

# **Econ 230B – Graduate Public Economics**

## **Capital taxation over time and across countries**

Gabriel Zucman

[zucman@berkeley.edu](mailto:zucman@berkeley.edu)

# Roadmap

1. What are capital taxes?
2. Who pays capital taxes?
3. Inheritance and its taxation in the long run

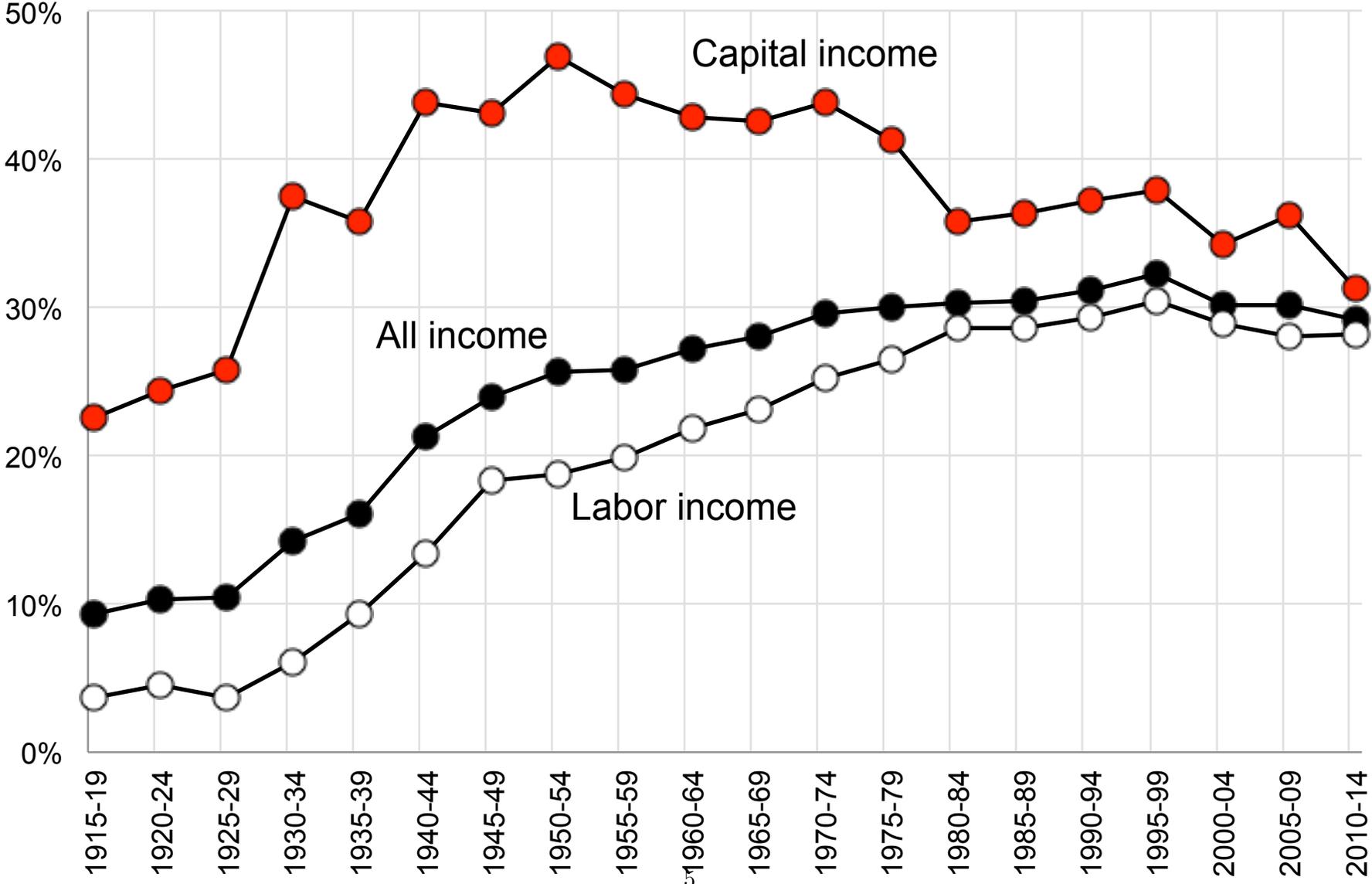
# 1 What are capital taxes?

- Taxes on the stock of capital: one-off taxes (inheritance, estates, gifts) vs. annual taxes (property, wealth)
- Taxes on the flow of capital income: corporate level (corporate profits) vs. individual level (dividends, interest, rents, capital gains)
- Capital taxes  $T_k$  account for a large share of government revenue
- In the US:  $T_k$  about 30% of government revenue
- In Europe:  $T_k$  about 20% of government revenue

## Macro capital tax rates

- In the U.S., macro capital tax rate  $\tau_K = T_K/Y_K = 30\%$
- Capital taxes  $T_K = 30\%$  of total tax revenue  $T$  and  $T = 30\%$  of total national income  $Y \rightarrow T_K = 9\%$  of  $Y$
- Capital income  $Y_K = 30\%$  of  $Y$  (capital/income ratio  $\beta = K/Y \approx 500\%$ ,  $r \approx 6\%$ ,  $\alpha = r \cdot \beta = 30\%$ )  $\rightarrow \tau_K = 30\%$
- Capital tax rate  $\tau_K$  declining over time (as in many other countries)

# Macro tax rates on labor and capital income in the US



## The structure of capital taxes in the US (Zucman JEP'14)

In the US, total capital taxes can be decomposed into three categories of roughly equal importance:

