Capital Taxation

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GOALS OF THIS LECTURE

(1) Understand basic concepts about capital income, savings, and wealth.

(2) Theory of capital taxation: series of (quite different) models.

(3) New model: A simpler framework for optimal capital tax theory

MOTIVATION

1) Capital income is about 25% of national income (labor income is 75%) but distribution of capital income is much more unequal than labor income

Capital income inequality is due to differences in savings behavior but also inheritances received

$\Rightarrow$ Equity suggests it should be taxed more than labor

2) Capital Accumulation correlated strongly with growth [although causality link is not obvious] and capital accumulation might be sensitive to the net-of-tax return.

$\Rightarrow$ Efficiency cost of capital taxation might be high.

MOTIVATION

3) Capital more mobile internationally than labor

Key distinction is **residence** vs. **source** base capital taxation:

Residence: Capital income tax based on residence of owner of capital.

Most individual income tax systems are residence based (with credits for taxes paid abroad)

Incidence falls on owner $\Rightarrow$ can only escape tax through evasion (tax heavens) or changing residence (mobility of persons)

Tax evasion of capital income through tax heavens is a very serious concern (Zucman QJE'13, '15)

Source: Capital income tax based on location of capital (most corporate income tax systems are source based)

Incidence is then partly shifted to labor if capital is mobile.

Example: 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 is fixed by the international rate of return r^* so that $(1 - \tau_c)F_K(K, L) = (1 - \tau_c)f'(k) = r^*$ where $k = K/L$ is capital stock per worker and τ_c corp tax rate

As $wL + r^*K = F(K, L)$, wage $w = F_L(K, L) = f(k) - r^* \cdot k$ falls with τ_c

4) Capital taxation is extremely complex and provides many tax avoidance opportunities

SAVING FLOWS

Saving is a flow and wealth or net worth is a stock

Three saving flows:

1) **Personal saving:** individual income less individual consumption [fell dramatically in the US since 1980s, recent ↑ since 2008]

2) **Corporate Saving:** retained earnings = after tax profits - distributions to shareholders

3) **Government Saving:** Taxes - Expenditures [federal, state and local]

Taxes on savings might affect different savings flows differently: savings subsidy through a tax credit can ↑ individual savings but ↓ govt saving [if govt spending stays constant]

WEALTH AND CAPITAL INCOME IN AGGREGATE

Definition: Capital Income = Returns from Wealth Holdings

Aggregate US **Personal** Wealth $\simeq$ 4*GDP $\simeq$ \$60 Tr

Tangible assets: residential real estate (land+buildings) [income = rents] and unincorporated business + farm assets [income = profits]

Financial assets: corporate stock [income = dividends + retained earnings], fixed claim assets (corporate and govt bonds, bank accounts) [income = interest]

Liabilities: Mortgage debt, Student loans, Consumer credit debt

Substantial amount of financial wealth is held indirectly through: pension funds [DB+DC], mutual funds, insurance reserves

INDIVIDUAL WEALTH AND CAPITAL INCOME

Wealth = W, Return = r, Capital Income = rW

$$W_t = W_{t-1} + r_t W_{t-1} + E_t + I_t - C_t$$

where W_t is wealth at age t, C_t is consumption, E_t labor income earnings (net of taxes), r_t is the average (net) rate of return on investments and I_t net inheritances (gifts received and bequests minus gifts given).

Replacing W_{t-1} and so on, we obtain the following expression (assuming initial wealth W_0 is zero):

$$W_t = \sum_{k=1}^{t} (E_k - C_k + I_k) \prod_{j=k+1}^{t} (1 + r_j)$$

INDIVIDUAL WEALTH AND CAPITAL INCOME

$$W_t = \sum_{k=1}^{t}(E_k - C_k) \prod_{j=k+1}^{t}(1+r_j) + \sum_{k=1}^{t} I_k \prod_{j=k+1}^{t}(1+r_j)$$

1st term is **life-cycle** wealth, 2nd term is **inheritance** wealth

Differences in Wealth and Capital income due to:

1) Age

2) past earnings, and past saving behavior $E_t - C_t$ [life cycle wealth]

3) Net Inheritances received I_t [transfer wealth]

4) Rates of return r_t

[details in Davies-Shorrocks '00, Handbook chapter]

WEALTH DISTRIBUTION

Wealth inequality is very large (much larger than labor income)

US Household Wealth is divided 1/3,1/3,1/3 for the top 1%, the next 9%, and the bottom 90% [bottom 1/2 households hold almost no wealth]

Financial wealth is more unequally distributed than (net) real estate wealth

Share of real estate wealth falls at the top of the wealth distribution

Growth of private pensions [such as 401(k) plans] has "democratized" stock ownership in the US

WEALTH MEASUREMENT

In the US, wealth distribution much less well measured than income distribution because no systematic administrative source (no wealth tax). 3 methods to estimate wealth distribution:

1) Surveys: US Survey of Consumer Finances (SCF)

Top 10% wealth share has grown from 67% in 1989 to 75% in 2010

Top 1% wealth share has grown "only" from 30% in 1989 to 35% in 2010 [Kennickell '09, '12]

