A Theory of Optimal Capital Taxation

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MOTIVATION: CAPITAL TAX THEORY FAILURE

1) Standard economic theory: (Atkinson-Stiglitz, Chamley-Judd) optimal tax rate $\tau_K = 0\%$ on all forms of capital taxes (stock- or flow-based) $\Rightarrow$ Elimination of all inheritance, property, corporate, and capital income taxes desirable

2) Practice: European Union 27 countries: tax/GDP = 39% and capital tax/GDP=9%. US: tax/GDP = 27% and capital tax/GDP=8%

(inheritance tax/GDP $< 1\%$ but significant top rates)

$\Rightarrow$ No government seems to believe this extreme zero-capital tax result which indeed relies on very strong assumptions

3) Huge gap between theory and practice on optimal capital taxation is a major failure of modern public economics

MOTIVATION AND GOALS

With no inheritance (100% life-cycle wealth as in Atkinson-Stiglitz or infinite life as in Chamley-Judd) **and** perfect capital markets then $1 + r =$ relative price of present consumption

$\Rightarrow \tau_K$ is not an efficient redistributive tool (relative to τ_L) and case for $\tau_K = 0$ is strong

This Paper develops a realistic, tractable optimal capital tax theory based upon two ingredients:

1) Inheritance: life is not infinite and inheritance is a significant source of lifetime inequality

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

KEY RESULTS

0) We develop a dynamic and tractable model of bequests with heterogeneous savings tastes and work abilities

1) We derive simple formulas for optimal inheritance tax rates expressed in terms of estimable parameters (elasticities, bequest flow, social preferences)

$\Rightarrow$ Our theory can account for the variety of observed top bequest tax rates

2) IN PROGRESS Uninsurable risk in individual rate of return on capital can easily explain why significant portion of inheritance tax is optimally partly shifted to capital income

$\Rightarrow$ Our theory can explain actual mix of inheritance vs. lifetime capital taxation [and why top inheritance and top capital income tax rates tend to be correlated]

