Taxing Top Incomes in a World of Ideas

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Overview

- Saez (2001) and following literature

  "Macro"-style calibration of optimal top income taxation

  Many extensions to K, H, dynamics — but not ideas!

- How does this calculation change when:
  - New ideas drive economic growth
  - The reward for a new idea is a top income
  - Creation of ideas is broad
    - A formal "research subsidy" is imperfect (Walmart, Amazon)
  - A small number of entrepreneurs $\Rightarrow$ the bulk of economy-wide growth

- $\uparrow \tau$ lowers consumption throughout the economy via nonrivalry

Literature

- Human capital: Badel and Huggett, Kindermann and Krueger
- Superstars/inventors: Scheuer and Werning, Chetty et al
- Spillovers: Lockwood-Nathanson-Weyl
- Mirrlees w/ Imperfect Substitution: Sachs-Tsyvinski-Werquin
- Inventors and taxes: Akcigit-Baslandze-Stantcheva, Moretti and Wilson, Akcigit-Grigsby-Nicholas-Stantcheva
- Growth and taxes: Stokey and Rebelo, Jaimovich and Rebelo

This paper does not calculate "the" optimal top tax rate

- Many other considerations:
  - Political economy of inequality
  - Occupational choice (other brackets, concavity)
  - Top tax diverts people away from finance to ideas?
  - Social safety net, lenient bankruptcy insure the downside
  - How sensitive are entrepreneurs to top tax rates?
  - Empirical evidence on growth and taxes
  - Rent seeking, human capital
- Still, including economic growth and ideas seems important

Basic Setup

Overview

- BGP of an idea-based growth model. Romer 1990, Jones 1995
  - Semi-endogenous growth
  - Basic R&D (subsidized directly), Applied R&D (top tax rate)
  - BGP simplifies: static comparison vs transition dynamics
- Three alternative approaches to the top tax rate:
  - Revenue maximization
  - Maximize welfare of “workers”
  - Maximize utilitarian social welfare

The Economic Environment

- Consumption goods produced by managers $\tilde{M}$, labor L, and nonrival "applied" ideas A:

$$Y = A^{\gamma} \tilde{M}^{\psi} L^{1-\psi} \tag{1}$$

- Applied ideas produced from entrepreneurs, effort e, talent z, and basic research ideas B:

$$\dot{A}_t = \bar{a}(\mathbb{E}(ez) S_{at})^{\lambda} A_t^{\phi_a} B_t^{\alpha}$$

- Fundamental ideas produced from basic research:

$$\dot{B}_t = \bar{b} S_{bt}^{\lambda} B_t^{\phi_b}$$

- $\tilde{M}$, L, S_a, S_b exogenous. e, z endogenous (unspecified for now)

BGP from a Dynamic Growth Model

- BGP implies that stocks are proportional to flows:
  - A and B are proportional to S_a and S_b (to some powers)
  - S_a, S_b, L, M: exogenous population growth
- Stock of applied ideas (being careless with exponents wlog)

$$A = \nu_a \mathbb{E}[ez] S_a B^{\beta} \tag{2}$$

- Stock of basic ideas

$$B = \nu_b S_b \tag{3}$$

Output = Consumption:

- Combining (1) - (3) with $\tilde{M} = \mathbb{E}[ez]M$:

$$Y = \left(\nu \mathbb{E}[ez] S_a S_b^{\beta}\right)^{\gamma} (\mathbb{E}[ez]M)^{\psi} L^{1-\psi}$$

  - Output per person $y \propto (S_a S_b^{\beta})^{\gamma}$
  - Intuition: y depends on stock of ideas, not ideas per person
  - LR growth $= \gamma(1+\beta)n$ where n is population growth

- Taxes distort $\mathbb{E}(ez)$:
  - ψ effect is traditional, but ψ small?
  - γ effect via nonrivalry of ideas, can be large!

