Optimal Taxation of Top Labor Incomes: A Tale of Three Elasticities

Thomas Piketty (PSE) Emmanuel Saez (Berkeley and NBER)
Stefanie Stantcheva (MIT)

January 2012

Introduction

- Top 1% share of income has surged in US and English-speaking countries (less so in Europe and Japan)
- ... while top tax rates have declined
- Possible explanations?
  - Market-driven skill-biased change (but why only some countries?)
  - Institution-driven (tolerance for pay and social norms change)
  - Taxes? (but through what channel?)

Introduction

How do taxes affect the top 1% share and top incomes? Three narratives

1. Standard supply side channel (Lindsey (1987), Feldstein (1995))

Introduction

How do taxes affect the top 1% share and top incomes? Three narratives

1. Standard supply side channel (Lindsey (1987), Feldstein (1995))
2. Avoidance and income shifting (Slemrod (1996), Slemrod and Kopczuk (2002), Reynolds (2007))

Introduction

How do taxes affect the top 1% share and top incomes? Three narratives

1. Standard supply side channel (Lindsey (1987), Feldstein (1995))
2. Avoidance and income shifting (Slemrod (1996), Slemrod and Kopczuk (2002), Reynolds (2007))
3. Compensation bargaining and rent-extraction

Introduction: Goal of the Paper

This paper:

- Simple model capturing all three responses
- Derives optimal tax formula as a function of the three elasticities
- Takes a first pass at an empirical analysis
    - using long-term evidence for the US
    - using international evidence for 18 OECD countries since 1975

Introduction: Results of the Paper

Main theoretical results:

- Sole limiting factor is real supply-side (first) elasticity
- Avoidance (second) elasticity should be minimized
- Compensation bargaining (third) elasticity tends to increase taxes, potentially a lot

Illustrative Empirical results:

- Large total elasticity of $e = e_1 + e_2 + e_3 = 0.5$ (strong correlation between top tax rates and income)
- US evidence: avoidance channel is not full story $\Rightarrow e_2 < 0.1$
- No correlation between top tax rates and growth: $\Rightarrow e_1$ small at the top

$\Rightarrow e_3 \simeq 0.3 \Rightarrow t = 83\%$ (compared to 57% in pure real supply side scenario).

Outline of the talk

1. Standard model with real supply-side response
2. Tax avoidance and income shifting responses
   - Pure Avoidance Model
   - Income Shifting Model
3. Bargaining and rent-seeking responses
4. Empirical evidence
   - US evidence
   - International evidence
   - Summary of scenarios
5. Conclusion

Outline of the talk

1. Standard model with real supply-side response
2. Tax avoidance and income shifting responses
   - Pure Avoidance Model
   - Income Shifting Model
3. Bargaining and rent-seeking responses
4. Empirical evidence
   - US evidence
   - International evidence
   - Summary of scenarios
5. Conclusion

Standard Model with Real Supply Side Responses

Mirrlees Model for top income tax: Individual response

- z: taxable income
- Consider a constant tax rate τ for $z \geq \bar{z}$.
- Utility (no income effects):

$$u_i(c, z) = c - h_i(z)$$

  with $c = z - T(z)$, disposable income and $h_i()$ cost of effort, increasing and convex.
- Individual optimization: $h_i'(z_i) = (1-\tau) \Rightarrow z_i = z_i(1-\tau)$
- Aggregating over all individuals: $z = z(1-\tau)$.
- First elasticity: $e_1 = \frac{dz}{d(1-\tau)} \frac{(1-\tau)}{z}$.

Standard Model with Real Supply Side Responses

Mirrlees Model for top income tax: Social Welfare Maximization

- Social welfare across agents of type i :

$$W = \int G\left(u_i\right) dv\left(i\right)$$

$$s.t: \quad \int T\left(z_i\right) dv\left(i\right) \geq T_0 \quad [p]$$

- Marginal social welfare weight: $g_i = \frac{G'\left(u_i\right)}{p}$
- Optimal tax rate with $g = 0$ at the top (revenue maximizing rate):

$$\tau^* = \frac{1}{1 + ae_1}$$

with $a = z / \left(z - \bar{z}\right) > 1$.

Standard Model with Real Supply Side Responses

Calibrating the formula (Diamond and Saez (2011))

- $a = 1.5$ for the US , $a \approx 2$ for Continental Europe
- e_1 hard to determine (Giertz, Saez and Slemrod (2011))
    1. $e_1 = 0.25 \;\Rightarrow\; \tau^* = 73\%$

- Effective rate in US 42.5%, Europe reaches 60%.

- $a = 1.5$ for the US , $a \approx 2$ for Continental Europe
- e_1 hard to determine (Giertz, Saez and Slemrod (2011))
  1. $e_1 = 0.25 \;\Rightarrow\; \tau^* = 73\%$
  2. $e_1 = 0.50 \;\Rightarrow\; \tau^* = 57\%$
- Effective rate in US 42.5%, Europe reaches 60%.