Figure 1: Top Inheritance Tax Rates 1900-2011

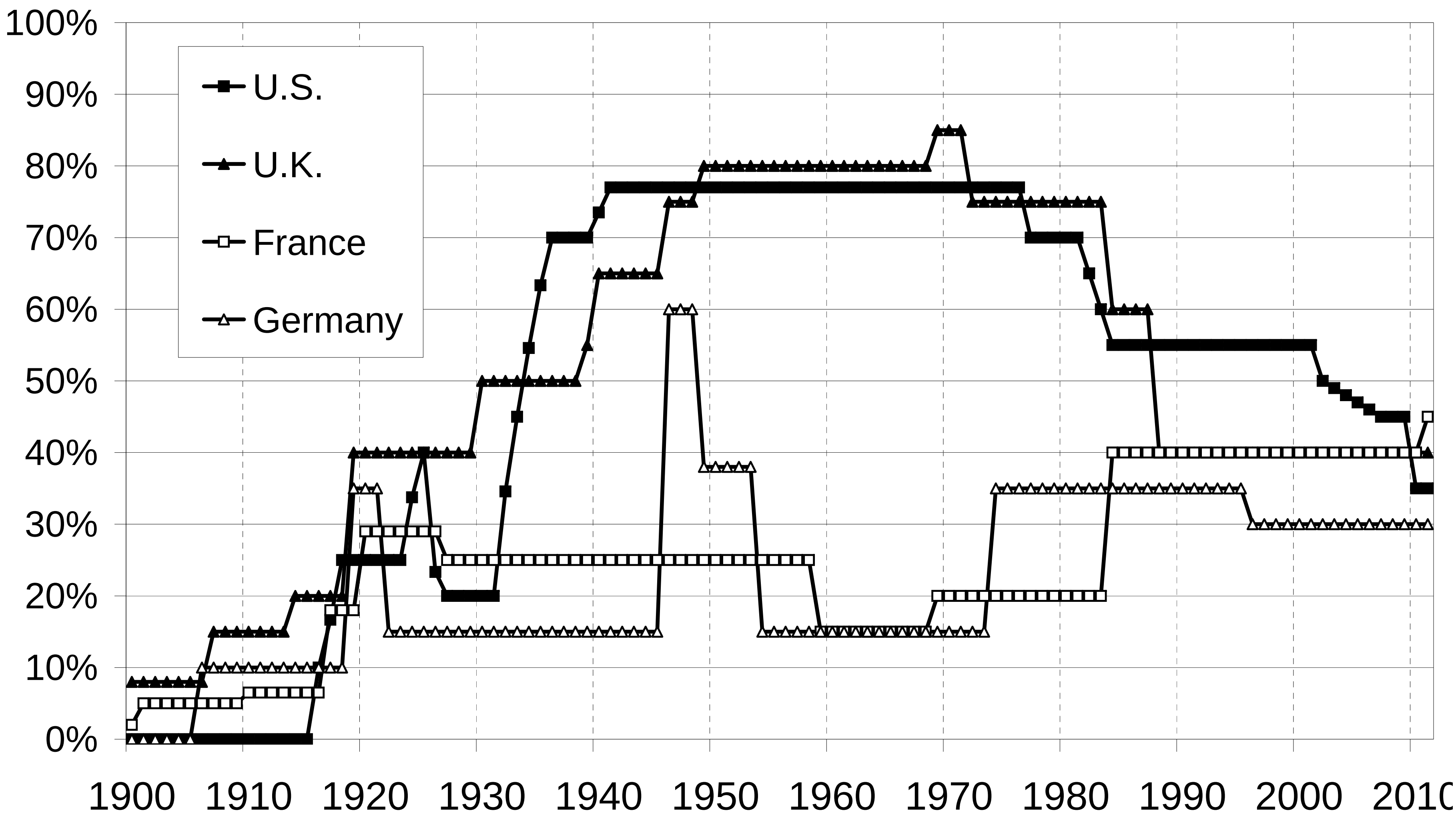
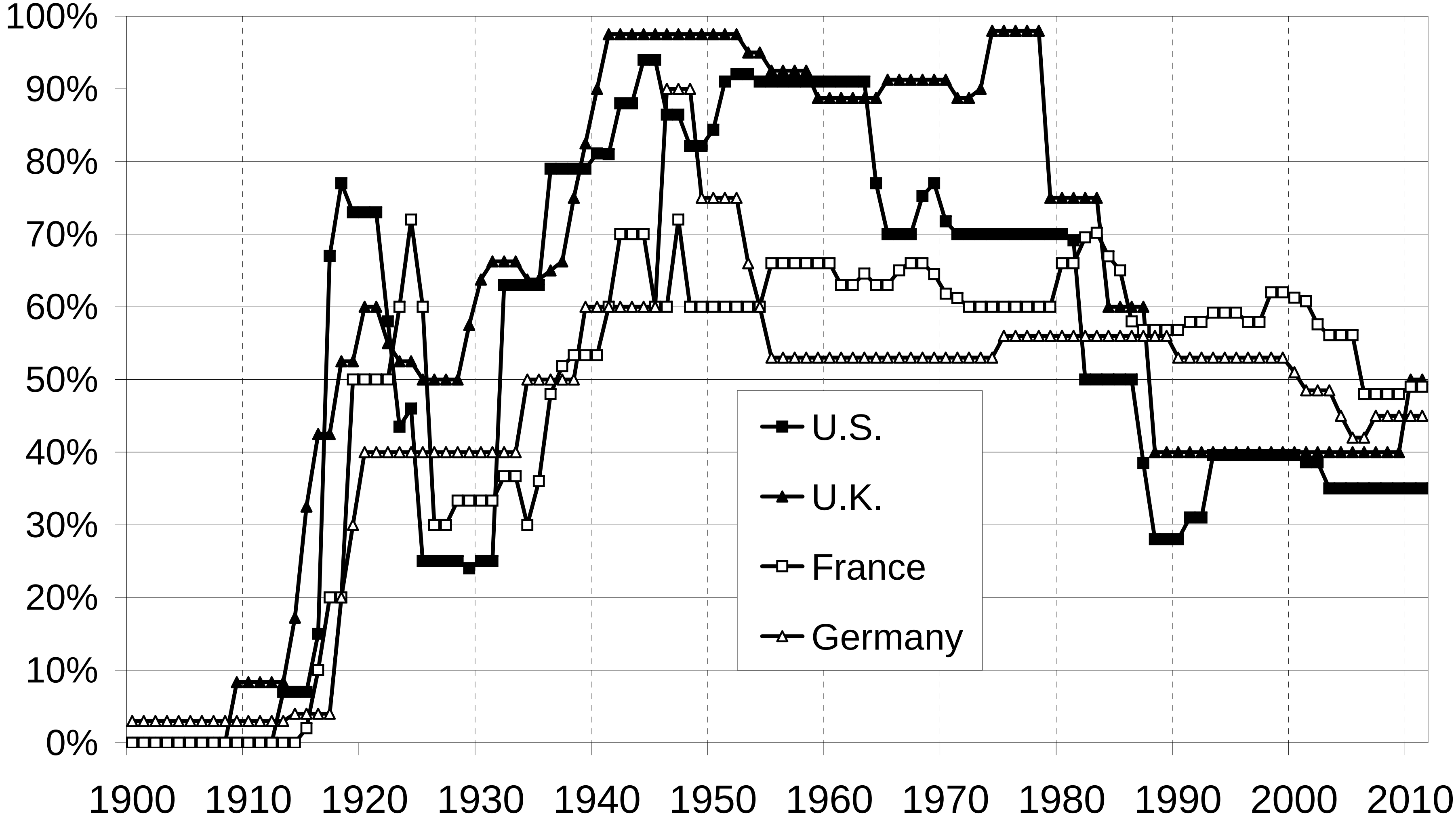


Figure 2: Top Income Tax Rates 1900-2011



OUTLINE

0) Empirical Facts on Bequest Flows

1) Links with Previous Work

2) Inheritance Tax Model

(a) Basic Model and Optimal Formulas

(b) Extensions: nonlinear bequest tax, elastic labor supply, closed economy, life-cycle, social discounting