- Corporate tax = 3% of  $Y$  (around 20% of a 15% tax base)
- Annual property taxes = 3% of  $Y$  (around 1% of a 300% tax base)
- Personal taxes on capital income = 2.8% of  $Y$  (around 30% of a  $15\% \times 60\% = 9\%$  tax base) + estates = 0.2% of  $Y$  (around 2% of a 10% tax base)

## Taxing flows vs. taxing stocks

- If rate of return  $r$  is the same for all individuals and assets, then flow and stock capital taxes are equivalent
- Ex: If  $r = 5\%$ , it is equivalent to tax capital stock at  $\tau_K = 1\%$  per year or to tax capital income flow at  $t_K = 20\%$  per year
- In practice returns differ; individual  $i$  prefers stock taxes if  $r_i > r$
- Key argument in favor of taxes on stock rather than on flow: they put incentives to get a high return on capital (Allais, 1966, 1977)
- See Guvenen et al. (2017) for recent analysis

## 2 Who pays capital taxes?

- Are capital taxes really paid by capital owners or shifted to labor?
- Key distinction: residence vs. source capital taxes
  - Residence: capital tax based on residence of owner of capital (or location of headquarter for firms) → not easy to avoid
  - Source: Capital income tax based on location of capital → incidence shifted to labor if capital is mobile
  - Most individual income tax systems are residence based (with credits for taxes paid abroad); most corp. taxes are source based

## The incidence of labor vs. capital taxes

- Consider  $Y = F(K, L) = Y_K + Y_L$  and a tax  $\tau_K$  on capital income  $Y_K$  and tax  $\tau_L$  on labor income  $Y_L$
- Is  $\tau_K$  paid by  $K$  and  $\tau_L$  paid by  $L$ ? Not necessarily; it depends on:
  - The elasticity of capital supply  $e_K = d\log K / d\log((1 - \tau_K)r)$
  - The elasticity of labor supply  $e_L = d\log L / d\log((1 - \tau_L)v)$
  - The elasticity of substitution between  $K$  &  $L$   $\sigma = \frac{d\log(K/L)}{d\log(v/r)}$   
(determines the elasticities of demand for  $K$  &  $L$ )

## Tax incidence with linear production

- Simplest case: linear production  $Y = rK + vL$  ( $\sigma \rightarrow \infty$ )
- $r$  = fixed marginal product of capital;  $v$  = fixed marginal product of labor
- Labor demand is infinitely elastic at rate  $v \rightarrow$  whatever  $e_L$ , labor pays labor taxes  $\tau_L$
- Capital demand is infinitely elastic at rate  $r \rightarrow$  whatever  $e_K$ , capital pays capital tax  $\tau_K$
- The factor markets are like 2 separate markets with no interaction

## Tax incidence with Cobb-Douglas production

- With  $Y = K^\alpha L^{1-\alpha}$ , the two factor markets interact and part of labor taxes are shifted to capital and vice versa
- Ex: Consider a small increase from  $\tau_L$  to  $\tau_L + d\tau$ , then

$$\frac{dv}{v} = \frac{\alpha e_L}{1 + \alpha e_L + (1 - \alpha)e_K} \cdot \frac{d\tau}{1 - \tau_L}$$
$$\frac{dr}{r} = \frac{-(1 - \alpha)e_L}{1 + \alpha e_L + (1 - \alpha)e_K} \cdot \frac{d\tau}{1 - \tau_L}$$

- If  $e_L = 0$  then labor bear full burden of  $\tau_L$ ; if  $e_L \rightarrow \infty$  then wage adjusts and  $\tau_L$  entirely shifted to K. Vice versa for  $\tau_K \rightarrow \tau_K + d\tau$

## Tax incidence with general production function

- With CES production, same conclusion as Cobb-Douglas except  $\sigma$  enters the formulas. See Sachs et al. (2016) for a general analysis.
- $\tau_K$  borne by capital if  $e_K$  small relative to  $\sigma$
- $\tau_K$  shifted to labor if  $e_K$  large relative to  $e_L$  and  $\sigma$
- For residence-based K tax,  $e_K$  likely to be small: can only avoid tax by changing residency or reducing saving
- For source-based K tax,  $e_K$  could in principle be higher, especially in small open economies

## Incidence of the corporate tax

**Case 1:** Open economy with fully mobile capital and source taxation

- Local GDP:  $wL + rK = F(K, L) = L \cdot F(K/L, 1) = L \cdot f(k)$   
where  $k = K/L$  is capital stock per worker
- Net-of-tax rate of return fixed by the international rate  $r^*$  so that

$$(1 - \tau_c)F_K(K, L) = (1 - \tau_c)f'(k) = r^*$$

- As  $wL + r^*K = F(K, L)$ , wage  $w = F_L(K, L) = f(k) - r^* \cdot k$   
falls with  $\tau_c \rightarrow$  corporate tax  $\tau_C$  is fully borne by labor