Nonlinear Income Tax Revenue

$$T = \underbrace{\tau_0[wL + wS_b + w_a\mathbb{E}(ez)S_a + w_m\mathbb{E}(ez)M]}_{\text{all income pays } \tau_0}$$

$$+ \underbrace{(\tau - \tau_0)[(w_a\mathbb{E}(ez) - \bar{w})S_a + (w_m\mathbb{E}(ez) - \bar{w})M]}_{\text{income above } \bar{w} \text{ pays an additional } \tau - \tau_0}$$

- Full growth model: entrepreneurs paid a constant share of GDP

$$\frac{w_a\mathbb{E}(ez)S_a}{Y} = \rho_s \quad \text{and} \quad \frac{w_m\mathbb{E}(ez)M}{Y} = \rho_m.$$

and $Y = wL + w_bS_b + w_a\mathbb{E}(ez)S_a + w_m\mathbb{E}(ez)M, \quad \rho \equiv \rho_s + \rho_m$

$$\Rightarrow T = \tau_0 Y + (\tau - \tau_0)\left[\rho Y - \bar{w}(S_a + M)\right]$$

Some Intuition

- Entrepreneurs/managers paid a constant share of GDP

$$\frac{w_a \mathbb{E}(ez) S_a}{Y} = \rho_s \quad \text{and} \quad \frac{w_m \mathbb{E}(ez) M}{Y} = \rho_m.$$

- Production: $Y = \left(\nu \mathbb{E}[ez] S_a S_b^{\beta}\right)^{\gamma} (\mathbb{E}[ez] M)^{\psi} L^{1-\psi}$

- Efficiency: Pay $\sim$ Cobb-Douglas exponents. IRS means cannot!

- Jones and Williams (1998) social rate of return calculation:

$$\tilde{r} = g_Y + \lambda g_y \left(\frac{1}{\rho_s (1-\tau)} - \frac{1}{\gamma} \right)$$

$\Rightarrow$ After tax share of payments to entrepreneurs should equal γ

$\rho_s(1-\tau)$ versus γ is one way of viewing the tradeoff

The Top Tax Rate that Maximizes Revenue

Revenue-Maximizing Top Tax Rate

- Key policy problem:

$$\max_{\tau} T = \tau_0 Y + (\tau - \tau_0)\left[\rho Y - \bar{w}(S_a + M)\right]$$

s.t.

$$Y = \left(\nu \mathbb{E}[ez] S_a S_b^{\beta}\right)^{\gamma} (\mathbb{E}[ez] M)^{\psi} L^{1-\psi}$$

- A higher τ reduces the effort of entrepreneurs/managers
  - Leads to less innovation
  - which reduces everyone's income (Y)
  - which lowers tax revenue received via τ_0

Solution

$$\tau^*_{rm} = \frac{1 - \tau_0 \cdot \frac{1-\rho}{\Delta\rho} \cdot \eta_{Y,1-\tau}}{1 + \frac{\rho}{\Delta\rho}\,\eta_{Y,1-\tau}} \quad \text{vs} \quad \tau^*_{ds} = \frac{1}{1 + \alpha \cdot \eta_{z_m,1-\tau}}$$

- Remarks: Two key differences
  - $\eta_{Y,1-\tau}$ versus $\eta_{z_m,1-\tau}$

    $\eta_{Y,1-\tau} \Rightarrow$ How GDP changes if researchers keep more

    $\eta_{z_m,1-\tau} \Rightarrow$ How average top incomes change
  - If $\tau_0 > 0$, then τ^* is lower

    Distorting research lowers GDP

    $\Rightarrow$ lowers revenue from other taxes!

