# 230B: Public Economics
# Capital Taxation

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# 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 $\tau_c$ corp tax rate

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

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

# MACRO FRAMEWORK

Constant return to scale aggregate production:

$Y = F(K, L) = rK + wL =$ output $=$ income

$K =$ capital stock (wealth), $L =$ labor input

$r =$ rate of return on capital, $w$ is wage rate

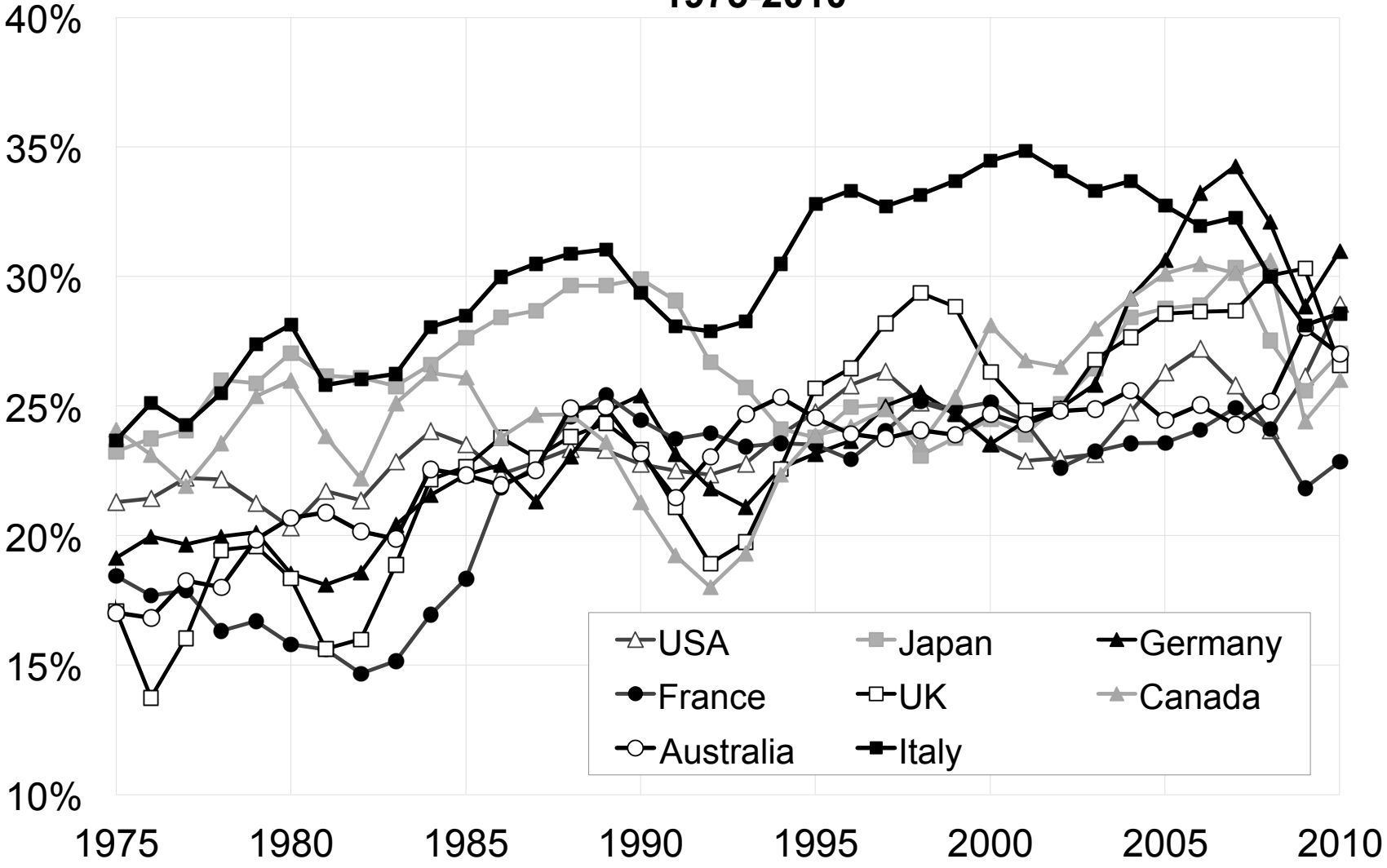
$rK =$ capital income, $wL =$ labor income