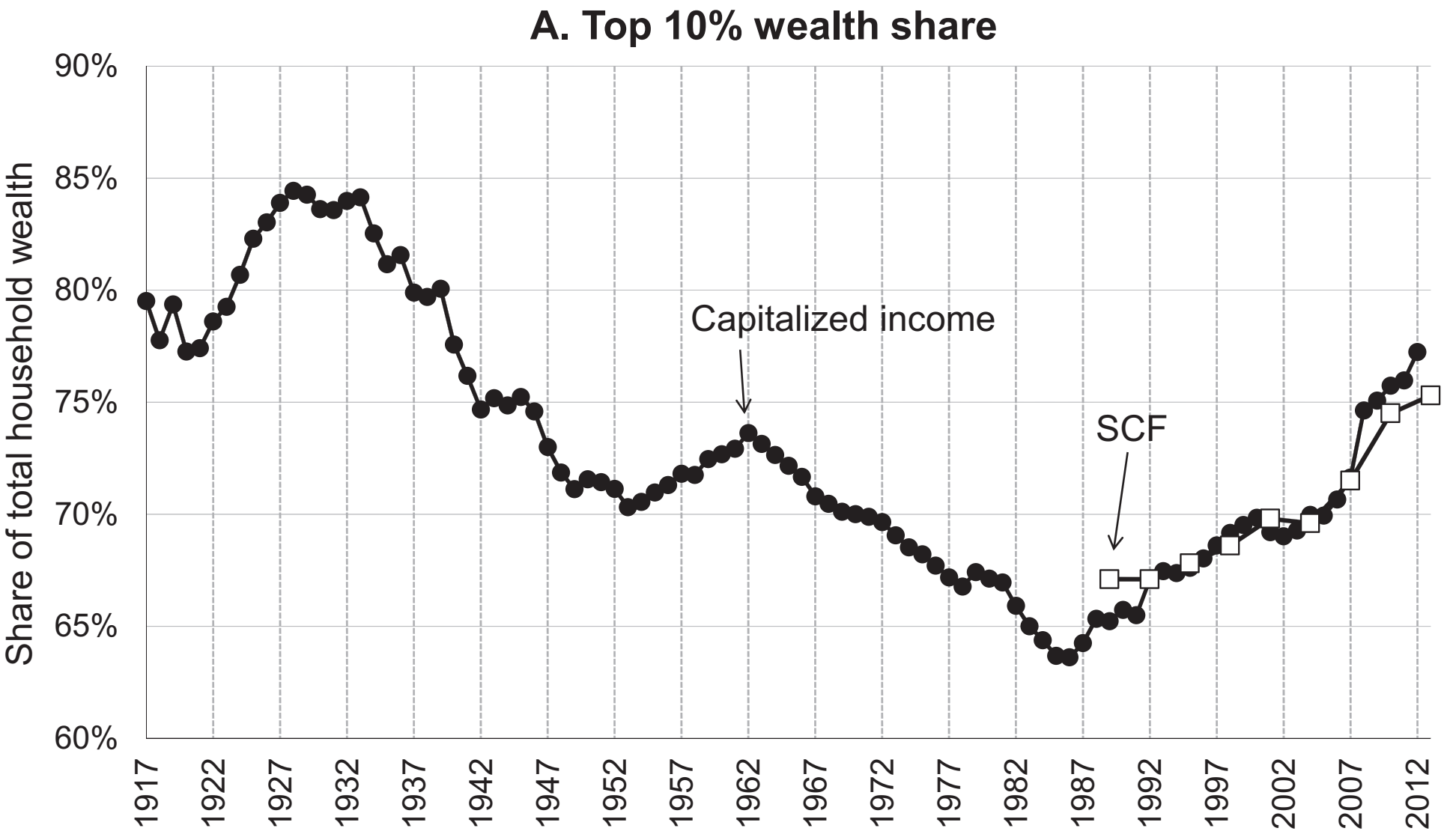
Problems: small sample size, measurement error, only every 3 years, starts in 1989

