

# **Public Economics: Tax & Transfer Policies**

*(Master PPD & APE, Paris School of Economics)*

Thomas Piketty

Academic year 2014-2015

## **Lecture 7: Optimal taxation of capital**

(March 3<sup>rd</sup> 2015)

*(check [on line](#) for updated versions)*

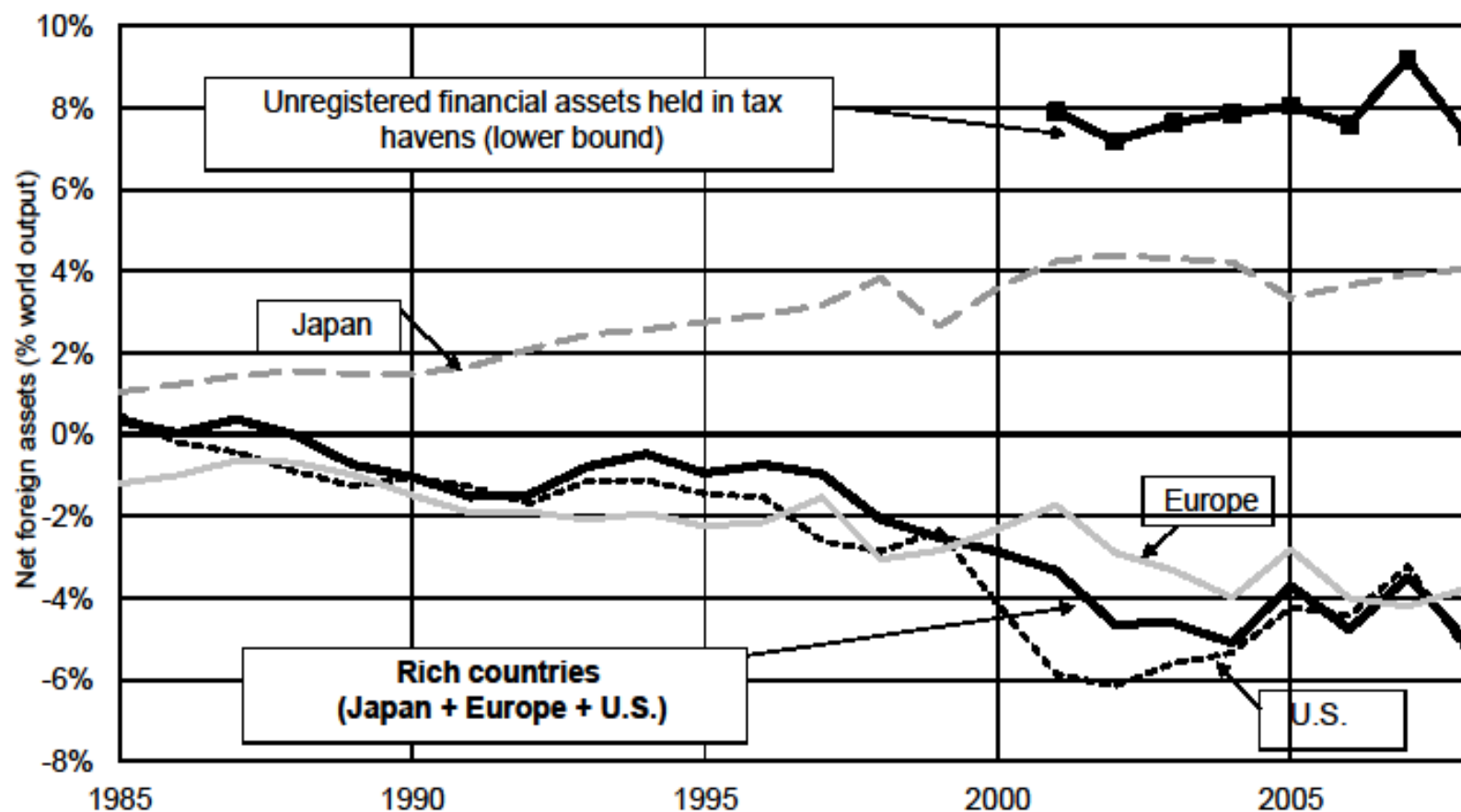
## Summary of today 's theoretical results