$\alpha = rK/Y =$ capital income share (constant $\alpha$ when $F(K, L) = K^{\alpha}L^{1-\alpha}$ Cobb-Douglas), $\alpha \simeq 30\%$

$\beta = K/Y =$ wealth to annual income ratio, $\beta \simeq 4 - 6$

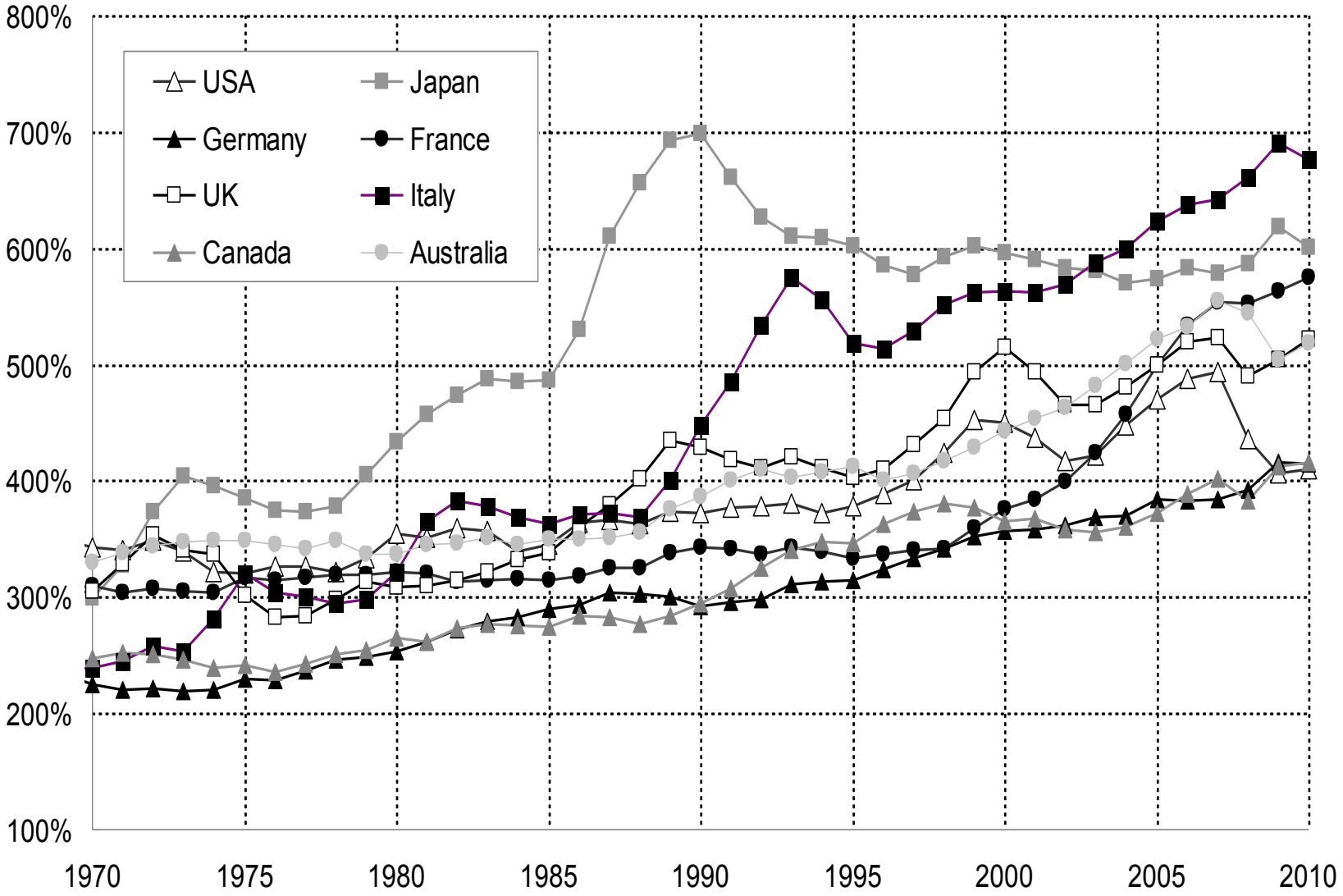
$r = (rK/Y) \cdot (Y/K) = \alpha/\beta$, $r = 5 - 6\%$