3) From Inheritance Taxation to Capital Taxation

EMPIRICAL FACTS: BEQUEST FLOW

$b_y = B/Y =$ aggregate annual bequest flow B to national income Y

U-shape historical pattern in France (Piketty QJE'11)

a) Very large $b_y \simeq 20 - 25\%$ in 19th century (rentier society)

b) Small $b_y \simeq 5\%$ in post-WWII decades (Modigliani lifecycle)

c) Increasing $b_y \simeq 15\%$ today $\Rightarrow$ Inheritance matters again

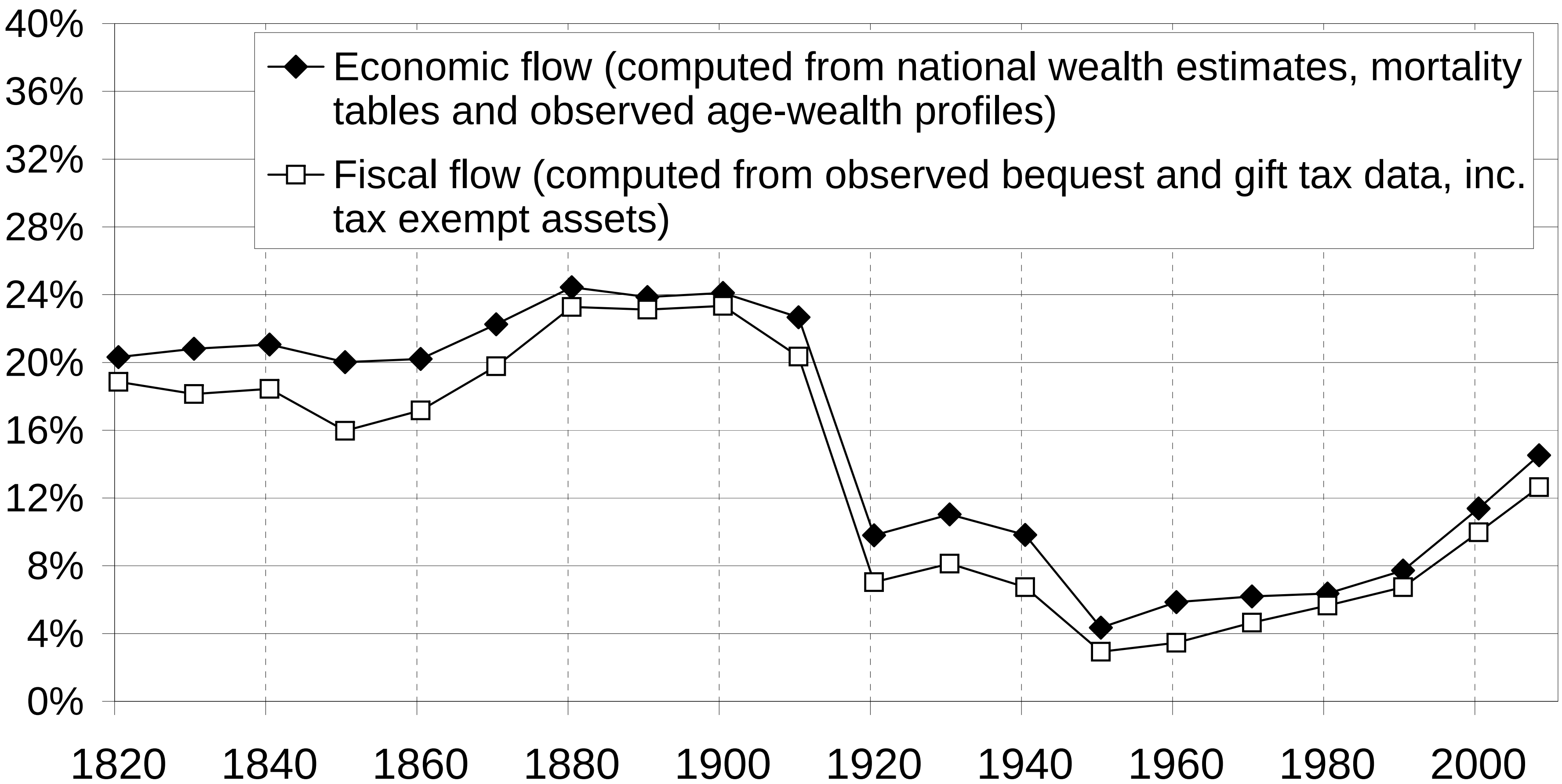
U-shape probably less pronounced in US

Key driver of b_y is $r - g$ (rate of return on K minus growth rate)

$r >> g \Rightarrow$ inherited wealth capitalizes fast $\Rightarrow b_y$ large

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

Figure 4: Annual inheritance flow as a fraction of national income, France 1820-2008



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

LINK WITH PREVIOUS WORK

1) Atkinson-Stiglitz JpubE'76: No capital tax in life-cycle model with homogeneous tastes for savings, consumption-leisure separability, and optimal 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

3) New Dynamic Public Finance: Capital tax desirable when uncertainty in future earnings ability affects savings decisions

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

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:

