Taxing Top Incomes in a World of Ideas

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September 2019
The Saez (2001) Calculation

- Income: \( z \sim \text{Pareto}(\alpha) \)

- 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:
  \[
  z_m - \bar{z} + \tau z'_m(\tau) = 0
  \]
  mechanical gain behavioral loss

- Divide by \( z_m \) ⇒ 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

  \[ \Rightarrow \tau_{d-s}^* \approx 77\% \]
Overview

- Saez (2001) and following literature
  
  “Macro”-style calibration of optimal top income taxation

- 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 ⇒ the bulk of economy-wide growth

- ↑τ 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
Environment for Full Growth Model

Final output

\[
Y_t = \int_0^A x_{it}^{1-\psi} \, di \left( \mathbb{E}(ez)M_t \right)^\psi
\]

Production of variety \(i\)

\[
x_{it} = \ell_{it}
\]

Resource constraint (\(\ell\))

\[
\int \ell_{it} \, di = L_t
\]

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 (\(S_a, M\))

\[
u(c, e) = \theta \log c - \zeta e^{1/\zeta}
\]
The Economic Environment

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

$$ Y = A^\gamma \tilde{M}^{\psi} L^{1-\psi} \quad (1) $$

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

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

• 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)
Nonrivalry of Ideas (Romer): \[ Y = A^\gamma \tilde{M}^\psi L^{1-\psi} \]

- Constant returns to rival inputs \( \tilde{M}, L \)
  - 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

- 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.

- Stock of applied ideas (being careless with exponents wlog)

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

- Stock of basic ideas

\[
B = \nu_b S_b
\]  
(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 $\mathbb{E}(ez)$:
  - $\psi$ effect is traditional, but $\psi$ small?
  - $\gamma$ effect via nonrivalry of ideas, can be large!
Nonlinear Income Tax Revenue

\[ T = \tau_0 \left[ wL + wS_b + w_a \mathbb{E}(ez)S_a + w_m \mathbb{E}(ez)M \right] \]

all income pays \( \tau_0 \)

\[ + (\tau - \tau_0) \left[ (w_a \mathbb{E}(ez) - \bar{w})S_a + (w_m \mathbb{E}(ez) - \bar{w})M \right] \]

income above \( \bar{w} \) 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 \( Y = wL + w_b S_b + w_a \mathbb{E}(ez)S_a + w_m \mathbb{E}(ez)M, \quad \rho \equiv \rho_s + \rho_m \)

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

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

\[\Rightarrow\text{After tax share of payments to entrepreneurs should equal } \gamma \]
\[
\rho_s (1 - \tau) \text{ versus } \gamma \text{ is one way of viewing the tradeoff} \]
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 \( \tau \) reduces the effort of entrepreneurs/managers
  - Leads to less innovation
  - which reduces everyone’s income \( (Y) \)
  - which lowers tax revenue received via \( \tau_0 \)
Solution

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

- **FOC:**
  \[
  \underbrace{(\rho - \bar{\rho}) Y}_{\text{mechanical gain}} + \frac{\partial Y}{\partial \tau} \cdot \left[ (1 - \rho) \tau_0 + \rho \tau \right] = 0
  \]
  where \( \bar{\rho} \equiv \frac{\bar{w}(S_a + M)}{Y} \)

- **Rearranging with** \( \Delta \rho \equiv \rho - \bar{\rho} \)
  \[
  \tau^*_r m = \frac{1 - \tau_0 \cdot \frac{1 - \rho}{\Delta \rho} \cdot \eta_{Y,1-\tau}}{1 + \frac{\rho}{\Delta \rho} \eta_{Y,1-\tau}}
  \]
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 \( \eta_{z_m,1-\tau} \)
    \[ \eta_{Y,1-\tau} \Rightarrow \text{How GDP changes if researchers keep more} \]
    \[ \eta_{z_m,1-\tau} \Rightarrow \text{How average top incomes change} \]
  - If \( \tau_0 > 0 \), then \( \tau^* \) is lower
    Distorting research lowers GDP
    \[ \Rightarrow \text{lowers revenue from other taxes!} \]
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 $\tau$, mechanical effect

$1 - \Delta \rho$ Tax base for $\tau_0$
What is $\eta_{Y,1-\tau}$?

