A Theory of Optimal Capital Taxation

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Motivation: The Failure of Capital Tax Theory

1) **Standard theory:** optimal tax rate τ_K=0% for all forms of capital taxes (stock- or flow-based)

➔ Complete supression of inheritance tax, property tax, corporate tax, K income tax, etc. is desirable… including from the viewpoint of individuals with zero property!

2) **Practice:** EU27: tax/GDP = 39%, capital tax/GDP = 9%

US: tax/GDP = 27%, capital tax/GDP = 8%

(inheritance tax: <1% GDP, but high top rates)

➔ Nobody seems to believe this extreme zero-tax result – which indeed relies on very strong assumptions

3) **Huge gap** between theory & practice (& common sense) on optimal k taxation is a major failure of modern economics

This Paper: Two Ingredients

In this paper we attempt to develop a realistic, tractable K tax theory based upon two key ingredients

1) Inheritance: life is not infinite, inheritance is a significant source of lifetime inequality → with 2-dimensional inequality, one needs a 2-dimensional optimal tax structure

2) Imperfect K markets: with uninsurable risk, lifetime K tax is a useful addition to inheritance tax

With no inheritance (100% life-cycle wealth or infinite life) **and** perfect K markets, then the case for τ_K=0% is indeed very strong: 1+r = relative price of present consumption → do not tax r, instead use redistributive labor income taxation τ_L only (Atkinson-Stiglitz)

- **Key parameter: b_y = B/Y**

= aggregate annual bequest flow B/national income Y

- Huge historical variations:

b_y=20-25% in 19^C & until WW1 (=very large: rentier society)

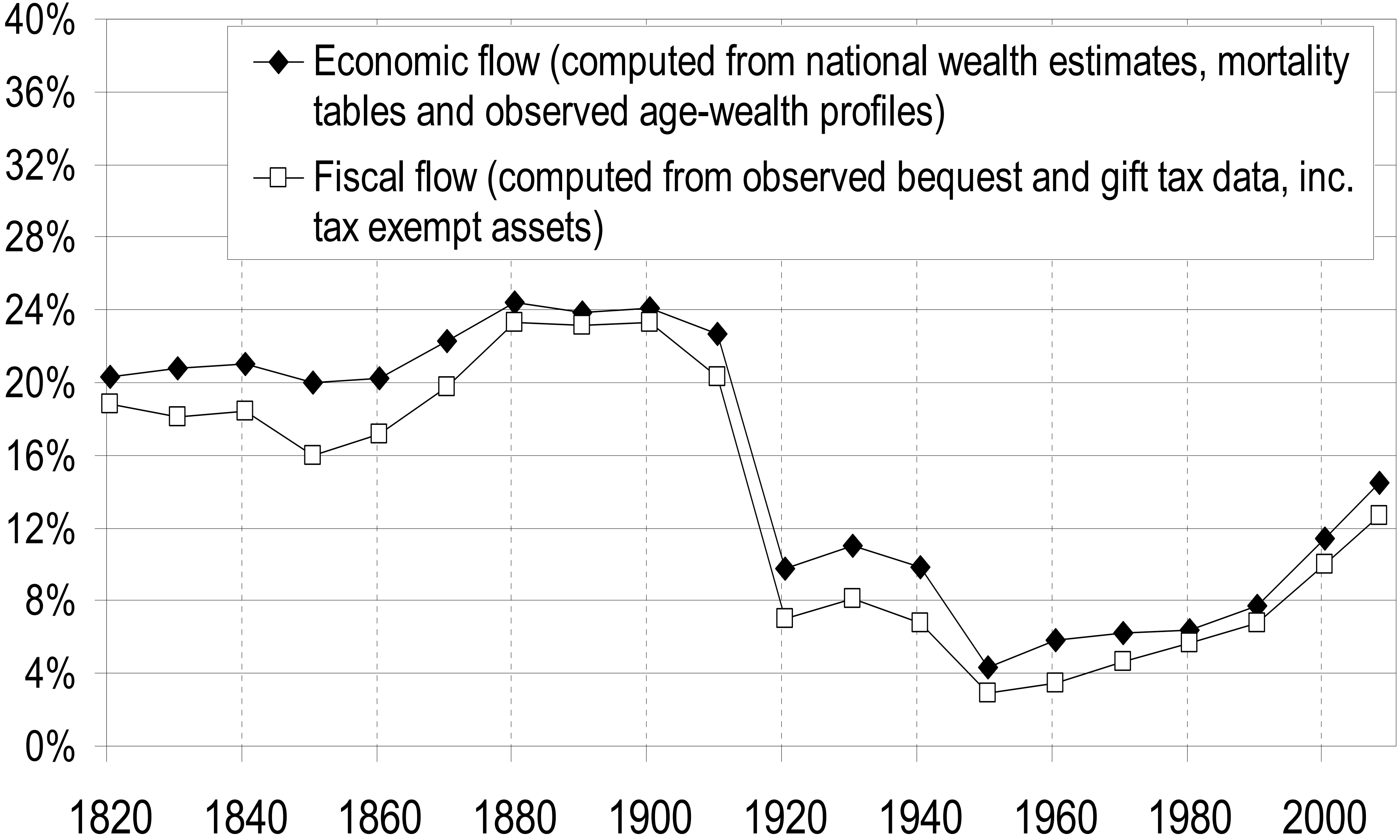
b_y<5% in 1950-60 (Modigliani lifecycle) (~A-S)

b_y back up to ~15% by 2010 → inheritance matters again

- See « On the Long-Run Evolution of Inheritance – France 1820-2050 », Piketty QJE'11
- **r>g story**: g small & r>>g → inherited wealth is capitalized faster than growth → b_y high
- U-shaped pattern probably less pronounced in US