Guide to Intuition

$\eta_{Y,1-\tau}$	The economic model
$\rho\,\eta_{Y,1-\tau}$	Behavioral effect via top earners
$(1-\rho)\,\eta_{Y,1-\tau}$	Behavioral effect via workers
$\Delta\rho \equiv \rho - \bar{\rho}$	Tax base for τ, mechanical effect
$1 - \Delta\rho$	Tax base for τ_0

What is $\eta_{Y,1-\tau}$?

$$Y = \left(\nu \mathbb{E}[ez] S_a S_b^{\beta}\right)^{\gamma} (\mathbb{E}[ez] M)^{\psi} L^{1-\psi} \quad \Rightarrow \quad \eta_{Y,1-\tau} = (\gamma + \psi)\zeta$$

- γ = degree of IRS via ideas
- ψ = manager's share = 0.15 (not important)
- ζ is the elasticity of $\mathbb{E}[ez]$ with respect to $1 - \tau$.
  - Standard Diamond-Saez elasticity: $\zeta = \eta_{z_m,1-\tau}$
  - How individual behavior changes when the tax rate changes
  - Cool insight from PublicEcon: all that matters is the value of this elasticity, not the mechanism!
  - So for now, just treat as a parameter (endogenized later)

Calibration

- Parameter values for numerical examples

$\frac{\zeta}{1-\zeta} \in \{0.2, 0.5\}$	Behavioral elasticity. Saez values
$\gamma \in [1/8, 1]$	$g_{tfp} = \gamma(1+\beta) \cdot g_S \approx 1\%$.
$\tau_0 = 0.2$	Average tax rate outside the top.
$\Delta\rho = 0.10$	Share of income taxed at the top rate; top returns account for 20% of taxable income.
$\rho = 0.15$	So $\frac{\rho}{\Delta\rho} = 1.5$ as in Saez pareto parameter, α.

Revenue-Maximizing Top Tax Rate, τ^*_{rm}

	Behavioral Elasticity	
Case	0.20	0.50
Diamond-Saez:	0.80	0.67
No ideas, $\gamma = 0$		
$\tau_0 = 0$:	0.96	0.93
$\tau_0 = 0.20$:	0.92	0.85
Degree of IRS, γ		
1/8	0.86	0.74
1/4	0.81	0.64
1/2	0.70	0.48
1	0.52	0.22

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Intuition: Double the "keep rate" $1-\tau$ (e.g. $\tau = 75\%$ to $\tau = 50\%$).

- What is the long-run effect on GDP?
  - Answer: $2^{\eta_{Y,1-\tau}} = 2^{\gamma\zeta}$
  - Baseline: $\gamma = 1/2$ and $\zeta = 1/6 \Rightarrow 2^{1/12} \approx 1.06$

Raises GDP by just 6%!

- With $\Delta\rho = 10\%$, the revenue cost is 2.5% of GDP

6% gain to everyone...

$>$ redistributing 2.5% to the bottom half!

- 6% seems small, but achieved by a small group of researchers working 15% harder...

Maximizing Worker Welfare

- Revenue-max ignores effect on consumption
- Worker welfare yields a clean closed-form solution

Choose τ and τ_0 to Maximize Worker Welfare

- Workers:

$$c^w = w(1 - \tau_0)$$

$$u_w(c) = \theta \log c$$

- Government budget constraint

$$\tau_0 Y + (\tau - \tau_0)[\rho Y - \bar{w}(S_a + M)] = \Omega Y$$

Exogenous government spending share of GDP = Ω

(to pay for basic research, legal system, etc.)