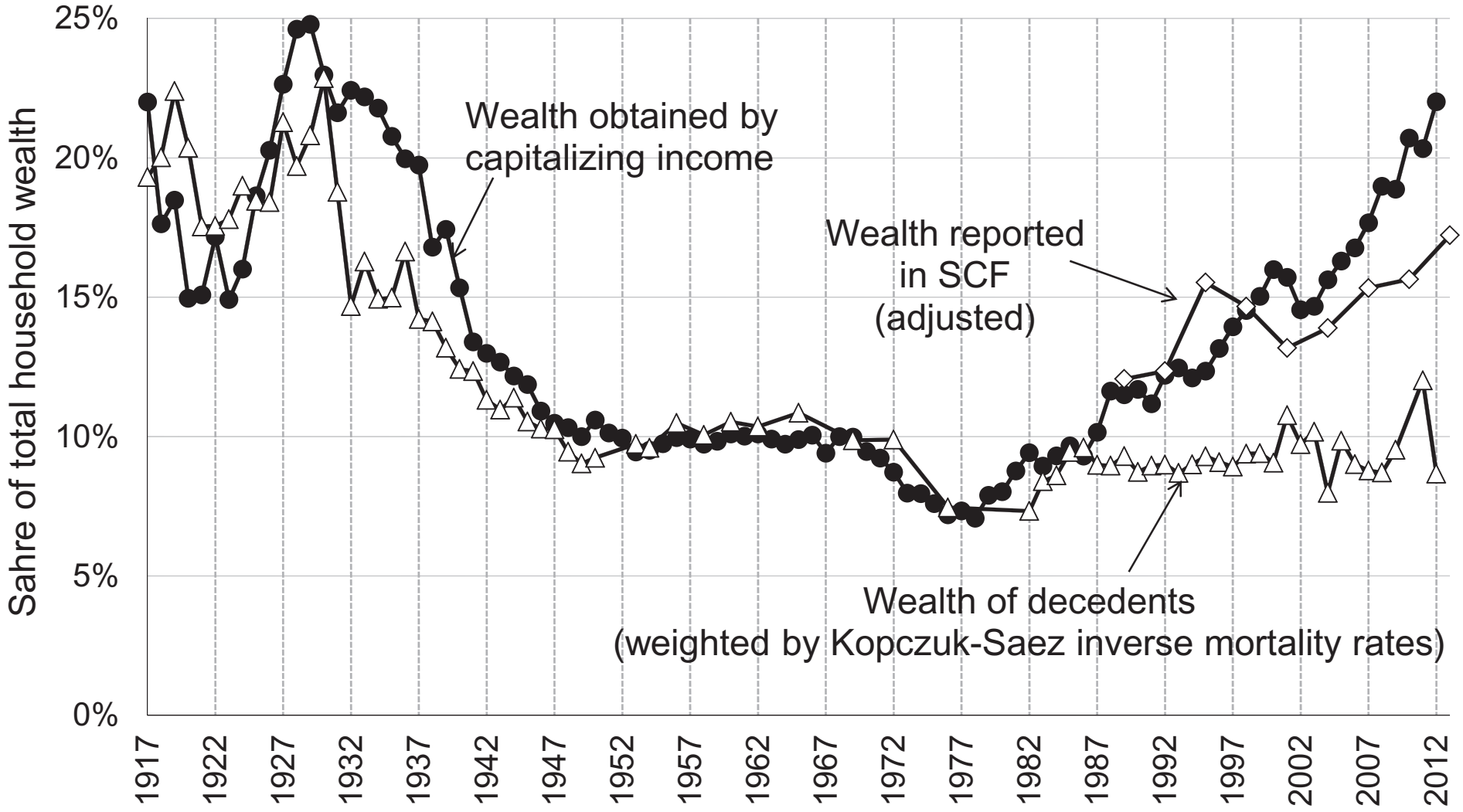
2) Estate multiplier method: use annual estate tax statistics and re-weights individual estates by inverse of death probability [based on age×gender×social class]

Kopczuk-Saez NTJ'04 create series 1916-2000 and find fairly small increases in wealth concentration in recent decades

Problems: social class effect on mortality not well known, significant estate tax avoidance, noisy measure of "young wealth", estates cover only the super rich (top .1% in recent years)

3) Capitalization method: use capital income from individuals tax statistics and estimates rates of returns by asset class to infer wealth: shows big increase in wealth concentration [Saez-Zucman '16]


A. Top 10% wealth share
Share of total household wealth
90%
85%
80%
75%
70%
65%
60%
Capitalized income
SCF
1917
1922
1927
1932
1937
1942
1947
1952
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
2012


A. Top 0.1% wealth share: comparison of estimates
Sahre of total household wealth
25%
20%
15%
10%
5%
0%
1917
1922
1927
1932
1937
1942
1947
1952
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
2012
Wealth obtained by capitalizing income
Wealth reported in SCF (adjusted)
Wealth of decedents (weighted by Kopczuk-Saez inverse mortality rates)

