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

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Introduction

- Top 1% share of pre-tax 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?)

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

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

This paper:

- Simple model capturing all three responses
- Derives optimal tax formula as a function of the three elasticities
- Empirical analysis
  - Macro evidence: long-term evidence for the US and international evidence for 18 OECD countries since 1960
  - Micro evidence on CEO pay in the US
  - International micro evidence on CEO pay and governance.

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2. Avoidance and income shifting (Slemrod (1996), Slemrod and Kopczuk (2002), Reynolds (2007))
3. Compensation bargaining and rent-extraction

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Introduction: Results of the Paper (I)

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.

Macro empirical results:

- Suggestive macro evidence:
  - Large total elasticity $e = e_1 + e_2 + e_3 = 0.5$ in 18 OECD countries.
  - US long-term 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, $\Rightarrow e_3 \simeq 0.3 \Rightarrow t = 83\%$ potentially (57% in pure supply side).

Introduction: Results of the Paper (II)

Micro empirical results:

- CEO pay and bargaining in the US:
  - CEOs are rewarded for "non-deserved" luck income
  - Sensitivity of pay to *luck* income (but not to true performance) has increased in the recent low tax period.
- International CEO compensation and governance:
  - CEO pay depends on top tax rates even after controlling for firm performance
  - Top retention rates increase CEO pay, but less so in well-governed firms $\longrightarrow$ part of increase in pay in badly governed firms is likely due to rent-extraction.

Outline of the talk

1. Standard model with real supply-side response
2. Tax Avoidance Responses
3. Bargaining and rent-seeking responses
4. Empirical evidence
   - Macro: US evidence
   - Macro: International evidence
   - Micro: CEO pay in the US
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Standard Model with Real Supply Side Responses

- z: taxable income
- Consider a constant tax rate τ for $z \geq \overline{z}$.
- 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

- Social welfare across agents of type i :

$$W = \int G(u_i)\, dv(i)$$

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

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

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

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

- **Calibration** (Diamond and Saez (2011)): $a = 1.5$ (US) , $a \approx 2$ (EU).
  $e_1 = 0.25 \Rightarrow \tau^* = 73\%$
  $e_1 = 1 \Rightarrow \tau^* = 40\%$.

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Tax Avoidance Responses

- Pure avoidance model: all shifting purely wasteful (income shifting model in slides' Appendix).
- y is real income, x sheltered income at cost $d_i(x)$
- Taxable income, $z = y - x$
- Utility:

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

where $c = R + (1 - \tau) y + (\tau - t) x$

Tax Avoidance Responses

- Solutions: $h_i'(y) = 1 - \tau$, and $d_i'(x) = (\tau - t)$
- Aggregating over all taxpayers:
  - $y = y(1 - \tau)$, with real elasticity e_1
  - $x = x(\tau - t)$, increasing in $\tau - t$.
  - $z = z(1 - \tau, t)$, increasing in $1 - \tau$ and t, with elasticity e.
- s is fraction of behavioral response due to tax avoidance, $e_2 = s.e$ is tax avoidance elasticity:

$$s = \frac{dx/d(\tau - t)}{\partial z/\partial(1 - \tau)}$$

- Total elasticity: $e = (y/z).e_1 + e_2$,
  (if no avoidance initially: $e = e_1 + e_2$).

Tax Avoidance Responses

- Partial optimum: For a given t, optimal τ:

$$\tau^* = \frac{1 + t.a.e_2}{1 + a.e}$$

- Full optimum:

$$\tau^* = t^* = \frac{1}{1 + a.e_1}$$

  Only real elasticity e_1 limits τ.

- **Comments:**
  - For $t = 0$: $\tau^* = 1/(1 + a.e)$ as in standard model (Feldstein (1999): irrelevant whether sheltering or real response $t = 0$).
  - If $t > 0$: "Fiscal externality" and $\tau > 1/(1 + a.e)$.
  - Govt should close all sheltering opportunities ($t = \tau$): in practice, which avoidance channels are too costly to close versus pure creations of tax system itself (loopholes).

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Compensation Bargaining

- Pay need not equal marginal productivity: bargaining, imperfect information on productivity
  - Entrenchment, rent-seeking $\Rightarrow$ 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 (2012)

Compensation Bargaining: Model

- 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 (Appendix in paper relaxes this).
  - Hence, demogrant $T(0)$ fully absorbs gain/loss.

Compensation Bargaining: 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.

Compensation Bargaining: Elasticities

- 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: Optimal tax

- s can be negative, leading to e_3 negative, 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, $\tau^* > 1/(1+ae_1)$.
If $e_1 = 0$, $\tau^* = 1$.

Compensation Bargaining: Comments

- **Implementing formula** requires knowing, in addition to total e, *either* e_3 or e_1 and (y/z). Hard (but see empirical section)!
- **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.

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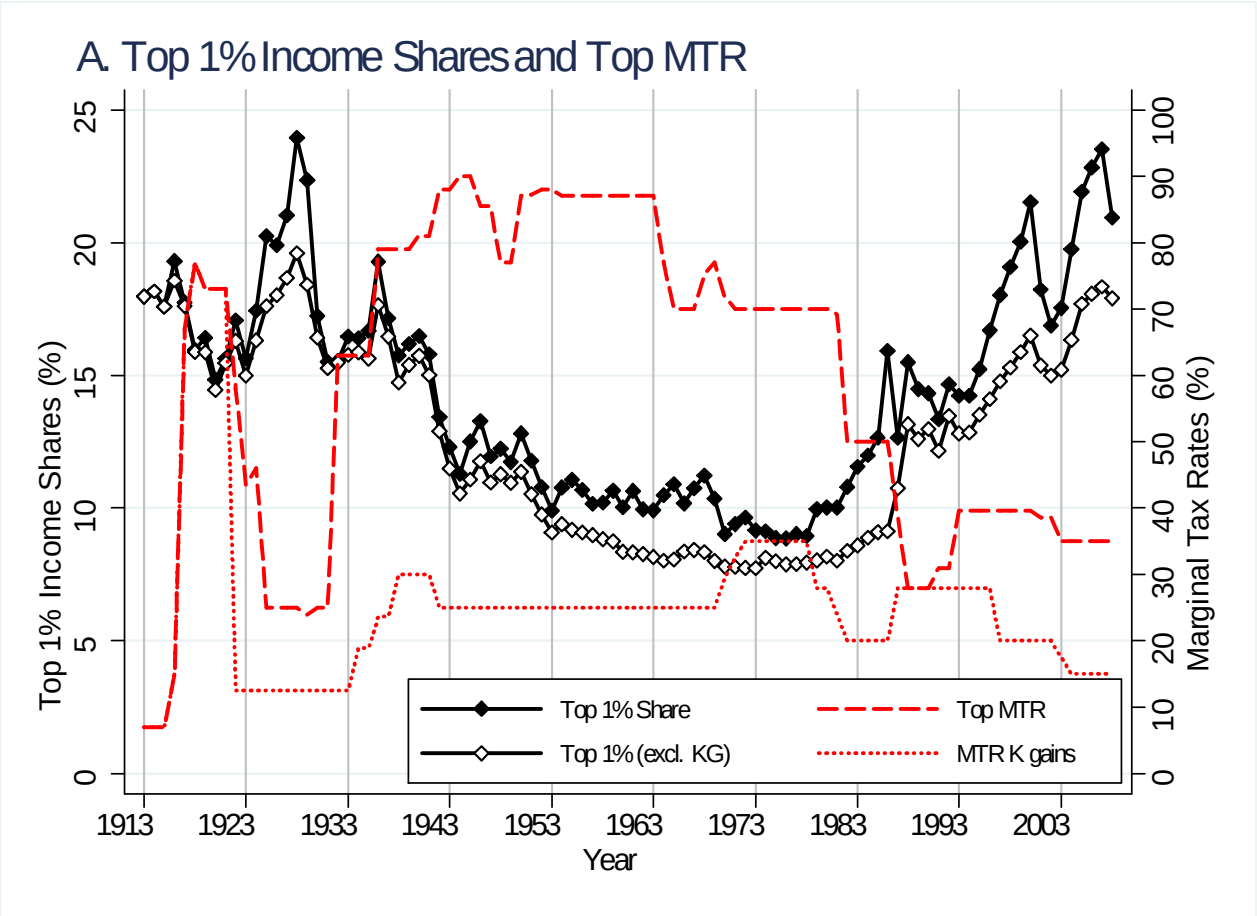
Macro Evidence: US