- One reason for not taxing capital: if full information on  $k$  income flows +  $k$  accumulation = 100% life-cycle wealth (zero inheritance) + perfect capital markets, then there is no reason to tax capital (**Atkinson-Stiglitz**)
- Three reasons for taxing capital:
- « **Fuzzy frontier argument** »: if the frontier btw labor and capital income flows not so clear (e.g. for self-employed), then it is better to tax both income flows at rates that are not too different
- « **Fiscal capacity argument** »: if income flows are difficult to observe for top wealth holders, then wealth stock may be a better indicator of the capacity to contribute than income
- « **Meritocratic argument** »: individuals are not responsible for their inherited wealth, so maybe this should be taxed more than their labor income; imperfect  $k$  markets then imply that part of the ideal inheritance tax should be shifted to lifetime  $k$  tax
- See « Rethinking capital and wealth taxation », [PSE 2013](#)

## **Warning: in practice, it is very difficult to tax capital with capital mobility and little international coordination**

- Without fiscal coordination (automated exchange of bank information, unified corporate tax base, etc.), all forms of k taxation might well disappear in the long run, whatever the true social optimum might be
- On these issues see the following papers:
- G. Zucman, “The missing wealth of nations”, [QJE 2013](#)
- **G. Zucman, “Taxing Across Borders: Tracking Personal Wealth and Corporate Profits”, [JEP 2014](#)**
- N. Johanssen and G. Zucman,, "The End of Bank Secrecy? An Evaluation of the G20 Tax Haven Crackdown", [WP 2012](#)
- K. Clausing, "In Search of Corporate Tax Incidence", [WP 2011 Tax Law Review 2012](#)

**Figure 12.6. The net foreign asset position of rich countries**



Unregistered financial assets held in tax havens are higher than the official net foreign debt of rich countries.

Sources and series: see [piketty.pse.ens.fr/capital21c](http://piketty.pse.ens.fr/capital21c).

*Table 1***The World's Offshore Financial Wealth**

	<i>Offshore wealth (\$ billions)</i>	<i>Share of financial wealth held offshore</i>	<i>Tax revenue loss (\$ billions)</i>
Europe	2,600	10%	75
United States	1,200	4%	36
Asia	1,300	4%	35
Latin America	700	22%	21
Africa	500	30%	15
Canada	300	9%	6
Russia	200	50%	1
Gulf countries	800	57%	0
<b>Total</b>	<b>7,600</b>	<b>8.0%</b>	<b>190</b>

*Source:* Author's computations (see Zucman 2013a, b) and online Appendix.

*Notes:* Offshore wealth includes financial assets only (equities, bonds, mutual fund shares, and bank deposits). Tax revenue losses only include the evasion of personal income taxes on investment income earned offshore as well as evasion of wealth, inheritance, and estate taxes.

- **From now on we assume closed economy (or perfect international coordination):** not because this is realistic, but because in order to know whether we should coordinate, we need to know what would be the coordinated optimum (some people believe that even if perfect coordination was possible, we should have zero  $k$  tax for purely economic reasons)
- Basic theoretical result = zero optimal capital tax rate = mechanical implication of Atkinson-Stiglitz 1976 no-differential-commodity-tax result to intertemporal consumption  
= relies on several assumptions: full observability of  $k$  income flows + 100% lifecycle wealth (zero inheritance) + perfect capital markets  
(or infinite horizon/infinite long-run elasticity of capital supply)  
If these assumptions are verified, then the case of zero capital tax is indeed very strong

# Basic result 1: without inheritance, and with perfect capital markets, optimal k tax = 0%

- Intuition: if 100% of capital accumulation comes from lifecycle savings, then taxing capital or capital income is equivalent to using differential commodity taxation (current consumption vs future consumption)
- Atkinson-Stiglitz: under fairly general conditions (separable preferences), differential commodity taxation is undesirable, and the optimal tax structure should rely entirely on direct taxation of labor income
- To put it differently: if inequality entirely comes from labor income inequality, then it is useless to tax capital; one should rely entirely on the redistributive taxation of labor income)

- Atkinson-Stiglitz 1976:
  - Model with two periods  $t=1$  &  $t=2$
  - Individual  $i$  gets labor income  $y_{L_i} = v_i l_i$  at  $t=1$  ( $v_i =$  wage rate,  $l_i =$  labor supply), and chooses how much to consume  $c_1$  and  $c_2$
  - Max  $U(c_1, c_2) - V(l)$
- under budget constraint:  $c_1 + c_2/(1+r) = y_L$
- Period 1 savings  $s = y_L - c_1 (\geq 0)$
  - Period 2 capital income  $y_k = (1+r)s = c_2$
  - $r =$  rate of return (= marginal product of capital  $F_K$  with production function  $F(K, L)$ )
- >>> taxing capital income  $y_k$  is like taxing the relative price of period 2 consumption  $c_2$