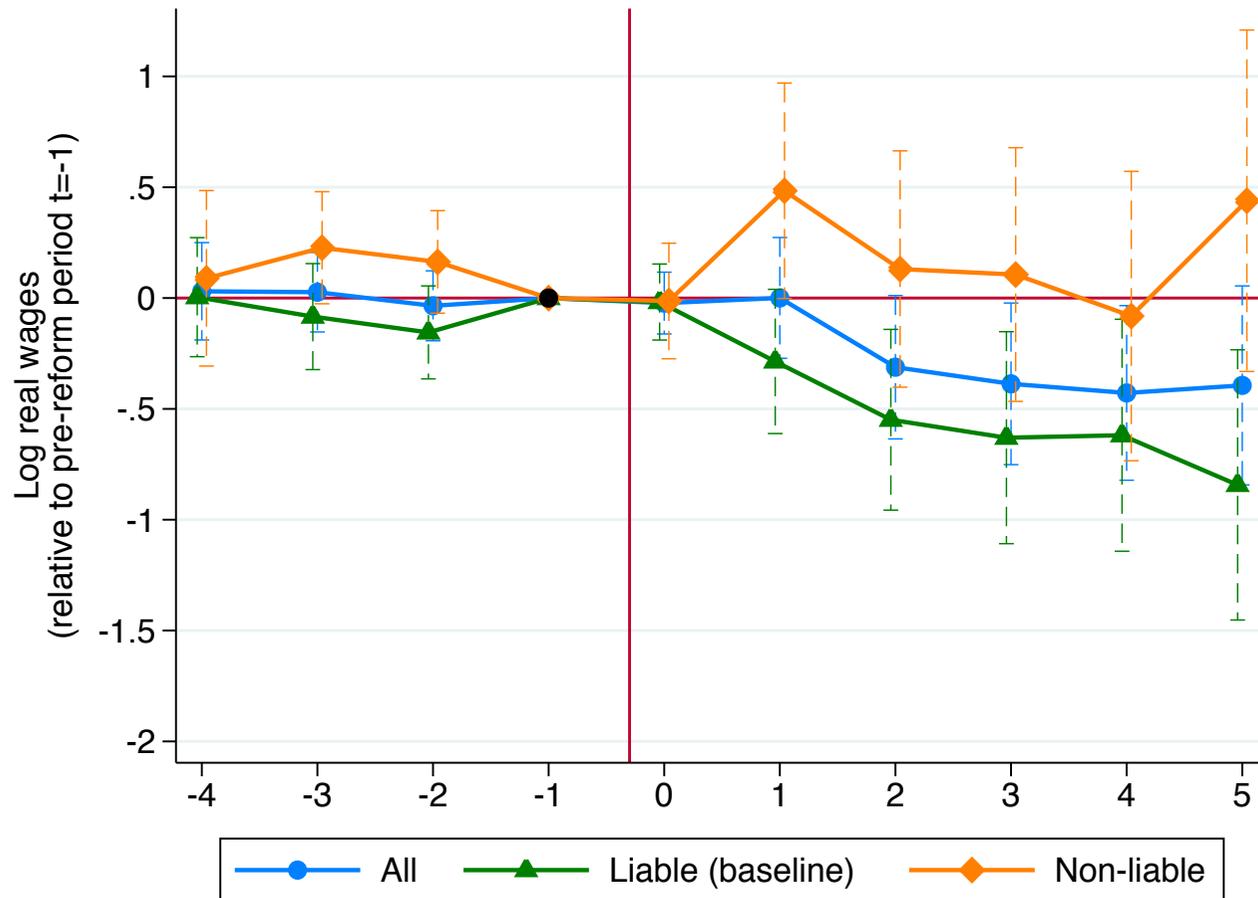
## Case 2: Capital not mobile internationally but mobile within country

- Then net return to corporate capital needs to equal return to non-corporate capital  $\rightarrow$  all capital affected by  $\tau_C$  (Harberger 1962)
- Unless little capital market integration (e.g., limited substitution between real estate and business capital)
- Small countries more likely to be in case 1, while big countries probably still more like in case 2.
- But limited empirical evidence, because hard to find large quasi-experimental variation in  $\tau_C$  and good control groups

## Fuest, Peichl & Siegloch (2016): municipal corporate tax incidence in Germany

- Municipalities  $\approx$  small open economies where incidence likely to be on labor
- Use 20-year panel of data on 10,000 German municipalities' tax rates linked to administrative matched employer-employee data
- Find about half of the tax shifted to workers
- Effect not through  $K$  accumulation but bargaining: workers lose part of rents generated by the firm when  $\tau_C$  rises.

Figure 2: Effects on firm wages – by liability to local business tax



Source: Fuest, Peichl & Siegloch (2016).

### Case 3: Capital not even perfectly mobile within country:

- Many firms depend on local amenities (pool of workers, other firms)
- Apple or Google could not costlessly move away from Silicon Valley  
→ such firms bear more of the corporate tax burden
- Suarez-Serrato and Zidar (2016) develop spatial equilibrium model with firms; estimate incidence and structural elasticities
- Find that firm owners bear roughly 40% of the incidence, while workers and landowners bear 30-35% and 25-30%, respectively

## The incidence of the property tax

**View 1:** the property tax is mostly a capital tax like the corporate tax

- Property tax in community  $i$  is  $\tau_i = \bar{\tau} + \epsilon_i$  with  $\bar{\tau}$  national average property tax rate and  $\epsilon_i$  local deviation (Mieszkowski, 1972)
- Harberger model  $\rightarrow \bar{\tau}$  tax on all forms of capital
- $\epsilon_i$  residual either shifted to prices or immobile factors (labor, land)
- Raising property taxes nationally is progressive, but locally can be regressive