Standard Model with Real Supply Side Responses

Calibrating the formula (Diamond and Saez (2011))

- $a = 1.5$ for the US , $a \approx 2$ for Continental Europe
- e_1 hard to determine (Giertz, Saez and Slemrod (2011))
  1. $e_1 = 0.25 \Rightarrow \tau^* = 73\%$
  2. $e_1 = 0.50 \Rightarrow \tau^* = 57\%$
  3. $e_1 = 1 \Rightarrow \tau^* = 40\%$
- Effective rate in US 42.5%, Europe reaches 60%.

Outline of the talk

1. Standard model with real supply-side response
2. Tax avoidance and income shifting responses
    - Pure Avoidance Model
    - Income Shifting Model
3. Bargaining and rent-seeking responses
4. Empirical evidence
    - US evidence
    - International evidence
    - Summary of scenarios
5. Conclusion

Tax Avoidance and Income Shifting Responses

Definition: changes in reported income due to changes in form of compensation but not in its total level (keeping econ output constant)
Examples: (Slemrod and Kopczuk (2002), Slemrod (1996))

- Shift to fringe benefits or deferred compensation (stock-options, future pensions)
- Increased consumption within firm (better offices, vacations as business travel, private use of corporate jets)
- Shifting profits from individual income tax base to corporate tax base (change in business organization)
- Re-characterization of ordinary income into tax favored capital gains
- Offshore accounts.

Unlike fundamental preferences, government can (potentially) affect evasion opportunities

- Real income: y
- Sheltered income: x (taxed at t)
- Taxable income $z = y - x$ (taxed at $\tau > t$)
- Cost of sheltering income $d_i(x)$, increasing and covex (sheltered income less valuable and pure waste)
- Utility

$$u_i(c, y, x) = c - h_i(y) - d_i(x)$$

  with $c = (1 - \tau) y + (\tau - t) x + R$ (R is virtual income $\tau \bar{z} - T(\bar{z})$).
- Solutions: $h_i'(y) = 1 - \tau \Rightarrow y_i = y_i(1 - \tau)$ and $d_i'(x) = \tau - t \ \Rightarrow x_i = x_i(\tau - t)$.

- Standard supply side elasticity e_1: $e_1 = \frac{dy}{d(1-\tau)} \frac{1-\tau}{y}$
- Avoidance "elasticity", e_2 : define s as the fraction of behavioral response due to evasion: $s = \frac{dx/d(\tau-t)}{dz/d(1-\tau)}$

$$e_2 = \frac{dx}{d\left(\tau - t\right)} \frac{1-\tau}{z}$$

- Total elasticity, e, at t constant:

$$e = \frac{\partial z}{\partial\left(1-\tau\right)} \frac{1-\tau}{z}$$

Note that $e = \frac{y}{z} e_1 + e_2 = \frac{e_2}{s}$.

Theorem

(Partial optimum) For a given t, the optimal tax rate is

$$\tau^* = \frac{1 + tae_2}{1 + ae}$$

Theorem

(Full Optimum): If sheltering occurs only within top bracket,

$$t^* = \tau^* = \frac{1}{1 + ae}$$

(t becomes irrelevant).

- If $t = 0$, standard model (irrelevant whether response of taxable income comes from real supply side or avoidance (Feldstein (1999)).
- If $t > 0$, fiscal externality. Government can improve efficiency with $\tau = t$

  $\Rightarrow$ only limiting factor is then real elasticity e_1.
- Not all avoidance opportunities costless to remove
  - Some are creations of tax system itself; should be removed: exemption of fringe benefits, tax-exempt local bonds
  - Real and costly hurdles: informal economy (developing countries), off-shore evasion, lobbying and political constraints

  $\Rightarrow$ but modern economies should be able to minimize avoidance

- Not all shifting purely wasteful $\longrightarrow$ Ramsey taxation considerations
- Two sources of income, labor, y_L (taxed at τ_L above $\bar{z}$) and capital y_K (taxed at τ_K). Produced at respective costs $h_{Li}(y_L)$ and $h_{Ki}(y_K)$.
- Can shift x from labor to capital income at cost $d_i(x)$
- Taxable incomes: $z_L = y_L - x$
  $z_K = y_K + x$
- Utility

$$u_i(c, y_L, y_K, x) = c - h_{Li}(y_L) - h_{Ki}(y_K) - d_i(x)$$

where $c = R + (1 - \tau_L) z_L + (1 - \tau_L) z_K + (\tau_L - \tau_K) x$

- Solutions: $h'_{Li}(y_L) = 1 - \tau_L$, $h'_{Ki}(y_K) = 1 - \tau_K$ and $d'_i(x) = (\tau_L - \tau_K)$
- Aggregating over all taxpayers:
  - $y_L = y_L(1 - \tau_L)$, with elasticity e_L
  - $y_K = y_K(1 - \tau_K)$, with elasticity e_K
  - $x = x(\tau_L - \tau_K)$, increasing in $\Delta\tau := \tau_L - \tau_K$.
- Reported incomes z_L and z_K more elastic than real incomes since react also along avoidance margin.
- Define $a_L = \frac{z_L}{z_L - \bar{z}}$ and $a = \frac{z_L + z_K}{z_L + z_K - \bar{z}}$