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

$\Rightarrow$ conditional on θl, high $b(left)$ is a signal of high $b(received)$
$\Rightarrow$ $b(left)$ should be taxed even with optimal $T(\theta l)$

Two-dim. heterogeneity requires two-dim. tax policy tool

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

CHAMLEY-JUDD FAILS WITH FINITE LIVES

Dynastic model (each period is a generation) implies that inheritance tax rate $\tau_K = 0$ in the long-run for 2 reasons:

(1) If social welfare is measured by the discounted utility of the **first** generation then inheritance tax creates an infinitely growing distortion

Not a good social welfare criterion when each period is a generation and there is heterogeneity in tastes for bequests

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

In our theory, e_B is a free parameter

A GOOD THEORY OF OPTIMAL K TAXATION

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

1) Welfare effects: people dislike taxes on bequests they leave, or inheritances they receive, but people also dislike labor taxes $\Rightarrow$ trade-off

2) Behavioral responses: bequest taxes might discourage wealth accumulation (but labor taxes might discourage labor supply)

3) Results should be **robust** to heterogeneity in tastes and motives for bequests within the population

4) Formulas should be expressed in terms of estimable **sufficient statistics**

MODEL: MICRO LEVEL

Agent i in cohort t (1 cohort =1 period =H years)

Receives bequest $b_{ti} = z_i b_t$ at beginning of period t where b_t average bequest and z_i (normalized) bequest received

At the end of period t, individual receives (inelastic) labor income $y_{Lti} = \theta_i y_{Lt}$, consumes c_{ti}, and leaves bequest b_{t+1i} to unique child so as to maximize:

$V^i(c_{ti}, b_{t+1i}, \bar{b}_{t+1i})$ s.c. $c_{ti} + b_{t+1i} \leq (1-\tau_B) b_t z_i e^{rH} + (1-\tau_L) y_{Lt} \theta_i$

$\tau_B =$ bequest tax rate, $\tau_L =$ labor income tax rate

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

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

V^i homogeneous of degree one (to allow for growth)

MODEL: MICRO LEVEL PREFERENCES

1) Special Case Cobb-Douglas preferences:

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

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

2) General preferences $V^i()$ homogeneous of degree one:

$V^i(c_{ti}, b_{t+1i}, (1-\tau_B)e^{rH} b_{t+1i}) \Rightarrow$ FOC $V_c^i = V_b^i + (1-\tau_B)e^{rH} V_{\bar{b}}^i$

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

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

Define $s_{bi}(e^{rH}(1-\tau_B)) = s_i \cdot (1-\tau_B) e^{rH} V_{\bar{b}}^i / V_c^i$

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

MODEL: MACRO

Open economy with exogenous return r and growth rate g

Inelastic labor income $y_{Lt} = y_{L0}e^{gHt}$

Domestic output $y_t = K_t^{\alpha} L_t^{1-\alpha}$ so that $y_{Lt} = y_t \cdot (1-\alpha)$ where $1-\alpha$ is labor share

Period by Period Government budget constraint:

$$\tau_L y_{Lt} + \tau_B b_t e^{rH} = \tau y_t \quad \text{i.e.,} \quad \tau_L(1-\alpha) + \tau_B b_{yt} = \tau$$

With $\tau =$ exogenous tax revenue requirement

$b_{yt} = e^{rH} b_t / y_t =$ inheritance-output ratio

τ_L is a function of τ_B to satisfy the budget constraint

EQUIVALENCE BETWEEN τ_K and τ_B

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

$$\bar{b}_{ti} = (1-\tau_B) b_{ti} e^{rH} = b_{ti} e^{r(1-\tau_K)H} \quad \text{i.e.,} \quad \tau_K = -\frac{\log(1-\tau_B)}{rH}$$

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

E.g., with $r = 3\%$ and $H = 30$, $\tau_B = 25\% \Leftrightarrow \tau_K = 32\%$, $\tau_B = 50\% \Leftrightarrow \tau_K = 77\%$, $\tau_B = 75\% \Leftrightarrow \tau_K = 154\%$

This equivalence no longer holds with (a) tax enforcement constraints , or (b) life-cycle savings, or (c) insurable risk in r

Optimal mix τ_B, τ_K then becomes interesting question (see extensions)

MODEL: NO MEMORY SIMPLIFICATION

$\theta_i, s_i, s_{bi}/s_i$ are **i.i.d.** across and within periods

$\Rightarrow s = E(s_i|\theta_i, b_{ti})$, $s_b = E(s_{bi}|\theta_i, b_{ti}) \Rightarrow$ simple agg. transition:

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

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

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

$$\Rightarrow b_y = \frac{b_t e^{rH}}{y_t} = \frac{s(1-\alpha-\tau)e^{(r-g)H}}{1 - se^{(r-g)H}}$$

b_y increases with $r-g$ (capitalization effect, Piketty QJE'11)

$r - g = 3\%, \tau = 10\%, H = 30, \alpha = 30\%, s = 10\% \Rightarrow b_y = 20\%$

$r - g = 1\%, \tau = 30\%, H = 30, \alpha = 30\%, s = 10\% \Rightarrow b_y = 6\%$