- Problem:

$$\max_{\tau,\tau_0} \log(1 - \tau_0) + \log Y(\tau) \quad \text{s.t.}$$

$$\tau_0 Y + (\tau - \tau_0)[\rho Y - \bar{w}(S_a + M)] = \Omega Y.$$

First Order Conditions

- The top rate that maximizes worker welfare satisfies

$$\tau_{ww}^* = \frac{1 - \eta_{Y,1-\tau} \left(\frac{1-\rho}{\Delta\rho} \cdot \tau_0^* + \frac{1-\Delta\rho}{\Delta\rho} \cdot (1 - \tau_0^*) - \frac{\Omega}{\Delta\rho} \right)}{1 + \frac{\rho}{\Delta\rho} \eta_{Y,1-\tau}}.$$

- Three new terms relative to Saez:

$\eta \frac{1-\rho}{\Delta\rho} \cdot \tau_0^*$	Original term from RevMax
$\eta \frac{1-\Delta\rho}{\Delta\rho} \cdot (1 - \tau_0^*)$	Direct effect of a higher tax rate reducing GDP $\Rightarrow$ reduce workers consumption
$\eta \frac{\Omega}{\Delta\rho}$	Need to raise Ω in revenue

Intuition

- When is a "flat tax" optimal?

$$\tau \leq \tau_0 \quad \Longleftrightarrow \quad \eta_{Y,1-\tau} \geq \frac{\Delta\rho}{1-\Delta\rho}.$$

  Two ways to increase c^w:

  - $\downarrow \tau \;\Rightarrow$ raises GDP by $\eta_{Y,1-\tau}$
  - Redistribute $\Rightarrow$ take from $\Delta\rho$ people, give to $1-\Delta\rho$

- Baseline parameters: $\eta_{Y,1-\tau} = \frac{1}{6}(\gamma+\psi)$ and $\frac{\Delta\rho}{1-\Delta\rho} = \frac{1}{9}$.

$$\gamma + \psi > 2/3 \;\Rightarrow\; \tau < \tau_0.$$

Tax Rates that Maximize Worker Welfare

Degree of IRS, γ	Behavioral elast. = 0.2 τ_{ww}^*	τ_0^*	Behavioral elast. = 0.5 τ_{ww}^*	τ_0^*
1/8	0.64	0.15	0.32	0.19
1/4	0.49	0.17	0.07	0.21
1/2	0.22	0.20	-0.37	0.26
1	-0.25	0.25	-1.03	0.34

The top rate that maximizes worker welfare can be negative!

Summary of Calibration Exercises

Exercise	Top rate, τ	
No ideas, $\gamma = 0$		
Revenue-maximization, $\tau_0 = 0$	0.96	
Revenue-maximization, $\tau_0 = 0.20$	0.92	
With ideas	$\gamma = 1/2$	$\gamma = 1$
Revenue-maximization	0.70	0.52
Maximize worker welfare	0.22	-0.25
Maximize utilitarian welfare	0.22	-0.05

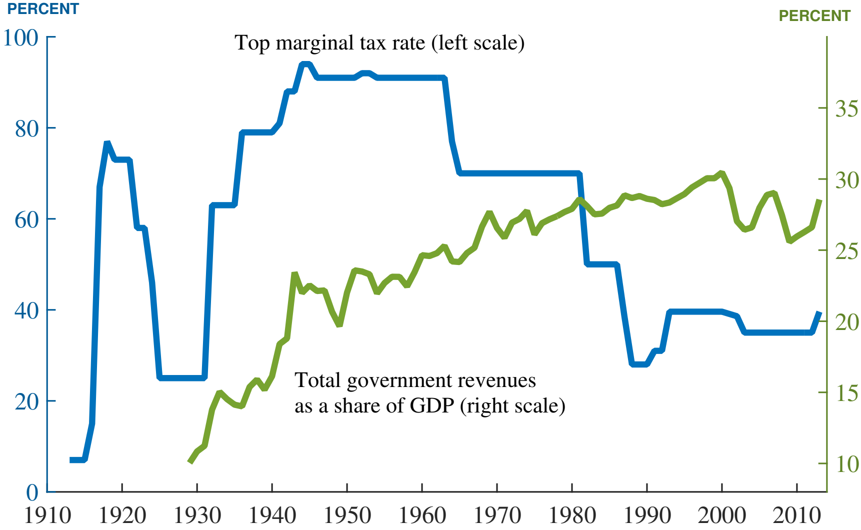
Incorporating ideas sharply lowers the top tax rate.