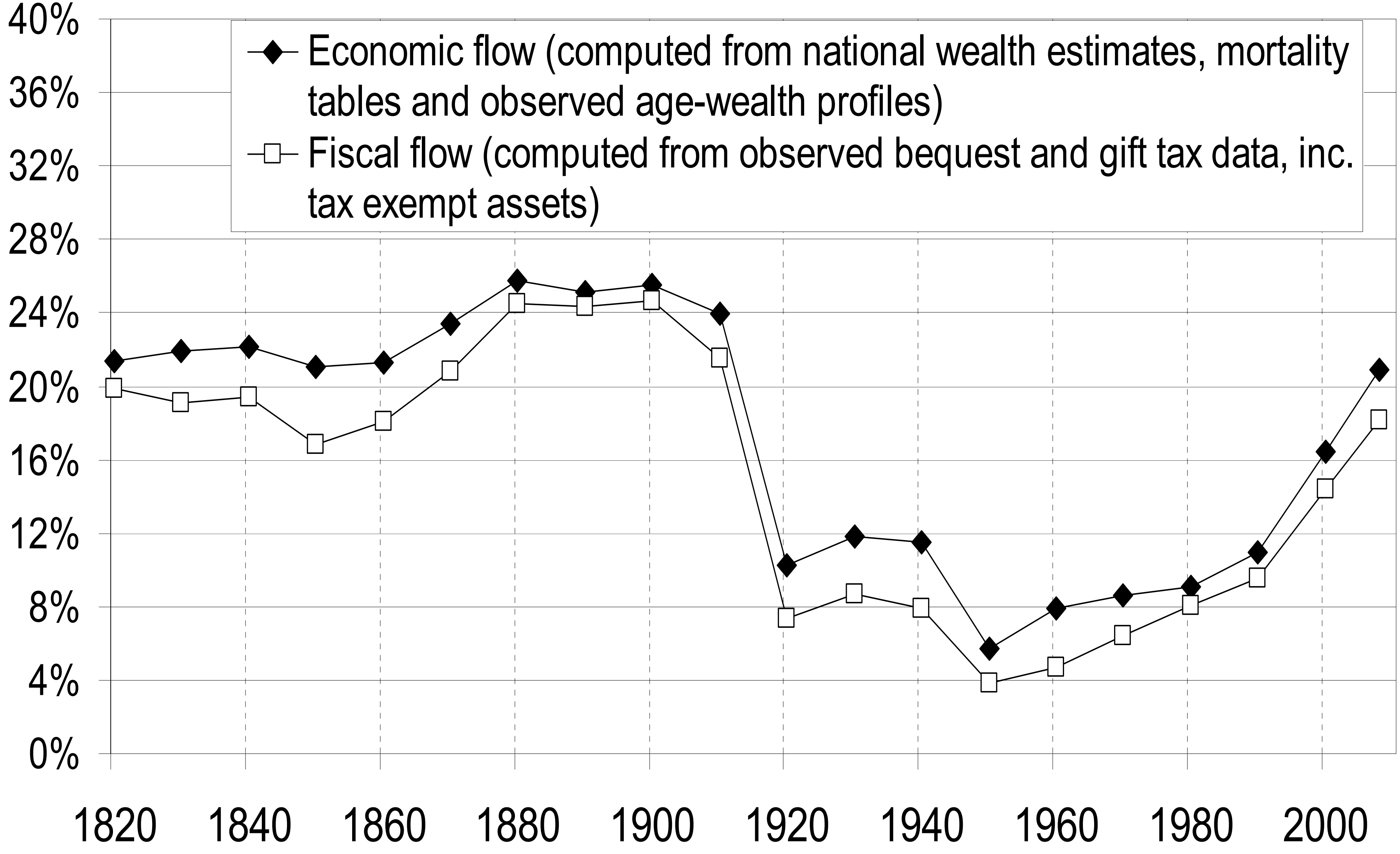
→ **Optimal τ_B is increasing with b_y (or r-g)**

Annual inheritance flow as a fraction of national income, France 1820-2008



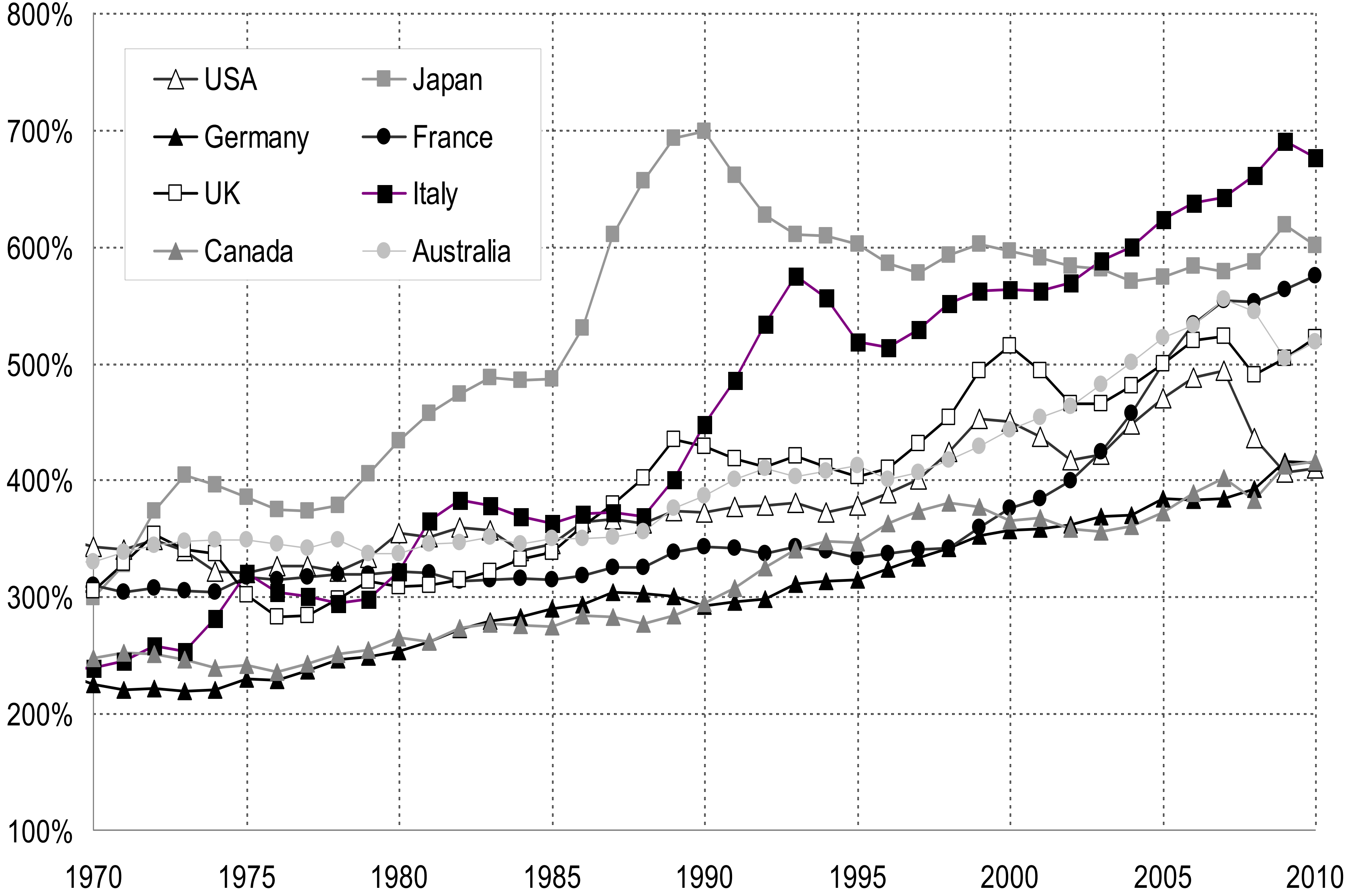
Source: T. Piketty, "On the long-run evolution of inheritance", QJE 2011