MODEL: STEADY STATE CONVERGENCE

With $V^i()$ homogenous of degree one and no memory

Unique steady-state: for given τ_L, τ_B, as $t \to +\infty$, $b_{yt} \to b_y$ and distribution of (normalized) inheritance z converges to $\Psi(z)$

Define:

$$e_B = \frac{1-\tau_B}{b_y} \frac{db_y}{d(1-\tau_B)}|_\tau$$

e_B = elasticity of steady-state bequest flow with respect to net-of-bequest-tax rate $1-\tau_B$

Cobb-Douglas preferences $\Rightarrow e_B = 0$

For general preferences, $e_B > 0$ (or < 0)

e_B is a free parameter in our model

MODEL: GOVERNMENT OBJECTIVE

Government chooses τ_B, τ_L to maximize **steady-state** social welfare

$$SWF = \int \omega^i V^i d\Psi(z) dF(\theta)$$

with $\Psi(z)$ cdf of (normalized) inheritance z and $F(\theta)$ cdf of labor productivity θ

subject to budget balance constraint

$$\tau_L y_{Lt} + \tau_B b_t e^{rH} = \tau y_t$$

Consider small $d\tau_B > 0$, can cut $d\tau_L < 0$ by:

$$-y_{Lt} d\tau_L = d\tau_B b_t e^{rH} \left(1 - e_B \frac{\tau_B}{1 - \tau_B}\right)$$

SIMPLIFICATION ASSUMPTIONS LATER RELAXED

0) No Memory in $\theta_i, s_i, s_{bi}/s_i$ processes

1) Linear inheritance tax

2) Inelastic labor supply

3) No lumpsum demogrant

4) Small open economy with fixed r

5) No Life-cycle Saving

6) No government debt and steady-state welfare objective

7) Homogeneous r across individuals

OPTIMAL INHERITANCE TAX RATE

Meritocratic Rawlsian Optimum: maximize welfare of those receiving no inheritance

$$\tau_B = \frac{1 + s_b - (s_b/s)e^{-(r-g)H}}{1 + s_b + e_B}$$

where s is average savings taste, s_b bequests savings tastes

$\tau_B \downarrow$ with e_B and s_b (as $se^{(r-g)H} < 1$)

If $s_b = 0$ then $\tau_B = 1/(1 + e_B)$ (revenue maximizing rate)

If $e_B = \infty$ then $\tau_B = 0$ (Chamley-Judd)

Even if $e_B = 0$, we have $\tau_B < 1$ as long as $s_b > 0$

$\tau_B \uparrow$ with $r - g$: Taxing bequests raises $\tau_B b_t e^{rH}$ from inheritors in my cohort but costs $\tau_B b_{t+1} = \tau_B b_t e^{gH}$ to what I leave to my child

OPTIMAL TAX RATE: NUMERICAL EXAMPLES

$$\tau_B = \frac{1 + s_b - (s_b/s)e^{-(r-g)H}}{1 + s_b + e_B}$$

0) Base Case: $r = 5\%, g = 2\%, H = 30, e^{-(r-g)H} = 40\%, e_B = 0,\ s_b = s = 10\% \Rightarrow \tau_B = 63\%$ (or $\tau_K = 66\%$)

1) If $s_b/s = .5$ (bequests half accidental) $\Rightarrow \tau_B = 81\%$ (or $\tau_K = 110\%$)

2) If $g = 4\%$ (post WWII reconstruction) $\Rightarrow \tau_B = 33\%$ (or $\tau_K = 27\%$)

3) If $e_B = 0.5$ (high elasticity) $\Rightarrow \tau_B = 43\%$ (or $\tau_K = 37\%$)

Optimal τ_B independent of τ (revenue requirement)

OPTIMAL INHERITANCE TAX RATE b_y

Optimal tax formula can be also be expressed using bequest flow b_y

$$b_y = \frac{b_t e^{rH}}{y_t} = \frac{s(1-\alpha-\tau)e^{(r-g)H}}{1-se^{(r-g)H}}$$

as

$$\tau_B = \frac{1+s_b-(s_b/s)e^{-(r-g)H}}{1+s_b+e_B} = \frac{1-(1-\alpha-\tau)s_b/b_y}{1+e_B+s_b}$$

τ_B increases with b_y (and decreases with s_b): Taxing bequests raises $\tau_B b_y y_t$ from inheritors in my cohort but costs $\tau_B s_b \cdot (1-\tau_L)y_{Lt} = \tau_B s_b \cdot (1-\alpha-\tau+\tau_B b_y)y_t$ to what I leave to my child

b_y formula easier to calibrate with instantaneous variables than $r-g$ formula (see life-cycle extension)

OPTIMAL TAX DERIVATION (Part 1)

$$\max_{b_{t+1i}} V^i((1-\tau_L)y_{Lt}\theta_i - b_{t+1i}, b_{t+1i}, (1-\tau_B)e^{rH}b_{t+1i})$$

Effect of $d\tau_B > 0, d\tau_L < 0$ on V^i using envelope theorem

$$dV^i = -V_c^i y_{Lt}\theta_i d\tau_L - V_{\bar{b}}^i b_{t+1i}e^{rH}d\tau_B = V_c^i \left[-y_{Lt}\theta_i d\tau_L - \frac{d\tau_B}{1-\tau_B}\frac{s_{bi}}{s_i}b_{t+1i} \right]$$