Theorem

Without shifting, optimal rates are $\tau_K^* = 1/(1+e_K)$, $\tau_L^* = 1/(1+ae_L)$ *and* $\tau_L > \tau_K$ *iff* $a_L e_L < e_K$ *(standard Ramsey result)*

Theorem

With infinite shifting elasticity, $\tau_K = \tau_L = \frac{1}{1+a\bar{e}}$ *where* $\bar{e} = \frac{y_L}{y_L+y_K} e_L + \frac{y_K}{y_L+y_K} e_K$

Theorem

In general, if $a_L e_L < e_K$, *then* $1/(1+ae_L) \geq \tau_L > \tau_K \geq 1/(1+e_K)$. *And if* $a_L e_L > e_K$, *inequality reversed.*

Shifting brings τ_L and τ_K closer together, even if e_L and e_K very different.

Outline of the talk

1. Standard model with real supply-side response
2. Tax avoidance and income shifting responses
    - Pure Avoidance Model
    - Income Shifting Model
3. Bargaining and rent-seeking responses
4. Empirical evidence
    - US evidence
    - International evidence
    - Summary of scenarios
5. Conclusion

Compensation Bargaining Response

Literature Review

- Pay need not equal marginal productivity
  - Entrenchment, bargaining $\Rightarrow$ overpay
  - Social norms, intolerance for high pay $\Rightarrow$ underpay
- Few taxation papers with imperfect labor markets. Typically focus on restoring efficiency: Fuest and Huber (1997), Aronsson and Sjogren (2004)
- Some look at redistribution: Hungerbuehler et. al. (2006), Stantcheva (2011), Rothschild and Scheuer (2011)

- Individual i receives fraction η of his actual product y: $z = \eta y = y + b$ where bargained earnings are $b = (\eta - 1) y$
- Individual utility:

$$u^i (c, \eta, y) = c - h_i (y) - k_i (\eta)$$

where $k_i (\eta)$ increasing and convex.

- $E (b)$: average bargaining in the economy.
- Important simplifying assumption:
  - any gain/loss from bargaining hits everyone in the economy uniformly (discussion later).
  - paper presents simple bargaining model where bargaining is at expense of profits and firms are uniformly owned by everyone
  - government's demogrant $T (0)$ can fully absorb the bargaining gain or loss

Compensation Bargaining Response

Individual behavior

- Individual optimization leads to:
  $h_i'(y) = (1-\tau)\eta$
  $k_i'(\eta) = (1-\tau)y$
- Defines the aggregate functions
  $y = y(1-\tau)$
  $\eta = \eta(1-\tau)$
  $b = b(1-\tau)$
  as increasing functions of the net-of-tax rate.

- Supply side elasticity e_1: as before $e_1 = \frac{dy}{d(1-\tau)} \frac{1-\tau}{y}$
- Bargaining "elasticity", e_3 : define s as fraction of behavioral response due to bargaining: $s = \frac{db/d(1-\tau)}{dz/d(1-\tau)}$

$$e_3 = \frac{db}{d(1-\tau)} \frac{1-\tau}{z}$$

Total elasticity: e :

$$e = \frac{\partial z}{\partial (1-\tau)} \frac{1-\tau}{z} = \frac{e_3}{s}$$

Note that $e = \frac{y}{z} e_1 + e_3$.

Compensation Bargaining Response

Optimal tax

- s can be negative, leading to e_3 negative.Happens if η sufficiently small ($\eta \leq \frac{e_1}{e_1+e_\eta}$)
- s and hence e_3 always positive if individuals are overpaid ($\eta > 1$)

Theorem

The optimal tax rate is

$$\tau^* = \frac{1+ae_3}{1+ae} = 1 - \frac{a\,(y/z)\,e_1}{1+ae}$$

τ^* decreases with the real elasticity e_1 and total elasticity e, increases with overpayment z/y and with the bargaining elasticity e_3.
If top earners are overpaid, $\tau^* > 1/\left(1+ae_1\right)$.

- **Implementing formula** requires knowing, in addition to total e, *either* e_3 or e_1 and (y/z). Hard!
- **Trickle up:** If top earners overpaid, lowering tax τ extracts resources from lower earners
    - If $e = 1$, and $y = z$, optimal tax in pure supply side case is 40%
    - If $e_1 = 0.5$, starting from $y = z$, optimal tax is 70%
    - If paid twice their marginal product, optimal rate is 85%
- **Trickle down:** If top earners underpaid, lowering tax τ transfers resources to lower earners
    - e.g.: if Japan has implicit caps on pay (social norms) optimal τ could be lower

Compensation Bargaining

Open questions and discussion

- **Regulation versus taxation?** Should the government rather directly regulate pay?
- **Differentiated taxation** across sectors with different degrees of rent extraction? Hard to measure and to avoid shifting.
- **Non uniform external effects:** Who bears cost from bargaining? If other high earners, social cost (and taxes) are lower (Rothschild and Scheuer (2011)).