Evasion cannot be full picture: series with or without capital gains move closely together

Macro Evidence: US

Table 1: US Evidence on Top Income Elasticities

		Income excluding capital gains (1)	Income including capital gains (to control for tax avoidance) (2)
A. 1975-1979 vs. 2004-2008 Comparison			
Top Marginal Tax Rate (MTR)	1960-4	85%	85%
	2004-8	35%	35%
Top 1% Income Share	1960-4	8.2%	10.2%
	2004-8	17.7%	21.8%
Elasticity estimate: Δ log (top 1% share) / Δ log (1-Top MTR)		0.52	0.52
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

Macro Evidence: US

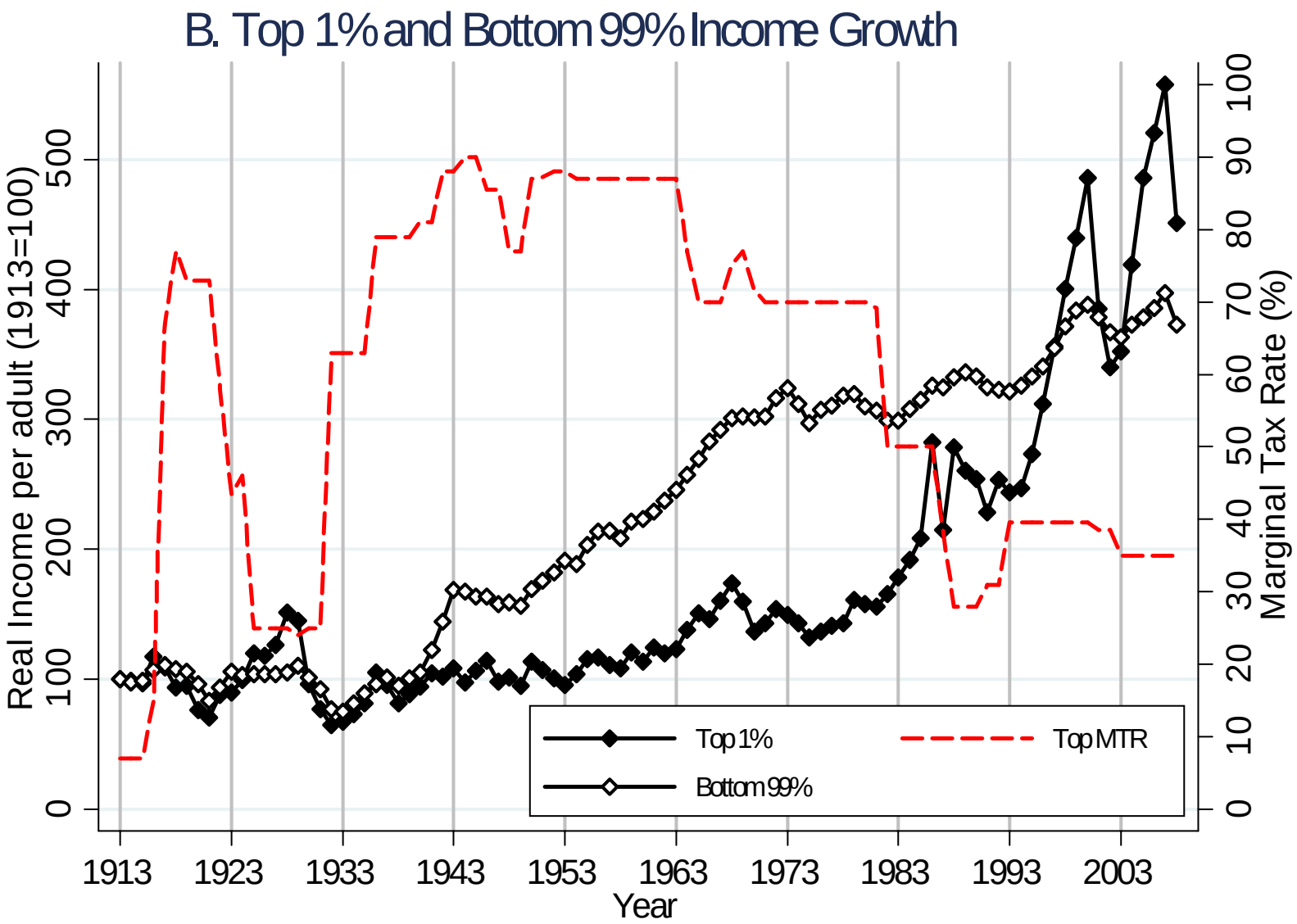
- Strong correlation between top income shares and top tax rates

$$\Rightarrow e \text{ is large}$$

- 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))

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

Macro Evidence: US



Macro Evidence: US

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).