Using budget balance equation and $b_{t+1i} = x_i b_t e^{gH}$, we get:

$$dV^i = d\tau_B e^{rH} b_t V_c^i \left[\theta_i \left(1 - e_B \frac{\tau_B}{1-\tau_B} \right) - \frac{(s_{bi}/s_i)x_i}{1-\tau_B} e^{-(r-g)H} \right]$$

Using no memory assumption $x_i \perp (s_{bi}/s_i)$ (and the fact that $\omega^i V_c^i$ is constant among zero-receivers):

$$\int_{zero\ receivers} \omega^i dV^i = 0 \;\Rightarrow\; \tau_B = \frac{1 - e^{-(r-g)H}(s_b/s)x_0}{1+e_B}$$

where $x_0 =$ mean (normalized) bequest left of zero-receivers

OPTIMAL TAX DERIVATION (Part 2)

Under no memory, zero-receivers have same s and y_{Lti} than average so relative bequests they leave is

$$x_0 = \frac{y_{Lt}(1-\tau_L)}{y_{Lt}(1-\tau_L) + b_t e^{rH}(1-\tau_B)}$$

$$\text{Using} \quad b_y = \frac{(1-\alpha)b_t e^{rH}}{y_{Lt}} = \frac{s(1-\alpha-\tau)e^{(r-g)H}}{1-se^{(r-g)H}}$$

$$\text{We get} \quad x_0 = 1-(1-\tau_B)se^{(r-g)H} \quad \text{hence}$$

$$\tau_B = \frac{1-e^{-(r-g)H}(s_b/s)x_0}{1+e_B} \;\Rightarrow\; \tau_B = \frac{1+s_b-(s_b/s)e^{-(r-g)H}}{1+s_b+e_B}$$

OPTIMAL TAX FOR z_p-RECEIVERS

Optimum tax rate for receivers at percentile p (of z distribution) is:

$$\tau_B = \frac{1 + s_b - (s_b/s)e^{-(r-g)H} - (1 + s_b + e_B + e_z)z_p}{(1 + s_b + e_B)(1 - z_p) - z_p e_z}$$

$\tau_B \downarrow$ with z_p as taxing bequests has a direct impact on inheritances received (e_z is elasticity of percentile z_p wrt $1 - \tau_B$)

Large inheritors ($z_p > 1$) want bequest subsidy as large as possible

Model allows double counting as taxing bequests hurts both donors (s_b terms) and inheritors (z_p terms)

Distribution of inheritances highly concentrated: bottom 50% inheritors receive 5% of inheritances $\Rightarrow$ Bottom 50%-receivers optimum close to zero-receivers optimum

OPTIMAL TAX FOR GENERAL SWF

Optimum tax rate is:

$$\tau_B = \frac{1 + s_b - (s_b/s)e^{-(r-g)H} - (1 + s_b + e_B)\bar{z}/\bar{\theta}}{(1 + s_b + e_B)(1 - \bar{z}/\bar{\theta})}$$

where $\bar{\theta}$ is average labor ability θ, $\bar{z}$ is average inheritance z received, all weighted by **social marginal welfare weights** $g_i = \omega^i V_c^i$

This formula nests all the previous ones but $\bar{\theta}$ and $\bar{z}$ are endogenous to τ_B

If $\bar{z} << \bar{\theta}$ then close to zero-receivers optimum

Perceptions about wealth inequality and mobility matter a lot:

If bottom receivers expect to leave large bequests, then they may prefer low bequest tax rates $\Rightarrow$ critical to estimate the right distributional parameters

EXTENSION: MEMORY

Suppose $s_i, s_{bi}/s_i, \theta_i$ are correlated within and across cohorts

Steady-state $b_y, \Psi(z,\theta)$ still exists under adequate ergodicity assumptions

Formula for b_y carries over but s is savings rate weighted by life-time resources $\tilde{y}_{ti} = (1-\tau_B)b_t z_i e^{rH} + (1-\tau_L)y_{Lt}\theta_i$

$$\Rightarrow b_y = \frac{b_t e^{rH}}{y_t} = \frac{s(1-\alpha-\tau)e^{(r-g)H}}{1-se^{(r-g)H}} \quad \text{with} \quad s = \frac{\int s_i \cdot \tilde{y}_{ti}}{\int \tilde{y}_{ti}}$$

Optimum tax formula becomes

$$\tau_B = \frac{1 + s_{b0} - (s_{b0}/s)e^{-(r-g)H}}{1 + s_{b0} + e_B}$$

with s_{b0} average of s_{bi} weighted by life-time resources **among zero-receivers**