Annual inheritance flow as a fraction of disposable income, France 1820-2008

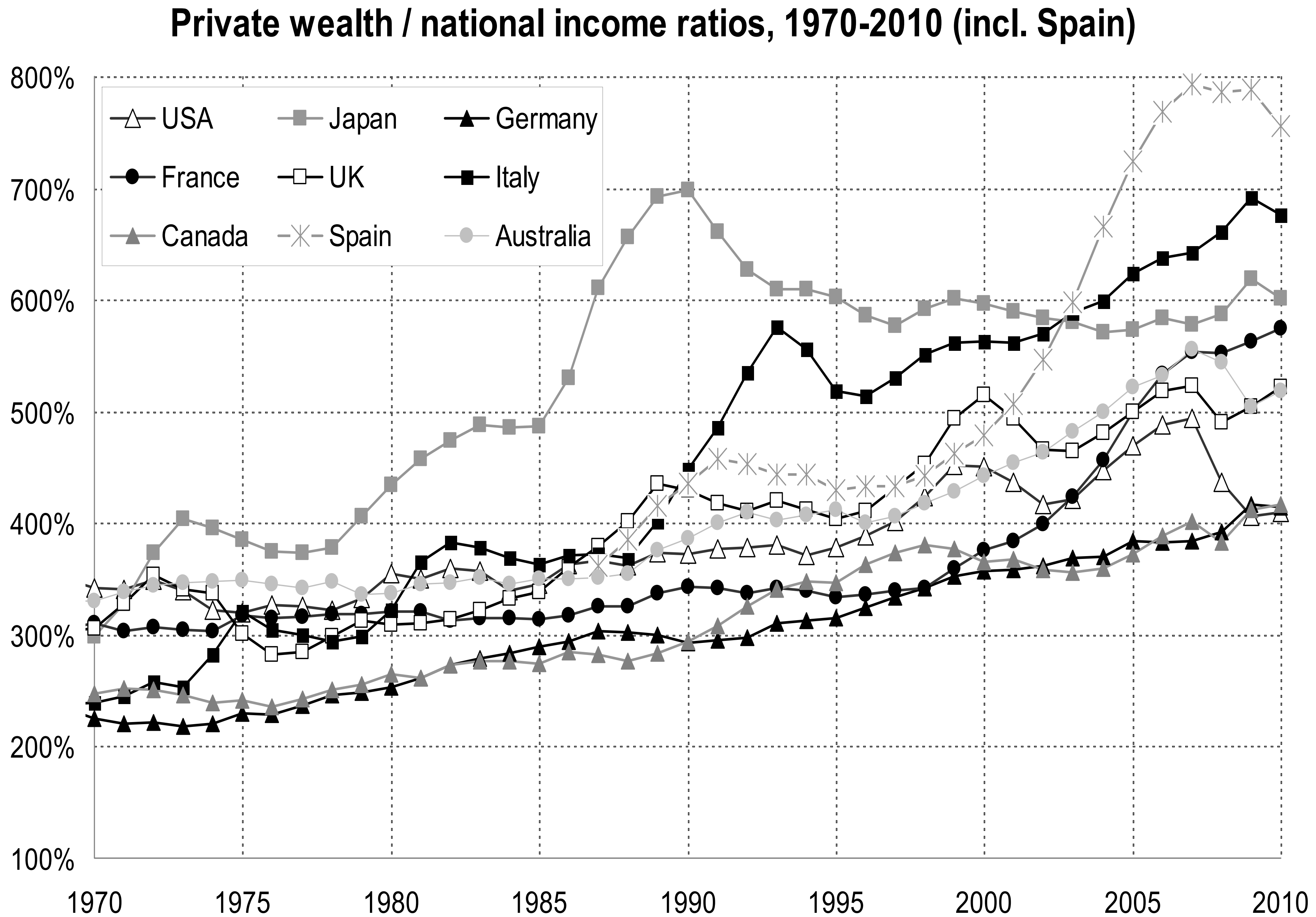


Source: T. Piketty, "On the long-run evolution of inheritance", QJE 2011

Private wealth / national income ratios, 1970-2010

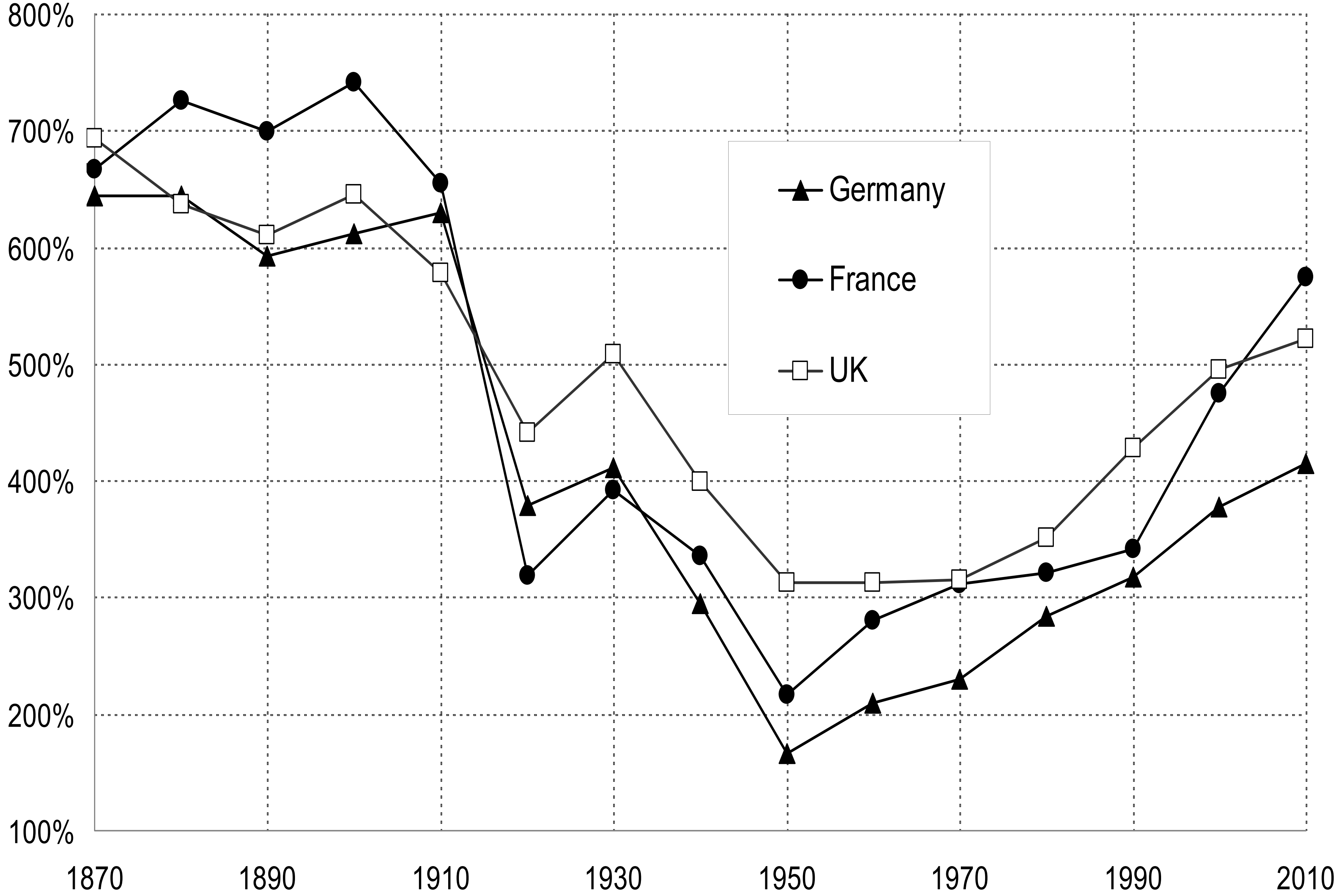


Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

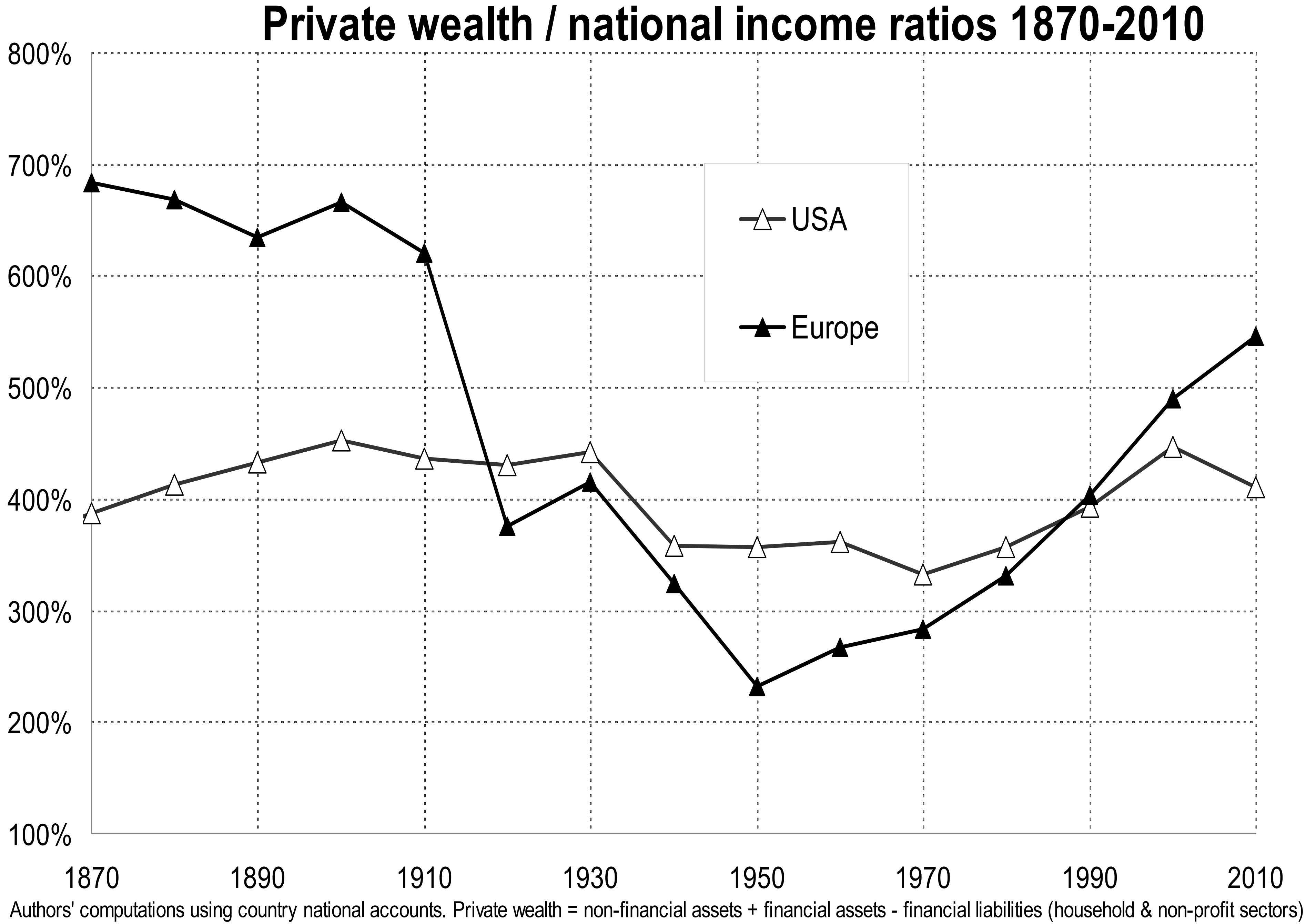


Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

Private wealth / national income ratios in Europe, 1870-2010



Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)


