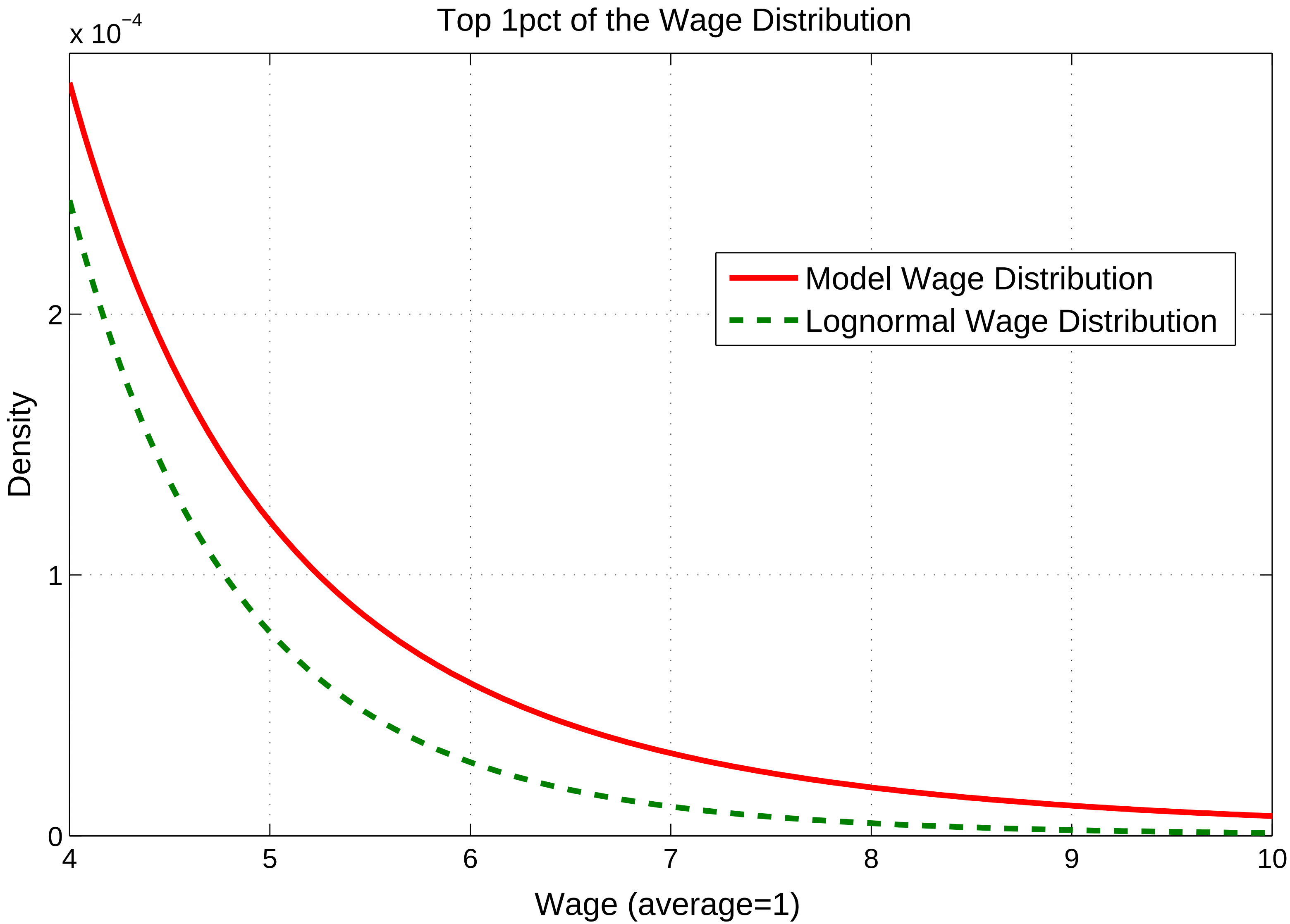
$$
\begin{aligned}
s &= \sqrt{\frac{\eta\mu\left(1-\tau\right)}{\theta}}\kappa \\
\pi_1 &= \sqrt{\frac{\eta}{\theta\mu\left(1-\tau\right)}} \qquad \text{(return to skill)}
\end{aligned}
$$

- Distribution of skill prices (in levels) is Pareto with parameter θ

$$
var(\log p(s)) = \frac{1}{\theta^2}
$$

Offsetting effects of τ on s and $p(s)$ leave pre-tax inequality unchanged

Upper tail of wage distribution



Equilibrium consumption allocation

$$\log c^*(\alpha, \varphi, s; g, \tau) = \log C^{RA}(g, \tau) + \underbrace{\mathcal{M}(v_\varepsilon)}_{\text{level effect from ins. variation}}$$

$$+\underbrace{(1-\tau)\log p(s;\tau)}_{\text{skill price}} - \underbrace{(1-\tau)\,\varphi}_{\text{pref. het.}} + \underbrace{(1-\tau)\,\alpha}_{\text{unins. shock}}$$

- Response to variation in $(p(s), \varphi, \alpha)$ mediated by progressivity
- Invariant to insurable shock ε

Equilibrium hours allocation

$$\log h^*(\varepsilon, \varphi; g, \tau) = \log H^{RA}(g, \tau) - \underbrace{\frac{1}{\widehat{\sigma}(1-\tau)} \mathcal{M}(v_\varepsilon)}_{\text{level effect from ins. variation}}$$

$$- \underbrace{\varphi}_{\text{pref. het.}} + \underbrace{\frac{1}{\widehat{\sigma}} \varepsilon}_{\text{ins. shock}}$$

- Response to ε mediated by tax-modified Frisch elasticity $\frac{1}{\hat{\sigma}} = \frac{1-\tau}{\sigma+\tau}$

- Invariant to skill price $p(s)$ and uninsurable shock α

Social Welfare Function

- Assume planner chooses constant (g, τ)
- Planner puts equal weight on period utility of all currently alive agents, discounts at rate β
- Impose constraint that new τ cannot exceed old τ
  - Otherwise tempted to expropriate past skill investments
- SWF becomes average period utility in the cross-section plus net skill investment costs