EXTENSION: NONLINEAR BEQUEST TAX

Marginal tax rate τ_B above $b_t^* = \bar{x} b_t$ (and 0 below)

$$\text{Optimum} \quad \tau_B = \frac{1 - e^{-(r-g)H}(s_b/s)((x-\bar{x})_0^+/(x-\bar{x})^+)}{1 + a \cdot e_B^*}$$

where $a \simeq 1.5$ is Pareto parameter of bequest distribution

e_B^* is elasticity of taxable bequests with respect to $1 - \tau_B$

Rentier Society: x thicker tail than $\theta \Rightarrow$ zero receivers hardly ever leave bequests above $b_t^* = \bar{x} b_t$ then $\tau_B \simeq 1/(1 + a \cdot e_B^*)$ [revenue max. top rate]

Self-Made Wealth: zero receivers can build large fortunes (and love bequests) then $\tau_B < 1/(1 + a \cdot e_B^*)$

Note: fully nonlinear schedule is intractable (as local MTR change affects full bequest distribution in ergodic equilibrium)

EXTENSION: ELASTIC LABOR SUPPLY

Utility $\log V^i(c, b, \bar{b}) - h(l)$ with $y_{Lti} = \theta_i w_t l$

Aggregate labor supply has elasticity e_L wrt to $1 - \tau_L$

Tax reform $d\tau_L, d\tau_B$ with budget balance $\Rightarrow$:

$$-y_{Lt}\left(1 - e_L \frac{\tau_L}{1-\tau_L}\right) d\tau_L = d\tau_B b_t e^{rH} \left(1 - e_B \frac{\tau_B}{1-\tau_B}\right)$$

Easy to obtain the optimum tax τ_B:

$$\tau_B = \frac{1 + \left(1 - \frac{\tau e_L}{1-\alpha-\tau}\right)\left(s_b - (s_b/s)e^{-(r-g)H}\right)}{1 + s_b \cdot (1 + e_L) + e_B}$$

$\tau_B \uparrow$ with e_L as labor tax is more costly with $e_L > 0$ (if τ not too small)

Note that e_L, e_B are GE elasticities where both τ_B and τ_L change

EXTENSION: ELASTIC LABOR SUPPLY

$$\tau_B = \frac{1 + \left(1 - \frac{\tau e_L}{1-\alpha-\tau}\right)\left(s_b - (s_b/s)e^{-(r-g)H}\right)}{1 + s_b \cdot (1 + e_L) + e_B}$$

Race between e_L and e_B

0) Base Case: $r = 5\%, g = 3\%, H = 30, e^{-(r-g)H} = 40\%, \alpha = 30\%$, $\tau = 30\%$, $s_b = s = 10\%, b_y = 13\%$, $e_B = 0$, $e_L = 0$ $\Rightarrow \tau_B = 63\%$ (or $\tau_K = 66\%$) , $\tau_L = 31\%$

1) If $e_L = 0.5, e_B = 0 \Rightarrow \tau_B = 70\%$ (or $\tau_K = 80\%$), $\tau_L = 30\%$

2) If $e_L = 0, e_B = 0.5 \Rightarrow \tau_B = 43\%$ (or $\tau_K = 37\%$), $\tau_L = 35\%$

3) If $e_L = 0.5, e_B = 0.5 \Rightarrow \tau_B = 49\%$ (or $\tau_K = 45\%$), $\tau_L = 34\%$

Optimal τ_B now depends on τ (revenue requirement)

EXTENSION: LUMPSUM DEMOGRANT

Assume bequest taxes fund a demogrant universal transfer $E_t = E_0 e^{gHt}$ Government budget

$$\tau_B b_t e^{rH} = E_t \quad \text{and} \quad \tau_L y_{Lt} = \tau y_t \quad \text{fixed}$$

Assume that $d\tau_B > 0$ is used to fund $dE > 0$ then zero-receivers optimum (assuming inelastic labor supply) is:

$$\tau_B = \frac{1 + s_b - (s_b/s)e^{-(r-g)H}}{1 + s_b + e_B}$$

Same formula as before as govt does not value redistribution within zero-receivers (for general SWF, just replace $\bar{\theta}$ by 1 in formula)

With elastic labor supply, get a formula that involves labor supply income effects

EXTENSION: CLOSED ECONOMY

Suppose economy is closed and capital stock is supplied by inheritances

Production $F(b_t, L_t) = Rb_t + wL_t$ with return $R = F_K$ and wage $w = F_L$ endogenous

After-tax price of factors $1 + \bar{R} = (1 + R)(1 - \tau_B)$ and $\bar{w} = w \cdot (1 - \tau_L)$

$\Rightarrow \tau_B, \tau_L$ allow government to fully control after-tax prices

$\Rightarrow$ Optimal tax formulas continue to apply as in open economy with e_B, e_L being the supply elasticities (keeping R and w fixed) as in the standard Diamond-Mirrlees (1971) model

EXTENSION: LIFE CYCLE

Possible to extend model to continuous overlapping generations with life duration D and utility $V(U, b, \bar{b})$ with

$$U = \left[\int_0^D e^{-\delta t} c_t^{1-\gamma} dt \right]^{\frac{1}{1-\gamma}} \Rightarrow V(U, b, \bar{b}) = V(\mu \tilde{c}, b, \bar{b})$$

with $\tilde{c} =$ capitalized lifetime consumption (at end of life)

Individual budget: $\tilde{c} + b_{t+Hi} = (1 - \tau_B) b_t e^{rH} + (1 - \tau_L) \tilde{y}_{Lti}$