Putting the three elasticities together

Total response = Real economic + Avoidance + Bargaining =

$$e = (y/z)\, e_1 + e_2 + e_3$$

If start with no rents ($y = z$) $e = e_1 + e_2 + e_3$
For a given t (tax on sheltered income) optimal tax rate is

$$\tau^* = \frac{1 + tae_2 + ae_3}{1 + a\,(e_1 + e_2 + e_3)}$$

If t can be optimized as well, avoidance elasticity irrelevant:

$$\tau^* = t = \frac{1 + ae_3}{1 + a\,(e_1 + e_3)}$$

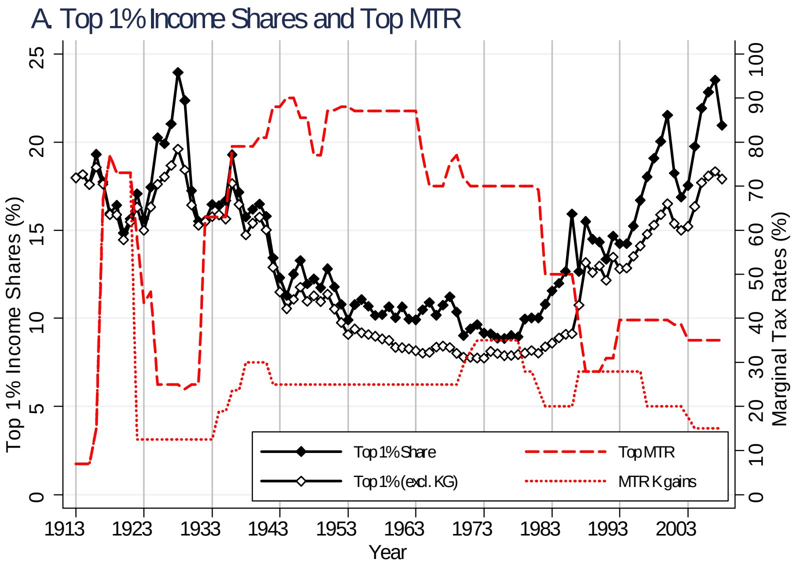
If weight $g < 1$ on top earners, then

$$\tau^* = \frac{1 - g + tae_2 + ae_3}{1 - g + a\,(e_1 + e_2 + e_3)}$$

Outline of the talk

1. Standard model with real supply-side response
2. Tax avoidance and income shifting responses
    - Pure Avoidance Model
    - Income Shifting Model
3. Bargaining and rent-seeking responses
4. Empirical evidence
    - US evidence
    - International evidence
    - Summary of scenarios
5. Conclusion

Empirical Evidence: US



Empirical Evidence: US

Table 1: US Evidence on Top Tax Rates, Top Income Shares, and Income Growth

		Income excluding capital gains	Income including capital gains
		(1)	(2)
A. 1975-1979 vs. 2004-2008 Comparison			
Top Marginal Tax Rate (MTR)	1975-9	70%	70%
	2004-8	35%	35%
Top 1% Income Share	1975-9	8.0%	9.1%
	2004-8	17.7%	21.8%
Elasticity estimate:			
Δ log (top 1% share) / Δ log (1-Top MTR)		1.03	1.12
B. Elasticity estimation (1913-2008): log(share) = a + e*log(1-Top MTR) + c*time + ε			
No time trend		0.25	0.26
		(0.07)	(0.06)
Linear time trend		0.30	0.29
		(0.06)	(0.05)
Number of observations		96	96

Empirical Evidence: US

Total effect and avoidance channel

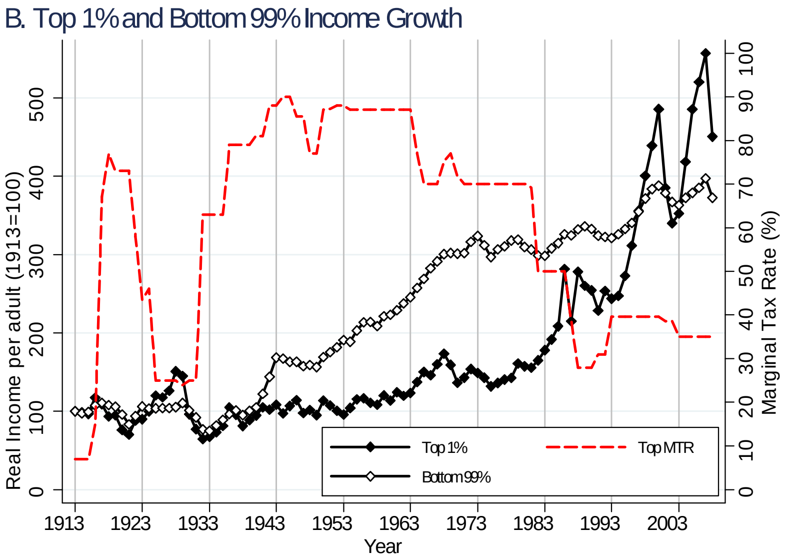
- Strong correlation between top income shares and top tax rates