**Figure 12: Capital shares in factor-price national income 1975-2010**



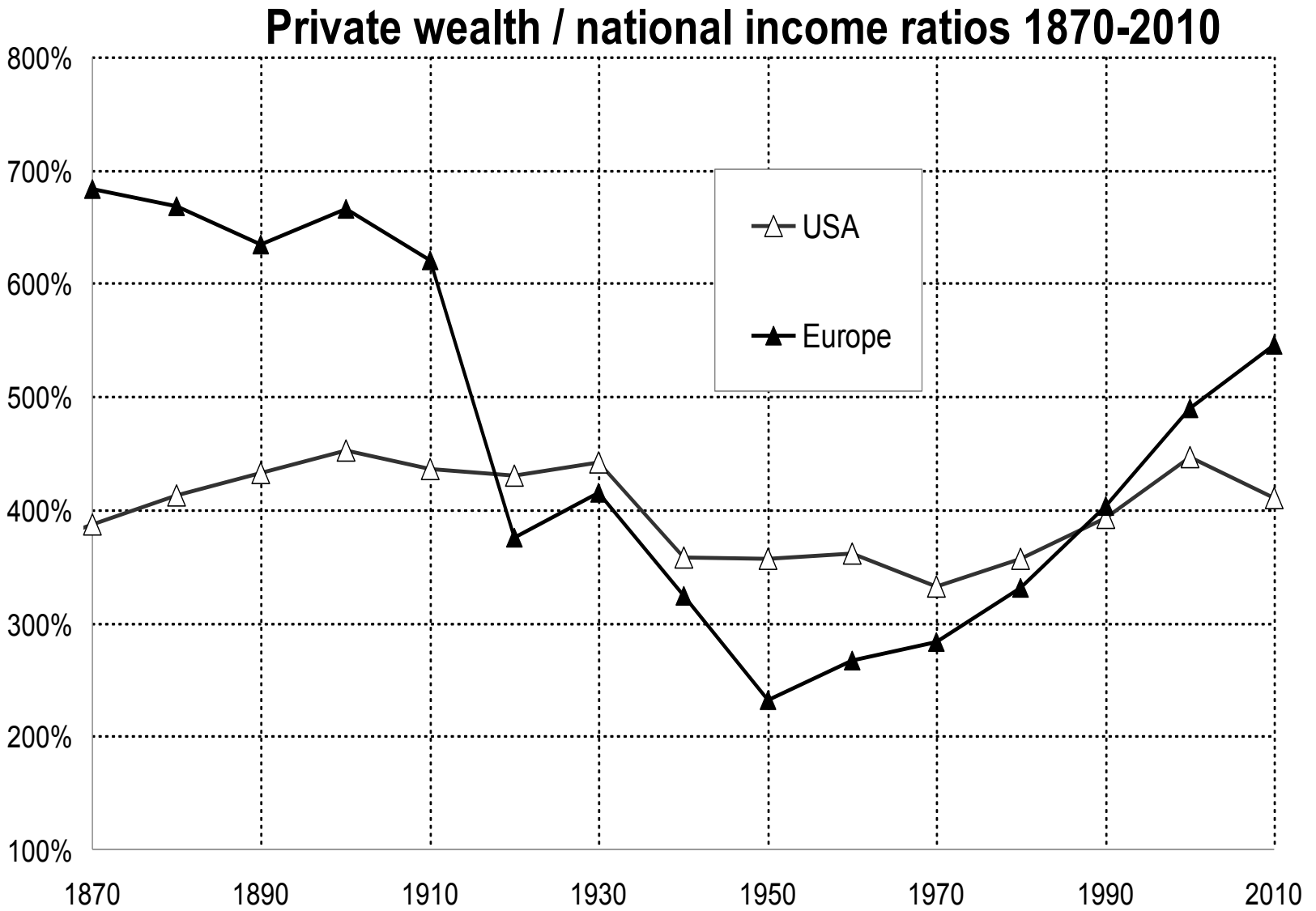

Source: Piketty and Zucman (2014)