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Macro Evidence: International

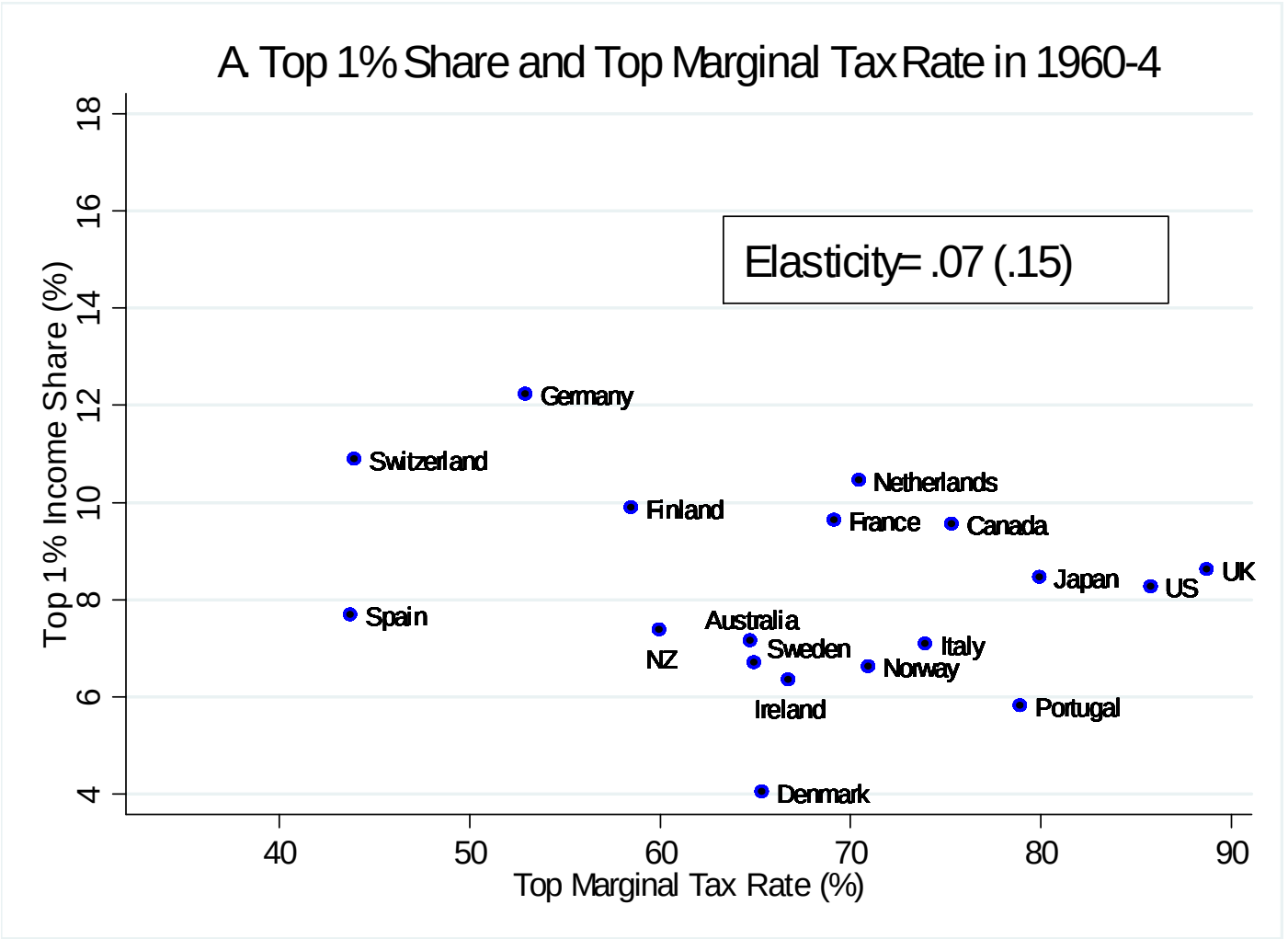
Data

- Data from **18 OECD countries 1960-2010**
- Construct marginal top tax rates (income tax (national+local), robustness check adds payroll + consumption taxes)
- Top Income Shares from **World Top Incomes Database**

Questions

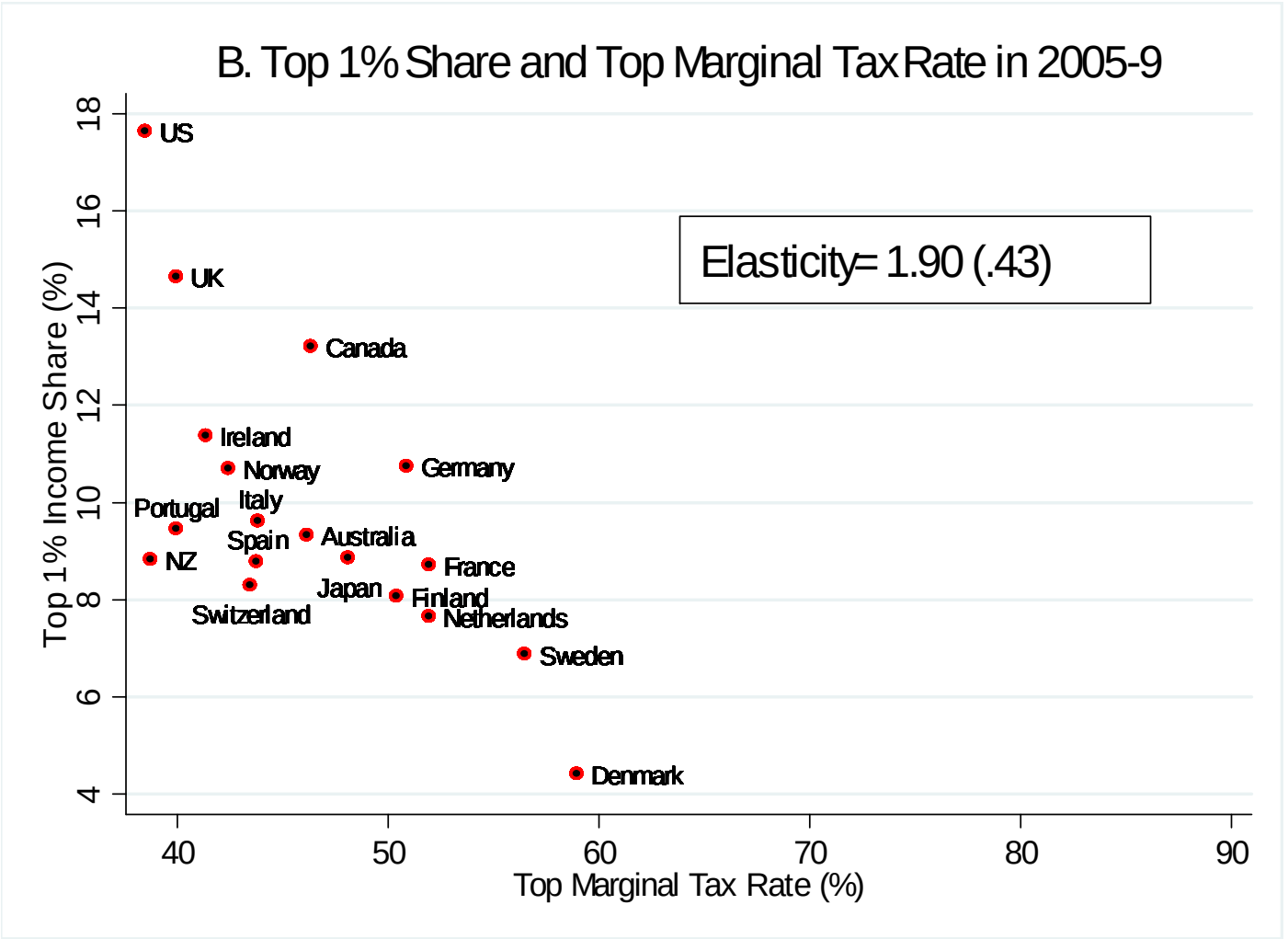
- Effect of top tax rates on top 1% share?
- Effect of top tax rates on growth?