Exact expression for SWF

$$
\begin{aligned}
\mathcal{W}(g,\tau) \quad = \quad & \log(1-g) + \chi \log g + (1+\chi)\frac{\log(1-\tau)}{(1+\hat{\sigma})(1-\tau)} - \frac{1}{(1+\hat{\sigma})} \\
& +(1+\chi)\left[\frac{-1}{\theta-1}\log\left(\sqrt{\frac{\eta\theta}{\mu(1-\tau)}}\right) + \frac{\theta}{\theta-1}\log\left(\frac{\theta}{\theta-1}\right)\right] \\
& -\frac{1}{2\theta}(1-\tau) + \frac{(1-\beta)\delta}{(1-\beta\delta)}\frac{1}{2\theta}(1-\tau_{-1}) \\
& -\left[-\log\left(1-\left(\frac{1-\tau}{\theta}\right)\right) - \left(\frac{1-\tau}{\theta}\right)\right] \\
& -(1-\tau)^2\frac{v_\varphi}{2} - \left[(1-\tau)\frac{\delta}{1-\delta}\frac{v_\omega}{2} - \log\left(\frac{1-\delta\exp\left(\frac{-\tau(1-\tau)}{2}v_\omega\right)}{1-\delta}\right)\right] \\
& -(1+\chi)\sigma\frac{1}{\hat{\sigma}^2}\frac{v_\varepsilon}{2} + (1+\chi)\frac{1}{\hat{\sigma}}v_\varepsilon
\end{aligned}
$$

Representative Agent component

$$\mathcal{W}(g,\tau) = \underbrace{\log(1-g) + \chi \log g + (1+\chi)\frac{\log(1-\tau)}{(1+\hat{\sigma})(1-\tau)} - \frac{1}{(1+\hat{\sigma})}}_{\text{Representative Agent Welfare} = \mathcal{W}^{RA}(g,\tau)}$$

$$+(1+\chi)\left[\frac{-1}{\theta-1}\log\left(\sqrt{\frac{\eta\theta}{\mu(1-\tau)}}\right) + \frac{\theta}{\theta-1}\log\left(\frac{\theta}{\theta-1}\right)\right]$$

$$-\frac{1}{2\theta}(1-\tau) + \frac{(1-\beta)\delta}{(1-\beta\delta)}\frac{1}{2\theta}(1-\tau_{-1})$$

$$-\left[-\log\left(1-\left(\frac{1-\tau}{\theta}\right)\right)-\left(\frac{1-\tau}{\theta}\right)\right]$$

$$-(1-\tau)^2\frac{v_\varphi}{2} - \left[(1-\tau)\frac{\delta}{1-\delta}\frac{v_\omega}{2} - \log\left(\frac{1-\delta\exp\left(\frac{-\tau(1-\tau)}{2}v_\omega\right)}{1-\delta}\right)\right]$$

$$-(1+\chi)\sigma\frac{1}{\hat{\sigma}^2}\frac{v_\varepsilon}{2} + (1+\chi)\frac{1}{\hat{\sigma}}v_\varepsilon$$

Skill investment component

$$\mathcal{W}(\tau) = \mathcal{W}^{RA}(\tau)$$

$$+(1+\chi)\underbrace{\left[\frac{-1}{\theta-1}\log\left(\sqrt{\frac{\eta\theta}{\mu\left(1-\tau\right)}}\right)+\frac{\theta}{\theta-1}\log\left(\frac{\theta}{\theta-1}\right)\right]}_{\text{productivity} = \log E\left[\left(p(s)\right)\right] = \log\left(Y/N\right)}$$

$$\underbrace{-\frac{1}{2\theta}(1-\tau)+\frac{(1-\beta)\delta}{(1-\beta\delta)}\frac{1}{2\theta}(1-\tau_{-1})}_{\text{net education cost}}$$

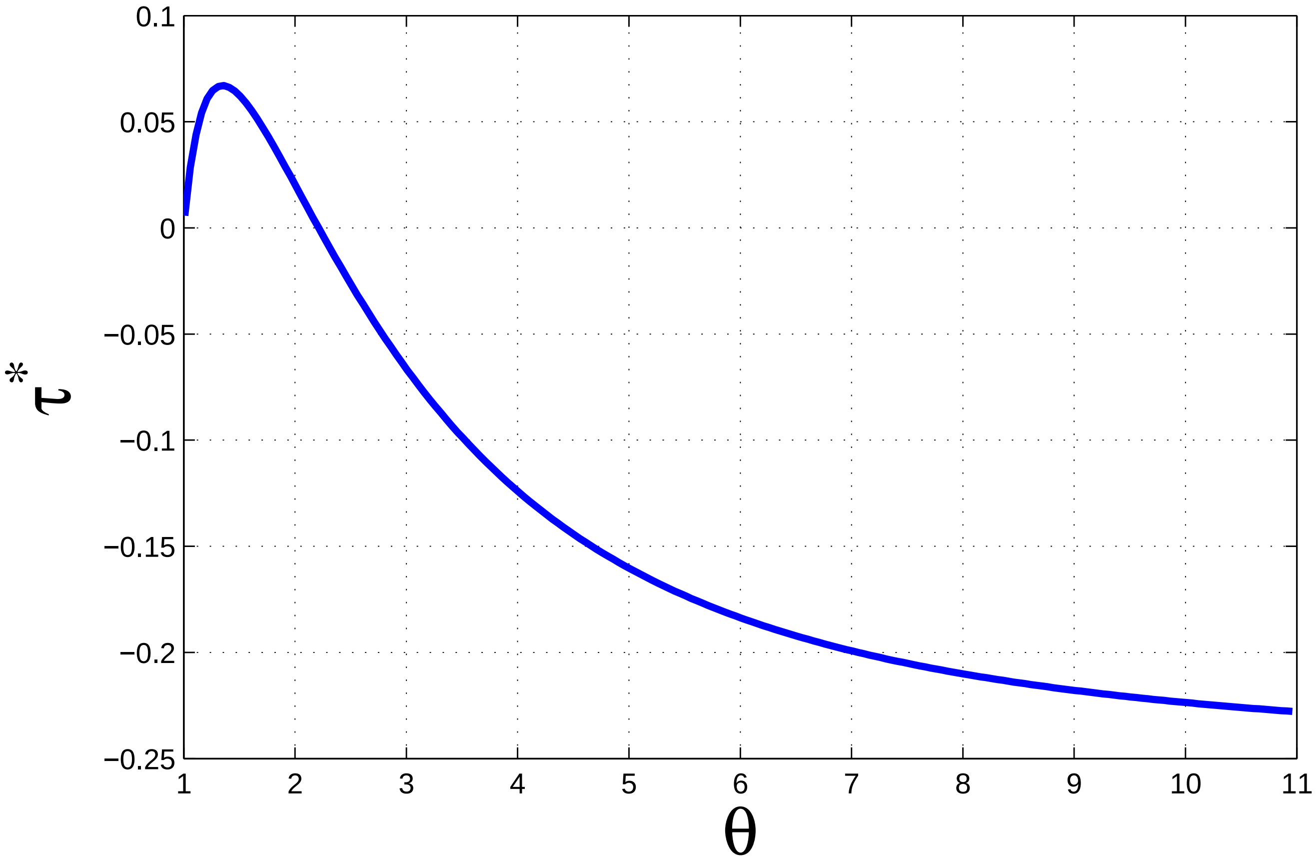
$$\underbrace{-\left[-\log\left(1-\left(\frac{1-\tau}{\theta}\right)\right)-\left(\frac{1-\tau}{\theta}\right)\right]}_{\text{consumption dispersion across skills}}$$

