Taxing Top Incomes in a World of Ideas

Chad Jones

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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

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

This Paper

- 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)
- Adds new terms to the Saez (2001) calculation
  - $\uparrow \tau \;\Rightarrow \downarrow w \;\Rightarrow$ Lowers revenue from other brackets
  - Also lowers consumption throughout the economy
- The efforts of a relatively small number of entrepreneurs is responsible for the bulk of economy-wide income growth

Literature Review

- 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

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 median worker
  - Maximize utilitarian social welfare

The Economic Environment

- Consumption goods produced by labor L and “applied” ideas A:

$$Y = A^{\gamma} L \tag{1}$$

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

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

- Fundamental ideas produced from basic research:

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

- L, S_a, S_b exogenous. e, z endogenous (unspecified for now)

Nonrivalry of Ideas (Romer): $Y = A^\gamma L$

- Constant returns to rival inputs (L)
  - Given a stock of nonrival blueprints/ideas A
  - Standard replication argument
- $\Rightarrow$ Increasing returns to ideas and rival inputs together
  - $\gamma > 0$ measures the degree of IRS
- Hints at why effects can be large
  - One computer or year of school $\Rightarrow$ 1 worker more productive
  - One new idea $\Rightarrow$ any number of people more productive

Distortions of the computer/schooling have small effects.
Distorting the creation of the idea...

BGP from a Dynamic Growth Model

- Production of basic ideas

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

- Production of applied ideas

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

- 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 all grow at the same exogenous population growth rate.

Output = Consumption:

- Combining (1) - (3):

$$Y = \left(\nu \mathbb{E}[ez] S_a S_b^{\beta}\right)^{\gamma} L. \tag{4}$$

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

- Taxes distort $\mathbb{E}(ez)$, not S_a or S_b here
  - Simplicity
  - Cutoff $\Rightarrow$ rich nonlinear tax could get it right?
  - Middle rate $\Rightarrow$ right number become entrepreneurs...

Nonlinear Income Tax

- Tax Revenue

$$T = \tau_0[wL + w_b S_b + w_a \mathbb{E}(ez) S_a] + (\tau - \tau_0)[w_a \mathbb{E}(ez) - \bar{w}] S_a$$

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

$$\frac{w_a \mathbb{E}(ez) S_a}{Y} = \rho$$

and $Y = wL + w_b S_b + w_a \mathbb{E}(ez) S_a$

- Therefore

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

The Top Tax Rate that Maximizes Revenue

Revenue-Maximizing Top Tax Rate

- Two key equations:

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

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

- Choose τ to maximize tax revenue (given τ_0 for now)
- A higher τ reduces the effort of entrepreneurs,
    - Leads to less innovation
    - which reduces everyone's income (Y)
    - which lowers tax revenue received via τ_0

Solution

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

- FOC:

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

where $\bar{\rho} \equiv \frac{\bar{w} S_a}{Y}$

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

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

Interpretation

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

- 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

$\rho\,\eta_{Y,1-\tau}$	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 $\eta_{Y,1-\tau}$?

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

- γ is the degree of IRS via ideas
- 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

$\gamma \in [1/8, 1]$ $\qquad$ $g_{tfp} = \gamma(1+\beta) \cdot g_S \approx 1\%$.

$\frac{\zeta}{1-\zeta} \in \{0.2, 0.5\}$ $\qquad$ Behavioral elasticity. Saez values

$\tau_0 = 0.2$ $\qquad$ Average tax rate outside the top.

$\Delta\rho = 0.10$ $\qquad$ Share of income taxed at the top rate; top returns account for 20% of taxable income.

$\rho = 0.15$ $\qquad$ So $\frac{\rho}{\Delta\rho} = 1.5$ as in Saez pareto parameter, α.