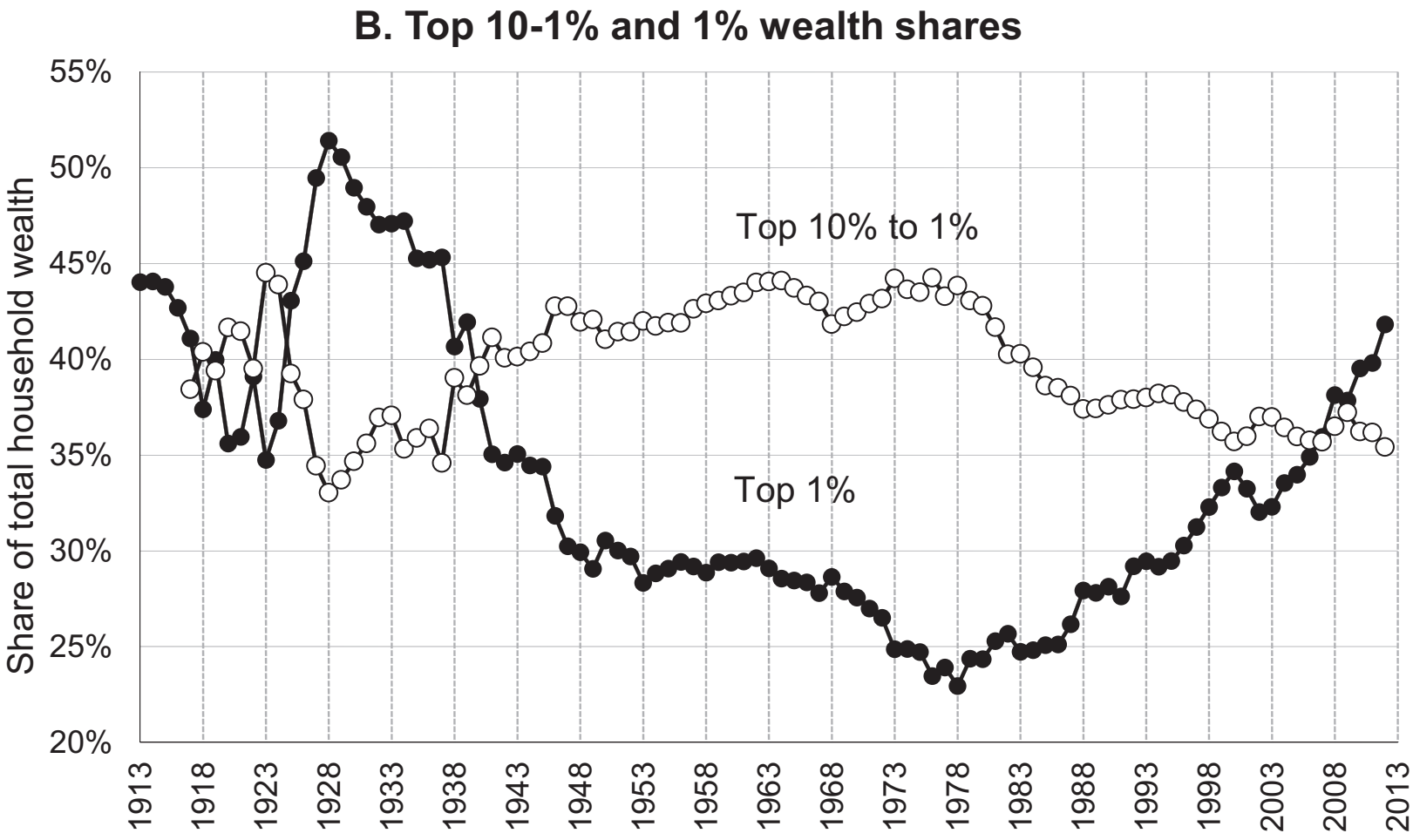
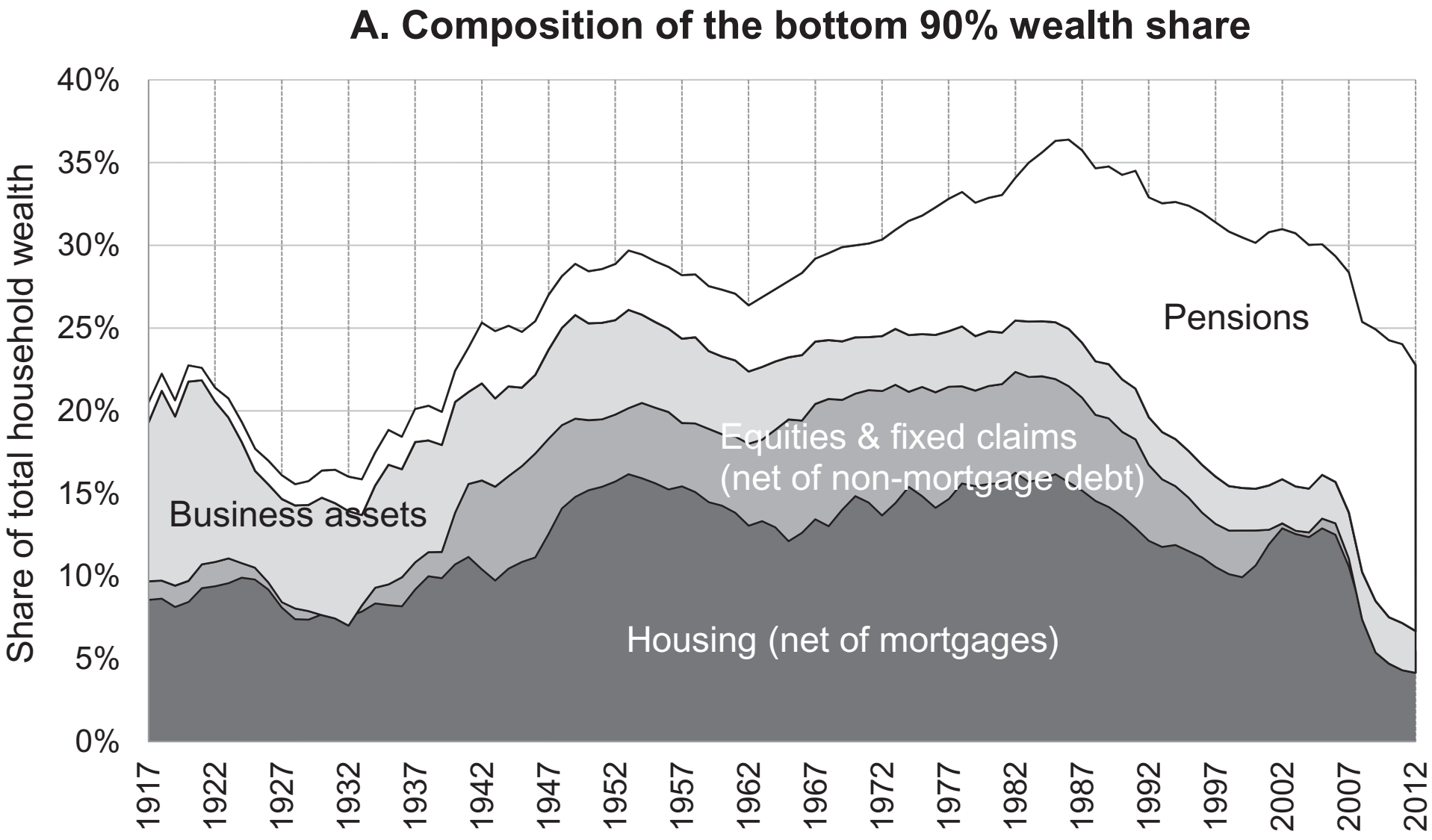