$$-(1-\tau)^2\frac{v_\varphi}{2}-\left[(1-\tau)\frac{\delta}{1-\delta}\frac{v_\omega}{2}-\log\left(\frac{1-\delta\exp\left(\frac{-\tau(1-\tau)}{2}v_\omega\right)}{1-\delta}\right)\right]$$

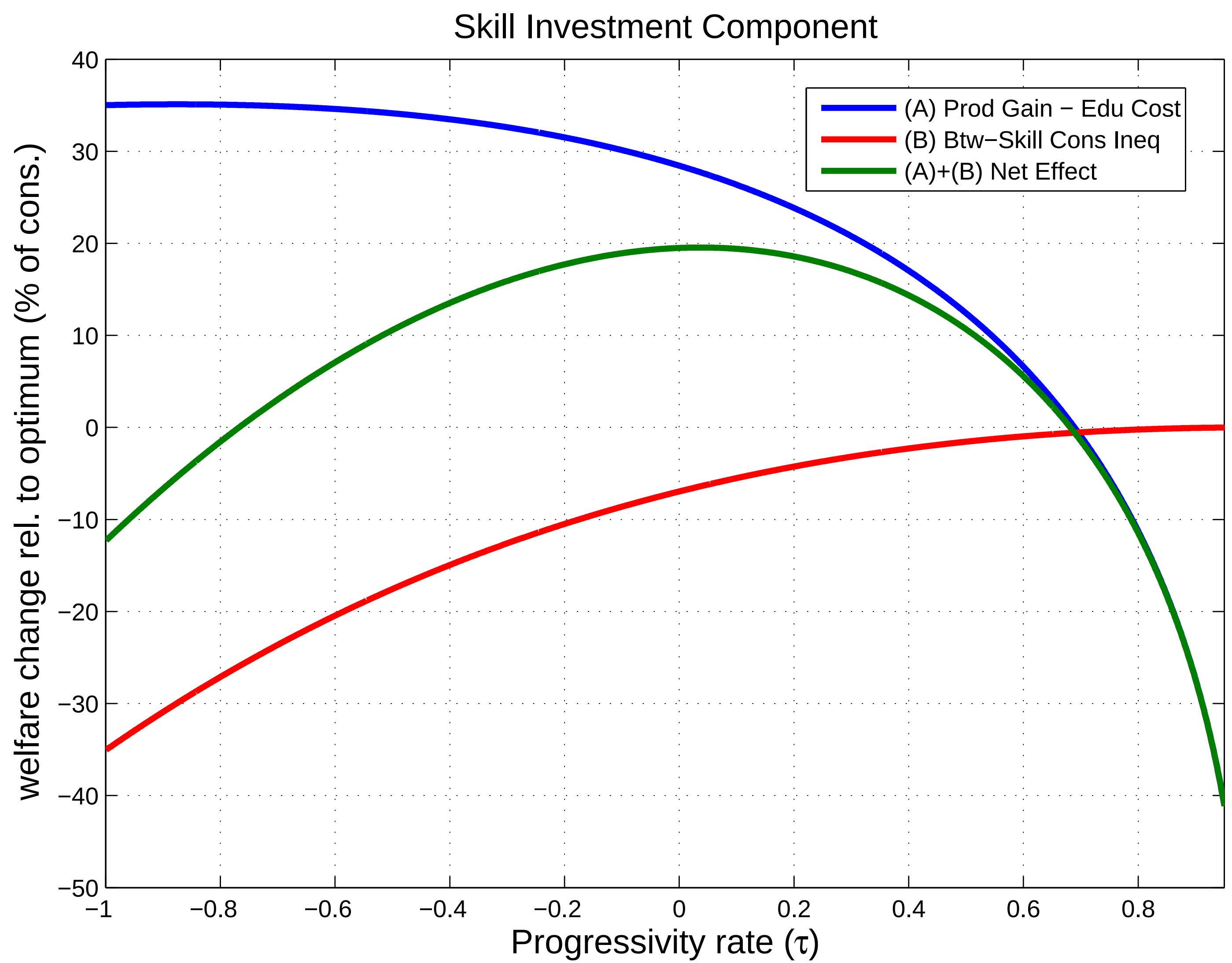
$$-(1+\chi)\sigma\frac{1}{\hat{\sigma}^2}\frac{v_\varepsilon}{2}+(1+\chi)\frac{1}{\hat{\sigma}}v_\varepsilon$$

Optimal τ as a function of θ

- Assume κ is the only source of heterogeneity
- Set $\sigma = 2$ and $\chi = 0.25$



Skill investment welfare decomposition ($\theta = 3$)