# 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)

Source: Piketty and Zucman '13

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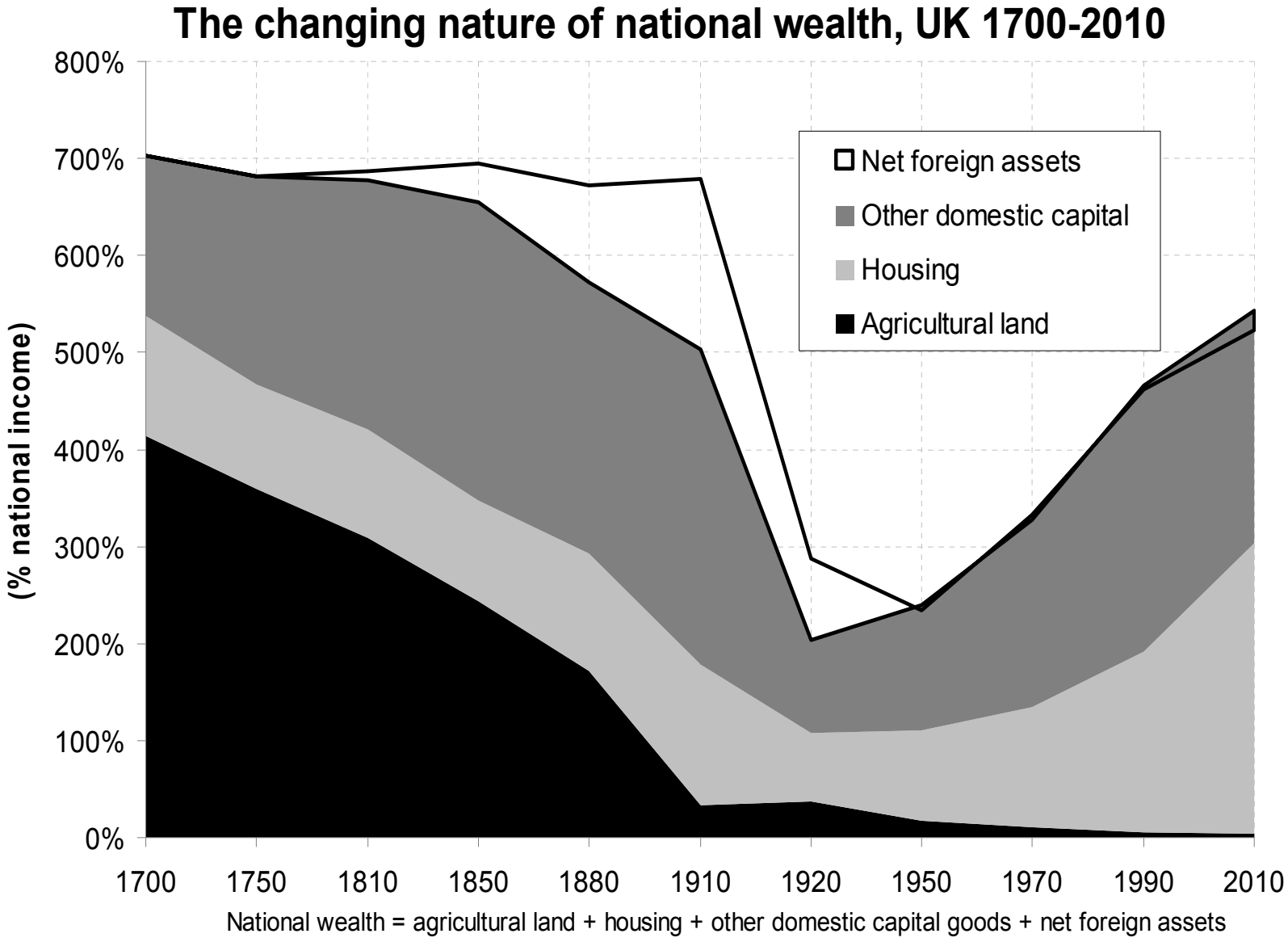