Top 1% share and top tax rates 1960-64



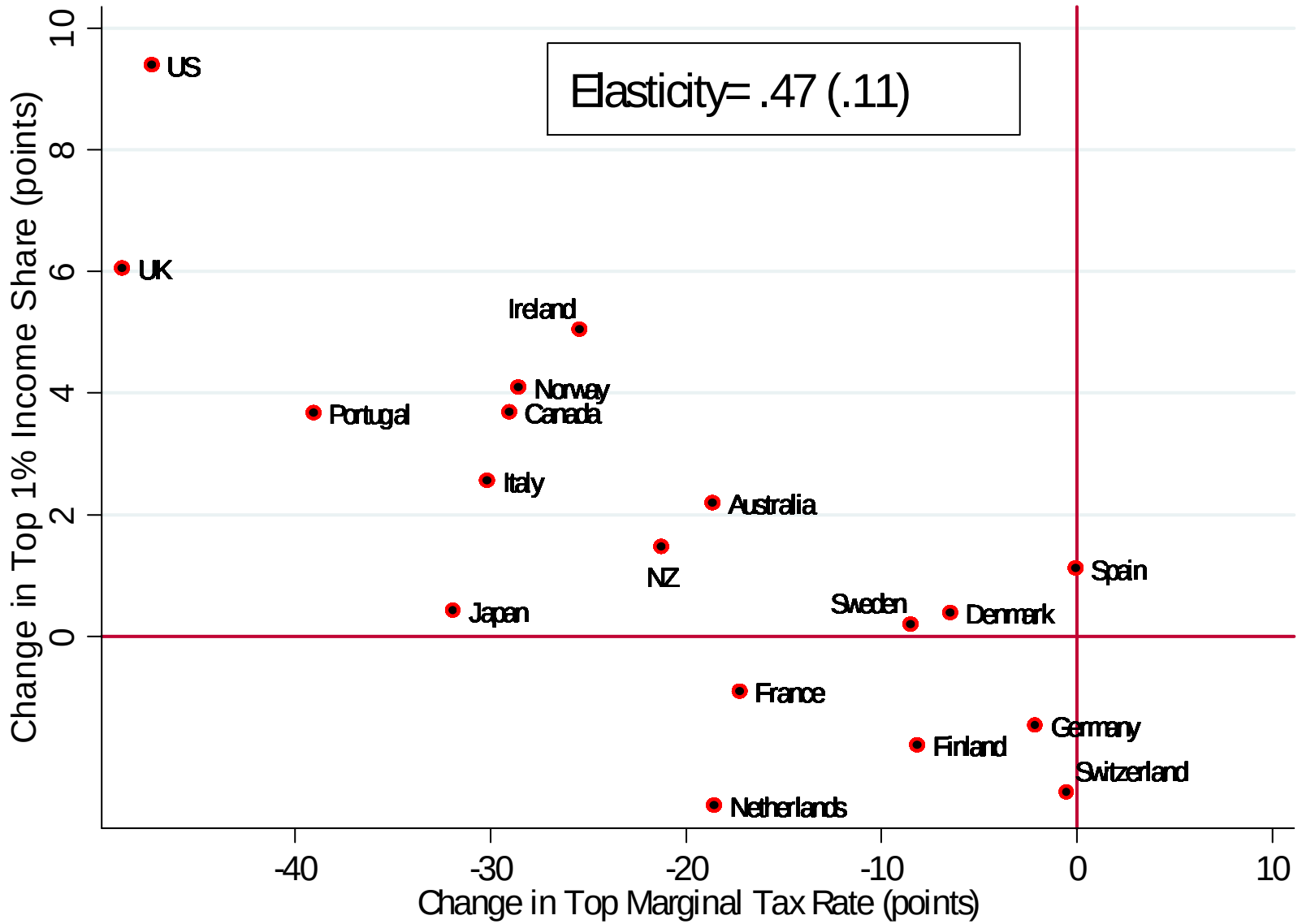
Weak negative correlation

Top 1% share and top tax rates around 2005-09



Strong negative correlation

Top 1% share and top tax rates 1960-2009

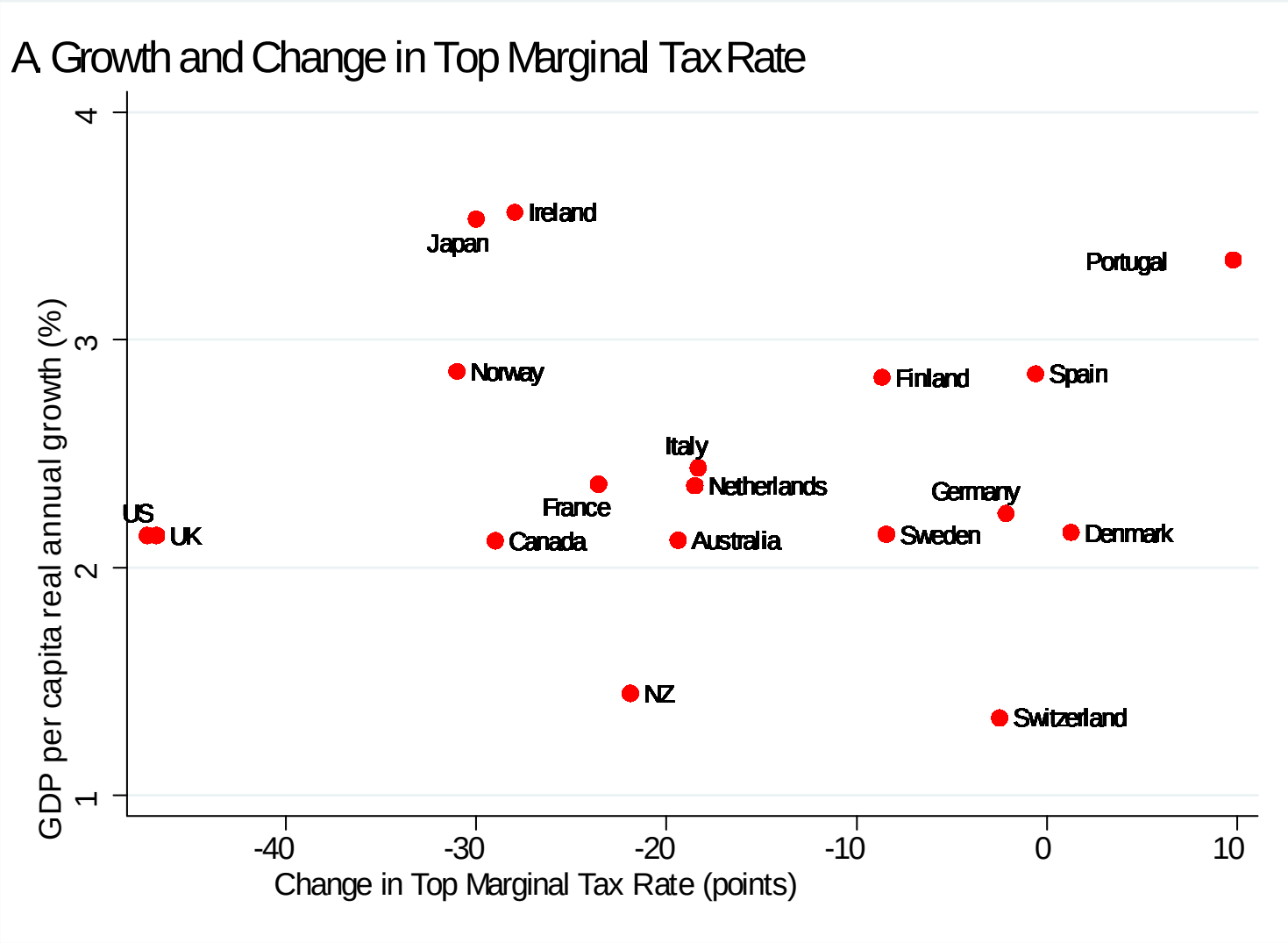


Top tax rates and top 1% income share 1960-2009

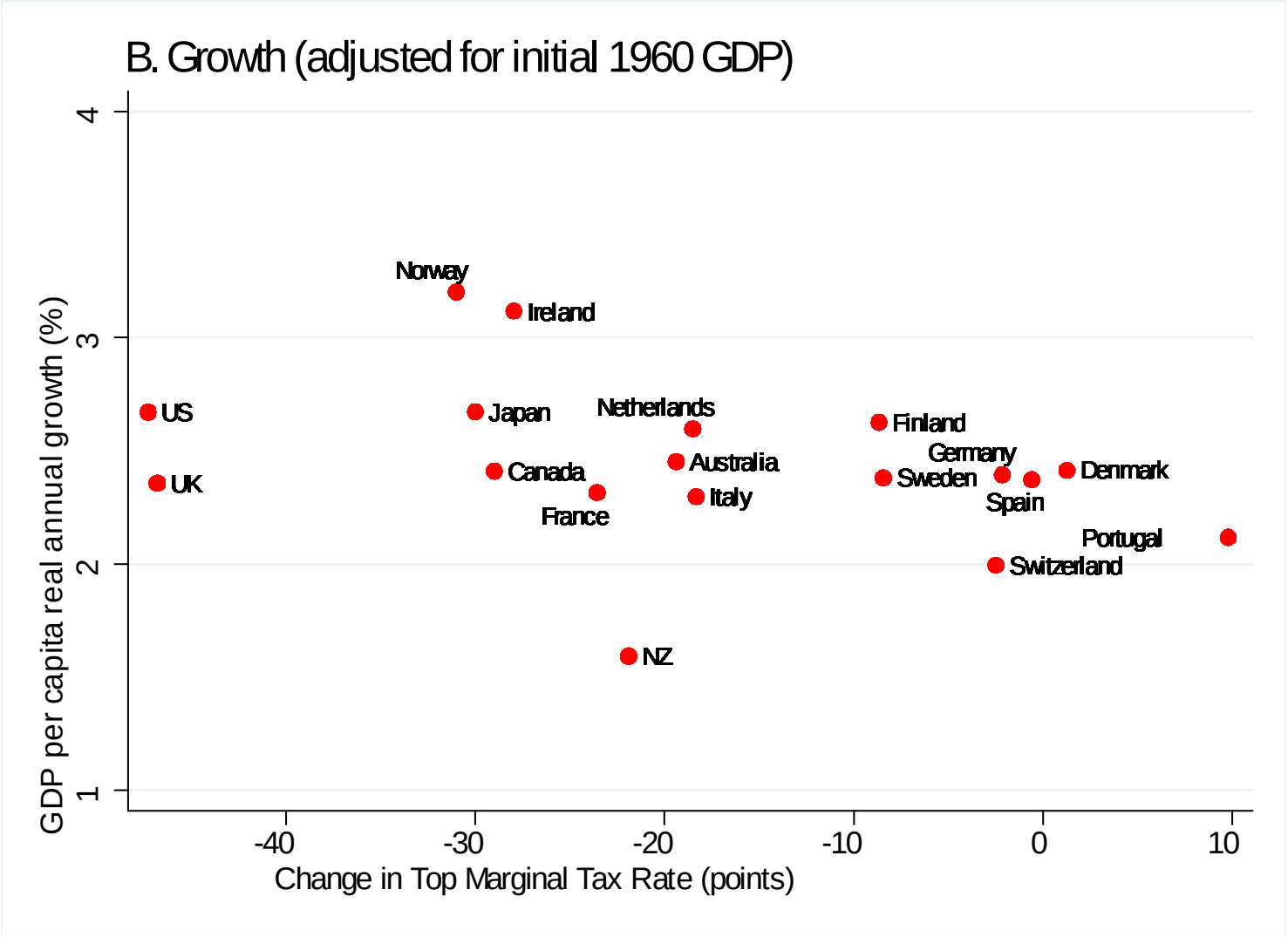
Table 2: International Evidence on Top Income Elasticities

	All 18 countries and fixed periods			Bootstrapping period and country set		
	1960-2010	1960-1980	1981-2010	Median	5th percentile	95th percentile
	(1)	(2)	(3)	(4)	(5)	(6)
A. Effect of the Top Marginal Income Tax Rate on Top 1% Income Share						
Regression: log(Top 1% share) = a + e*log(1-Top MTR) + ε						
No controls	0.324	0.163	0.803	0.364	0.128	0.821
	(0.034)	(0.039)	(0.053)	(0.043)	(0.085)	(0.032)
Time trend control	0.375	0.182	0.656	0.425	0.191	0.761
	(0.042)	(0.030)	(0.056)	(0.045)	(0.091)	(0.032)
Country fixed effects	0.314	0.007	0.626	0.267	0.008	0.595
	(0.025)	(0.039)	(0.044)	(0.035)	(0.070)	(0.026)
Number of observations	774	292	482	286	132	516