Uninsurable component

$$
\begin{aligned}
\mathcal{W}(\tau) \quad &= \quad \ldots \\
&- \quad \underbrace{(1-\tau)^2 \frac{v_\varphi}{2}}_{\text{cons. disp. due to prefs}} \\
&- \underbrace{\left[(1-\tau)\frac{\delta}{1-\delta}\frac{v_\omega}{2} - \log\left(\frac{1-\delta\exp\left(\frac{-\tau(1-\tau)}{2}v_\omega\right)}{1-\delta}\right)\right]}_{\text{consumption dispersion due to uninsurable shocks} \approx \ (1-\tau)^2\frac{v_\alpha}{2}} \\
&-(1+\chi)\sigma\frac{1}{\hat{\sigma}^2}\frac{v_\varepsilon}{2} + (1+\chi)\frac{1}{\hat{\sigma}}v_\varepsilon
\end{aligned}
$$

Insurable component

$$\mathcal{W}(\tau) = \ldots$$

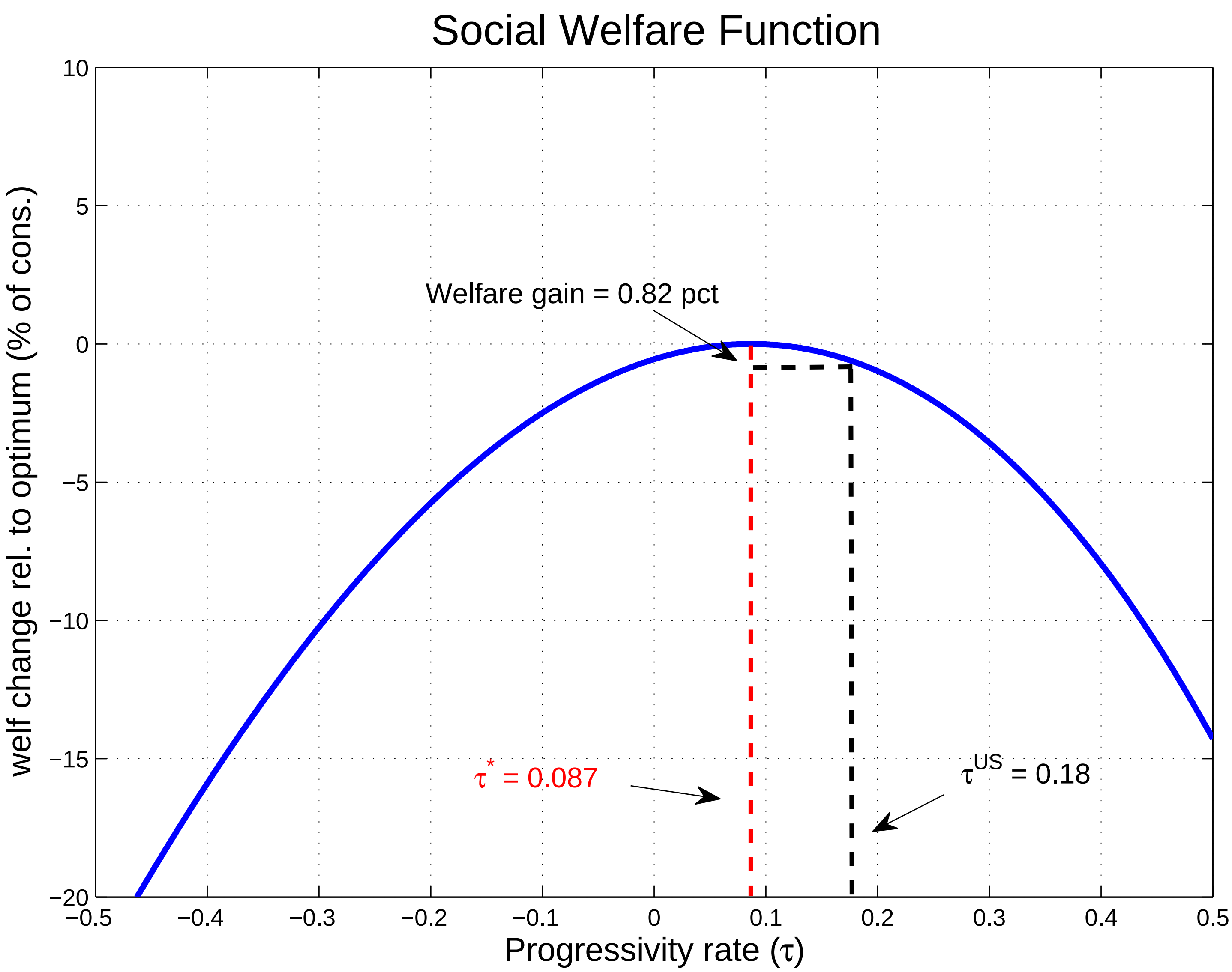
$$-(1+\chi)\sigma \underbrace{\frac{1}{\hat{\sigma}^2}\frac{v_\varepsilon}{2}}_{\text{hours dispersion}} + (1+\chi) \underbrace{\frac{1}{\hat{\sigma}}v_\varepsilon}_{\text{prod. gain from ins. shock}=\log(N/H)}$$