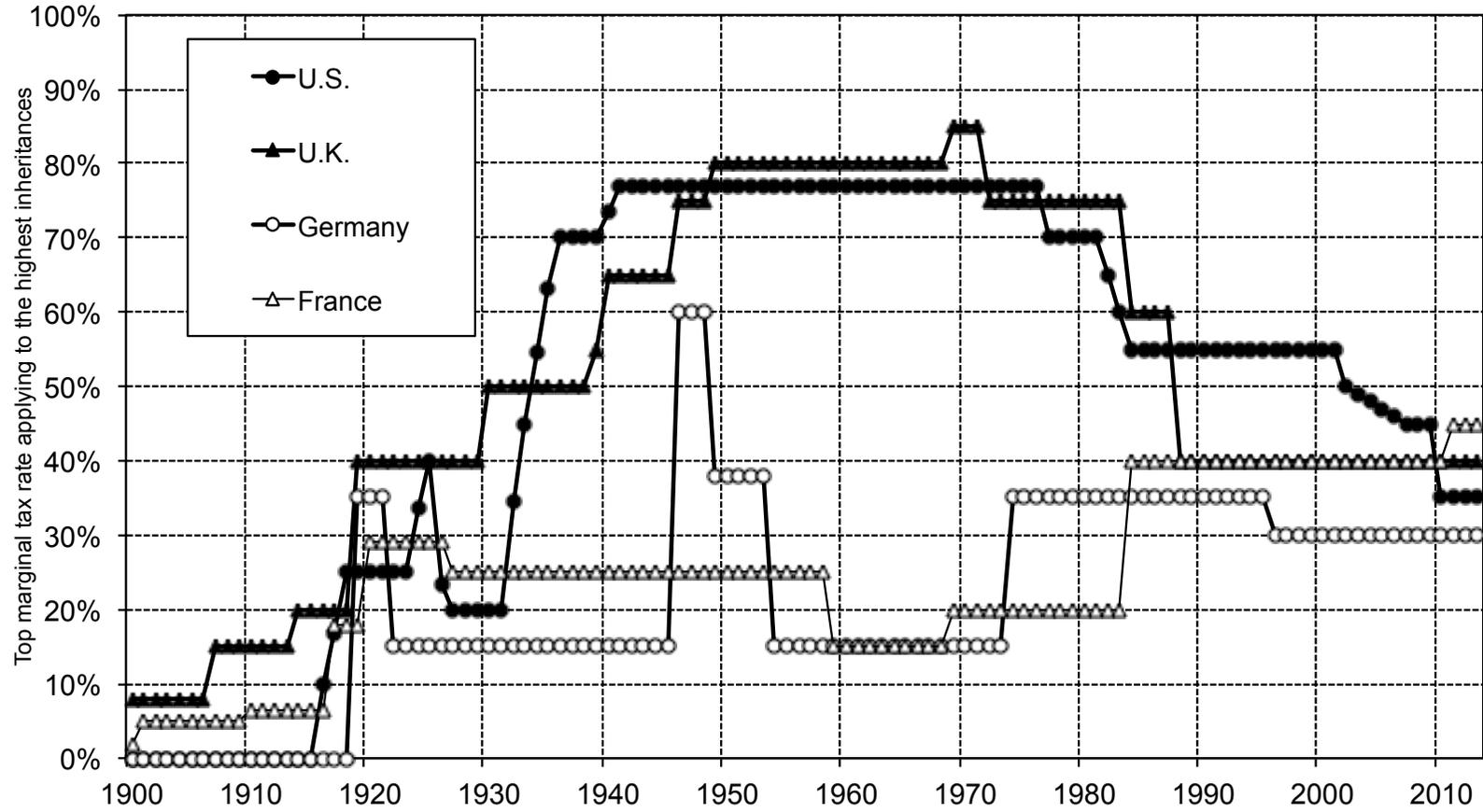
**View 2:** the property tax is not really a tax (“benefit view”)

- Property taxes finance local public goods
- Mobile taxpayers would not live in a jurisdiction that charges a tax higher than value of its local public goods: Tiebout (1956)
- Local property tax is a price paid for those local goods (it’s like a fee paid to a gated community for the community’s pool)
- Problem: taxpayers probably not as mobile as Tiebout assumes; part of property taxes do not fund local public goods (e.g., part goes to State)

### 3 Inheritance and its taxation

- Estate / inheritance taxes: smaller (in terms of revenue) than other capital taxes
- But more progressive than other capital taxes → critical role for inequality
- Big increase in inheritance taxation after mass-mobilization wars (Scheve and Stasavage, 2012, 2016)
- Important differences across countries in implementation and top rates

### Top inheritance tax rates, 1900-2013



The top marginal tax rate of the inheritance tax (applying to the highest inheritances) in the U.S. dropped from 70% in 1980 to 35% in 2013. Sources and series: see [piketty.pse.ens.fr/capital21c](http://piketty.pse.ens.fr/capital21c).

Source: Piketty (2014).

## Why tax inheritances?

- Most normative theories of distributive justice put a strong emphasis on individual merit → tax bequests
- But individuals value the possibility of leaving a bequest to their children → don't tax bequests
- Less bequest (and capital) taxation means more labor taxation (for given government spending)

→ Interesting trade-offs studied by Piketty and Saez (Econometrica 2013)

## Piketty and Saez (Econometrica 2013)

- Measure one of individuals, who are both bequests receivers and bequest leavers (in ergodic general equilibrium)
- Linear tax  $\tau_B$  on bequests funds lumpsum grant  $E$
- Life-time budget constraint:  $c_i + b_i = R(1 - \tau_B)b_i^r + y_{Li} + E$
- with  $c_i$  consumption,  $b_i$  bequests left,  $y_{Li}$  inelastic labor income,  $b_i^r$  pre-tax bequests received,  $R = 1 + r$  generational rate of return
- Individual  $i$  has utility  $V^i(c, \underline{b})$  with  $\underline{b} = R(1 - \tau_B)b$  is net-of-tax

bequests left and solves

$$\max_{b_i} V^i(y_{Li} + E + R(1 - \tau_B)b_i^r - b_i, Rb_i(1 - \tau_B)) \Rightarrow V_c^i = R(1 - \tau_B)V_{\underline{b}}^i$$

- Gov B.C.:  $E = \tau_B b$  with  $b$  aggregate (=average) bequests; solves:

$$\max_{\tau_B} \int_i \omega_i V^i(y_{Li} + \tau_B b + R(1 - \tau_B)b_i^r - b_i, Rb_i(1 - \tau_B))$$

- with  $\omega_i \geq 0$  Pareto weights
- Meritocratic Rawlsian criterion: maximize welfare of those receiving no inheritances with uniform social marginal welfare weight  $\omega_i V_c^i$  among zero-receivers