$\Rightarrow$ e is large

- Almost same for income series including capital gains: shifting is not full story (in short run, a lot of shifting effects, Auerbach (1988), Gordon and Slemrod (2000))
- Other types of tax-exempt compensation ignored here, BUT seems they increased despite tax rates falling
  - Off-shore accounts have not decreased (Zucman (2011))
  - Perks: would have had to be huge in 70s to account for full effect Median CEO pay pre-1970s was $0.75 (Frydman and Saks (2010)); lower than perks reported in the press today! (Yermack (2006))

$\Rightarrow e_2$ small in long-run $\Rightarrow e_1 + e_3$ large

Empirical Evidence: US



Empirical Evidence: US

Table 1: US Evidence on Top Tax Rates, Top Income Shares, and Income Growth

	Income excluding capital gains	Income including capital gains (to control for tax
	(1)	(2)
C. Effect of Top MTR on income growth (1913-2008): log(income) = a + b*log(1-Top MTR) + c*time + ε		
Top 1% real income	0.265	0.261
	(0.047)	(0.041)
Bottom 99% real income	-0.080	-0.076
	(0.040)	(0.039)
Average real income	-0.027	-0.027
	(0.018)	(0.034)
Number of observations	96	96

Empirical Evidence: US

- Separate e_1 from e_3 by examining effect of $(1 - \textit{top tax rate})$ on growth of bottom 99%.
  - Strong positive effect on top 1% income growth
  - Negative effect on bottom 99% income growth, zero effect on overall average growth
- Suggests real elasticity $e_1 \approx 0$.
- Problem is validity of this simple OLS: growth could have slowed down for other reasons (and top 1% did not suffer because of tax cuts).

Empirical Evidence: International

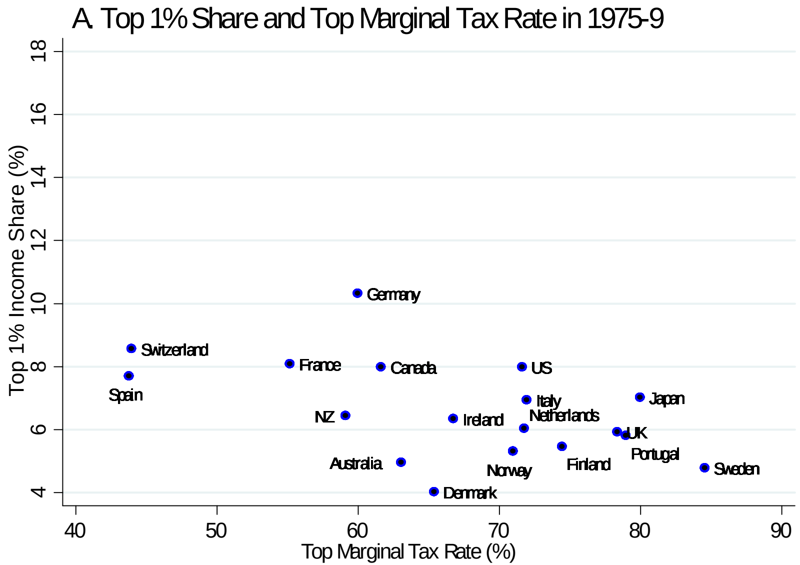
Data

- Data from **18 OECD countries 1975-2009**
- Construct marginal top tax rates (income tax (national+local), robustness check adds payroll + consumption taxes)
- Top Income Shares from **World Top Incomes Database**