>>> Atkinson-Stiglitz: under separable preferences  $U(C_1, C_2) - V(l)$ , there is no point taxing capital income; it is more efficient to redistribute income by using solely a labor income tax  $t(y_L)$

With non-separable preferences  $U(C_1, C_2, l)$ , it might make sense to tax less the goods that are more complement with labor supply (say, tax less day care or baby sitters, and tax more vacations); but this requires a lot of information on cross-derivatives

- See A.B. Atkinson and J. Stiglitz, “The design of tax structure: direct vs indirect taxation”, [Journal of Public Economics 1976](#)
- V. Christiansen, « Which Commodity Taxes Should Supplement the Income Tax ? », [Journal of Public Economics 1984](#)
- E. Saez, “The Desirability of Commodity Taxation under Non-Linear Income Taxation and Heterogeneous Tastes”, [Journal of Public Economics 2002](#)
- E. Saez, « Direct vs Indirect Tax Instruments for Redistribution : Short-run vs Long-run », [Journal of Public Economics 2004](#)

Basic result 2: with infinite-horizon dynasties, optimal linear k tax = 0% (=because of infinite elasticity of long run capital supply), but optimal progressive k tax > 0%

- Simple model with capitalists vs workers
- Consider an infinite-horizon, discrete-time economy with a continuum  $[0;1]$  of dynasties.
- For simplicity, assume a two-point distribution of wealth. Dynasties can be of one of two types: either they own a large capital stock  $k_t^A$ , or they own a low capital stock  $k_t^B$  ( $k_t^A > k_t^B$ ). The proportion of high-wealth dynasties is exogenous and equal to  $\lambda$  (and the proportion of low-wealth dynasties is equal to  $1-\lambda$ ), so that the average capital stock in the economy  $k_t$  is given by:
  - $k_t = \lambda k_t^A + (1-\lambda)k_t^B$

- Consider first the case  $k_t^B=0$ . I.e. low-wealth dynasties have zero wealth (the “workers”) and therefore zero capital income. Their only income is labor income, and we assume it is so low that they consume it all (zero savings). High-wealth dynasties are the only dynasties to own wealth and to save. Assume they maximize a standard dynastic utility function:
- $$U_t = \sum_{t \geq 0} U(c_t)/(1+\theta)^t$$

$$(U'(c) > 0, U''(c) < 0)$$
- All dynasties supply exactly one unit of (homogeneous) labor each period. Output per labor unit is given by a standard production function  $f(k_t)$  ( $f'(k) > 0, f''(k) < 0$ ), where  $k_t$  is the average capital stock per capita of the economy at period  $t$ .

- Markets for labor and capital are assumed to be fully competitive, so that the interest rate  $r_t$  and wage rate  $v_t$  are always equal to the marginal products of capital and labor:
- $r_t = f'(k_t)$
- $v_t = f(k_t) - r_t k_t$
- In such a dynastic capital accumulation model, it is well-known that the long-run steady-state interest rate  $r^*$  and the long-run average capital stock  $k^*$  are uniquely determined by the utility function and the technology (irrespective of initial conditions): in steady-state,  $r^*$  is necessarily equal to  $\theta$ , and  $k^*$  must be such that:
  - $f'(k^*) = r^* = \theta$
  - I.e.  $f'(\lambda k_A) = r^* = \theta$

- This result comes directly from the first-order condition:
- $U'(c_t)/U'(c_{t+1}) = (1+r_t)/(1+\theta)$
- I.e. if the interest rate  $r_t$  is above the rate of time preference  $\theta$ , then agents choose to accumulate capital and to postpone their consumption indefinitely ( $c_t < c_{t+1} < c_{t+2} < \dots$ ) and this cannot be a steady-state. Conversely, if the interest rate  $r_t$  is below the rate of time preference  $\theta$ , agents choose to desaccumulate capital (i.e. to borrow) indefinitely and to consume more today ( $c_t > c_{t+1} > c_{t+2} > \dots$ ). This cannot be a steady-state either.
- Now assume we introduce linear redistributive capital taxation into this model. That is, capital income  $r_t k_t$  of the capitalists is taxed at tax rate  $\tau$  (so that the post-tax capital income of the capitalists becomes  $(1-\tau)r_t k_t$ ), and the tax revenues are used to finance a wage subsidy  $s_t$  (so that the post-transfer labor income of the workers becomes  $v_t + s_t$ ).
- Note  $k_\tau^*$ ,  $k_{A\tau}^* = k_\tau^*/\lambda$  and  $r_\tau^*$  the resulting steady-state capital stock and pre-tax interest rate. The Golden rule of capital accumulation implies that:
- $(1-\tau) f'(k_\tau^*) = (1-\tau) r_\tau^* = \theta$