## Optimal inheritance tax rate:

$$\tau_B = \frac{1 - \bar{b}}{1 + e_B}$$

- With  $e_B$ : elasticity of aggregate bequests, and  $\bar{b} = E[b_i | b_i^r = 0] / b$  relative bequest left by zero-receivers
1. Optimal  $\tau_B < 1/(1 + e_B)$  revenue maximizing rate because zero-receivers care about bequests they leave
  2.  $\tau_B = 0$  if  $\bar{b} = 1$  (i.e, zero-receivers leave as much bequest as avg)
  3. If bequests are quantitatively important, highly concentrated, and low wealth mobility then  $\bar{b} \ll 1$

## The inheritance flow

- Key parameter to think about inheritance and its taxation:  $b$
- How big is the flow of wealth transmitted at death every year in a country?
- There are 2 ways to measure this flow:
  - Fiscal flow: use tax data on inheritances / estates
  - Economic flow, using the following accounting equation:

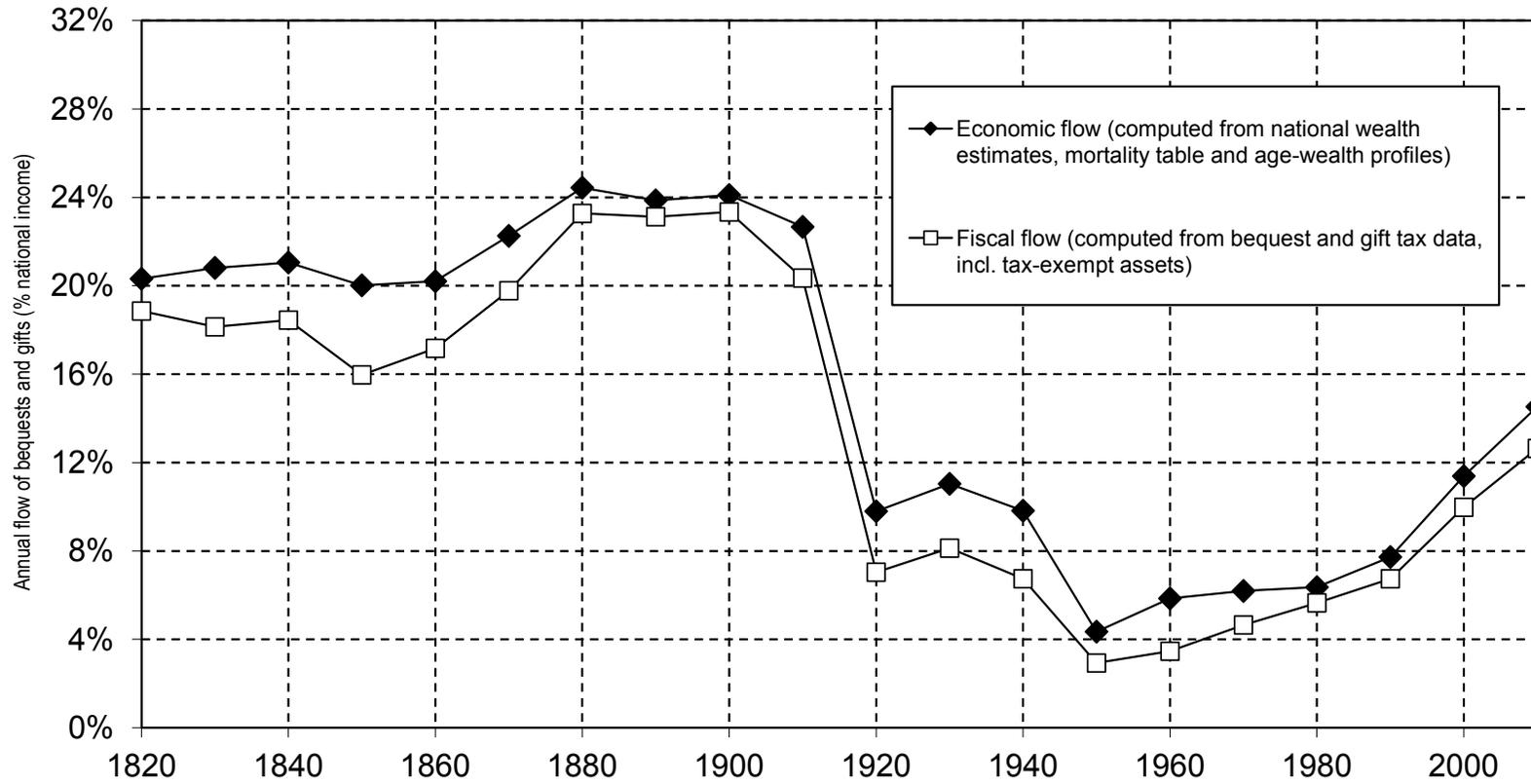
$$b_t = (1 + v_t) \cdot \mu_t \cdot m_t \cdot \beta_t$$

- Where:  $m_t$  = mortality rate (number of adult decedents divided by total adult population)
- $\mu_t$  = ratio between average adult wealth at death and average adult wealth for the entire population
- $v_t = V_t/B_t$  = estimate of the gift/bequest flow ratio
- $\beta_t$  = private wealth / national income ratio
- Gap between the fiscal and economic flows can be interpreted as capturing tax evasion and other measurement errors

## Piketty (QJE 2011)

- Estimates bequest flow  $b$  in France, country where inheritance tax data are exceptionally good
- $b$  has followed a spectacular U-shaped pattern over the 20th century.
- $b$  was relatively stable around 20–25% of national income throughout the 1820–1910 period (with a slight upward trend)
- Then divided by a factor of 5–6 between 1910 and the 1950s, and multiplied by a factor of 3–4 between the 1950s and the 2000s

**Figure 4.1. The annual inheritance flow as a fraction of national income, France 1820-2010**



The annual inheritance flow was about 20-25% of national income during the 19th century and until 1914; it then fell to less than 5% in the 1950s, and returned to about 15% in 2010.