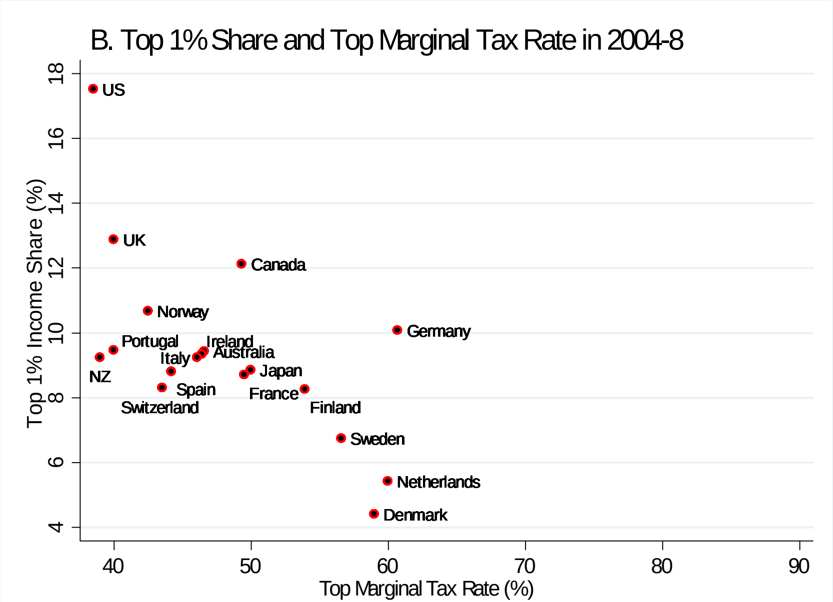
Questions

- Effect of top tax rates on top 1% share?
- Effect of top tax rates on growth?

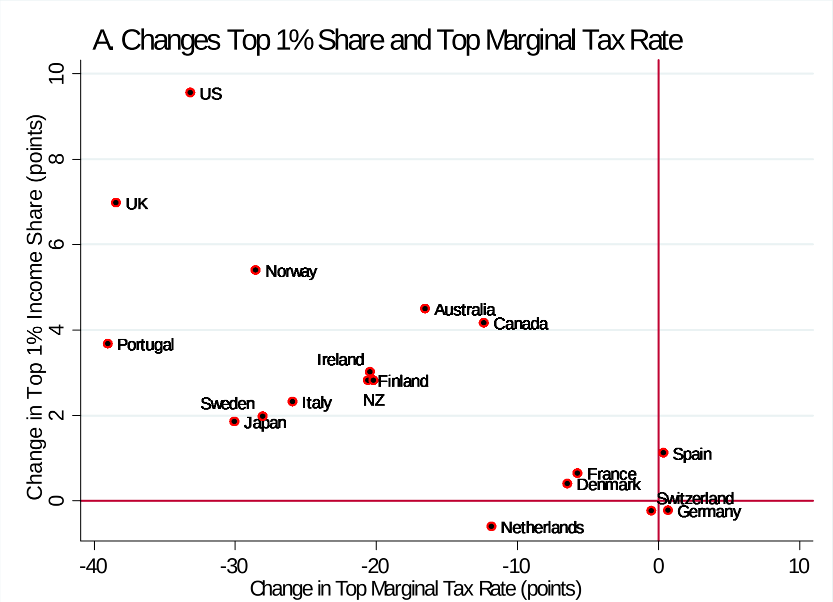
Top 1% share and top tax rates around 1975



Top 1% share and top tax rates around 2009



Top 1% share and top tax rates 1975-2009

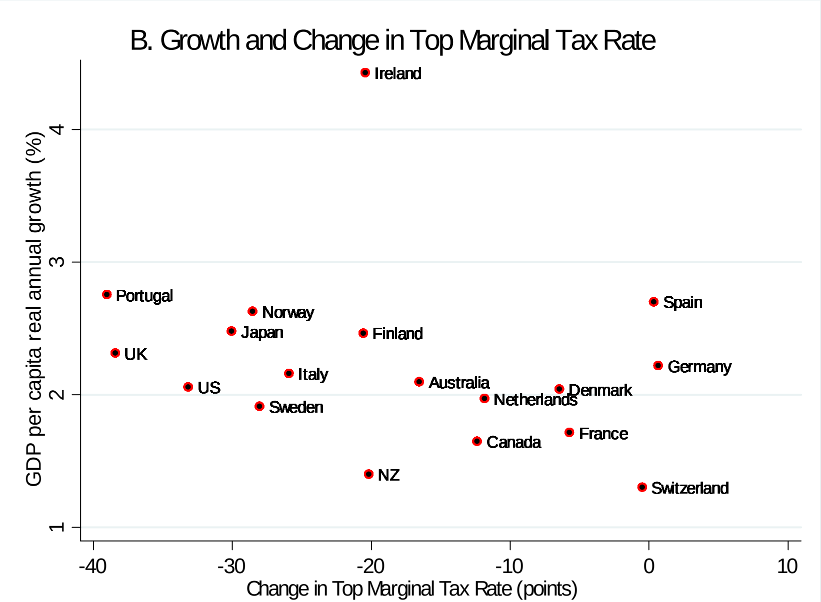


Top tax rates and Top 1% Income share

Table 2: International Evidence on Top Tax Rates, Top Income Shares, and Income Growth