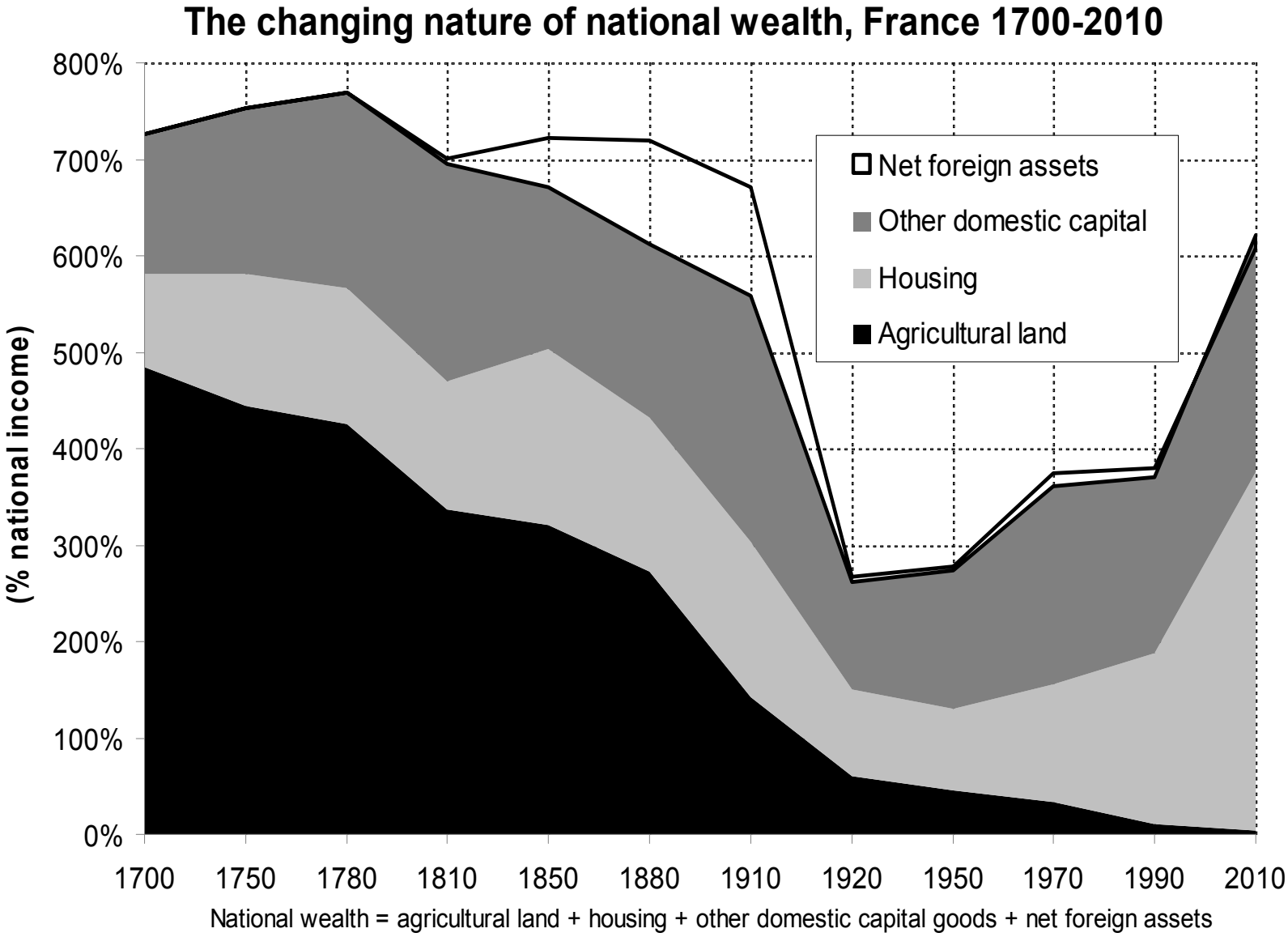
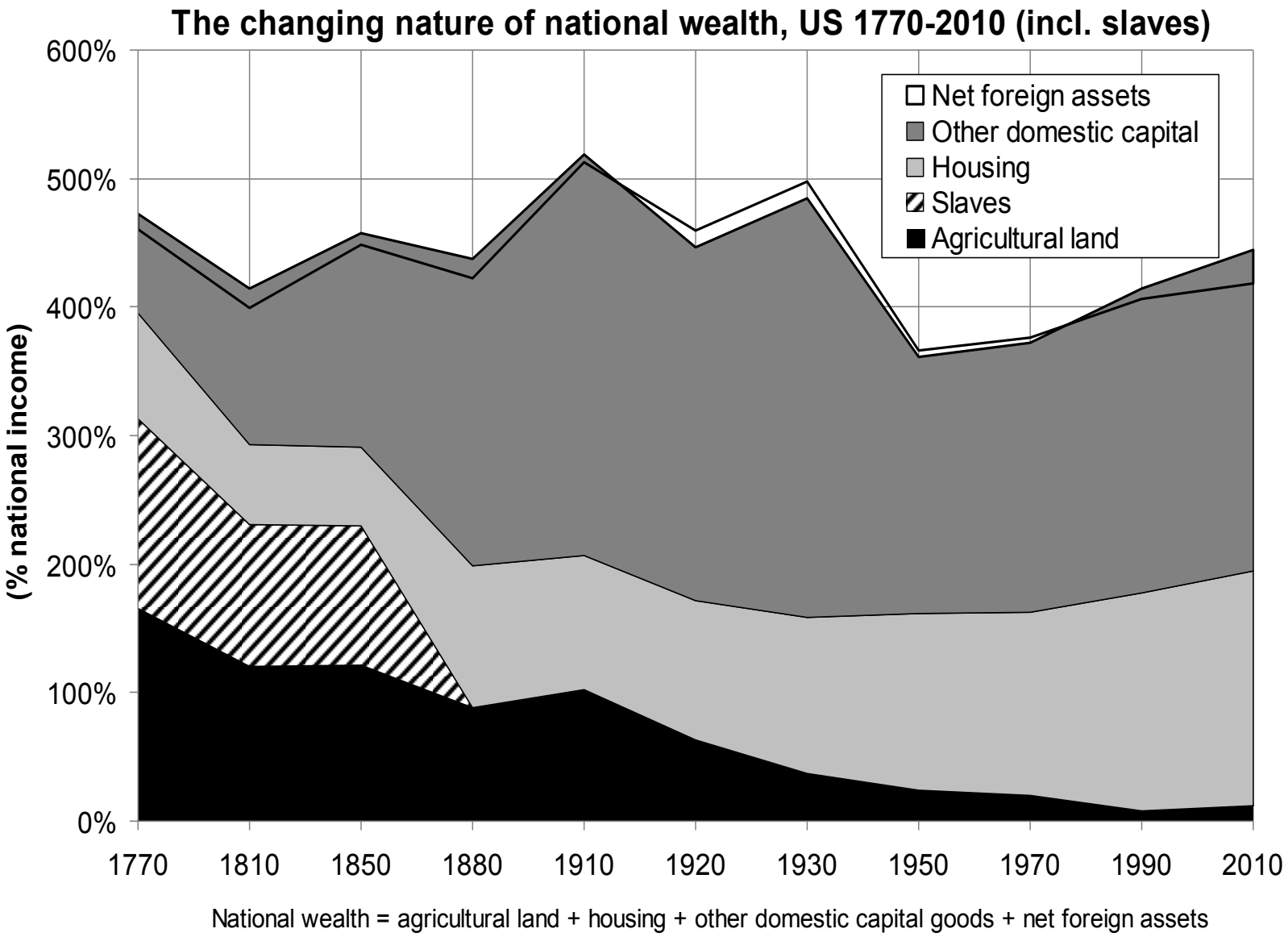