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

Degree of IRS, γ	Behav. Elas = 0.2 $\tau_0 = 0$	Behav. Elas = 0.2 $\tau_0 = 0.2$	Behav. Elas = 0.5 $\tau_0 = 0$	Behav. Elas = 0.5 $\tau_0 = 0.2$
1/8	0.970	0.935	0.941	0.875
1/4	0.941	0.875	0.889	0.763
1/2	0.889	0.763	0.800	0.573
1	0.800	0.573	0.667	0.289

Intuition

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

  Going from $\tau = 75\%$ to $\tau = 50\%$ raises GDP by just 6%!

- With $\Delta\rho = 10\%$, the revenue cost is 2.5% of GDP
  $\Rightarrow$ 6% gain to all $>$ 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 Maxmimize Worker Welfare

- Workers:

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

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

- Government budget constraint

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

Exogenous government spending share of GDP = Ω

- Therefore:

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

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

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

Solution

- Combining with the Govt Budget Constraint:

$$\tau^*_{ww} = \frac{1 - \eta_{Y,1-\tau}\left[\frac{1-\Delta\rho}{\Delta\rho} - \frac{\Omega}{\Delta\rho}\left(1 + \frac{\bar{\rho}}{1-\Delta\rho}\right)\right]}{1 + \frac{\rho}{\Delta\rho}\eta_{Y,1-\tau} + \frac{\bar{\rho}}{1-\Delta\rho}\eta_{Y,1-\tau}},$$

- Another intuition: when is "flat tax" optimal?

$$\tau \leq \tau_0 \text{ and } \kappa \geq \kappa_0 \iff \eta_{Y,1-\tau} \geq \frac{\Delta\rho}{1-\Delta\rho}.$$

  - Increase κ raises GDP by $\eta_{Y,1-\tau}$
  - Redistribution: take from $\Delta\rho$ people, give to $1-\Delta\rho$

- Baseline parameters: $\frac{\Delta\rho}{1-\Delta\rho} = \frac{1}{9}$ and $\eta_{Y,1-\tau} = \frac{1}{6} \cdot \gamma$.
  So $\gamma > 2/3 \Rightarrow \tau < \tau_0$.

Tax Rates that Maximize Worker Welfare

Degree of IRS, γ	Behavioral elast. = 0.2 τ^*_{ww}	Behavioral elast. = 0.2 τ^*_0	Behavioral elast. = 0.5 τ^*_{ww}	Behavioral elast. = 0.5 τ^*_0
1/8	0.830	0.130	0.670	0.148
1/4	0.670	0.148	0.377	0.180
1/2	0.377	0.180	-0.118	0.235
1	-0.118	0.235	-0.854	0.317

The top rate that maximizes worker welfare can be negative!

Maximizing Utilitarian Social Welfare

Entrepreneurs

- Utility function depends on consumption and effort:

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

- Researcher with talent z solves

$$\begin{aligned} &\max_{c,e} u(c,e) \quad \text{s.t.} \\ c =& \bar{w}(1-\tau_0) + [w_s e z - \bar{w}](1-\tau) + R \\ =& \bar{w}(1-\tau_0) - \bar{w}(1-\tau) + w_s e z(1-\tau) + R \\ =& \bar{w}(\tau-\tau_0) + w_s e z(1-\tau) + R \end{aligned}$$

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 $1-\tau$
  - governs tradeoff with redistribution

Utilitarian Social Welfare

- Social Welfare:

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

- Substitution of equilibrium conditions gives

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

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

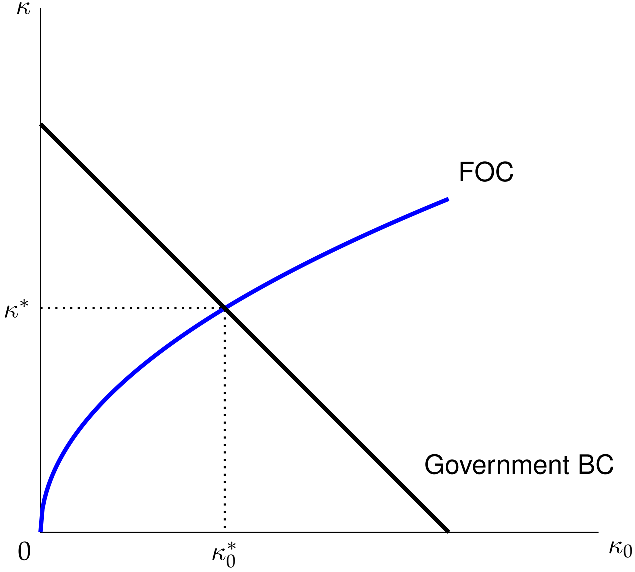
Tax Rates that Maximize Social Welfare

- 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:

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

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

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	0.714	0.3%	0.505	2.8%
1/4	0.563	2.3%	0.257	8.7%
1/2	0.283	8.4%	-0.182	22.8%
1	-0.198	23.0%	-0.873	48.9%

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	0.477	0.8%	0.387	1.9%
1/4	0.400	1.8%	0.244	4.5%
1/2	0.251	4.5%	-0.022	11.1%
1	-0.023	11.1%	-0.480	25.7%

Summary of Calibrtion Exercises

	Top rate, τ	
Exercise	$\gamma = 1/2$	$\gamma = 1$
Saez revenue-maximization, $\tau_0 = 0$	0.89	0.80
Revenue-maximization w/ ideas	0.76	0.57
Worker welfare (incl. worker consumption)	0.38	-0.12
Utilitarian welfare (incl. entrepreneur cons.)	0.28	-0.20

Incorporating ideas sharply lowers the top tax rate.

Extensions

Does Michael Jordan Create Ideas?

- Group M of top earners who do not create ideas

$$Y = A^{\gamma}(\mathbb{E}(ez)M)^{\psi}L^{1-\psi}$$

- Paid fraction ρ_m of GDP. Total tax revenue:

$$\begin{aligned} T &= \tau_0 Y + (\tau - \tau_0)[(w_a\mathbb{E}(ez) - \bar{w})S_a + (w_m\mathbb{E}(ez) - \bar{w})M] \\ &= \tau_0 Y + (\tau - \tau_0)[(\rho_s + \rho_m)Y - \bar{w}(S_a + M)]. \end{aligned}$$

where $\rho \equiv \rho_s + \rho_m$.

$\Rightarrow$ *Same formula for τ^* applies; interpret ρ and $\Delta\rho$ to include all top earners. MJ does not create ideas; ideas create MJ!*

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:

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

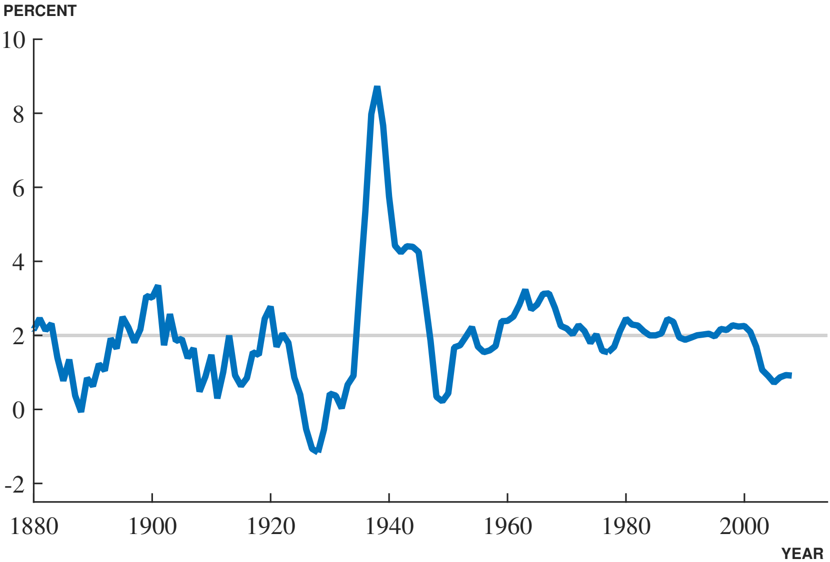
$\Rightarrow$ After tax share of payments to entrepreneurs should equal γ

- 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...