A. Effect of the Top Marginal Income Tax Rate on Top 1% Income Share	
A1. Cross Country Cross-Sectional Comparisons:	
Regression: log(Top 1% share) = a + e*log(1-Top MTR) + ε	
Elasticity in 1975-9	0.329
	(0.148)
Elasticity in 2004-8	1.396
	(0.381)
Number of obs.	18
A2. Cross Country Changes from 1975-9 to 2004-8:	
Regression: Δ log(Top 1% share) = a + e*Δ log(1-Top MTR) + ε	
Elasticity	0.490
	(0.144)
Number of observations	18
A3. Full Time Series analysis (1975-2008):	
Regression: log(Top 1% share) = a + e*log(1-Top MTR) + ε	
No controls	0.561
	(0.034)
Time trend control	0.512
	(0.039)
Country fixed effects	0.455
	(0.029)
Number of observations	518

Top tax rates and average growth 1975-2009



Top tax rates and average growth 1975-2009

B. Effect of the Top Marginal Income Tax Rate on real GDP per capita

Regression: log(real GDP per capita) = a + b*log(1-Top MTR) + c*time + ε

No country fixed effects	0.027
	(0.036)
Country fixed effects	0.012
	(0.013)
Number of observations	518

$\Rightarrow$ Weak and positive

Using Growth effect $=$ top 1% share $\times$ e_1 and effect $\leq$ 0.02 $\Rightarrow$ $e_1 \leq 0.2$

Given $e \approx 0.5$, $e_3 \geq 0.3$

Macro estimates rely on strong identifying assumptions

- Countries could cut top tax rates when growth expected to slow down (Anglo-saxon countries in 70s?)
- Social norms and tolerance for inequality can drive both top incomes and taxes
- Yet, European countries cut back work hours, which should have reduced their growth more

Empirical Evidence: International

Discussion of the results II

Micro evidence from corporate econ literature confirms hypothesis of non competitively set pay at top:

- Hidden parts of compensation packages and effect of disclosure rules (Bebchuk and Fried (2004), Kuhnen and Zwiebel (2009))
- Reward for positive outcomes outside of CEOs control; no punishment for bad outcomes (Bertrand and Mullainathan (2001))
- Pay decreases when board control increases (Chhaochharia and Grinstein (2009))
- Malpractice widespread, options backdating, spring loading (Yermack (1997), Lie (2005))

Empirical Evidence: Scenarios

Table 3: Synthesis of Various Scenarios

Total elasticity $e = e_1 + e_2 + e_3 =$	0.5

Scenario 1: Standard supply side tax effects		Scenario 2: Tax avoidance effects (a) current narrow tax base	Scenario 2: Tax avoidance effects (b) after base broadening	Scenario 3: Compensation bargaining effects	
$e_1 =$	0.5	$e_1 = 0.2$	$e_1 = 0.2$	$e_1 =$	0.2
$e_2 =$	0.0	$e_2 = 0.3$	$e_2 = 0.1$	$e_2 =$	0.0
$e_3 =$	0.0	$e_3 = 0.0$	$e_3 = 0.0$	$e_3 =$	0.3

Optimal top tax rate $\tau^* = (1+ tae_2 + ae_3)/(1+ae)$	
Pareto coefficient a =	1.5
Alternative tax rate t =	20%

Scenario 1		Scenario 2 (a) e_2=0.3	Scenario 2 (b) e_2=0.1	Scenario 3	
$\tau^* =$	57%	τ^* = 62 %	τ^* = 71 %	$\tau^* =$	83%

Empirical Evidence: Scenarios

Table 3: Synthesis of Various Scenarios

Total elasticity $e = e_1 + e_2 + e_3 =$ 0.5

Scenario 1: Standard supply side tax effects	Scenario 2: Tax		Scenario 3: Compensation ...rgaining effects	
$e_1 =$ 0.5			$e_1 =$	0.2
$e_2 =$ 0.0			$e_2 =$	0.0
$e_3 =$ 0.0	$e_3 = 0.0$	$e_3 = 0.0$	$e_3 =$	0.3

International evidence not in favor

No big changes in hours worked at the top (Moffitt and Wilhelm (2000))

Optimal top tax rate $\tau^* = (1 + tae_2 + ae_3)/(1+ae)$

Pareto coefficient $a =$	1.5
Alternative tax rate $t =$	20%

Scenario 1	Scenario 2		Scenario 3
	(a) $e_2=0.3$	(b) $e_2=0.1$	
$\tau^* =$ 57%	$\tau^* = 62$ %	$\tau^* = 71$ %	$\tau^* =$ 83%

Empirical Evidence: Scenarios

Table 3: Synthesis of Various Scenarios

Total elasticity $e = e_1 + e_2 + e_3 =$ 0.5

Scenario 1: Standard supply side tax effects		Scenario 2: Tax avoidance effects (a) current narrow tax base	Scenario 2: Tax avoidance effects (b) after base broadening	Scenario 3: Compensation bargaining effects	
$e_1 =$	0.5	$e_1 = 0.2$	$e_1 = 0.2$	$e_1 =$	0.2
			$_2 = 0.1$	$e_2 =$	0.0
			$_3 = 0.0$	$e_3 =$	0.3