- I.e. the capitalists choose to desaccumulate capital until the point where the net interest rate is back to its initial level (i.e. the rate of time preference). **In effect, the long-run elasticity of capital supply is infinite in the infinite-horizon model:** any infinitesimal change in the net interest rate generates a savings response that is unsustainable in the long run, unless the net interest rate returns to its initial level.
- The long run income of the workers  $y_\tau^*$  will be equal to:
  - $y_\tau^* = v_\tau^* + s_\tau^*$
  - with:  $v_\tau^* = f(k_\tau^*) - r_\tau^* k_\tau^*$
  - and:  $s_\tau^* = \tau r_\tau^* k_\tau^*$
  - That is:
  - $y_\tau^* = f(k_\tau^*) - (1-\tau) r_\tau^* k_\tau^* = f(k_\tau^*) - \theta k_\tau^*$
  - Question: what is the capital tax rate  $\tau$  maximizing workers' income  $y_\tau^* = f(k_\tau^*) - \theta k_\tau^*$  ?
  - Answer:  $\tau$  must be such that  $f'(k_\tau^*) = \theta$ , i.e.  $\tau = 0\%$

- Proposition: The capital tax rate  $\tau$  maximizing long run workers' welfare is  $\tau = 0\%$ 
  - >>> in effect, even agents with zero capital loose from capital taxation (no matter how small)
  - (= the profit tax is shifted on labor in the very long run)
- But this result requires three strong assumptions: infinite elasticity of capital supply; perfect capital markets; and linear capital taxation: **with progressive tax, middle-class capital accumulation will compensate for the rich decline in k accumulation** (see E. Saez, "Optimal Progressive Capital Income Taxes in the Infinite Horizon Model", [WP 2004](#) )
- Most importantly: **the zero capital tax result breaks down whenever the long run elasticity of capital supply is finite**

- Three reasons for taxing capital:
  - « **Fuzzy frontier argument** »: if one can only observe total income  $y = y_L + y_K$ , then one needs to use a comprehensive income tax  $t(y)$ ; more generally, if high income-shifting elasticity, then  $t(y_L)$  &  $t(y_K)$  should not be too different
  - « **Fiscal capacity argument** »: if income flow  $y$  is difficult to observe for top wealth holders (family holdings, corporate consumption, etc.: fiscal income reported by billionaires can be very small as compared to their wealth), then one needs to use a wealth tax  $t(w)$  in addition to the income tax  $t(y)$
  - These two informational arguments are discussed in « Rethinking capital and wealth taxation », [PSE 2013](#)
  - « **Meritocratic argument** »: even with full observability of  $y_L$ ,  $y_K$ ,  $w$ , inheritance should be taxed as long as the relevant elasticity is finite; imperfect  $k$  markets then imply that part of the ideal inheritance tax should be shifted to lifetime  $k$  tax; see « A Theory of Optimal Inheritance Taxation », [Econometrica 2013](#)
- (long version: see "A Theory of Optimal Capital Taxation", [WP 2012](#) ; see also [Slides](#))