Parameterization

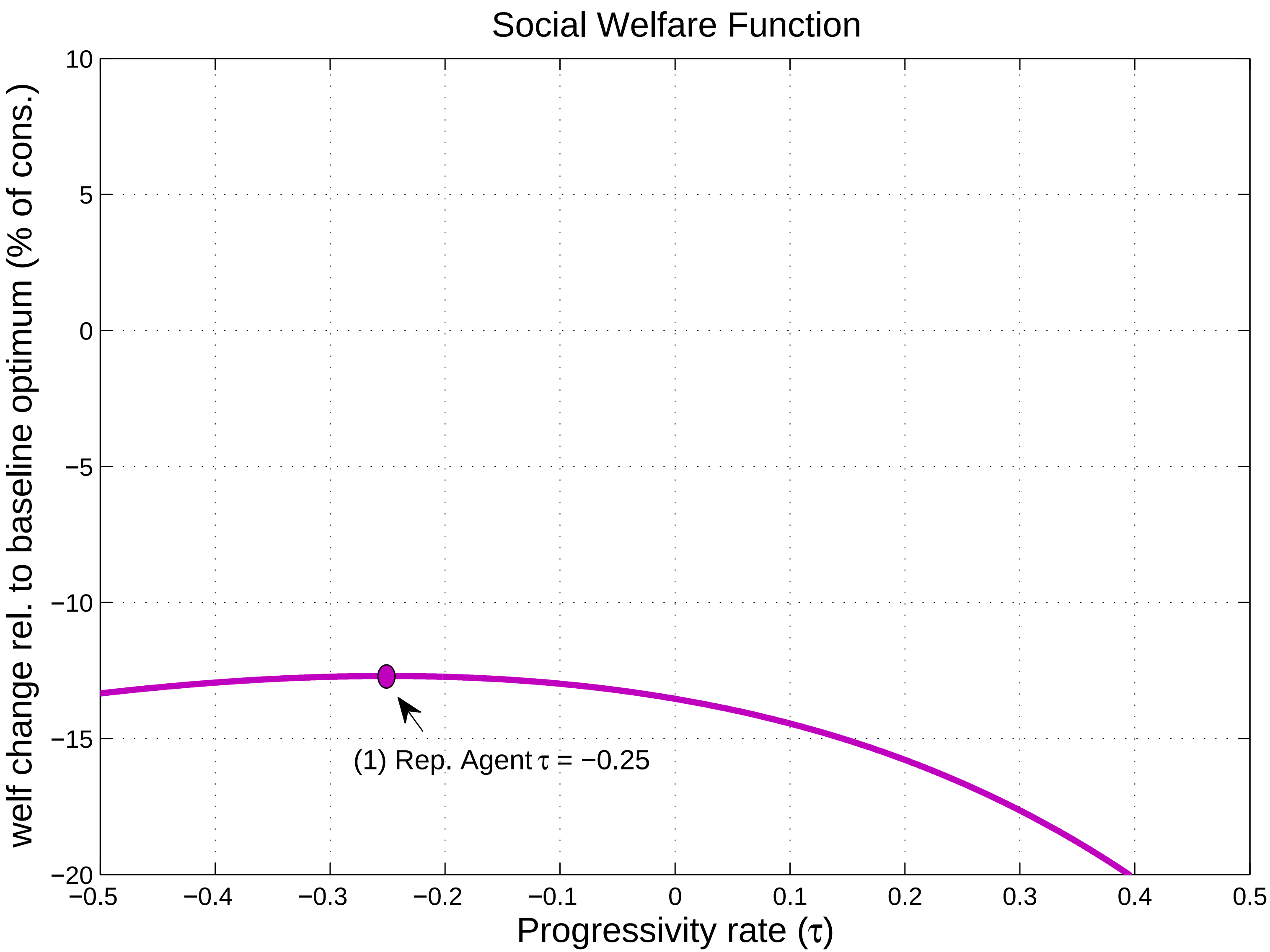
- Parameter vector $\{\chi, \sigma, \delta, \theta, v_\varphi, v_\omega, v_\varepsilon, \}$
- To match $G/Y = 0.20$: $\rightarrow \chi = 0.25$
- Frisch elasticity (micro-evidence): $\rightarrow \sigma = 2$

$$
\begin{aligned}
cov(\log h, \log w) &= \frac{1}{\hat{\sigma}} v_\varepsilon && \rightarrow v_\varepsilon = 0.18 \\
var(\log h) &= v_\varphi + \frac{1}{\hat{\sigma}^2} v_\varepsilon && \rightarrow v_\varphi = 0.06 \\
var^0(\log c) &= (1-\tau)^2 \left(v_\varphi + \frac{1}{\theta^2} \right) && \rightarrow \theta = 3 \\
\Delta var(\log w) &= v_\omega && \rightarrow v_\omega = 0.005, \delta = 0.963
\end{aligned}
$$

Optimal progressivity



Optimal progressivity: decomposition



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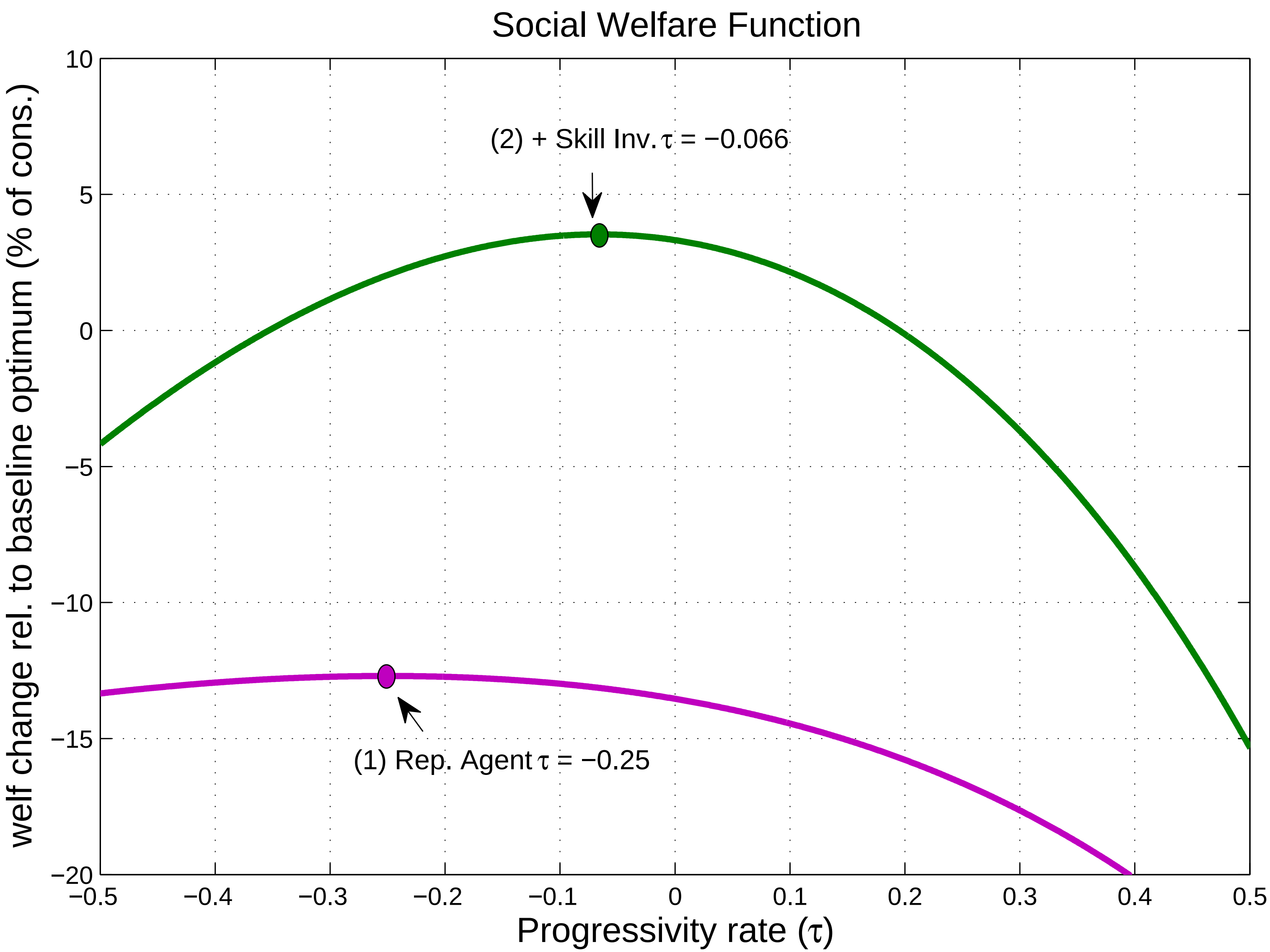