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

- $\gamma$ = degree of IRS via ideas
- $\psi$ = manager’s share = 0.15 (not important)
- $\zeta$ is the elasticity of $\mathbb{E}[ez]$ with respect to $1-\tau$.
  - Standard Diamond-Saez elasticity: $\zeta = \eta_{zm,1-\tau}$
  - 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

\[ \gamma \in \left[ \frac{1}{8}, 1 \right] \quad g_{tfp} = \gamma (1 + \beta) \cdot g_s \approx 1\% . \]

\[ \frac{\zeta}{1 - \zeta} \in \{0.2, 0.5\} \quad \text{Behavioral elasticity. Saez values} \]

\[ \tau_0 = 0.2 \quad \text{Average tax rate outside the top.} \]

\[ \Delta \rho = 0.10 \quad \text{Share of income taxed at the top rate; top returns account for 20\% of taxable income.} \]

\[ \rho = 0.15 \quad \text{So } \frac{\rho}{\Delta \rho} = 1.5 \text{ as in Saez pareto parameter, } \alpha . \]
## Revenue-Maximizing Top Tax Rate, $\tau_{rm}^*$

<table>
<thead>
<tr>
<th>Case</th>
<th>Behavioral Elasticity</th>
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<tbody>
<tr>
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<td>0.20</td>
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<tr>
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<td>0.80</td>
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<td>No ideas, $\gamma = 0$</td>
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<tr>
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<tr>
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Intuition: 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

  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

– In Saez (2001), revenue max = max worker welfare
– Not here! Ignores effect on consumption
– Worker welfare yields a clean closed-form solution
Choose $\tau$ and $\tau_0$ to Maximize Worker Welfare

- Workers:
  \[ c^{\tilde{w}} = w(1 - \tau_0) \]
  \[ u_w(c) = \theta \log c \]

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

Exogenous government spending share of GDP = $\Omega$
(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

\[ \tau_{ww}^* = \frac{1 - \eta Y_{1-\tau}}{1 + \rho \eta Y_{1-\tau}} \left( \frac{1-\rho}{\Delta \rho} \cdot \tau_0^* + \frac{1-\Delta \rho}{\Delta \rho} \cdot (1 - \tau_0^*) - \frac{\Omega}{\Delta \rho} \right) \]

- Three new terms relative to Saez:

\[ \eta \frac{1-\rho}{\Delta \rho} \cdot \tau_0^* \quad \text{Original term from RevMax} \]

\[ \eta \frac{1-\Delta \rho}{\Delta \rho} \cdot (1 - \tau_0^*) \quad \text{Direct effect of a higher tax rate reducing GDP} \]

\[ \Rightarrow \text{reduce workers consumption} \]

\[ \eta \frac{\Omega}{\Delta \rho} \quad \text{Need to raise} \ \Omega \ \text{in revenue} \]
Intuition

- When is a “flat tax” optimal?

\[ \tau \leq \tau_0 \iff \eta_{Y,1-\tau} \geq \frac{\Delta \rho}{1-\Delta \rho}. \]

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 $\frac{\Delta \rho}{1-\Delta \rho} = \frac{1}{9}$.

\[ \gamma + \psi > \frac{2}{3} \Rightarrow \tau < \tau_0. \]
## Tax Rates that Maximize Worker Welfare

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<td>0.64</td>
<td>0.15</td>
</tr>
<tr>
<td>1/4</td>
<td>0.49</td>
<td>0.17</td>
</tr>
<tr>
<td>1/2</td>
<td>0.22</td>
<td>0.20</td>
</tr>
<tr>
<td>1</td>
<td>-0.25</td>
<td>0.25</td>
</tr>
</tbody>
</table>

*The top rate that maximizes worker welfare can be negative!*
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

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

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

\[
= \bar{w}(1 - \tau_0) - \bar{w}(1 - \tau) + w_s e z(1 - \tau) + R
\]

\[
= \bar{w}(\tau - \tau_0) + w_s e z(1 - \tau) + R
\]

where \( R \) is a lump sum rebate.