Discussion

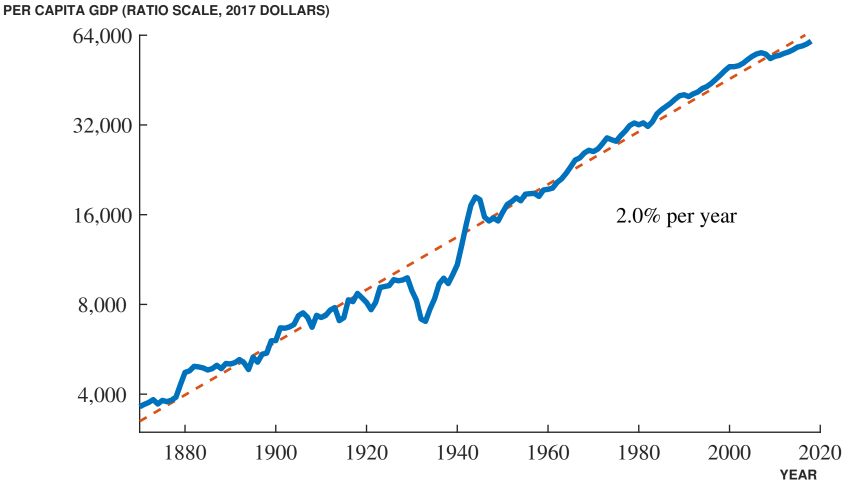
Evidence on Growth and Taxes? Important and puzzling!!!

- Stokey and Rebelo (1995)
  - Growth rates flat in the 20th century
  - Taxes changed a lot!
- But the counterfactual is unclear
  - Government investments in basic research after WWII
  - Decline in basic research investment in recent decades?
  - Maybe growth would have slowed sooner w/o $\downarrow \tau$
- Short-run vs long-run?
  - Shift from goods to ideas may reduce GDP in short run...

Taxes in the United States



U.S. GDP per person



Environment for Full Growth Model

Final output	$Y_t = \int_0^{A_t} x_{it}^{1-\psi} di \, (\mathbb{E}(ez) M_t)^{\psi}$
Production of variety i	$x_{it} = \ell_{it}$
Resource constraint (ℓ)	$\int \ell_{it} di = L_t$
Resource constraint (N)	$L_t + S_{bt} = N_t$
Population growth	$N_t = \bar{N} \exp(nt)$
Entrepreneurs	$S_{at} = \bar{S}_a \exp(nt)$
Managers	$M_t = \bar{M} \exp(nt)$
Applied ideas	$\dot{A}_t = \bar{a}(\mathbb{E}(ez) S_{at})^{\lambda} A_t^{\phi_a} B_t^{\alpha}$
Basic ideas	$\dot{B}_t = \bar{b} S_{bt}^{\lambda} B_t^{\phi_b}$
Talent heterogeneity	$z_i \sim F(z)$
Utility (S_a, M)	$u(c, e) = \theta \log c - \zeta e^{1/\zeta}$

Conclusion

- Lots of unanswered questions
  - Why is evidence on growth and taxes so murky?
  - What is true effect of taxes on growth and innovation? Akcigit et al (2018) makes progress...
  - At what income does the top rate apply?
  - Capital gains as compensation for innovation
  - Transition dynamics
- Still, innovation is a key force that needs to be incorporated
  - Distorting the behavior of a small group of innovators can affect all our incomes

Extra Slides

The Saez (2001) Calculation

- Income: $z \sim$ Pareto(α)
- Tax revenue:

$$T = \tau_0 \bar{z} + \tau(z_m - \bar{z})$$

where z_m is average income above cutoff $\bar{z}$

- Revenue-maximizing top tax rate:

$$\underbrace{z_m - \bar{z}}_{\text{mechanical gain}} + \underbrace{\tau z_m'(\tau)}_{\text{behavioral loss}} = 0$$