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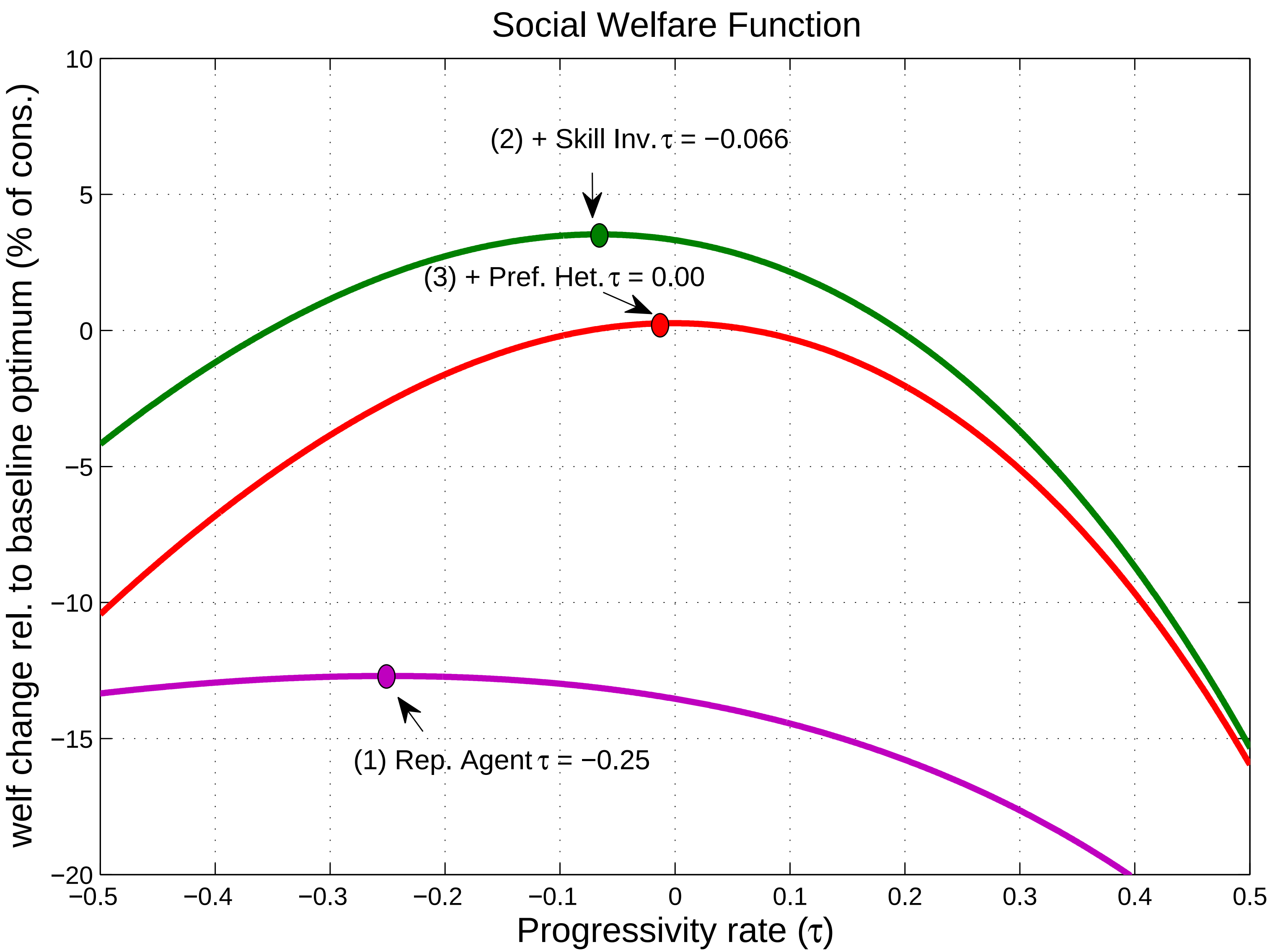