Private wealth / national income ratios 1870-2010
800%
700%
600%
500%
400%
300%
200%
100%
1870
1890
1910
1930
1950
1970
1990
2010
USA
Europe
Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

Result 1: Optimal Inheritance Tax Formula

- **Simple formula** for optimal bequest tax rate expressed in terms of estimable parameters:

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

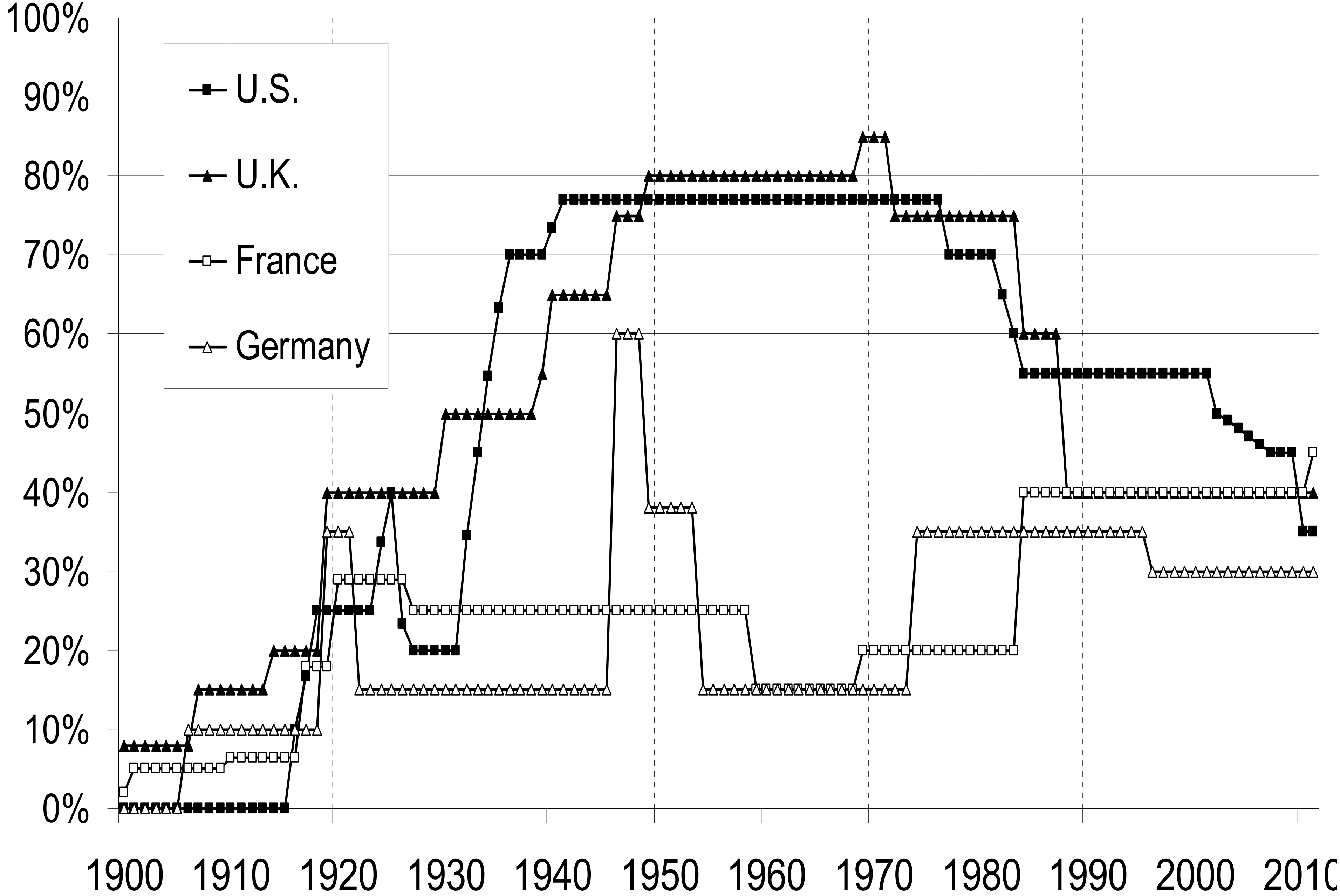
with: b_y = bequest flow, e_B = elasticity, s_{b0} = bequest taste
→ τ_B increases with b_y and decreases with e_B and s_{b0}