- FOC:

\[ e^{1/\zeta} - 1 = \frac{\theta w_s z(1 - \tau)}{c} \]
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

\[
c_z = w_s ez(1 - \tau)^{1-\alpha}
\]

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

where \( \alpha \) 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:

\[
SWF \equiv Lu(c^w) + S_b u(c^b) + S_a \int u(c_s^s, e_s^s) dF(z) + M \int u(c_m^m, e_m^m) dF(z)
\]

- 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:

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

$$\kappa_0 (1 - \Delta \rho) + \kappa \Delta \rho = 1 - \Omega.$$
Maximizing Social Welfare: $\alpha = 1$
### Tax Rates that Maximize Social Welfare ($\alpha = 1$)

<table>
<thead>
<tr>
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<tr>
<td></td>
<td>$\tau^*$ if $\tau = 0.75$</td>
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</tr>
<tr>
<td>1/8</td>
<td>0.65 0.7%</td>
<td>0.40 3.6%</td>
</tr>
<tr>
<td>1/4</td>
<td>0.50 2.8%</td>
<td>0.16 9.6%</td>
</tr>
<tr>
<td>1/2</td>
<td>0.23 8.9%</td>
<td>-0.26 23.6%</td>
</tr>
<tr>
<td>1</td>
<td>-0.24 23.4%</td>
<td>-0.92 49.3%</td>
</tr>
</tbody>
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## Tax Rates that Maximize Social Welfare ($\alpha = 1/2$)

<table>
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<tbody>
<tr>
<td></td>
<td>$\tau^*$</td>
<td>GDP loss if $\tau = 0.75$</td>
</tr>
<tr>
<td>1/8</td>
<td>0.45</td>
<td>0.8%</td>
</tr>
<tr>
<td>1/4</td>
<td>0.37</td>
<td>1.9%</td>
</tr>
<tr>
<td>1/2</td>
<td>0.22</td>
<td>4.6%</td>
</tr>
<tr>
<td>1</td>
<td>-0.05</td>
<td>11.3%</td>
</tr>
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Intuition: First-Best Effort

- What if social planner could choose consumption and effort?
- The tax rate that implements first-best effort satisfies
  \[(1 - \tau)^\alpha = \frac{\gamma}{s_a}\]

  \[\Rightarrow \text{Negative top tax rate if } s_a < \gamma.\]

- Illustrates a key point:
  the fact that a small share of people, \(s\)
  create nonrival ideas that drive growth via \(\gamma\)
  constrains the top tax rate, \(\tau\)
## Summary of Calibration Exercises

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Top rate, $\tau$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No ideas, $\gamma = 0$</strong></td>
<td></td>
</tr>
<tr>
<td>Revenue-maximization, $\tau_0 = 0$</td>
<td>0.96</td>
</tr>
<tr>
<td>Revenue-maximization, $\tau_0 = 0.20$</td>
<td>0.92</td>
</tr>
<tr>
<td><strong>With ideas</strong></td>
<td></td>
</tr>
<tr>
<td>$\gamma = 1/2$</td>
<td></td>
</tr>
<tr>
<td>$\gamma = 1$</td>
<td></td>
</tr>
<tr>
<td>Revenue-maximization</td>
<td>0.70</td>
</tr>
<tr>
<td>Maximize worker welfare</td>
<td>0.22</td>
</tr>
<tr>
<td>Maximize utilitarian welfare</td>
<td>0.22</td>
</tr>
</tbody>
</table>

*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 ↓ \( \tau \)

- Short-run vs long-run?
  - Shift from goods to ideas may reduce GDP in short run...
Taxes in the United States

- Top marginal tax rate (left scale)
- Total government revenues as a share of GDP (right scale)
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:

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

⇒ 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...
Environment for Full Growth Model

Final output
\[ Y_t = \int_0^A x_{it}^{1-\psi} di (\mathbb{E}(ez)M_t)^\psi \]

Production of variety \( i \)
\[ x_{it} = \ell_{it} \]

Resource constraint (\( \ell \))
\[ \int \ell_{it} di = L_t \]

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