FIGURE VI

Top Wealth Shares in the United States, 1913–2012


A. Composition of the bottom 90% wealth share
Share of total household wealth
40%
35%
30%
25%
20%
15%
10%
5%
0%
1917
1922
1927
1932
1937
1942
1947
1952
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
2012
Pensions
Equities & fixed claims
(net of non-mortgage debt)
Business assets
Housing (net of mortgages)

CAPITAL TAXATION IN THE US

Good US references: Gravelle '94 book, Slemrod-Bakija '04 book

1) **Corporate Income Tax** (fed+state): 21% Federal tax rate on profits of corporations [complex rules with many industry specific provisions]: effective tax rate much lower and incidence depends on mobility of capital

2) **Individual Income Tax** (fed+state): taxes many forms of capital income

Realized capital gains and dividends (dividends since '03 only) receive preferential treatment

Imputed rent of home owners, returns on pension funds, state+local government bonds interest are exempt

FACTS OF US CAPITAL INCOME TAXATION

3) **Estate and gift taxes:**

Fed taxes estates above $11.2M exemption for singles and $22.4M for married, tax rate is 40% above exemption.

Charitable and spousal giving is exempt

Substantial tax avoidance activity through tax accountants

Step-up of realized capital gains at death (lock-in effect)

4) **Property taxes** (local) on real estate (old tax):

Tax varies across jurisdictions. About 0.5% of market value on average, like a 10% tax on imputed rent if return is 5%

Lock-in effect in states that use purchase price base such as California

TAXES IN OLG LIFE-CYCLE MODEL

$\max \; U = u(c_1, l_1) + \delta u(c_2, l_2)$

No tax situation: earn $w_1 l_1$ in period 1, $w_2 l_2$ in period 2

Savings $s = w_1 l_1 - c_1$, $c_2 = w_2 l_2 + (1 + r)s$

Capital income rs

Intertemporal budget with no taxes:

$c_1 + c_2/(1 + r) \leq w_1 l_1 + w_2 l_2/(1 + r)$

This model has uniform rate of return and does not capture excess returns

TAXES IN OLG MODEL

Budget with consumption tax t_c:

$$(1 + t_c)[c_1 + c_2/(1 + r)] \leq w_1 l_1 + w_2 l_2/(1 + r)$$

Budget with labor income tax τ_L:

$$c_1 + c_2/(1 + r) \leq (1 - \tau_L)[w_1 l_1 + w_2 l_2/(1 + r)]$$

Consumption and labor income tax are equivalent if

$$1 + t_c = 1/(1 - \tau_L)$$

Both taxes distort only labor-leisure choice

TAXES IN OLG MODEL

Budget with capital income tax τ_K:

$$c_1 + c_2/(1 + r(1 - \tau_K)) \leq w_1 l_1 + w_2 l_1/(1 + r(1 - \tau_K))$$

τ_K distorts only inter-temporal consumption choice

Budget with comprehensive income tax τ:

$$c_1 + c_2/(1 + r(1 - \tau)) \leq (1 - \tau)[w_1 l_1 + w_2 l_2/(1 + r(1 - \tau))]$$

τ distorts both labor-leisure and inter-temporal consumption choices

τ imposes "double" tax: (1) tax on earnings, (2) tax on savings

EFFECT OF r ON SAVINGS

Assume that labor supply is fixed. Suppose $r \uparrow$:

1) Substitution effect: price of $c_2 \downarrow \Rightarrow c_2 \uparrow$, $c_1 \downarrow \Rightarrow$ savings $s = w_1 l_1 - c_1 \uparrow$.

2) Wealth effect: Price of $c_2 \downarrow \Rightarrow$ both c_1 and $c_2 \uparrow \Rightarrow$ save less

3) Human wealth effect: present discounted value of labor income $\downarrow \Rightarrow$ both c_1 and $c_2 \downarrow \Rightarrow$ save more

Note: If $w_2 l_2 < c_2$ (ie $s > 0$), 2)+3) $\Rightarrow$ save less

Total net effect is theoretically ambiguous $\Rightarrow \tau_K$ has ambiguous effects on s

SHIFT FROM LABOR TO CONSUMPTION TAX

Labor and consumption are equivalent for the individual if $1 + t_c = 1/(1 - \tau_L)$ but savings pattern is different

Assume $w_2 = 0$ and $l_1 = 1$

$(1 + t_c)[c_1 + c_2/(1 + r)] = w_1$ with consumption tax

$c_1 + c_2/(1 + r) = (1 - t_L)w_1$ with labor tax

1) Consumption tax t_c: $c_1^c = (w_1 - s_c)/(1 + t_c)$, $c_2^c = (1 + r)s_c/(1 + t_c)$

2) Labor income tax τ_L: $c_1^L = w_1(1 - \tau_L) - s_L$, $c_2^L = (1 + r)s_L$

Same consumption in both cases so $s_L = s_c/(1 + t_c) \Rightarrow$ Save more with a consumption tax

OPTIMAL CAPITAL INCOME TAXATION

Complex problem with many sub-literatures: Banks and Diamond Mirrlees Review '09 provide recent survey

1) Life-cycle models [linear and non-linear earnings tax]

2) Models with bequests [many models including the infinite horizon model]

3) Models with future earnings uncertainty: New Dynamic Public Finance [Kocherlakota '09 book] (will cover this later).