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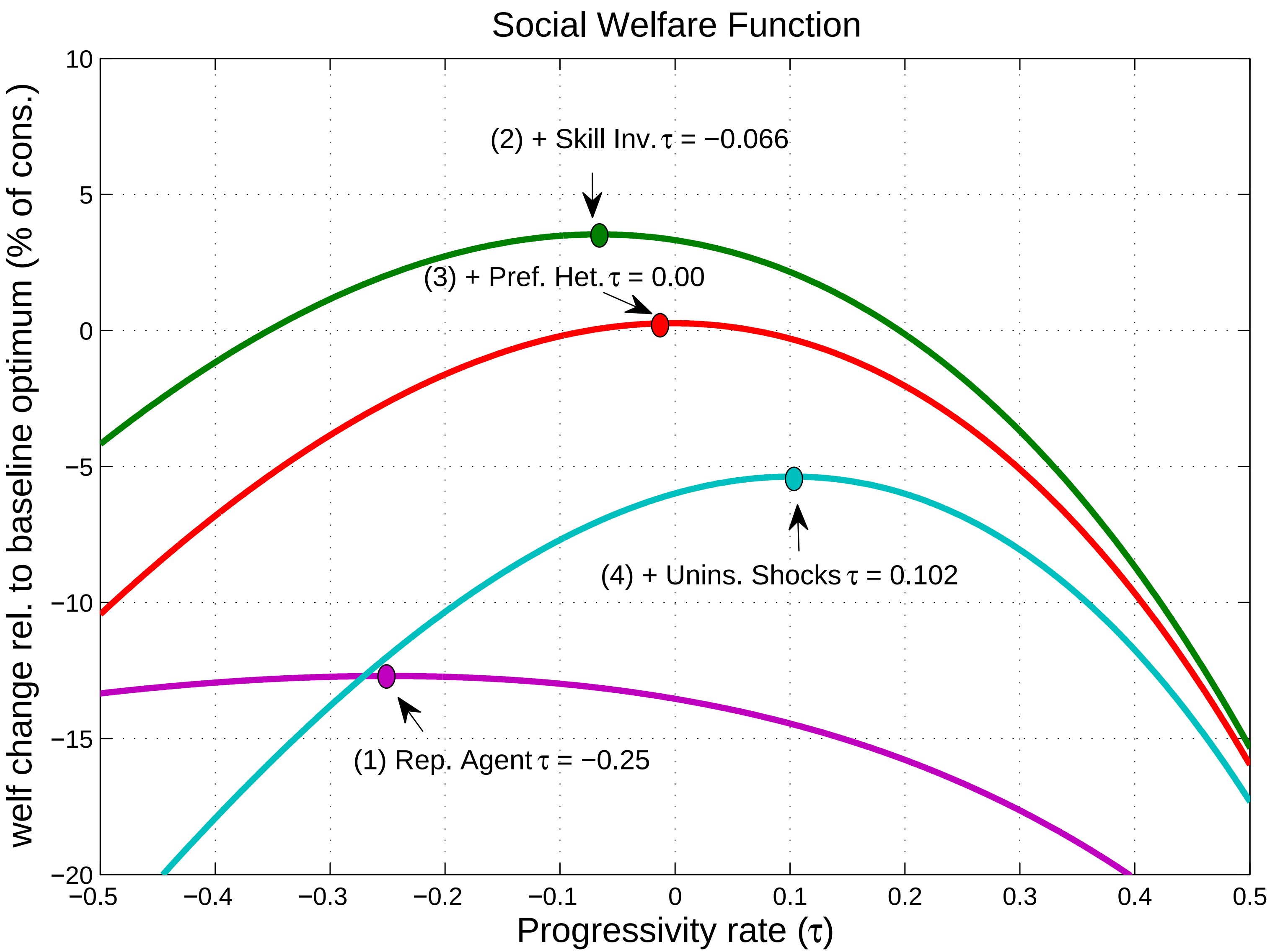