# The optimal taxation of inheritance

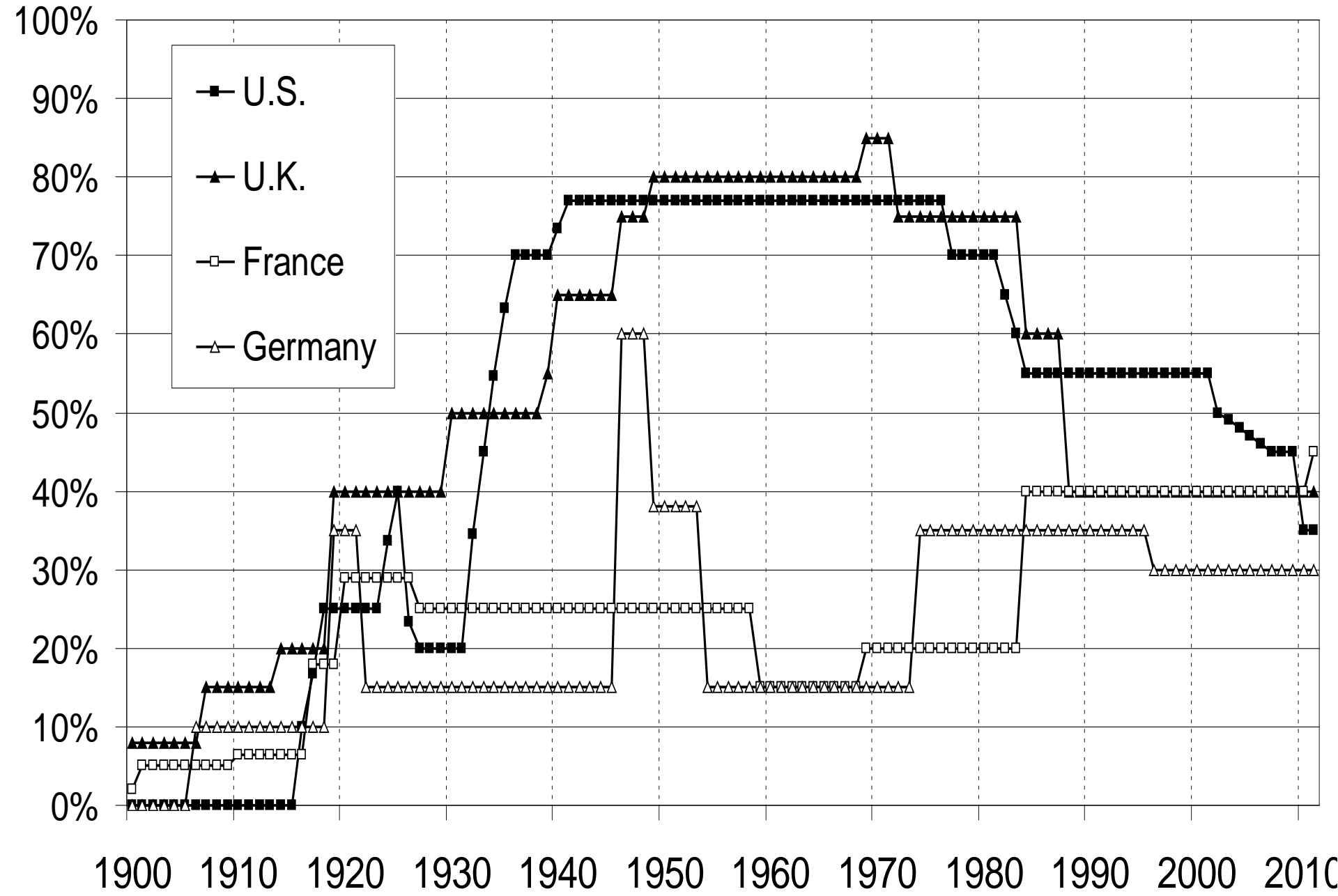
- Summary of main results from « A Theory of Optimal Inheritance Taxation », [Econometrica 2013](#)
- **Result 1: Optimal Inheritance Tax Formula** (macro version, NBER WP'12)
- Simple formula for optimal bequest tax rate expressed in terms of estimable macro parameters:

$$\tau_B = (1 - (1 - \alpha - \tau)s_{b0}/b_y)/(1 + e_B + s_{b0})$$

with:  $b_y$  = macro bequest flow,  $e_B$  = elasticity,  $s_{b0}$  = bequest taste  
→  $\tau_B$  increases with  $b_y$  and decreases with  $e_B$  and  $s_{b0}$

- For realistic parameters:  $\tau_B = 50-60\%$  (or more..or less...)  
→ **this formula can account for the variety of observed top bequest tax rates (30%-80%)**

# Top Inheritance Tax Rates 1900-2011



- Intuition for  $\tau_B = (1 - (1-\alpha-\tau)s_{b0}/b_y)/(1+e_B+s_{b0})$
- Meritocratic rawlsian optimum, i.e. social optimum from the viewpoint of zero bequest receivers
- $\tau_B$  increases with  $b_y$  and decreases with  $e_B$  and  $s_{b0}$
- If bequest taste  $s_{b0}=0$ , then  $\tau_B = 1/(1+e_B)$   
 → standard revenue-maximizing formula
- If  $e_B \rightarrow +\infty$ , then  $\tau_B \rightarrow 0$  : back to zero tax result
- If  $e_B=0$ , then  $\tau_B < 1$  as long as  $s_{b0} > 0$
- I.e. zero receivers do not want to tax bequests at 100%, because they themselves want to leave bequests  
 → **trade-off between taxing rich successors from my cohort vs taxing my own children**

**Example 1:**  $\tau=30\%$ ,  $\alpha=30\%$ ,  $s_{bo}=10\%$ ,  $e_B=0$

- If  $b_y=20\%$ , then  $\tau_B=73\%$  &  $\tau_L=22\%$
- If  $b_y=15\%$ , then  $\tau_B=67\%$  &  $\tau_L=29\%$
- If  $b_y=10\%$ , then  $\tau_B=55\%$  &  $\tau_L=35\%$
- If  $b_y=5\%$ , then  $\tau_B=18\%$  &  $\tau_L=42\%$