Bigger gap between theory and policy practice than in the case of static labor income taxation

4) Saez and Stantcheva (2016) "A Simpler Theory of Optimal Capital Taxation"

Life-Cycle model: Atkinson-Stiglitz JpubE '76

Heterogeneous individuals and government uses nonlinear tax on earnings. Should the govt also use tax on savings?

$V^h = \max U^h(v(c_1, c_2), l)$ st $c_1 + c_2/(1 + r(1 - \tau_K)) = wl - T_L(wl)$

If utility is weakly separable and $v(c_1, c_2)$ is the same for all individuals, then the government should use only labor income tax and should not use tax on savings

E.g.: $v(c_1, c_2) = u(c_1) + \frac{u(c_2)}{1+\delta}$

Tax on savings justified within Saez (2002) framework if:

(1) High skill people have higher taste for saving (e.g, high skill people have lower discount rate, better education)

(2) c_2 is complementary with leisure.

(3) Inheritances (won't have same consumption patterns conditional on earned income).

INFINITE HORIZON MODEL: CHAMLEY-JUDD

Govt can collect taxes using linear labor income tax or capital income taxes that vary period by period τ_L^t, τ_K^t

Goal of the government is to maximize utility of the dynasty

$$V_0 = \sum_t u(c_t, l_t)/(1+\delta)^t \text{ st} \quad \sum_t q_t c_t \leq \sum_t q_t w_t (1-\tau_L^t) l_t + A_0 \quad (\lambda)$$

$q_0 = 1$, ..., $q_t = 1/\prod_{s=1}^t (1 + r_s(1-\tau_K^s))$, ...

With constant tax rate τ_K and constant r: Before tax price: $p_t = 1/(1+r)^t$ and after-tax price $q_t = 1/(1+r(1-\tau_K))^t \Rightarrow$

Price distortion q_t/p_t grows exponentially with time

CHAMLEY-JUDD: RESULTS

Chamley-Judd show that the capital income tax rate always tends to zero asymptotically: no capital tax in the long-run:

Two equivalent ways to understand this result:

(1) A constant tax on capital income creates an exponentially growing distortion which is inefficient

(2) The PDV of the capital income tax base is infinitely elastic with respect to an increase in τ_K in the distant future [Piketty-Saez '13]

Intuition: $u_c(c_{t+1})/u_c(c_t) = (1+\delta)/(1+r(1-\tau_K)) \Rightarrow$ savings decisions infinitely elastic to $r(1-\tau_K)-\delta$

If $r(1-\tau_K) > \delta$, accumulate forever. If $r(1-\tau_K) < \delta$, get in debt as much as possible.

ISSUES IN INFINITE HORIZON MODEL

1) Taxing initial wealth is most efficient [as this is lumpsum taxation] $\Rightarrow$ solutions typically bang-bang: tax capital as much as possible early, then zero

2) Chamley-Judd tax is not time consistent: the government would like to renege and start taxing capital again

3) Zero-long run tax result is not robust to using progressive income taxation [Piketty, '01, Saez JpubE'13]

4) Dynastic model requires strong homogeneity assumptions (in discount rates) to generate reasonable steady states [unlikely to hold in practice. Saez and Stantcheva JPubE'18]

5) Introducing stochastic shocks in labor/preferences in dynastic model leads to finite elasticities (and reasonable optimal tax rates) [Piketty-Saez ECMA'13]

A Simpler Model of Capital Taxation

For exposition: Exogenous and uniform labor income z

Heterogeneous discount rate δ_i (assume $\delta_i > r$)

Exogenous and uniform rate of return r on wealth k, income: rk

Time invariant tax $T_K(rk)$

Initial wealth k_i^{init}, exogenous.

Individual i has instantaneous utility $u_i(c, k) = c + a_i(k)$

linear in consumption c and increasing and concave in wealth k.

Maximizes:

$$U_i = \delta_i \cdot \int_{t=0}^{\infty} [c_i(t) + a_i(k_i(t))] e^{-\delta_i t}$$

$$\text{s.t. } \frac{dk_i(t)}{dt} = rk_i(t) - T_K(rk_i(t)) + z_i(t) - c_i(t)$$

Solving the Individual's Maximization Problem

$$U_i = \delta_i \cdot \int_{t=0}^{\infty} [c_i(t) + a_i(k_i(t))] e^{-\delta_i t}$$

$$\text{s.t. } \frac{dk_i(t)}{dt} = rk_i(t) - T_K(rk_i(t)) + z_i(t) - c_i(t)$$

Hamiltonian: $c_i(t) + a_i(k_i(t)) + \lambda_i(t) \cdot [rk_i(t) - T_K(rk_i(t)) + z_i(t) - c_i(t)]$

$$\text{FOC in } c_i(t): \quad \lambda_i(t) = 1 \Rightarrow \text{ constant multiplier}$$

$$\text{FOC in } k_i(t): \quad a_i'(k_i(t)) + \lambda_i(t) \cdot r \cdot (1 - T_K') = -\frac{d\lambda_i(t)}{dt} + \delta_i \cdot \lambda_i(t)$$

$$\Rightarrow a_i'(k_i(t)) = \delta_i - \bar{r} \quad \text{where} \quad \bar{r} = r \cdot (1 - T_K')$$

Steady State

Utility for wealth puts limit on impatience to consume ($\delta_i > \bar{r}$)

MU for wealth $a_i'(k) = \delta_i - \bar{r}$ = value lost in delaying consumption

Wealth accumulation depends on heterogeneous preferences $a_i(\cdot), \delta_i$, and net-of-tax return $\bar{r}$ (substitution effects, no income effects)

$\Rightarrow$ Heterogeneity in (non-degenerate) steady-state wealth.