+ $tae_2 + ae_3)/(1+ae)$

a =	1.5
t =	20%

Scenario 1		Scenario 2 (a) e_2=0.3	Scenario 2 (b) e_2=0.1	Scenario 3	
$\tau^* =$	57%	τ^* = 62 %	τ^* = 71 %	$\tau^* =$	83%

Documented by Giertz, Saez and Slemrod (2011)

US evidence not supportive

International evidence neither (measured growth should have increased if hidden income reported after tax decreases)

Empirical Evidence: Scenarios

Table 3: Synthesis of Various Scenarios

Total elasticity $e = e_1 + e_2 + e_3 =$ 0.5

Scenario 1: Standard supply side tax effects	Scenario 3: Compensation bargaining effects
$e_1 =$ 0.5	$e_1 =$ 0.2
$e_2 =$ 0.0	$e_2 =$ 0.0
$e_3 =$ 0.0	$e_3 =$ 0.3

Hard to estimate empirically

Suggests institutional setup of country matters

- **In Europe and Japan may be hard to bargain for higher pays at the top**
- **In English speaking countries, Reagan and Thatcher revolutions changed mindsets**

+ae)

Scenario 1	Scenario 2		Scenario 3
	(a) e_2=0.3	(b) e_2=0.1	
$\tau^* =$ 57%	τ^* = 62 %	τ^* = 71 %	$\tau^* =$ 83%

Outline of the talk

1. Standard model with real supply-side response
2. Tax avoidance and income shifting responses
   - Pure Avoidance Model
   - Income Shifting Model
3. Bargaining and rent-seeking responses
4. Empirical evidence
   - US evidence
   - International evidence
   - Summary of scenarios
5. Conclusion

Conclusion

- We presented simple model capturing 1.Standard supply side responses 2.Tax avoidance responses 3.Compensation bargaining responses
- Derived optimal tax formula as function of three elasticities: taxable income elasticity no longer a sufficient statistic.
- Empirical analysis *suggested* that
  - Top income share very sensitive to top tax rates $\Rightarrow$ overall elasticity e is large
  - Standard real supply side and avoidance channels both seem insufficient.
  - Hard to convincingly establish bargaining channel, but empirical evidence not inconsistent with it

Future work (some in progress!) needed to quantify compensation channel

Real Supply Side Responses: Optimal tax rate derivation

Equivalent to maximizing top tax revenue:

$$T = \tau \left[z \left(1 - \tau \right) - \bar{z} \right]$$

FOC:

$$\begin{aligned} z - \bar{z} - \tau \frac{dz}{d\left(1-\tau\right)} &= 0 \\ \frac{z - \bar{z}}{z}\left(1-\tau\right) - \tau \frac{dz}{d\left(1-\tau\right)} \frac{1-\tau}{z} &= 0 \\ \frac{\tau}{1-\tau} e_1 &= \frac{1}{a} \end{aligned}$$

Avoidance Responses: Optimal tax rate derivation

Equivalent to maximizing top tax revenue:

$$T = \tau \left[z - \bar{z} \right] + tx$$

FOC for a fixed t :

$$\begin{aligned} z - \bar{z} - \tau \frac{dz}{d(1-\tau)} + t \frac{dx}{d(\tau - t)} &= 0 \\ z - \bar{z} - \tau \frac{dz}{d(1-\tau)} + st \frac{\partial z}{\partial (1-\tau)} &= 0 \\ \frac{\tau - ts}{1-\tau} e &= \frac{1}{a} \end{aligned}$$

FOC with respect to t : using that $z = y - x$

$$x + [\tau - t] \frac{dx}{d(\tau - t)} = 0$$

Since $x \geq 0$ and $\tau \geq t$, this can only hold if $\tau = t$ and $x = x(0) = 0$.

Optimal Tax Derivation: Compensation Channel

Equivalent to maximizing revenue from the top bracket net of bargaining cost (incurred by all N agents in the economy).

$$T = \tau\left(y + b - \bar{z}\right) - NE\left(b\right)$$

If τ triggers a change in b, then that change is reflected one-to-one in $NE\left(b\right)$. Hence $\frac{db}{d(1-\tau)} = \frac{NdE(b)}{d(1-\tau)}$. Hence the FOC for τ is:

$$y + b - \bar{z} - \tau\frac{dy}{d\left(1-\tau\right)} - \tau\frac{db}{d\left(1-\tau\right)} + \tau\frac{db}{d\left(1-\tau\right)} = 0$$

$$\begin{aligned}
\tau\left(\frac{dy}{d\left(1-\tau\right)} + \frac{db}{d\left(1-\tau\right)}\right) - \tau\frac{db}{d\left(1-\tau\right)} &= z - \bar{z} \\
\left[\tau - s\right]\frac{dz}{d\left(1-\tau\right)} &= z - \bar{z} \\
\frac{\left[\tau - s\right]}{1-\tau}e &= \frac{z-\bar{z}}{z} = \frac{1}{a}
\end{aligned}$$

can also be rearranged using the fact that $e_3 = se$