→ with high bequest flow  $b_y$ , zero receivers want to tax inherited wealth at a higher rate than labor income (73% vs 22%); with low bequest flow they want the opposite (18% vs 42%)

**Intuition:** with low  $b_y$  (high  $g$ ), not much to gain from taxing bequests, and this is bad for my own children

With high  $b_y$  (low  $g$ ), it's the opposite: it's worth taxing bequests, so as to reduce labor taxation and allow zero receivers to leave a bequest

**Example 2:**  $\tau=30\%$ ,  $\alpha=30\%$ ,  $s_{bo}=10\%$ ,  $b_y=15\%$

- If  $e_B=0$ , then  $\tau_B=67\%$  &  $\tau_L=29\%$
- If  $e_B=0.2$ , then  $\tau_B=56\%$  &  $\tau_L=31\%$
- If  $e_B=0.5$ , then  $\tau_B=46\%$  &  $\tau_L=33\%$
- If  $e_B=1$ , then  $\tau_B=35\%$  &  $\tau_L=35\%$

→ behavioral responses matter but not hugely as long as the elasticity  $e_B$  is reasonable

Kopczuk-Slemrod 2001:  $e_B=0.2$  (US)

(French experiments with zero-children savers:  $e_B=0.1-0.2$ )

- **Optimal Inheritance Tax Formula (micro version, EMA'13)**
- The formula can be rewritten so as to be based solely upon estimable distributional parameters and upon  $r$  vs  $g$  :
- $\tau_B = (1 - Gb^*/Ry_L^*)/(1+e_B)$

With:  $b^*$  = average bequest left by zero-bequest receivers as a fraction of average bequest left

$y_L^*$  = average labor income earned by zero-bequest receivers as a fraction of average labor income

$G$  = generational growth rate,  $R$  = generational rate of return

- If  $e_B=0$  &  $G=R$ , then  $\tau_B = 1 - b^*/y_L^*$  (**pure distribution effect**)

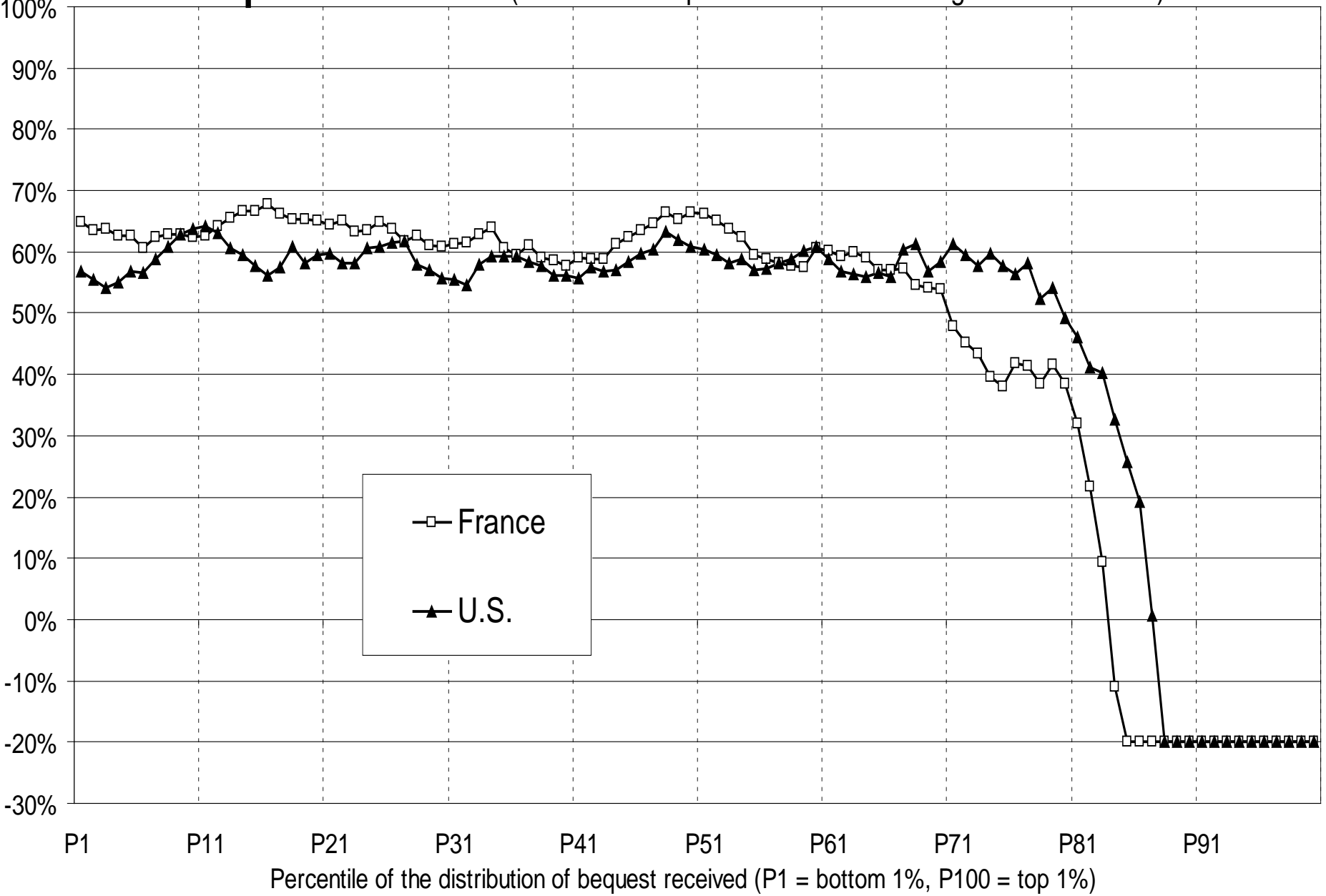
→ if  $b^*=0.5$  and  $y_L^*=1$ ,  $\tau_B = 0.5$  : if zero receivers have same labor income as rest of the pop and expect to leave 50% of average bequest, then it is optimal from their viewpoint to tax bequests at 50% rate