Source: Piketty (2011).

## The share of inherited wealth in total wealth

- What is the fraction of total wealth  $W$  that is self-made vs. comes from inheritances?
- Most natural way to define the share of inherited wealth in aggregate wealth is to cumulate past inheritance flows

$$W_{Bt} = \int_{s \leq t} B_s \cdot ds$$

- Pb 1: key to include in this sum not only past bequest flows  $B_s$  (wealth transmissions at death) but also inter vivos gift flows

- Pb 2: One should only take into account fraction of inheritance flows  $B_{st} \leq B_s$  received at time  $s$  by individuals still alive at time  $t$
- Requires very detailed individual-level information
- Standard simplifying assumption: cumulate the full inheritance flows observed the previous  $H$  years, where  $H =$  generation length
- Pb 3 (key): inheritances produce flow returns!
- So past inheritance flows need to be upgraded

## Kotlikoff-Summers (1981) vs. Modigliani (1986)

- Modigliani (1986, 1988) chooses zero capitalization.

$$W_{Bt}^M = \int_{t-30 \leq s \leq t} B_s^* \cdot ds$$

- Assume fixed inheritance flow-national income ratio  $b_y = B_s^*/Y_s$ , growth rate  $g$  (so that  $Y_t = Y_s \cdot e^{g(t-s)}$ ), generation length  $H$ , and aggregate private wealth-national income ratio  $\beta = W_t/Y_t$ .
- Steady-state stock of inherited wealth relative to national income  $W_{Bt}^M/Y_t$  and share of inherited wealth  $\varphi_t^M = W_{Bt}^M/W_t$  given by:

$$W_{Bt}^M / Y_t = \frac{1}{Y_t} \int_{t-30 \leq s \leq t} B_s^* \cdot ds = \frac{1 - e^{-gH}}{g} \cdot b_y$$

$$\varphi_t^M = W_{Bt}^M / W_t = \frac{1 - e^{-gH}}{g} \cdot \frac{b_y}{\beta}$$

- Kotlikoff and Summers (1981, 1988): full capitalization

$$W_{Bt}^{KS} / Y_t = \frac{1}{Y_t} \int_{t-30 \leq s \leq t} e^{r(t-s)} \cdot B_s^* \cdot ds = \frac{e^{(r-g)H} - 1}{r - g} \cdot b_y$$

$$\varphi_t^{KS} = W_{Bt}^{KS} / W_t = \frac{e^{(r-g)H} - 1}{r - g} \cdot \frac{b_y}{\beta}$$

- If growth rates and rates of return are negligible then both definitions coincide:  $\varphi_t^M = \varphi_t^{KS} = Hb_y/\beta$
- If  $g$  and  $r - g$  are significantly different from zero, the two definitions can lead to widely different conclusions
- Ex: with  $g = 2\%$ ,  $r = 4\%$  and  $H = 30$ , for a given inheritance flow  $b_y = 10\%$  and aggregate wealth-income ratio  $\beta = 400\%$ ,  $\varphi_t^M = 56\%$  and  $\varphi_t^{KS} = 103\%$ .

## Piketty et al. (EHH, 2014)

Wealth accumulation process always involves two different kinds of people and wealth trajectories

- Inheritors: people whose assets are worth less than the capitalized value of the wealth they inherited (over time they consume more than their labor income)
- Severs: people whose assets are worth more than the capitalized value of the wealth they inherited (they consume less than their labor income)