Top tax rates and average growth 1960-2009



Top tax rates and average growth 1960-2009



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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	-0.064	-0.018	-0.097	0.002	-0.214	0.173
	(0.033)	(0.041)	(0.043)	(0.042)	(0.080)	(0.026)
Country fixed effects	-0.029	-0.082	0.037	-0.004	-0.087	0.071
	(0.014)	(0.016)	(0.019)	(0.016)	(0.031)	(0.011)
Initial GDP per capita	-0.095	-0.025	-0.023	-0.054	-0.149	0.022
	(0.019)	(0.016)	(0.014)	(0.017)	(0.030)	(0.011)
Initial GDP per capita, time*intial GDP per cap	-0.088	0.004	-0.037	-0.060	-0.160	0.012
	(0.017)	(0.011)	(0.014)	(0.016)	(0.030)	(0.011)
Country fixed effects, time*initial GDP per cap	-0.018	0.000	0.008	-0.015	-0.069	0.040
	(0.011)	(0.014)	(0.017)	(0.013)	(0.031)	(0.009)
Number of observations	918	378	540	317	152	576

Macro Evidence: International, Discussion

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

Macro Evidence: International, Discussion

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))

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CEO Pay in the US

- Bargaining b = extracting "not deserved" pay/more than marginal product.
  - For example: being rewarded for luck (Bertrand and Mullainathan (2001)).
- We ask two questions:
  1. Is there pay for luck/bargaining?
  2. If yes, does it decrease with top tax rates as predicted by bargaining model?

CEO Pay in the US: Model

- Let p be observed performance measure:

$$p = a + \delta p_{luck} + \varepsilon$$

  a: effort, p_{luck}: observable "luck" component, δ: sensitivity of performance measure to luck, ε: unobservable random noise

- With optimal (linear) contract (Holmstrom and Milgrom (1987)): Total pay $z = \alpha + \beta (p - \delta p_{luck}) = \alpha + \beta (a + \varepsilon) = y$ "real product" and $b = 0$ $(\eta = 1)$.
- With bargaining and non-optimal contract: $z = y + \beta_{luck} (\delta p_{luck}) = y + b$.

CEO Pay in the US: Empirical Strategy

- Effect of general performance on pay (OLS):

$$pay_{it} = \beta * p_{it} + \gamma_i + \chi_t + \alpha_X * X_{it} + \varepsilon_{it}$$

pay_{it}: CEO pay in firm i at time t, p_{it}: performance measure, γ_i: firm FE, χ_t: time FE, X_{it}: CEO controls (age, tenure).

- Effect of luck performance on pay (IV):
  1. **Stage**: Effect of luck on performance measure

$$p_{it} = b * p_{luck,it} + g_i + c_t + \alpha_X * X_{it} + e_{it} \quad (1)$$

$p_{luck,it}$: luck measure (asset-weighted average industry performance). Part of performance due to (observable) luck $\hat{p}_{it}$ = prediction from (1).

  2. **Stage**: Estimate sensitivity of pay to predictable changes in p_{it}:

$$y_{it} = \beta_{luck} * \hat{p}_{it} + \gamma_i + \chi_t + \alpha_X * X_{it} + \varepsilon_{it}$$

If $\beta_{luck} \neq 0$: pay for luck.
If $\beta_{luck} \geq \beta$: no filtering at all of luck component.

CEO Pay in the US: Luck and performance measures

- Performance measures:
  1. Net Income
  2. Shareholder Wealth (log)
- Measure of pay: Total Pay
- Measure of luck: Mean asset-weighted performance of other firms in industry.
- Data: Forbes 800 + Execucomp, COMPUSTAT-CRSP.
- Years: **1970-2010**
- Analysis repeated for high tax period (pre-1986) and low tax period (post-1987) to study effect of tax rates.

Table 3: US CEO Pay Evidence, 1970-2010

Firm performance measure	Log(net income)			Log(stock-market value)		
Outcome (LHS variable)	Log(CEO pay)	Log(CEO pay)	Log(industry level workers pay)	Log(CEO pay)	Log(CEO pay)	Log(industry level workers pay)
OLS vs. IV	OLS	Industry luck IV	Industry level OLS regression	OLS	Industry luck IV	Industry level OLS regression
	(1)	(2)	(3)	(4)	(5)	(6)
A. Effect of firm performance on log-pay in high-top tax rate period (1970-1986)						
Firm performance (RHS variable)	0.23***	0.34***	0.00	0.28***	0.22*	0.00
	(0.013)	(0.072)	(0.010)	(0.022)	(0.123)	(0.015)
Number of observations	8,632	8,503	890	9,005	8,865	898
B. Effect of firm performance on log-pay in low-top tax rate period (1987-2010)						
Firm performance (RHS variable)	0.27***	0.70***	-0.02	0.37***	0.95***	-0.02
	(0.012)	(0.148)	(0.020)	(0.021)	(0.309)	(0.023)
Number of observations	14,914	14,697	1,422	17,775	17,593	1,443
C. Test for difference between low- and high- top tax rate periods						
Difference Panel B - Panel A	0.04***	0.36*	-0.019	0.09***	0.72**	-0.023
p-value of difference	0.01	0.06	0.440	0.00	0.05	0.46

CEO Pay in the US: Results

- Incomplete filtering of luck component in CEO pay: $\beta_{luck} \neq 0$.
- Pay for luck is large and almost no filtering: $\beta_{luck} \geq \beta$.
- Pay for luck much stronger in low tax period, consistent with bargaining model.

CEO Pay in the US: Discussion

Could pay for luck be consistent with optimal contracting view?

- CEO incentivized to predict luck shocks? But why reward average performance (2SLS uses no between firm variation) and why reward less when MTR higher?
- Maybe not bargaining but impossibility to filter out luck?
  - Badly governed firms exhibit more pay for luck (BM and our results - not shown for sake of time).
  - Still means there is a lot of "non-deserved" pay!
- Most important criticism: CEO human capital value increasing in industry performance?
  - Strikingly, workers' wages show no 'pay for luck' (columns 3 and 6).