- For realistic parameters: τ_B=50-60% (or more..or less...)

→ **our theory can account for the variety of observed top bequest tax rates (30%-80%)**

→ hopefully our approach can contribute to a tax debate based more upon empirical estimates of key distributional & behavioral parameters (and less about abstract theory)

Top Inheritance Tax Rates 1900-2011



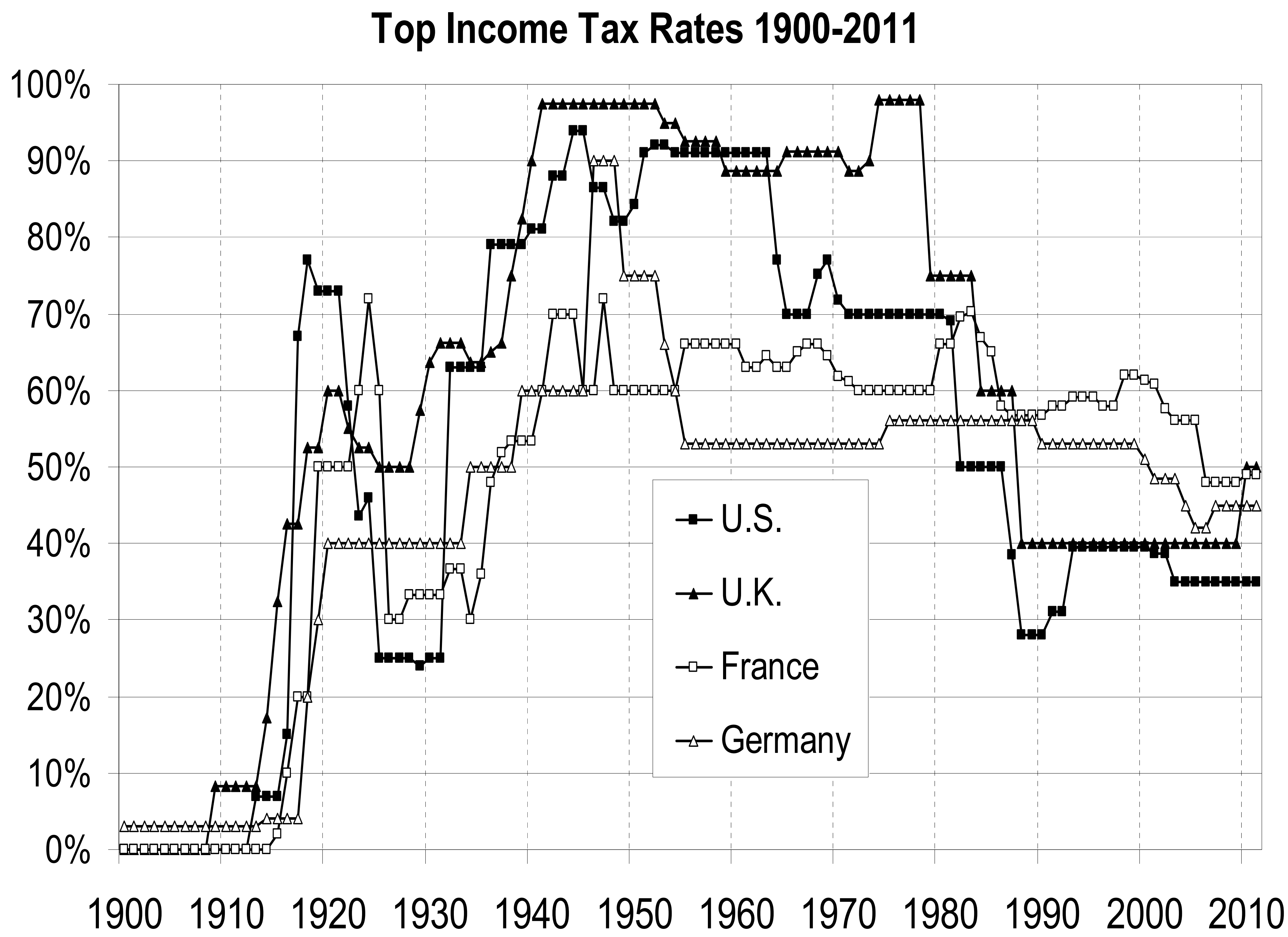
Result 2: Optimal Capital Tax Mix

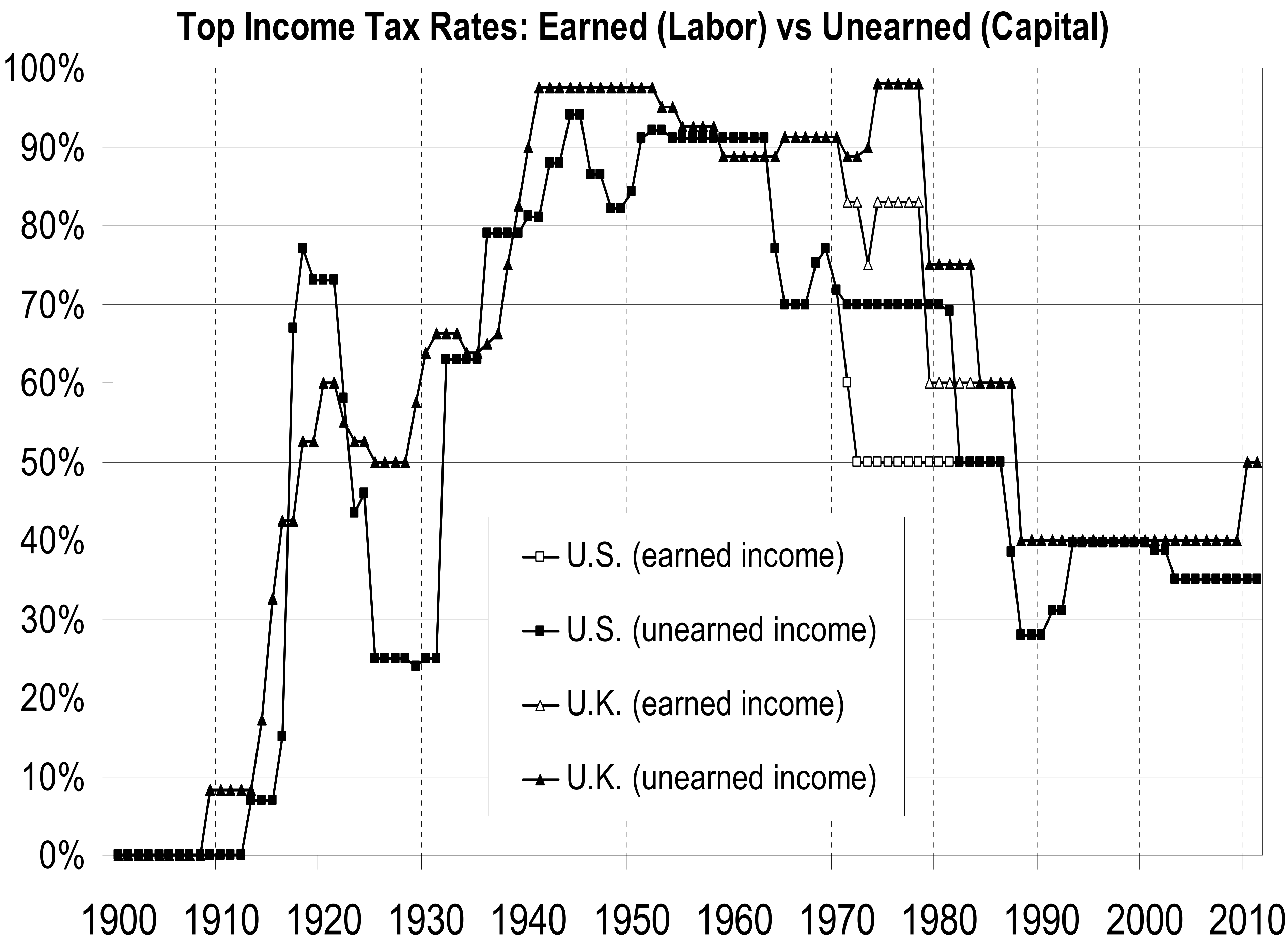
- **K market imperfections** (e.g. uninsurable idiosyncratic shocks to rates of return) can justify shifting one-off inheritance taxation toward lifetime capital taxation (property tax, K income tax,..)

- **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

→ **our theory 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)


Top Income Tax Rates 1900-2011
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
U.S.
U.K.
France
Germany
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010


Top Income Tax Rates: Earned (Labor) vs Unearned (Capital)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
U.S. (earned income)
U.S. (unearned income)
U.K. (earned income)
U.K. (unearned income)

Link with previous work

1. **Atkinson-Stiglitz JPupE'76**: No capital tax in life-cycle model with homogenous tastes for savings, consumption-leisure separability and nonlinear labor income tax
2. **Chamley EMA'86-Judd JPubE'85**: No capital tax in the long run in an infinite horizon model with homogenous discount rate (infinite elasticity)
3. **Precautionary savings**: Capital tax desirable when uncertainty about future earnings ability affect savings decisions (positive but small capital tax rate)
4. **Credit Constraints** can restore desirability of capital tax to redistribute from the unconstrained to the constrained
5. **Time Inconsistent Governments** always want to tax existing capital → here we focus on long-run optima with full commitment (most difficult case for τ_K>0)

Atkinson-Stiglitz fails with inheritances

A-S applies when sole source of lifetime income is labor:
$c_1+c_2/(1+r)=\theta l-T(\theta l)$ (θ = productivity, l = labor supply)

Bequests provide an additional source of life-income:

$c+b(\text{left})/(1+r)=\theta l-T(\theta l)+b(\text{received})$