At time 0: jump from k_i^{init} to $k_i(t)$ (consumption quantum Dirac jump):

$$U_i = \underbrace{rk_i(t) - T_K(rk_i(t)) + z_i(t)}_{c_i(t)} + a_i(k_i(t)) + \delta_i \cdot (k_i^{init} - k_i(t))$$

Dynamic model equivalent to a static model:

$$U_i = c_i + a_i(k_i) + \delta_i \cdot (k_i^{init} - k_i) \quad \text{with} \quad c_i = rk_i - T_K(rk_i) + z_i$$

Announced vs. unannounced tax reforms have same effect.

Isomorphism with Static Labor Taxation Model

$$U_i = c_i + a_i(k_i) + \delta_i \cdot (k_i^{init} - k_i) \quad \text{with} \quad c_i = rk_i - T_K(rk_i) + z_i$$

is mathematically isomorphic to static labor income model:

$$U_i = c_i - h_i(z_i) \quad \text{with} \quad c_i = z_i - T_L(z_i)$$

Optimal K tax analysis isomorphic to optimal L income tax theory.

- Differences of degree rather than of kind, quantitative differences.
- Key differences (e.g.: uncertainty, shocks to productivity vs. taste) reflected in estimable elasticities.
- In general model, slow adjustment will be reflected in lower elasticity.

Bypasses transitional dynamics, greatly simplifies K tax analysis

- Like labor supply decisions (not instantaneous, e.g. human capital investment).

Government Optimization

Government sets a time invariant budget balanced $T_K(\cdot)$ to maximize its social objective

$\int_i g_i \cdot U_i(c_i, k_i)di$ with $g_i \geq 0$ social marginal welfare weight

Optimal $T_K(\cdot)$ depends on three key ingredients:

(1) Social preferences: g_i = value of \$1 extra given to i ($\int_i g_i = 1$).

(2) Efficiency costs: Elasticitiy $e_K = (\bar{r}/k) \cdot (dk/d\bar{r})$ measures how wealth k responds to $\bar{r} = r \cdot (1 - T_K')$

(3) Distribution of capital income: $H_K(rk)$ (for nonlinear tax).

Optimal Linear Capital Taxation at rate τ_K

$k^m(\bar{r}) \equiv \int_i k_i di$ average wealth (depends on $\bar{r}$ with elasticity e_K).

Revenues $\tau_K k^m(\bar{r})$ rebated lump-sum.

τ_K maximizes $SWF = \int_i g_i \cdot U_i(c_i, k_i) di$ with

$$U_i = \underbrace{rk_i \cdot (1 - \tau_K) + \tau_K \cdot rk^m(\bar{r}) + z_i}_{c_i} + a_i(k_i) + \delta_i \cdot (k_i^{init} - k_i)$$

Standard optimal tax derivation (using envelope thm for k_i):

$$\frac{dSWF}{d\tau_K} = rk^m \cdot \underbrace{\int_i g_i \cdot \left(1 - \frac{k_i}{k^m}\right)}_{\text{Mechanical Revenue net of Welfare Effect}} - rk^m \cdot \underbrace{\frac{\tau_K}{1 - \tau_K} \cdot e_K}_{\text{Behavioral Effect}}$$

Optimal τ_K such that $dSWF / d\tau_K = 0$.

Optimal Linear Capital Tax τ_K

$$\tau_K = \frac{1 - \bar{g}_K}{1 - \bar{g}_K + e_K} \quad \text{with} \quad \bar{g}_K = \frac{\int_i g_i \cdot k_i}{\int_i k_i} \quad \text{and} \quad e_K = \frac{\bar{r}}{k^m} \cdot \frac{dk^m}{d\bar{r}} > 0$$

Zero capital tax result: $\tau_K = 0$ only if:

$\bar{g}_K = 1$ (no inequality in rk, or no redistributive concerns $g_i \equiv 1$), or

$e_K = \infty$.

$\tau_K > 0$ as long as g_i decreasing in k_i, or wealth concentrated among low g_i agents.

$\tau_K = 1/(1 + e_K)$ is revenue-maximizing in Rawlsian case: $g_i = 0$ if $k_i > 0$.

Top revenue maximizing rate: $\tau_K = 1/(1 + a_K^{top} \cdot e_K^{top})$ with a_K^{top} the Pareto tail parameter for top bracket.

Optimal Nonlinear Capital Tax

$$T'_K(rk) = \frac{1 - \bar{G}_K(rk)}{1 - \bar{G}_K(rk) + \alpha_K(rk) \cdot e_K(rk)}$$

1) $\bar{G}_K(rk) \equiv \frac{\int_{\{i:rk_i \geq rk\}} g_i d_i}{P(rk_i \geq rk) \int_i g_i di}$ is the average g_i above capital income level rk

2) $\alpha_K(rK)$ the local Pareto parameter of capital income distribution

3) $e_K(rk)$ the local elasticity of k wrt to $1 - T'_K(rk)$ at income level rk

Capital income is very concentrated (top 1% capital income earners have 60%+ of total capital income)
$\Rightarrow$ Asymptotic formula:
$T'_K(\infty) = (1 - G_K(\infty))/(1 - G_K(\infty) + \alpha_K(\infty) \cdot e_K(\infty))$ relevant for most of the tax base