Govt budget **continuously** balanced: $\tau_L Y_{Lt} + \tau_B B_t = \tau Y_t$

$$\text{Optimal} \quad \tau_B = \frac{1 + s_b/\lambda - (s_b/(\lambda \cdot s))e^{-(r-g)H}}{1 + s_b/\lambda + e_B}$$

Replace s_b by s_b/λ where λ is an exogenous factor correcting for when inheritances are received relative to labor income: $\lambda = 1$ if inheritances are **realistically** received in mid-adult life ($\lambda > 1$ if before mid-life)

EXTENSION: LIFE CYCLE AND TIMING OF TAXES

Optimal τ_B in discrete model depends on timing of taxes in govt budget

$$(0) \quad \tau_L y_{Lt} + \tau_B b_t e^{rH} = \tau y_t \quad \text{vs.} \quad (1) \quad \tau_L y_{Lt} + \tau_B b_{t+1} = \tau y_t$$

(0) was our initial model, (1) leads to a formula for τ_B where s_b is replaced by $s_b e^{(r-g)H}$ (hence τ_B much lower)

No good way to decide between (0) and (1) in discrete model

Life cycle model with realistic continuous budget balance and empirically realistic $\lambda = 1$ implies that (0) is the correct specification

GOVT. DEBT AND CAPITAL ACCUMULATION

Suppose govt maximizes inter-temporal, infinite-horizon SWF

In closed economy, optimum capital stock should be given by modified Golden Rule:

$$f'(k) = r^* = \delta + \Gamma g$$

where $\delta \geq 0$ is discount rate of government, Γ is curvature of SWF, and g is growth rate

If govt can use debt, then govt can achieve modified Golden Rule (for any tax structure)

In that case, long-run optimal τ_B is given by a formula similar to static one (when $\delta \to 0$): capital accumulation is **orthogonal** to redistributive bequest taxation

If govt cannot use debt, capital stock may be too large or too small and optimal formula for τ_B needs to be corrected

FROM INHERITANCE TAX TO LIFETIME K TAX

1) With perfect K markets, it's always better to have a big tax τ_B on bequest, and zero lifetime capital tax $\tau_K = 0$, so as to avoid inter-temporal distortion

2) However in the real world most people prefer paying a property tax of 1% during 30 years rather than a big bequest tax $\tau_B = 30\%$

3) Total K taxes = 9% GDP, but bequest tax $< 1\%$ GDP

4) In our view, the collective choice in favor of lifetime K taxes is a rational consequence of K markets imperfections, not necessarily of tax illusion

FUZZY FRONTIER BT CAPITAL AND LABOR

Tax τ_K on generation return R, net bequest is

$$\bar{b}_{ti} = b_{ti}(1-\tau_B)(1+R(1-\tau_K)) \quad \text{with} \quad R = e^{rH} - 1$$

τ_B, τ_K is equivalent to $\bar{\tau}_B, \tau_K = 0$ with

$$\bar{\tau}_B = \tau_B + (1-\tau_B)\tau_K \frac{R}{1+R}$$

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

With fully fuzzy frontier, then govt has to set $\tau_K = \tau_L$ (capital income tax rate = labor income tax rate)

Adjust τ_B down to keep total tax $\bar{\tau}_B$ the same as before

Bequest tax $\tau_B > 0$ is optimal iff $\bar{\tau_B}$ sufficiently large $\Rightarrow$ comprehensive income tax + bequest tax = what we observe in many countries

UNINSURABLE UNCERTAINTY IN RETURN R

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 years (idiosyncratic risk + aggregate uncertainty)

$\Rightarrow$ with uninsurable idiosyncratic shocks on returns r_{ti}, more efficient to split the tax burden between one-off transfer taxes and lifetime capital taxes

With no moral hazard on r_{ti}, 100% tax on r_{ti} (and corresponding reduction in τ_B) is optimal

MORAL HAZARD IN RATE OF RETURN R

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

With: $\varepsilon_{ti} =$ 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 close to zero

Conversely if effort matters a lot, then e_R large

MORAL HAZARD IN RATE OF RETURN R

Depending on parameters, optimal capital income tax rate τ_K can be $>$ or $<$ than labor income tax rate τ_L

If e_R small enough and/or by large enough, then $\tau_K > \tau_L$ (=what we observe in UK and US during the 1970s)

Examples: $\tau = 30\%, \alpha = 30\%, s = s_b = 10\%, r = 4\%, g = 2\%, e_B = e_L = 0$

If $e_R = 0$, then $\tau_K = 100\%, \tau_B = 9\%, \tau_L = 34\%$

If $e_R = 0.1$, then $\tau_K = 78\%, \tau_B = 35\%, \tau_L = 35\%$

If $e_R = 0.5$, then $\tau_K = 17\%, \tau_B = 56\%, \tau_L = 37\%$

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 distortions exist but are probably second-order)

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

a) r is large: $r > g \Rightarrow$ tax inheritance, otherwise society is dominated by rentiers

b) r is volatile and unpredictable $\Rightarrow$ use lifetime K taxes to implement optimal inheritance tax