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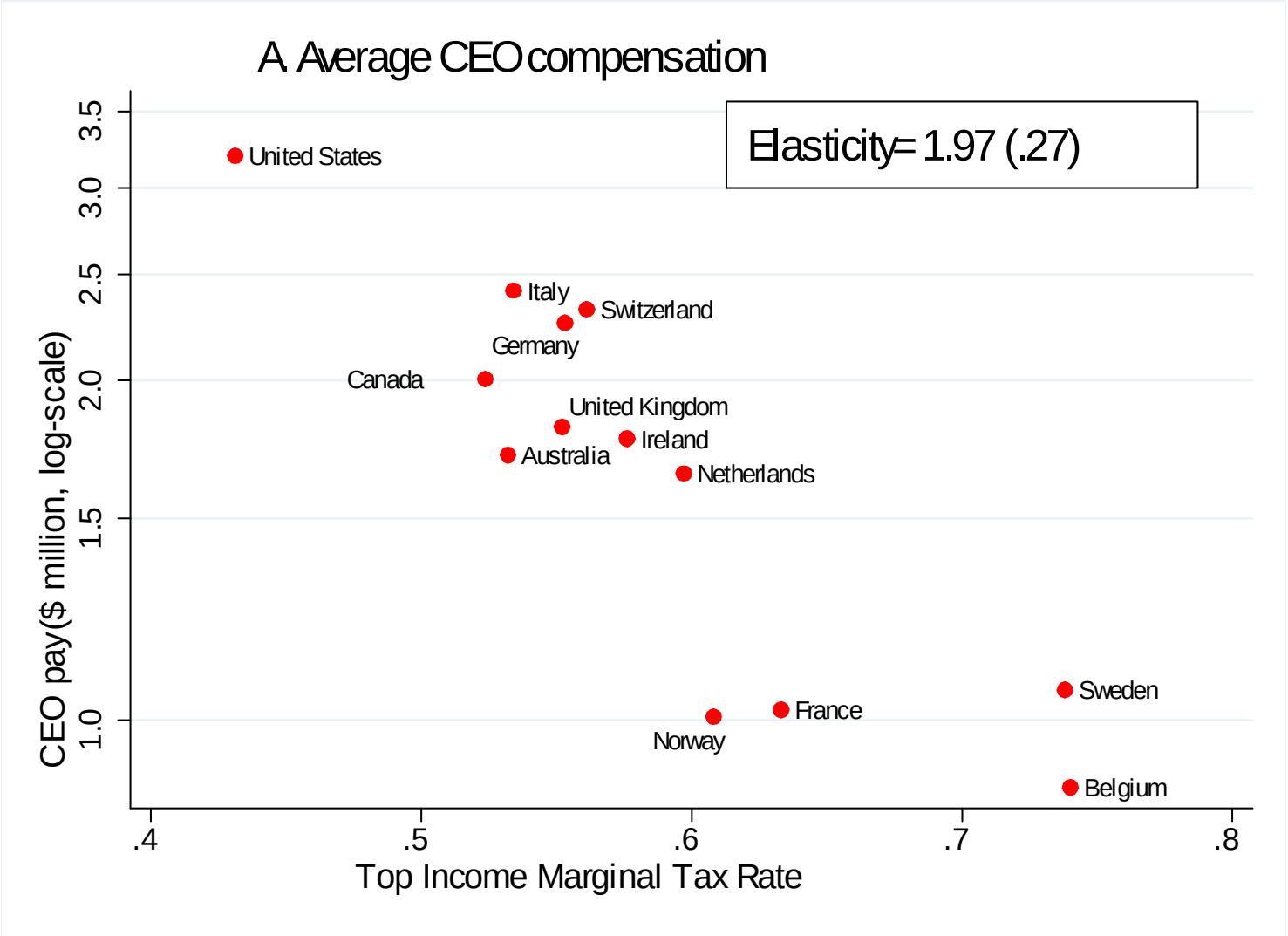
International CEO pay: Data

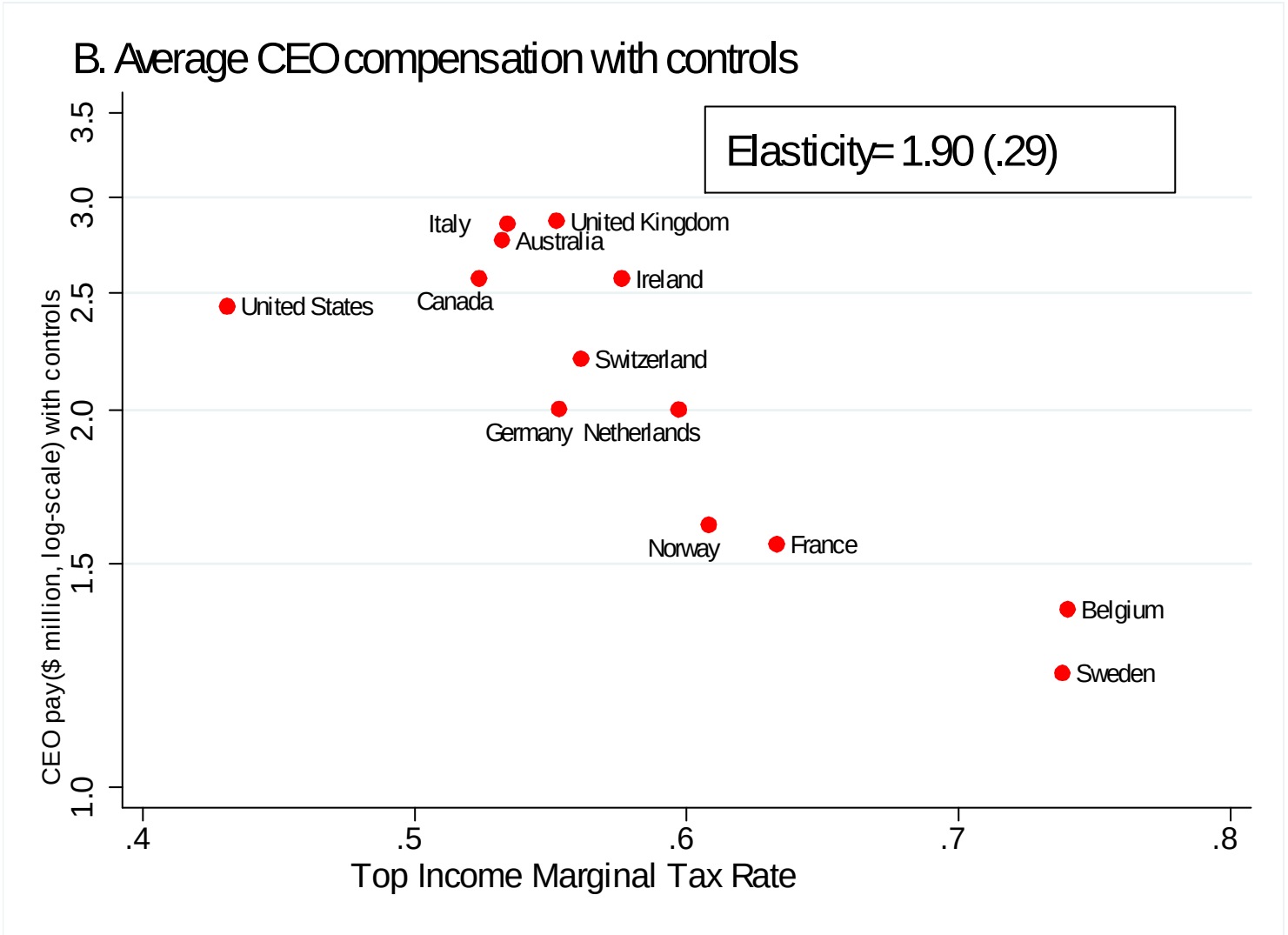
- Fernandez et. al. (2012) data:
  - Compensation (BoardEx + Execucomp)
  - Stock ownership (LionShares)
  - Firm Performance (Worldscope and Datastream)
  - Firm governance (various sources)