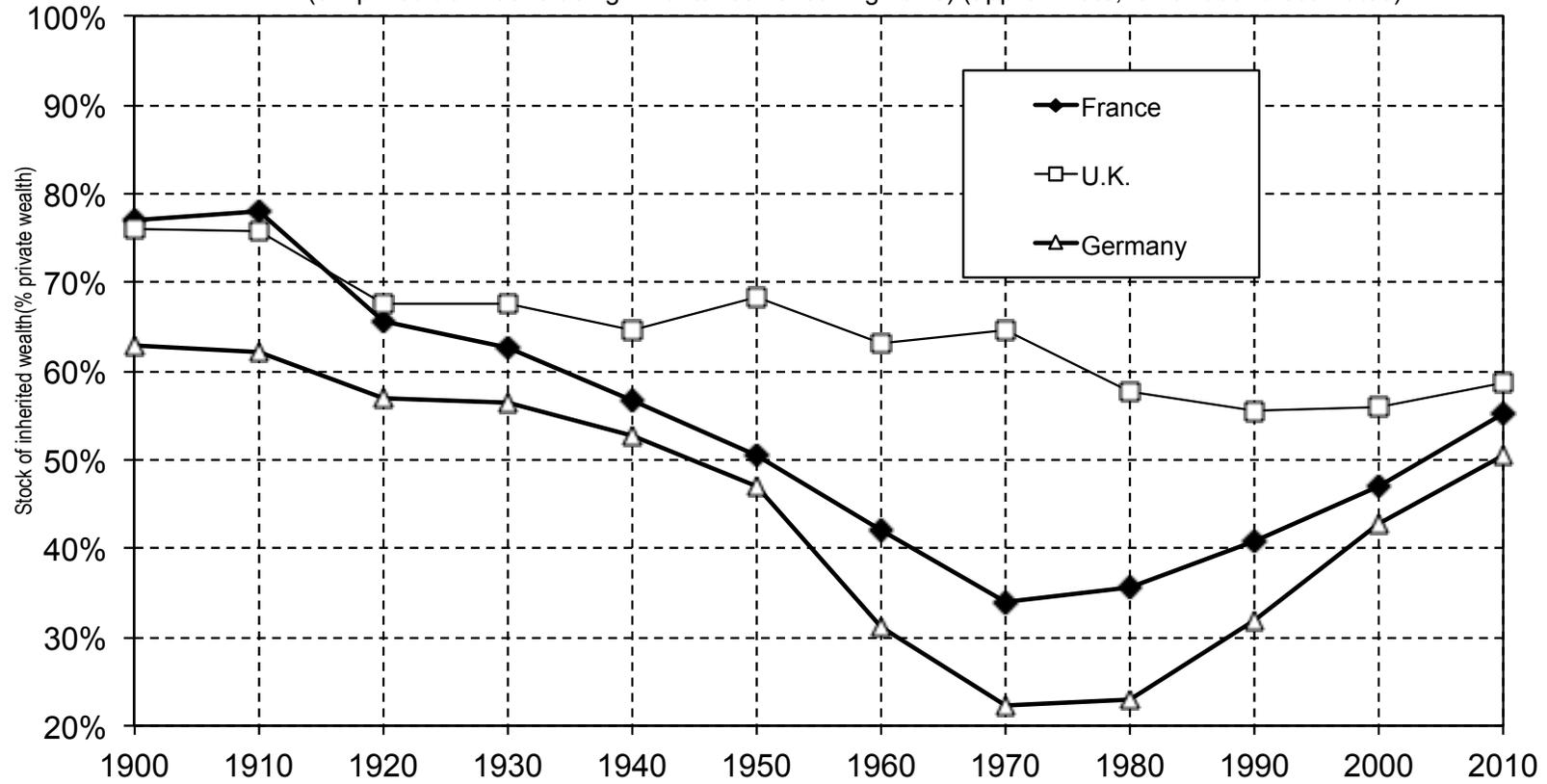
- Aggregate inherited wealth can then be defined as the sum of inheritors' wealth plus the inherited fraction of savers' wealth
- Self-made wealth is then equal to the non-inherited fraction of savers' wealth.
- By construction, inherited and self-made wealth are less than 100% and sum to aggregate wealth,
- Downside of this definition: more demanding in terms of data availability. Requires micro data.

## Estimates of the share of inherited wealth in total wealth

- Burgeoning literature attempts to estimate  $b$  and  $\varphi$  (Alvaredo et al., 2017; Atkinson, 2013; Ohlsson et al. 2016)
- In Europe,  $b_t$  and  $\varphi_t$  have also followed a U-shaped pattern over the past century
- Less marked in the United States
- Data limitations, however, make it difficult at this stage to make precise comparisons between countries

**Figure 4.6. The inheritance stock in Europe 1900-2010**

(simplified definitions using inheritance vs. saving flows) (approximate, lower-bound estimates)