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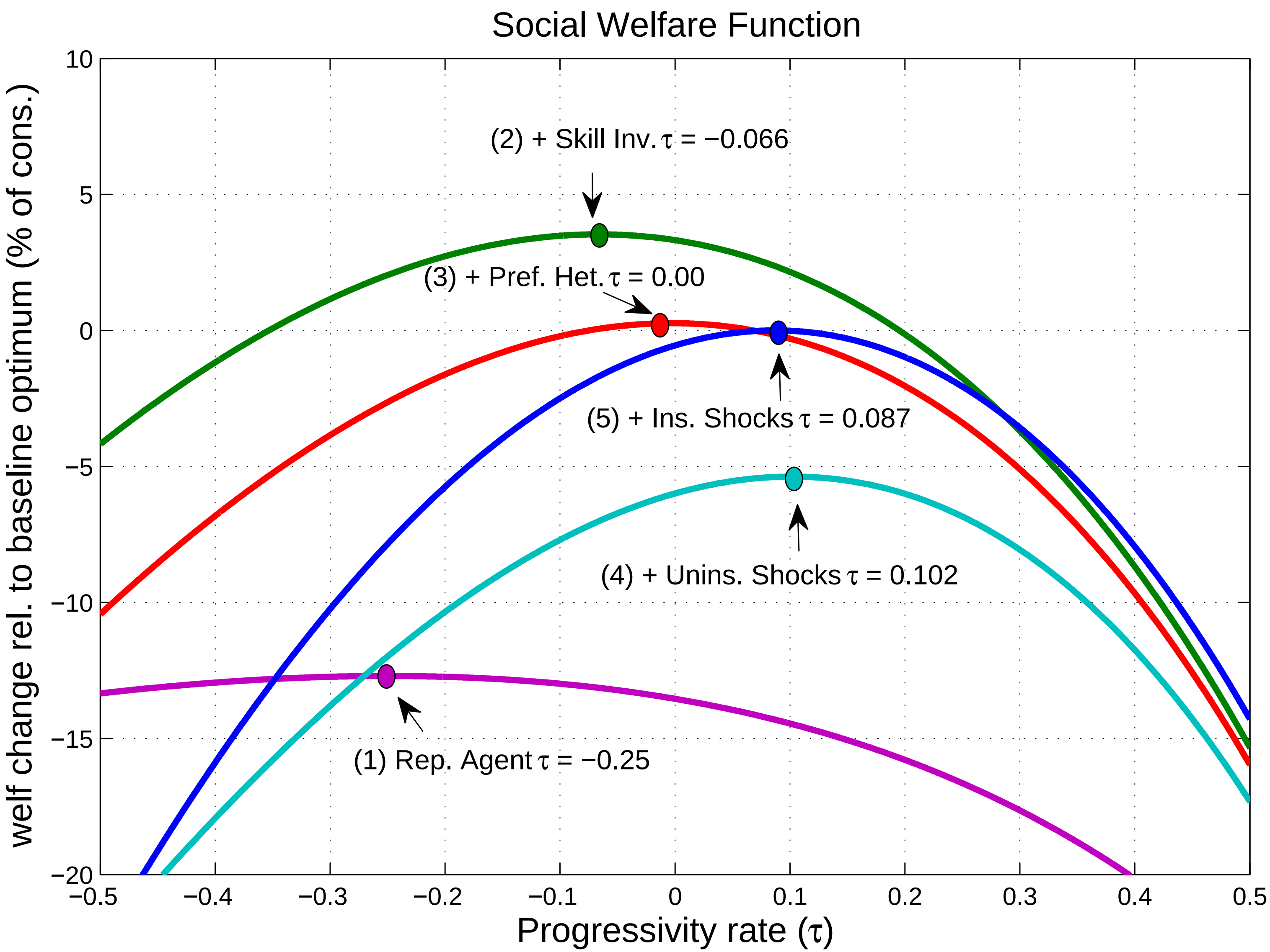
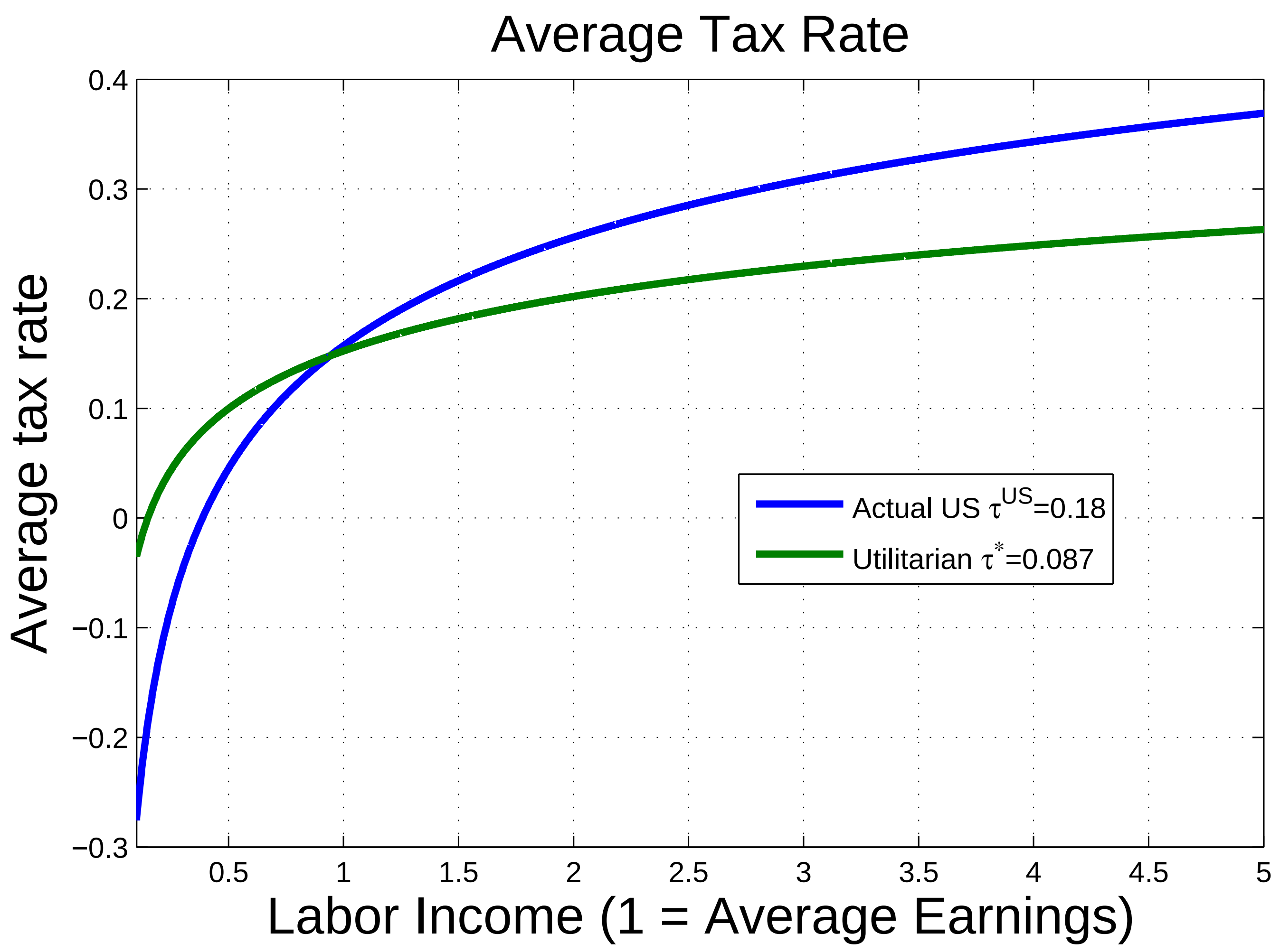


Actual and optimal progressivity



Factors limiting progressivity

1. Discourages skill investment

2. Reduces labor supply

    - especially important when G valued

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	Welfare maxizing τ	var($\log(\lambda y^{1-\tau})$) / var($(\log y)$)
Baseline	0.087	0.83
(1) Exog. skills	0.238	0.58
(2) $\sigma = 20$	0.219	0.61
(3) $\chi = 0$	0.209	0.63
(1)+(2)	0.626	0.14
(1)+(2)+(3)	0.671	0.11

Alternative assumptions on G

1. G endogenous and valued: $\chi = 0.25$, $G^* = \chi/(1+\chi) = 0.2$
2. G endogenous but non valued: $\chi = 0$, $G^* = 0$
3. G exogenous and proportional to Y: $G/Y = \bar{g} = 0.2$
4. G exogenous and fixed in level: $G = \bar{G} = 0.2 \times Y^{US}$

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			Utilitarian SWF	Insurance-only SWF
		$\frac{G}{Y(\tau^*)}$	τ^*	τ^*
G endogenous	$\chi = 0.25$	0.200	0.087	-0.012
G endogenous	$\chi = 0$	0.000	0.209	0.103
g exogenous	$\bar{g} = 0.2$	0.200	0.209	0.103
G exogenous	$\bar{G} = 0.2 \times Y(\tau^{US})$	0.188	0.095	0.002

Going forward

- Median voter choosing (g, τ) once and for all
- Skill-biased technical change
- Comparison with Mirlees solution
- Rent-extraction by top earners? (Piketty-Saez view)
- Endogenous growth?