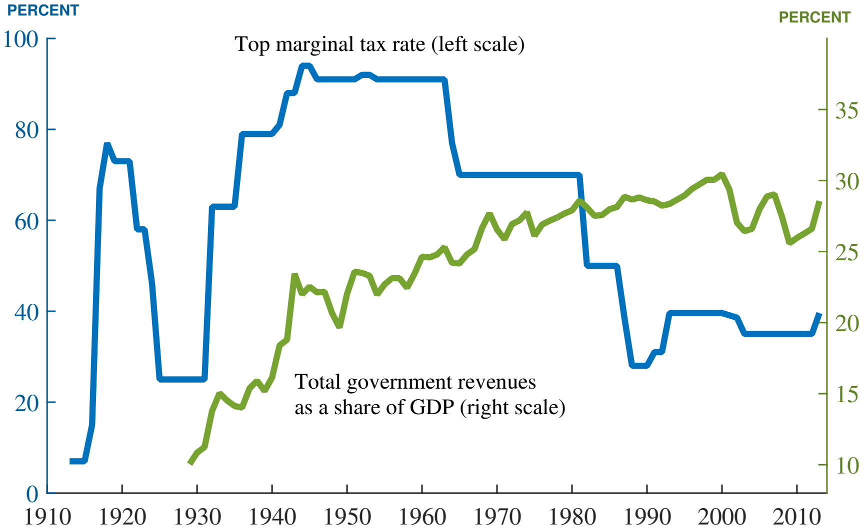
Evidence on Growth and Taxes? Important and puzzling!!!

- Stokey and Rebelo (1995)
  - Growth rates flat in the 20th century
  - Taxes increased a lot!
- But other things were not equal!
  - Massive government investments in basic research after WWII
  - Decline in basic research investment in recent decades?
- Short-run vs long-run?
  - Shift from goods to ideas may reduce GDP in short run...

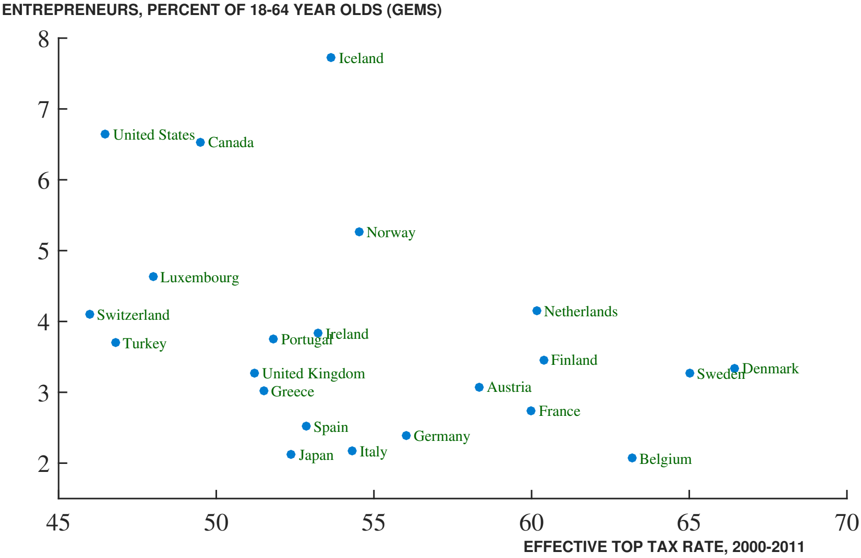
Growth in U.S. GDP per person (smoothed)



Taxes in the United States



GEMS Entrepreneurs versus Taxes



Environment for Full Growth Model

Final output	$Y_t = \int_0^{A_t} x_{it}^{\rho} di \, (\mathbb{E}(ez) M_t)^{1-\rho}$
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
  - What is the "right" top tax rate? Many other considerations...
  - 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...
- Still, innovation is a key force that needs to be incorporated
  - Taxes affect entrepreneurship and innovation
  - Innovation is largely responsible for economic growth
  - Distorting the behavior of a small group of innovators can affect all our incomes

To Do: Endogenize S_b financed by government?