- Divide by $z_m \Rightarrow$ elasticity form and rearrange:

$$\tau^* = \frac{1}{1 + \alpha \cdot \eta_{z_m, 1-\tau}}$$

where $\alpha = \frac{z_m}{z_m - \bar{z}}$.

$$\tau^* = \frac{1}{1 + \alpha \cdot \eta_{z_m, 1-\tau}}$$

- Intuition
  - Decreasing in $\eta_{z_m,1-\tau}$: elasticity of top income wrt $1-\tau$
  - Increasing in $\frac{1}{\alpha} = \frac{z_m - \bar{z}}{z_m}$: change in revenue as a percent of income = Pareto inequality
- Diamond and Saez (2011) Calibration
  - $\alpha = 1.5$ from Pareto income distribution
  - $\eta = 0.2$ from literature

$$\Rightarrow \quad \tau^*_{\text{d-s}} \approx 77\%$$

Solution

$$\max_{\tau} T = \tau_0 Y(\tau) + (\tau - \tau_0)\left[\rho Y(\tau) - \bar{w} S_a\right]$$

- FOC:

$$\underbrace{(\rho - \bar{\rho})\, Y}_{\text{mechanical gain}} \quad + \underbrace{\frac{\partial Y}{\partial \tau} \cdot \left[(1-\rho)\tau_0 + \rho\tau\right]}_{\text{behavioral loss}} = 0$$

where $\bar{\rho} \equiv \frac{\bar{w}(S_a + M)}{Y}$

- Rearranging with $\Delta\rho \equiv \rho - \bar{\rho}$

$$\tau^*_{rm} = \frac{1 - \tau_0 \cdot \frac{1-\rho}{\Delta\rho} \cdot \eta_{Y,1-\tau}}{1 + \frac{\rho}{\Delta\rho}\, \eta_{Y,1-\tau}}$$

Maximizing Utilitarian Social Welfare

Entrepreneurs and Managers

- Utility function depends on consumption and effort:

$$u(c,e) = \theta \log c - \zeta e^{1/\zeta}$$

- Researcher with talent z solves

$$\max_{c,e} u(c,e) \quad \text{s.t.}$$

$$\begin{aligned} c =& \bar{w}(1-\tau_0) + [w_s e z - \bar{w}](1-\tau) + R \\ =& \bar{w}(1-\tau_0) - \bar{w}(1-\tau) + w_s e z(1-\tau) + R \\ =& \bar{w}(\tau-\tau_0) + w_s e z(1-\tau) + R \end{aligned}$$

where R is a lump sum rebate.

- FOC:

$$e^{\frac{1}{\zeta}-1} = \frac{\theta w_s z(1-\tau)}{c}.$$

SE/IE and Rebates

- Log preferences imply that SE and IE cancel: $\frac{\partial e}{\partial \tau} = 0$
- Standard approach is to rebate tax revenue to neutralize the IE.
  - Tricky here because IE's are heterogeneous!
- Shortcut: heterogeneous rebates that vary with z to deliver

$$c_z = w_s e z (1-\tau)^{1-\alpha}$$

$$e_z = e^* = [\theta(1-\tau)^{\alpha}]^{\zeta},$$

where α parameterizes the elasticity of effort wrt $1-\tau$

  - $\eta_{Y,1-\tau} = \alpha\zeta(\gamma+\psi)$
  - governs tradeoff with redistribution

Utilitarian Social Welfare

- Social Welfare:

$$SWF \equiv Lu(c^w) + S_b u(c^b) + S_a \int u(c_z^s, e_z^s) dF(z) + M \int u(c_z^m, e_z^m) dF(z)$$