➔ conditional on θl, high b(left) is a signal of high b(received) [and hence low u_c] ➔ "commodity" b(left) should be taxed even with optimal $T(\theta l)$

➔ **two-dimensional heterogeneity requires two-dim. tax policy tool**

Extreme example: no heterogeneity in productivity θ but pure heterogeneity in bequests motives ➔ bequest taxation is desirable for redistribution

Note: bequests generate positive externality on donors and hence should be taxed less (but still >0)

Chamley-Judd fails with finite lives

C-J in the dynastic model implies that inheritance tax rate τ_K should be zero in the long-run

(1) If social welfare is measured by the discounted utility of first generation then $\tau_K=0$ because inheritance tax creates an infinitely growing distortion but…

this is a crazy social welfare criterion that does not make sense when each period is a generation

(2) If social welfare is measured by long-run steady state utility then $\tau_K=0$ because supply elasticity e_B of bequest wrt to price is infinite but…

we want a theory where e_B is a free parameter

A Good Theory of Optimal Capital Taxation

Should follow the optimal labor income tax progress and hence needs to capture key trade-offs robustly:

1) **Welfare effects:** people dislike taxes on bequests they leave, or inheritances they receive, but people also dislike labor taxes → interesting trade-off
2) **Behavioral responses:** taxes on bequests might (a) discourage wealth accumulation, (b) affect labor supply of inheritors (Carnegie effect) or donors
3) **Results should be robust** to heterogeneity in tastes and motives for bequests within the population and formulas should be expressed in terms of estimable **"sufficient statistics"**

Part 1: Optimal K tax with perfect markets

- Agent i in cohort t (1 cohort =1 period =H years, H≈30)
- Receives bequest $b_{ti}=z_i b_t$ at beginning of period t
- Works during period t
- Receives labor income $y_{Lti}=\theta_i y_{Lt}$ and capitalized bequest $b_{ti}e^{rH}$ at end of period t
- Consumes c_{ti} & leaves bequest b_{t+1i} so as to maximize:

$$\textbf{Max } V_i(c_{ti}, b_{t+1i}, \underline{b}_{t+1i})$$
$$\textbf{s.c. } c_{ti} + b_{t+1i} \leq (1-\tau_B) b_{ti} e^{rH} + (1-\tau_L) y_{Lti}$$

With: b_{t+1i} = end-of-life wealth (wealth loving)