Source: Piketty, Handbook chapter, 2014




Source: Piketty, Handbook chapter, 2014




Source: Piketty and Zucman '13

## Piketty (2014) book: Capital in the 21st Century

Analyzes income, wealth, inheritance data over the long-run:

1) Growth rate $n+g$ = population growth + growth per capita. Population growth will converge to zero, growth per capita for frontier economies is modest (1%) $\Rightarrow$ long-run $g \simeq 1\%, n \simeq 0\%$

2) Long-run steady-state Wealth to income ratio ($\beta$) = savings rate ($s$) / annual growth ($n+g$): $\beta = s/(n+g)$

Proof: $K_{t+1} = (1+n+g) \cdot K_t = K_t + s \cdot Y_t \Rightarrow K_t/Y_t = s/(n+g)$

With $s = 8\%$ and $n+g = 2\%$, $\beta = 400\%$ but with $s = 8\%$ and $n+g = 1\%$, $\beta = 800\%$ $\Rightarrow$ Wealth will become important

## Piketty (2014) book: Capital in the 21st Century

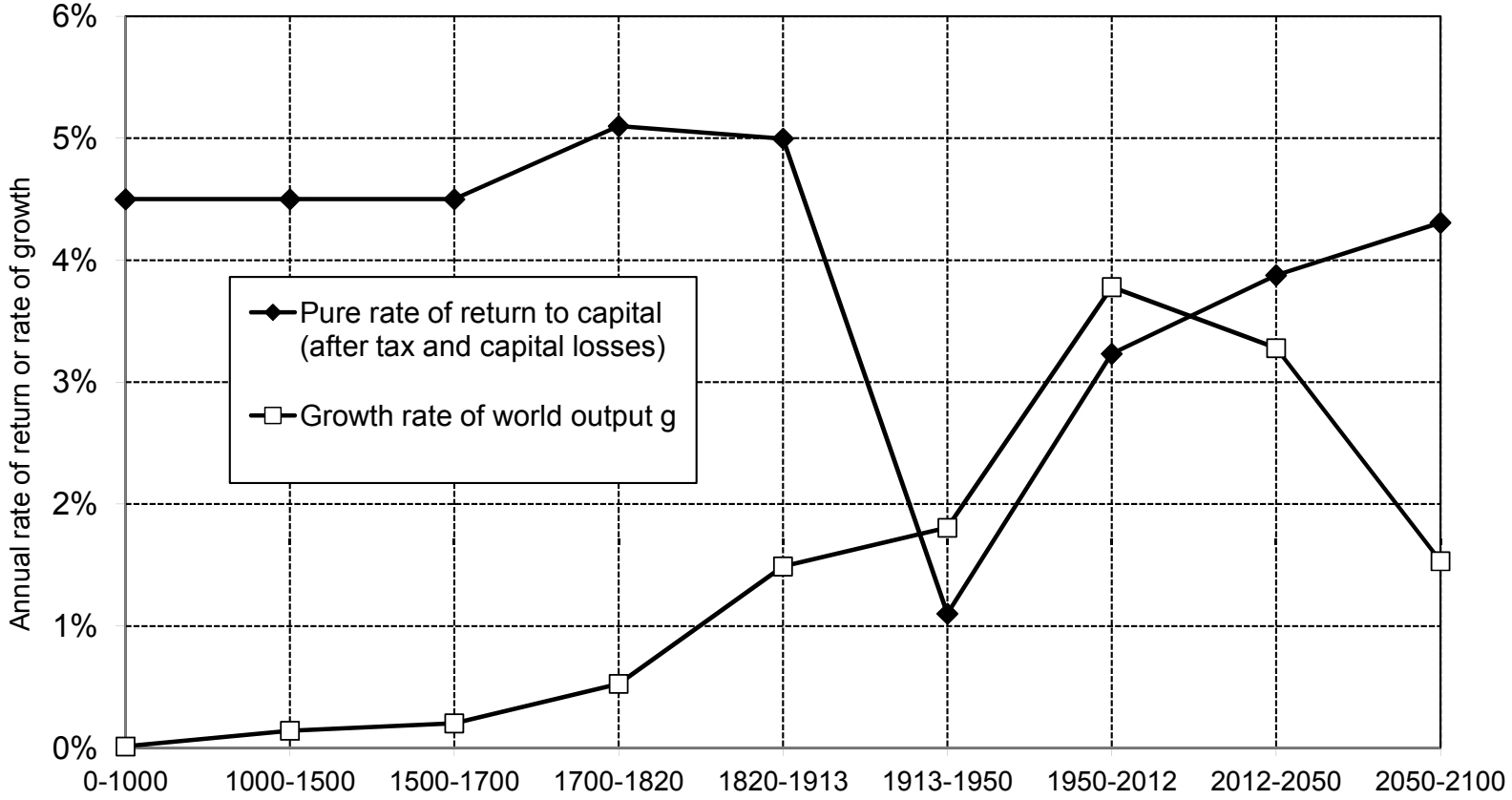
3) After-tax rate of return on wealth $\bar{r} = r(1 - \tau_K) = 4 - 5\%$ significantly larger than $n + g$ [except exceptional period of 1930–1970]

With $\bar{r} > n + g$, role of inheritance in wealth and wealth concentration become large [past swallows the future]

Explanation: Rentier who saves all his return on wealth accumulates wealth at rate $\bar{r}$ bigger than $n + g$ and hence his wealth grows relative to the size of the economy. The bigger $\bar{r} - (n + g)$, the easier it is for wealth to "snowball"

$\Rightarrow$ Capital taxation reduces $r$ to $\bar{r} = r \cdot (1 - \tau_K)$ $\Rightarrow$ This can reduce wealth concentration