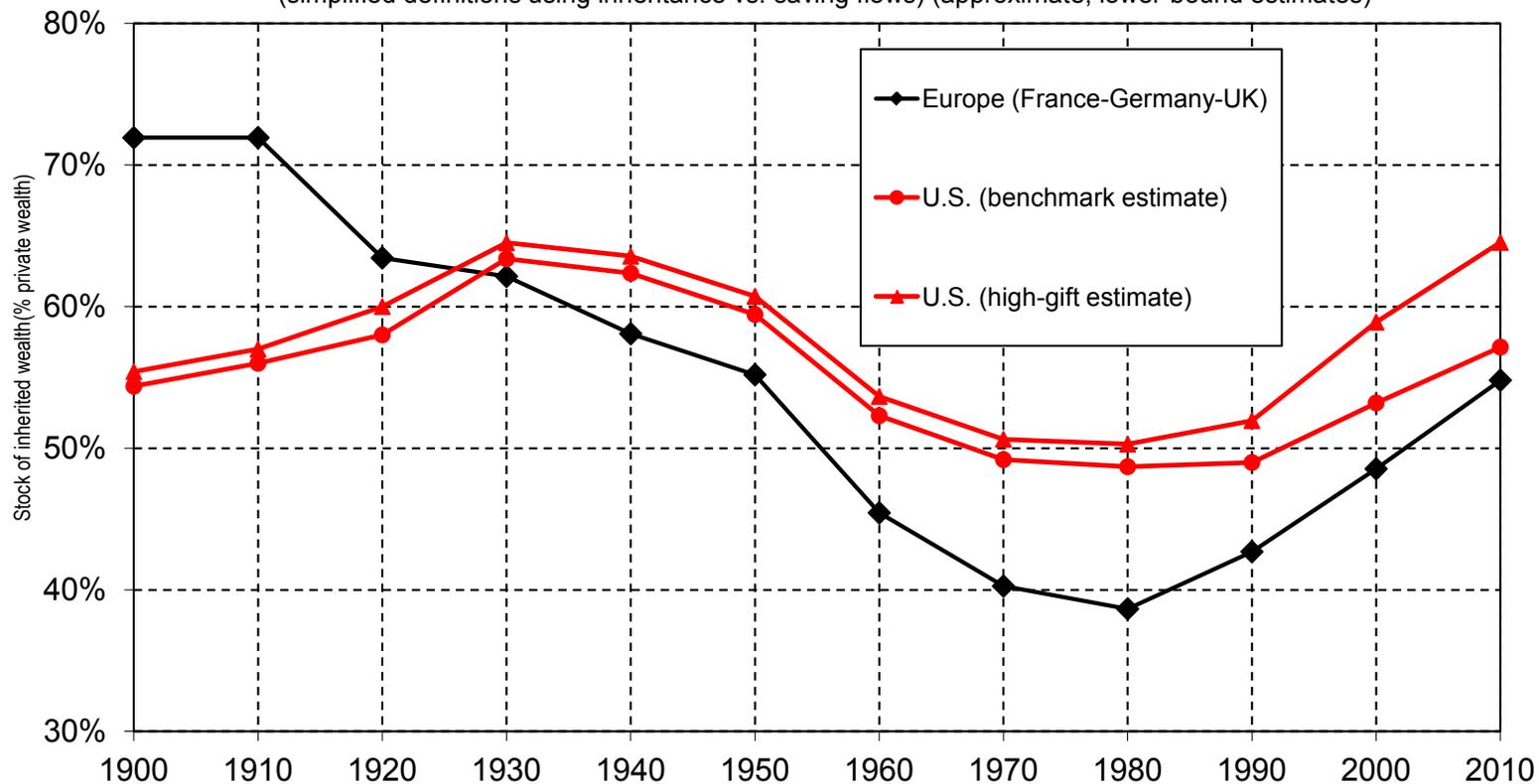


The inheritance share in aggregate wealth accumulation follows a U-shaped curve in France and Germany (and to a more limited extent in the U.K. and Germany). It is possible that gifts are under-estimated in the U.K. at the end of the period.

Source: Piketty and Zucman (2015).

**Figure 1. The share of inherited wealth. Europe and the U.S. 1900-2010**

(simplified definitions using inheritance vs. saving flows) (approximate, lower-bound estimates)



The inheritance share in aggregate wealth accumulation was over 70% in Europe in 1900-1910. It fell abruptly following 1914-1945 shocks, down to 40% in 1970-1980 period. It is back to about 50-60% in 2000-2010 and rising. The U.S. pattern also appears to be U-shaped, but less marked, and with significant uncertainty regarding recent trends, due to data limitations.

Source: Alvaredo, Garbinti and Piketty (2015)

## References

Allais, Maurice, “L’impôt sur le capital”, *Droit Social* (29), 465–544, 1966.

Allais, Maurice, *L’impôt sur le capital et la réforme monétaire*, Hermann, 1977.

Alvaredo, Facundo, Bertrand Garbinti, and Thomas Piketty, “On the share of inheritance in aggregate wealth Europe and the United States, 1900-2010”, *Economica*, 2017, (web)

Atkinson A.B. “Wealth and Inheritance in Britain from 1896 to the Present”, working paper 2013 (web)

Fuest, Clemens, Andreas Peichl, and Sebastian Siegloch “Do Higher Corporate Taxes Reduce Wages? Micro Evidence from Germany”, working paper 2016 (web)

Fullerton, Don and Gilbert E. Metcalf, “Tax incidence,” *Handbook of public economics*, 4, 2002 (web)

Güvenen, Fatih, Gueorgui Kambourov, Burhan Kuruscu, Sergio Ocampo, and Daphne Chen, “Use it or Lose It: Efficiency Gains from Wealth Taxation”, working paper, 2017 (web)

Harberger, Arnold C., “The incidence of the corporation income tax,” *Journal of Political Economy*, 1962 (web)

Kotlikoff, Laurence J. and Lawrence H. Summers, “The Role of Intergenerational Transfers in Aggregate Capital Accumulation”, *Journal of Political Economy* 1981 (web)

Kotlikoff, Laurence, “Intergenerational Transfers and Savings”, *Journal of Economic Perspectives* 1988 (web)

Mieszkowski, Peter, “The Property Tax: An Excise Tax or a Profit Tax?”, *Journal of Public Economics*, 1972, (web)

Modigliani, Franco, “Life Cycle, Individual Thrift, and the Wealth of Nations”, *American Economic Review* 1986 (web)

Modigliani, Franco, “The Role of Intergenerational Transfers and Life Cycle Saving in the Accumulation of Wealth”, *Journal of Economic Perspectives* 1988 (web)

Ohlsson H., J. Roine and D. Waldenström, “Inherited Wealth over the Path of Development: Sweden, 1810-2010”, working paper 2016 (web)

Piketty, Thomas, “On the Long-Run Evolution of Inheritance: France 1820-2050”, *Quarterly Journal*

*of Economics*, 2011 (web)

Piketty, Thomas, *Capital in the 21st Century*, Cambridge: Harvard University Press, 2014 (web)

**Piketty, Thomas, and Emmanuel Saez “A Theory of Optimal Inheritance Taxation”, *Econometrica*, 2013 (web)**

Piketty, Thomas, Gilles Postel-Vinay and Jean-Laurent Rosenthal, “Inherited vs Self-Made Wealth: Theory and Evidence from a Rentier Society” *Explorations in Economic History* 2013 (web)

Sachs, Dominik, Aleh Tsyvinski, and Nicolas Werquin, “Nonlinear Tax Incidence and Optimal Taxation in General Equilibrium”, working paper 2016, (web)

**Scheve Kenneth & D. Stasavage, “Democracy, War, and Wealth: Lessons from Two Centuries of Inheritance Taxation”, *American Political Science Review*, 2012 (web)**

Scheve Kenneth, and David Stasavage, “Taxing the Rich : A History of Fiscal Fairness in the United States and Europe”, Princeton University Press, 2016

Suarez Serrato, Juan Carlos, and Owen Zidar, “Who Benefits from State Corporate Tax Cuts? A Local Labor Markets Approach with Heterogeneous Firms”, *American Economic Review*, 2016, (web)

Tiebout C. M., “A Pure Theory of Local Expenditure”, *Journal of Political Economy*, 1956, (web)

Zucman, Gabriel, “Taxing Across Borders: Tracking Personal Wealth and Corporate Profits”,  
*Journal of Economic Perspectives*, 2014 (web)