$\underline{b}_{t+1i}=(1-\tau_B)b_{t+1i}e^{rH}$ = net-of-tax capitalized bequest left (bequest loving)

τ_B= capitalized bequest tax rate, τ_L=labor income tax rate

$V_i()$ homogeneous of degree one (to allow for growth)

- **Special case: Cobb-Douglas preferences**:

$V_i(c_{ti}, b_{t+1i}, \underline{b}_{t+1i}) = c_{ti}^{1-s_i}\, b_{t+1i}^{s_{wi}}\, \underline{b}_{t+1i}^{s_{bi}}$ (with $s_i = s_{wi} + s_{bi}$)

$\rightarrow \quad b_{t+1i} = s_i\,[(1-\tau_B) z_i b_t e^{rH} + (1-\tau_L)\theta_i y_{Lt}] = s_i\, \underline{y}_{ti}$

- **General preferences: $V_i()$ homogenous of degree one:**

Max $V_i() \rightarrow$ FOC $V_{ci} = V_{wi} + (1-\tau_B) e^{rH} V_{bi}$

All choices are linear in total life-time income $\underline{y}_{ti}$

$\rightarrow \quad b_{t+1i} = s_i\, \underline{y}_{ti}$

Define $s_{bi} = s_i\,(1-\tau_B) e^{rH}\, V_{bi}/V_{ci}$

Same as Cobb-Douglas but s_i and s_{bi} now depend on $1-\tau_B$

- **Random productivities θ_i and random tastes s_i**

- We allow for any distribution and any ergodic random process for taste shocks s_i and productivity shocks θ_i

→ **endogenous dynamics of the joint distribution $\Psi_t(z,\theta)$ of normalized inheritance z and productivity θ**

- **Macro side**: open economy with exogenous return r, domestic output $Y_t = K_t^{\alpha} L_t^{1-\alpha}$, with $L_t = L_0 e^{gHt}$ and g=exogenous productivity growth rate

(inelastic labor supply $l_{ti}=1$, fixed population size = 1)

- **Period by period government budget constraint**:

$$\tau_L Y_{Lt} + \tau_B B_t e^{rH} = \tau Y_t$$

I.e. $$\boldsymbol{\tau_L(1-\alpha) + \tau_B b_{yt} = \tau}$$

With τ = exogenous tax revenue requirement (e.g. τ=30%)

$b_{yt} = e^{rH} B_t / Y_t$ = capitalized inheritance-output ratio

- **Government objective:**

We take τ≥0 as given and solve for the optimal tax mix τ_L, τ_B maximizing steady-state SWF = $\int \omega_{z\theta} V_{z\theta} \, d\Psi(z,\theta)$

with Ψ(z,θ) = steady-state distribution of z and θ

$\omega_{z\theta}$ = social welfare weights

Equivalence between τ_B and τ_K

- In basic model, tax τ_B on capitalized inheritance is equivalent to tax τ_K on annual return r to capital as:

  $\underline{b}_{ti} = (1-\tau_B) b_{ti} e^{rH} = b_{ti} e^{(1-\tau_K)rH}$, i.e. $\tau_K = -\log(1-\tau_B)/rH$

- E.g. with r=5% and H=30, τ_B=25% ↔ τ_K=19%, τ_B=50% ↔ τ_K=46%, τ_B=75% ↔ τ_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 τ_B,τ_K then becomes an interesting question (see below)

- **Special case**: taste and productivity shocks s_i and θ_i are i.e. across and within periods (no memory)

$\rightarrow s=E(s_i \mid \theta_i,z_i) \rightarrow$ simple aggregate transition equation:

$$b_{t+1i} = s_i \, [(1-\tau_B)z_i b_t e^{rH} + (1-\tau_L)\theta_i y_{Lt}]$$

$$\rightarrow b_{t+1} = s \, [(1-\tau_B)b_t e^{rH} + (1-\tau_L)y_{Lt}]$$

Steady-state convergence: $b_{t+1}=b_t e^{gH}$

$$\rightarrow \qquad b_{yt} \rightarrow b_y = \frac{s(1-\tau-\alpha)e^{(r-g)H}}{1-se^{(r-g)H}}$$

- b_y increases with r-g (capitalization effect, Piketty QJE'11)
- If $r-g=3\%, \tau=10\%, H=30, \alpha=30\%, s=10\% \rightarrow b_y=20\%$
- If $r-g=1\%, \tau=30\%, H=30, \alpha=30\%, s=10\% \rightarrow b_y=6\%$

- **General case:** under adequate ergodicity assumptions for random processes s_i and θ_i :

Proposition 1 (unique steady-state): for given τ_B, τ_L, then as $t \to +\infty$, $b_{yt} \to b_y$ and $\Psi_t(z,\theta) \to \Psi(z,\theta)$

- Define: $$e_B = \frac{db_y}{d(1-\tau_B)} \frac{1-\tau_B}{b_y}$$

- e_B = elasticity of steady-state bequest flow with respect to net-of-bequest-tax rate $1-\tau_B$
- With $V_i()$ = Cobb-Douglas and i.i.d. shocks, $e_B = 0$
- For general preferences and shocks, $e_B>0$ (or <0)

→ we take e_B as a free parameter

- Meritocratic rawlsian optimum, i.e. social optimum from the viewpoint of zero bequest receivers (z=0):

Proposition 2 (zero-receivers tax optimum)

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

with: s_{b0} = average bequest taste of zero receivers

- τ_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 $e_B \to +\infty$, then $\tau_B \to 0$: back to Chamley-Judd
- If e_B=0, then τ_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: τ=30%, α=30%, s_{bo}=10%, e_B=0

- If b_y=20%, then τ_B=73% & τ_L=22%
- If b_y=15%, then τ_B=67% & τ_L=29%
- If b_y=10%, then τ_B=55% & τ_L=35%
- If b_y=5%, then τ_B=18% & τ_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 oposite (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: τ=30%, α=30%, s_{bo}=10%, b_y=15%

- If e_B=0, then τ_B=67% & τ_L=29%
- If e_B=0.2, then τ_B=56% & τ_L=31%
- If e_B=0.5, then τ_B=46% & τ_L=33%
- If e_B=1, then τ_B=35% & τ_L=35%

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

Kopczuk-Slemrod 2001: e_B=0.2 (US)

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

- **Proposition 3** (z%-bequest-receivers optimum):

$$\tau_B = \frac{1-(1-\alpha-\tau)s_{bz}/b_y-(1+e_B+s_{bz})z/\theta_z}{(1+e_B+s_{bz})(1-z/\theta_z)}$$

- If z large, $\tau_B<0$: top successors want bequest subsidies
- But since the distribution of inheritance is highly concentrated (bottom 50% successors receive ~5% of aggregate flow), the bottom-50%-receivers optimum turns out to be very close to the zero-receivers optimum

- Perceptions about wealth inequality & mobility matter a lot: if bottom receivers expect to leave large bequests, then they may prefer low bequest tax rates