- If  $e_B=0$  &  $b^*=y_L^*=1$ , then  $\tau_B = 1 - G/R$  (**fiscal Golden rule**)

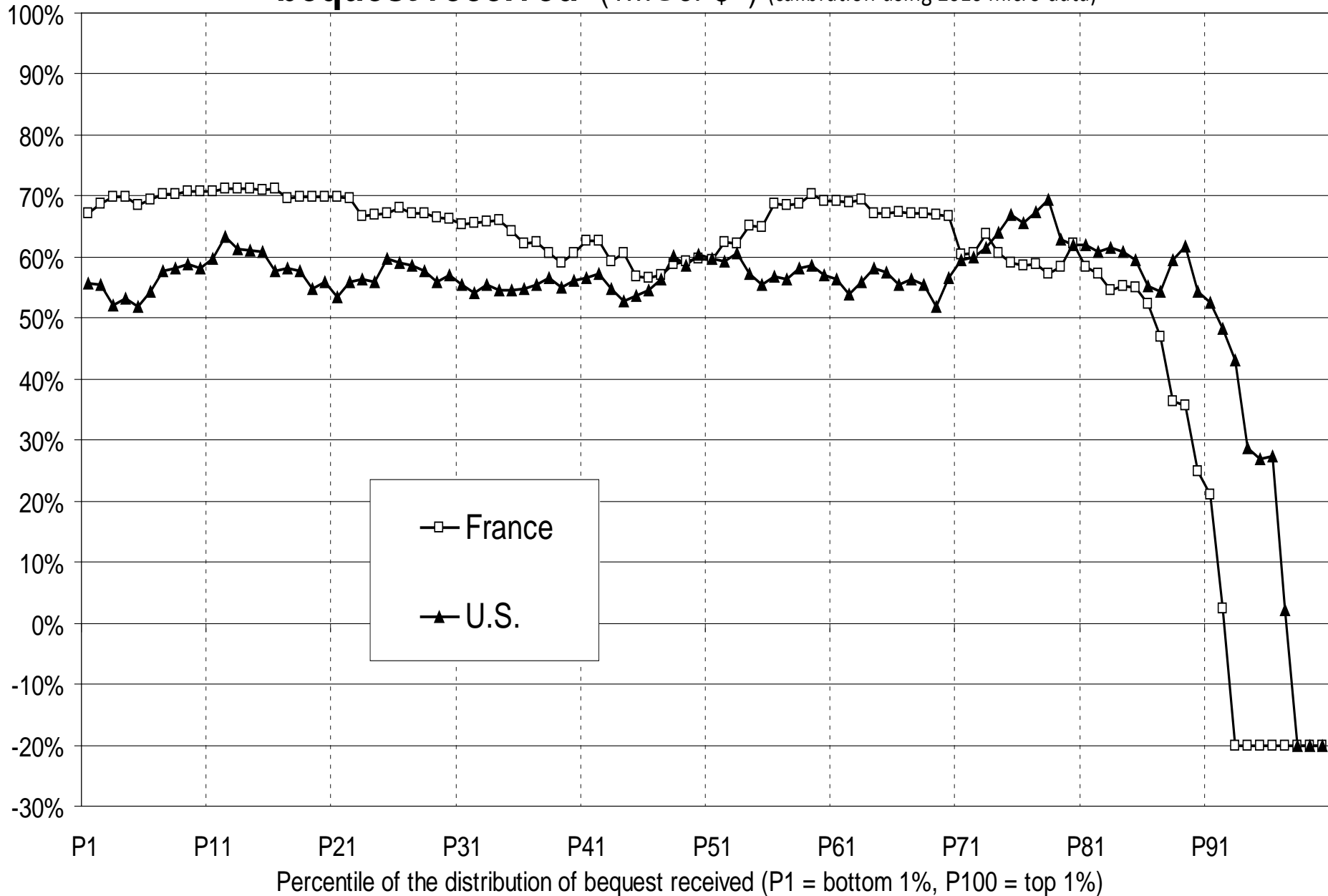
→ if  $R \rightarrow +\infty$ ,  $\tau_B \rightarrow 1$ : zero receivers want to tax bequest at 100%, even if they plan to leave as much bequest as rest of the pop