1. Does controlling for firm performance still leave CEO pay dependent on top tax rates?
2. Does effect of top tax rate on CEO pay depend on firm governance?

International CEO pay: Reward for Performance

- Does controlling for firm performance still leave CEO pay dependent on top tax rates?
  - In supply side story, should not (increase in labor effort translates into firm performance).
  - In bargaining story, additional negative effect of top tax rate on CEO pay through rent-seeking.
  - Requires very comprehensive set of measures of firm performance (use firm sales, stock market return and std dev, leverage, Tobin's q)
- Result:
  - Without controls for firm performance, elasticity 1.97 of CEO pay to top retention rate
  - With controls: elasticity 1.9.
  - Almost none of the effect of top MTR goes through firm performance (i.e., productive CEO effort?)


A. Average CEO compensation
Elasticity= 1.97 (.27)
United States
Italy
Switzerland
Germany
Canada
United Kingdom
Ireland
Australia
Netherlands
Sweden
France
Norway
Belgium
CEO pay($ million, log-scale)
1.0
1.5
2.0
2.5
3.0
3.5
.4
.5
.6
.7
.8
Top Income Marginal Tax Rate


B. Average CEO compensation with controls
Elasticity= 1.90 (.29)
Italy
United Kingdom
Australia
Ireland
Canada
United States
Switzerland
Germany
Netherlands
Norway
France
Belgium
Sweden
CEO pay($ million, log-scale) with controls
1.0
1.5
2.0
2.5
3.0
3.5
.4
.5
.6
.7
.8
Top Income Marginal Tax Rate

International CEO pay: Governance

- Does effect of top tax rate on CEO pay depend on firm governance?
  - In badly governed firms, pay should react more to tax rates as both real supply side response and bargaining response add up.
- Index of (good) governance :
  - Insider ownership
  - Institutional ownership
  - Whether CEO also chairman of board
  - Average number of outside board positions of board members
  - Fraction of independent board directors.
- Result:
  - Retention rate increases CEO pay, but less so in well-governed firms
  - Huge elasticity of bonuses and equity pay to tax rates, very small one for salaries (extraction easier through discretionary bonuses and equity pay?)

International CEO Pay: Governance

Table 4: International CEO Pay Evidence

Outcome (LHS variable)	Log(CEO pay)	Log(CEO pay)	Log(CEO pay)	Log(CEO pay)	Log(CEO salary)	Log(CEO bonus and equity pay)
	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory variables (RHS variables)						
log(1-Top MTR)	1.97***	1.90***	1.92***	1.90***	0.35*	4.68***
	(0.27)	(0.286)	(0.336)	(0.328)	(0.189)	(0.782)
Governance index			-0.10***	-0.19***	-0.02	-0.26
			(0.020)	(0.038)	(0.072)	(0.201)
log(1-Top MTR)*Governance index				-0.13**	0.06	-0.03
				(0.057)	(0.089)	(0.281)
Firm and CEO controls	no	yes	yes	yes	yes	yes
Number of observations	2,959	2,844	2,711	2,711	2,691	2,711

Outline of the talk

1. Standard model with real supply-side response
2. Tax Avoidance Responses
3. Bargaining and rent-seeking responses
4. Empirical evidence
   - Macro: US evidence
   - Macro: International evidence
   - Micro: CEO pay in the US
   - Micro: International CEO pay and governance
5. Conclusion

Conclusion

- 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 suggests that
  - Top income share very sensitive to top tax rates $\Rightarrow$ overall elasticity e is large
  - US and international macro evidence suggest standard supply side and avoidance channels insufficient.
  - Micro evidence for US: pay for luck prevalent and higher in recent, low tax period.
  - International CEO pay: top tax rates reduce CEO pay despite controls for firm performance and more so in badly governed firms.

Conclusion: Scenarios

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

Scenario 1: Standard supply side tax effects	
$e_1 =$	0.5
$e_2 =$	0.0
$e_3 =$	0.0

Scenario 2: Tax avoidance effects	
(a) current narrow tax base	(b) after base broadening
$e_1 = 0.2$	$e_1 = 0.2$
$e_2 = 0.3$	$e_2 = 0.1$
$e_3 = 0.0$	$e_3 = 0.0$

Scenario 3: Compensation bargaining effects	
$e_1 =$	0.2
$e_2 =$	0.0
$e_3 =$	0.3

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

Scenario 1	
$\tau^* =$	57%

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

Scenario 3	
$\tau^* =$	83%

Real Supply Side Responses: Optimal tax rate derivation

Equivalent to maximizing top tax revenue:

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

FOC:

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

Avoidance Responses: Optimal tax rate derivation

Equivalent to maximizing top tax revenue:

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

FOC for a fixed t :

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

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

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

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

Income Shifting Responses: Supplementary model

- Pure avoidance model in the paper. But not all shifting purely wasteful $\longrightarrow$ Ramsey taxation considerations
- Two sources of income, labor, y_L (taxed at τ_L above $\overline{z}$) 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 $c = R + (1 - \tau_L) z_L + (1 - \tau_L) z_K + (\tau_L - \tau_K) x$

Income Shifting Responses: Supplementary model

- 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 $a_L = \frac{z_L}{z_L - \overline{z}}$ and $a = \frac{z_L + z_K}{z_L + z_K - \overline{z}}$

Income Shifting Responses: Supplementary model

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, $\tau_K = \tau_L = \frac{1}{1+a\overline{e}}$ *where* $\overline{e} = \frac{y_L}{y_L+y_K} e_L + \frac{y_K}{y_L+y_K} e_K$

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.

Optimal Tax Derivation: Compensation Bargaining Channel

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

$$T = \tau (y + b - \overline{z}) - NE(b)$$

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

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

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

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