Equity Considerations: The Ant and the Grasshopper

Credit: Adelya Tumasyeva

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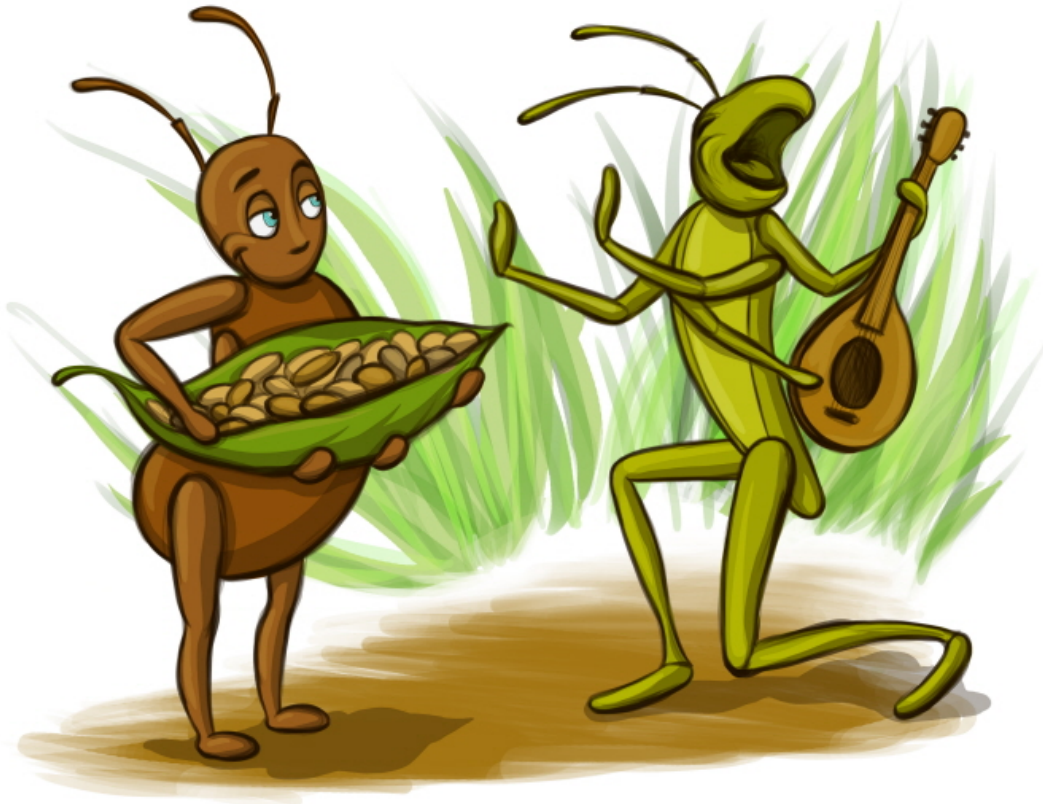

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Equity Considerations for Capital Taxation: Generalized Welfare Weights

(1) Inequality in wealth deemed fair and wealth is not a tag

Equality of opportunity argument: grasshopper had same savings opportunities as ant, conditional on labor earnings.

Capital accumulated by sacrificing consumption, why punish saving behavior?

What if ant had higher work (grain harvesting) ability? $\rightarrow$ role for nonlinear labor income tax.

$\rightarrow g_i$ independent of and uncorrelated with $k_i \rightarrow \tau_K = 0$.

Equity Considerations for Capital Taxation: Generalized Welfare Weights

(2) Inequality in wealth viewed as unfair

Even conditional on labor earnings, high wealth comes from higher patience δ_i or higher valuation of wealth a_i – unfair heterogeneity, like earnings ability.

or parental wealth (k_i^{init}) – ant's parents left extra grain.

or higher returns r_i (luck) – ant speculated on grain-forward derivatives.

$\rightarrow g_i$ decreasing in $k_i \rightarrow \tau_K > 0$.

Equity Considerations for Capital Taxation: Generalized Welfare Weights

(3) Wealth as a tag

May or may not care about k per se (g_i may not depend on k_i directly).

But wealth may be tag for aspects that enter g_i negatively: parental background (see Saez-Stantcheva), ability.

Having more grain means more likely to come from rich family.

$\bar{G}_K(rk)$ is representation index of agents from poor background at income rk.

$\rightarrow corr(g_i, k_i) < 0 \rightarrow \tau_K > 0$.

Different Types of Capital Assets

Could have $\neq$ elasticities (housing vs. financial assets)

Different social judgments or distributional characteristics $\bar{g}_K^j$.

Formulas hold asset by asset, determined by: $\bar{g}_K^j$, e_K^j, and cross-elasticities $e_{K^s,(1-\tau_K^j)}$.

$$\tau_K^j = \frac{1 - \bar{g}_K^j}{1 - \bar{g}_K^j + e_K^j}$$

$$\bar{g}_K^j = \frac{\int_i g_i \cdot k_i^j}{\int_i k_i^j}, \quad e_K^j = \frac{\bar{r}^j}{k^{m,j}} \cdot \frac{dk^{m,j}}{d\bar{r}^j} > 0, \quad e_{K^s,(1-\tau_K^j)} = \frac{\bar{r}^j}{k^{m,s}} \cdot \frac{dk^{m,s}}{d\bar{r}^j}$$

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