# Figure 1: Optimal linear inheritance tax rates, by percentile of bequest received

(calibration of optimal tax formulas using 2010 micro data)



**Figure 2: Optimal top inheritance tax rates, by percentile of bequest received (1m€ or \$+) (calibration using 2010 micro data)**





- **Result 2: Optimal Capital Tax Mix** (NBER WP'12)
  - **K market imperfections** (e.g. uninsurable idiosyncratic shocks to rates of return) can justify shifting one-off inheritance taxation toward lifetime capital taxation (property tax, K income tax,..)
  - **Intuition:** what matters is capitalized bequest, not raw bequest; but at the time of setting the bequest tax rate, there is a lot of uncertainty about what the rate of return is going to be during the next 30 years → so it is more efficient to split the tax burden
- **this can explain the actual structure & mix of inheritance vs lifetime capital taxation**
- (& why high top inheritance and top capital income tax rates often come together, e.g. US-UK 1930s-1980s)

# Equivalence between $\tau_B$ and $\tau_K$

- In basic model with perfect markets, tax  $\tau_B$  on inheritance is equivalent to tax  $\tau_K$  on annual return  $r$  to capital as:

after tax capitalized inheritance  $\underline{b}_{ti} = (1 - \tau_B)b_{ti}e^{rH} = b_{ti}e^{(1-\tau_K)rH}$

$$\text{i.e. } \tau_K = -\log(1-\tau_B)/rH$$

- E.g. with  $r=5\%$  and  $H=30$ ,  $\tau_B=25\% \leftrightarrow \tau_K=19\%$ ,  
 $\tau_B=50\% \leftrightarrow \tau_K=46\%$ ,  $\tau_B=75\% \leftrightarrow \tau_K=92\%$

- This equivalence no longer holds with

**(a)** tax enforcement constraints, or **(b)** life-cycle savings,

or **(c)** uninsurable risk in  $r=r_{ti}$

→ Optimal mix  $\tau_B, \tau_K$  then becomes an interesting question

→ Full formulas are complicated: one needs to find simple sufficient statistics, e.g. unequal wealth growth rates by wealth levels

→ More research is needed on the optimal capital tax mix

**Table 12.1. The growth rate of top global wealth, 1987-2013**

<i>Average real growth rate per year (after deduction of inflation)</i>	1987-2013
The top 1/(100 million) highest wealth holders <small>(about 30 adults out of 3 billions in 1980s, and 45 adults out of 4,5 billions in 2010s)</small>	6,8%
The top 1/(20 million) highest wealth holders <small>(about 150 adults out of 3 billions in 1980s, and 225 adults out of 4,5 billions in 2010s)</small>	6,4%
Average world wealth per adult	2,1%
Average world income per adult	1,4%
World adult population	1,9%
World GDP	3,3%

Between 1987 and 2013, the highest global wealth fractiles have grown at 6%-7% per year, vs. 2,1% for average world wealth and 1,4% for average world income. All growth rates are net of inflation (2,3% per year between 1987 and 2013). Sources: see [piketty.pse.ens.fr/capital21c](http://piketty.pse.ens.fr/capital21c).