- Substitution of equilibrium conditions gives

$$SWF \propto \log Y + \ell \log(1-\tau_0) + s[(1-\alpha)\log(1-\tau) - \zeta(1-\tau)^\alpha]$$

where $s \equiv \frac{S_a+M}{L+S_b+S_a+M}$, $\ell \equiv 1-s$,

Tax Rates that Maximize Social Welfare

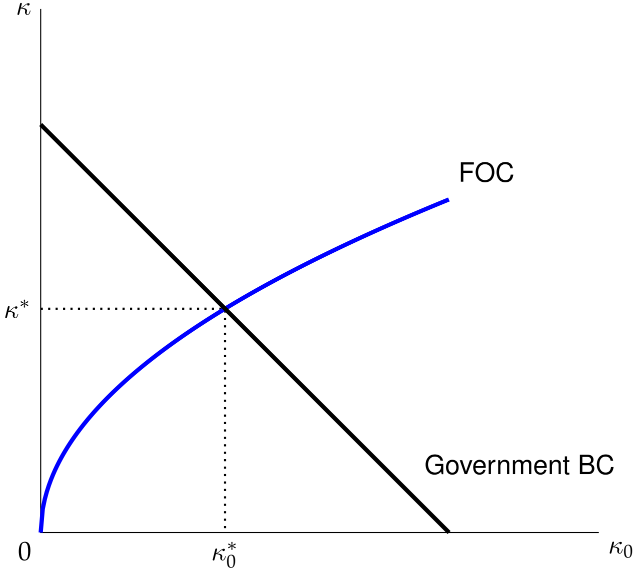
- Proposition 2 gives the tax rates, written in terms of the "keep rates" $\kappa \equiv 1-\tau$ and $\kappa_0 \equiv 1-\tau_0$.

- Two well-behaved nonlinear equations:

$$\alpha\zeta s\kappa^{\alpha} + \frac{\kappa}{\kappa_0}\cdot\frac{\ell}{1-\Delta\rho}\left(\Delta\rho+\bar{\rho}\eta\right) = \eta\left(1+\frac{\bar{\rho}\ell}{1-\Delta\rho}\right) + s(1-\alpha)$$

$$\kappa_0(1-\Delta\rho)+\kappa\Delta\rho = 1-\Omega.$$

Maximizing Social Welfare: $\alpha = 1$



Tax Rates that Maximize Social Welfare ($\alpha = 1$)

	Behavioral elast. = 0.2		Behavioral elast. = 0.5	
Degree of IRS, γ	τ^*	GDP loss if $\tau = 0.75$	τ^*	GDP loss if $\tau = 0.75$
1/8	0.649	0.7%	0.400	3.6%
1/4	0.502	2.8%	0.163	9.6%
1/2	0.231	8.9%	-0.255	23.6%
1	-0.238	23.4%	-0.919	49.3%

Tax Rates that Maximize Social Welfare ($\alpha = 1/2$)

	Behavioral elast. = 0.2		Behavioral elast. = 0.5	
Degree of IRS, γ	τ^*	GDP loss if $\tau = 0.75$	τ^*	GDP loss if $\tau = 0.75$
1/8	0.445	0.8%	0.328	2.0%
1/4	0.369	1.9%	0.189	4.8%
1/2	0.222	4.6%	-0.070	11.4%
1	-0.047	11.3%	-0.517	26.0%

The Social Return to Research

- How big is the gap between equilibrium share and optimal share to pay for research?
- Jones and Williams (1998) social rate of return calculation here:

$$\tilde{r} = g_Y + \lambda g_y \left(\frac{1}{\rho_s(1-\tau)} - \frac{1}{\gamma} \right)$$

$\Rightarrow$ After tax share of payments to entrepreneurs should equal γ

- Simple calibration: $\tau = 1/2 \Rightarrow \tilde{r} = 39\%$ if $\rho_s = 10\%$
  - Consistent with SROR estimates e.g. Bloom et al. (2013)
  - But those are returns to formal R&D...

GEMS Entrepreneurs versus Taxes