→ it is critical to estimate the right distributional parameters

- **Proposition 7** (optimum with elastic labor supply):

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

- Race between two elasticities: e_B vs e_L
- τ_B decreases with e_B but increases with e_L

Example : τ=30%, α=30%, s_{bo}=10%, b_y=15%

- If e_B=0 & e_L=0, then τ_B=67% & τ_L=29%
- If e_B=0.2 & e_L=0, then τ_B=56% & τ_L=31%
- If e_B=0.2 & e_L=0.2, then τ_B=59% & τ_L=30%
- If e_B=0.2 & e_L=1, then τ_B=67% & τ_L=29%

Other extensions

- **Optimal non-linear bequest tax**: simple formula for top rate; numerical solutions for full schedule
- **Closed economy**: $F_K = R = e^{rH}-1$ = generational return

→ optimal tax formulas continue to apply as in open economy with e_B,e_L being the pure supply elasticities

- **Lifecycle saving**: assume agents consume between age A and D, and have a kid at age H. E.g. A=20, D=80, H=30, so that everybody inherits at age I=D-H=50.

→ Max V(U,b,b) with $U = [\int_{A\leq a\leq D} e^{-\delta a} c_a^{1-\gamma}]^{1/(1-\gamma)}$

→ same b_y and τ_B formulas as before, except for a factor λ correcting for when inheritances are received relative to labor income: $\lambda\approx 1$ if inheritance received around mid-life

(early inheritance: $b_y,\tau_B \uparrow$; late inheritance: $b_y,\tau_B \downarrow$)

Part 2: Optimal K tax with imperfect markets

- One-period model, perfect K markets: equivalence btw bequest tax and lifetime K tax as $(1-\tau_B)e^{rH} = e^{(1-\tau_K)rH}$

- Life-cycle savings, perfect K markets: it's always better to have a big tax τ_B on bequest, and zero lifetime capital tax τ_K, so as to avoid intertemporal consumption distorsion

- However in the real world most people seem to prefer paying a property tax τ_K=1% during 30 years rather than a big bequest tax τ_B=30%
- Total K taxes = 9% GDP, but bequest tax <1% GDP

- **In our view, the observed collective choice in favour of lifetime K taxes is a rational consequence of K markets imperfections, not of tax illusion**

Simplest imperfection: fuzzy frontier between capital income and labor income flows, can be manipulated by taxpayers (self-employed, top executives, etc.) (= tax enforcement problem)

Proposition 5: With fully fuzzy frontier, then $\tau_K=\tau_L$ (capital income tax rate = labor income tax rate), and bequest tax $\tau_B>0$ is optimal iff bequest flow b_y sufficiently large

Define $\underline{\tau}_B=\tau_B+(1-\tau_B)\tau_K R/(1+R)$, with $R=e^{rH}-1$.

$\tau_K=\tau_L \rightarrow$ adjust τ_B down to keep $\underline{\tau}_B$ the same as before

→ **comprehensive income tax + bequest tax**

= what we observe in many countries

Uninsurable uncertainty about future rate of return: what matters is $b_{ti}e^{r_{ti}H}$, not b_{ti} ; but at the time of setting the bequest tax rate τ_B, nobody knows what the rate of return $1+R_{ti}=e^{r_{ti}H}$ is going to be during the next 30 or 40 years…

(idiosyncratic + aggregate uncertainty)

→ **with uninsurable shocks on returns r_{ti}, it's more efficient to split the tax burden between one-off transfer taxes and lifetime capital taxes**

Intuition: if you inherit a Paris or NYC appartment worth 100 000€ in 1972, nobody knows what the total cumulated return will be btw 1972 & 2012; so it's better to charge a moderate bequest tax and a larger annual tax on property values & flow returns

- Assume rate of return $R_{ti} = \varepsilon_{ti} + \xi e_{ti}$

With: ε_{ti} = i.i.d. random shock with mean R_0

e_{ti} = effort put into portfolio management (how much time one spends checking stock prices, looking for new investment opportunities, monitoring one's financial intermediary, etc.)

$c(e_{ti})$ = convex effort cost proportional to portfolio size

- **Define e_R = elasticity of aggregate rate of return R with respect to net-of-capital-income-tax rate $1-\tau_K$**
- If returns mostly random (effort parameter small as compared to random shock), then $e_R \approx 0$
- Conversely if effort matters a lot, then e_R large

- **Proposition 6.** Depending on parameters, optimal capital income tax rate τ_K can be > or < than optimal labor income tax rate τ_L; if e_R small enough and/or b_y large enough, then $\tau_K > \tau_L$

(=what we observe in UK & US during the 1970s)

Example : τ=30%, α=30%, s_{bo}=10%, b_y=15%, e_B=e_L=0

- If e_R=0, then τ_K=100%, τ_B=9% & τ_L=34%
- If e_R=0.1, then τ_K=78%, τ_B=35% & τ_L=35%
- If e_R=0.3, then τ_K=40%, τ_B=53% & τ_L=36%
- If e_R=0.5, then τ_K=17%, τ_B=56% & τ_L=37%
- If e_R=1, then τ_K=0%, τ_B=58% & τ_L=38%

Govt Debt and Capital Accumulation

- So far we imposed period-by-period govt budget constraint: no accumulation of govt debt or assets allowed
- In closed-economy, optimum capital stock should be given by modified Golden rule: $F_K = r^* = \delta + \Gamma g$

  with δ = govt discount rate, Γ = curvature of SWF
- If govt cannot accumulate debt or assets, then capital stock may be too large or too small
- If govt can accumulate debt or assets, then govt can achieve modified Golden rule
- In that case, long run optimal τ_B is given by a formula similar to previous one (as $\delta \to 0$): capital accumulation is **orthogonal** to redistributive bequest and capital taxation

Consumption tax τ_C

- Consumption tax τ_C redistributes between agents with different tastes s_i for wealth & bequest, not between agents with different inheritance z_i ; so τ_C cannot be a subsitute for optimal capital tax τ_B
- If optimal τ_B not feasible, then τ_C can be a useful (Kaldor'55: upset with the fact that top labor earners pay more tax than top successors, who manage to evade progressive taxes via trust funds and k gains → create a progressive consumption tax so as to tax rentiers)
- E.g. a positive $\tau_C>0$ can finance a labor subsidy $\tau_L<0$

→ but this is a fairly indirect way to tax rentiers: it is better to improve k tax collection (annual wealth declarations)

- Consumption tax is also an inadequate tool for saving incentives: better use debt policy to achieve Golden rule

Conclusion

- **(1)** Main contribution: simple, tractable formulas for analyzing optimal tax rates on inheritance and capital

- **(2)** Main idea: economists' emphasis on 1+r = relative price is excessive (intertemporal consumption distorsions exist but are probably second-order)

- **(3)** The important point about the rate of return to capital r is that

  (a) r is large: r>g → tax inheritance, otherwise society is dominated by rentiers

  (b) r is volatile and unpredictable → use lifetime K taxes to implement optimal inheritance tax