**Figure 10.10. After tax rate of return vs. growth rate at the world level, from Antiquity until 2100**




The rate of return to capital (after tax and capital losses) fell below the growth rate during the 20th century, and may again surpass it in the 21st century. Sources and series : see piketty.pse.ens.fr/capital21c

Source: Piketty (2014)

# 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]

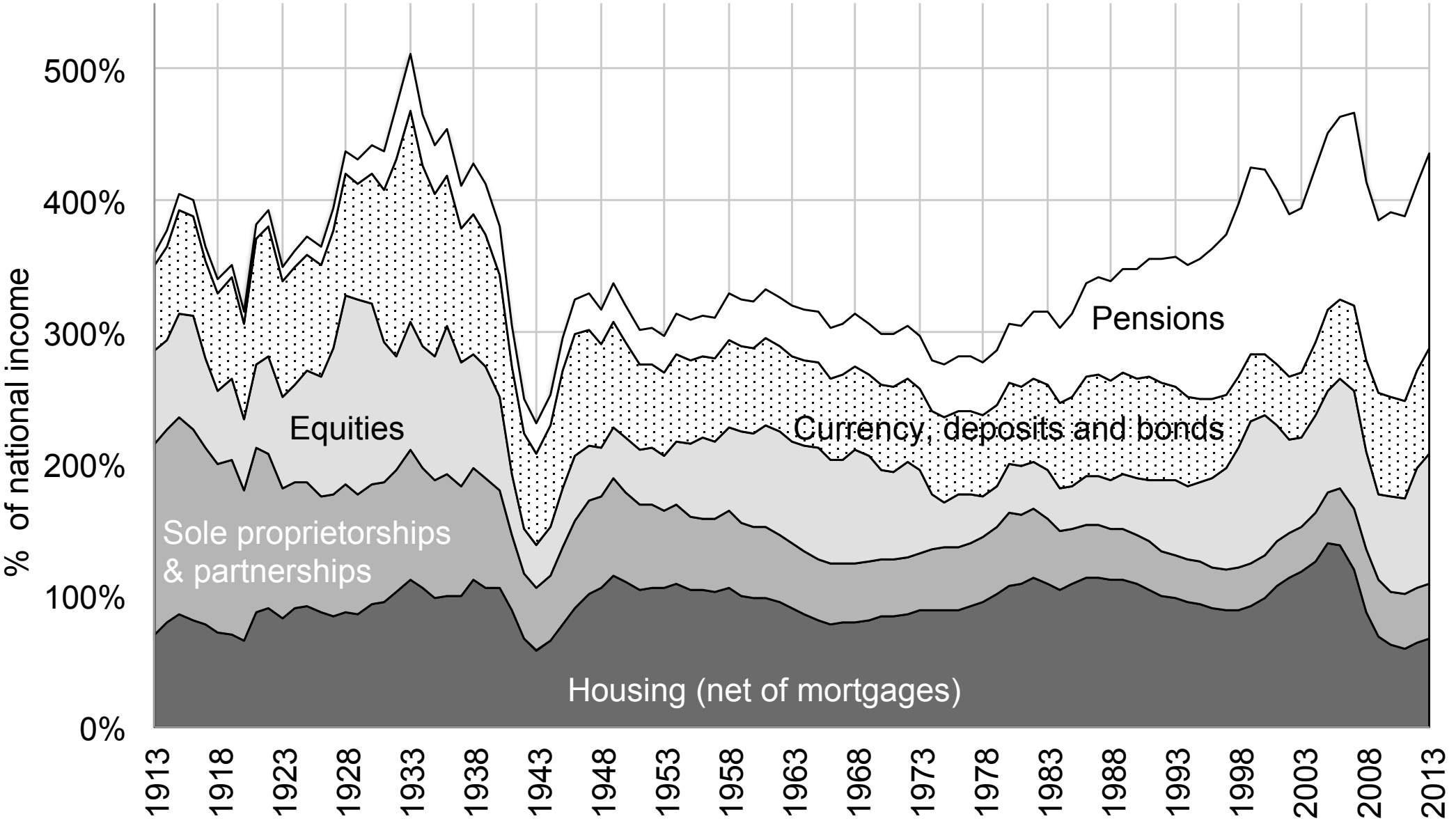
**Financial assets:** corporate stock [income = dividends + retained earnings], fixed claim assets (corporate and govt bonds, bank accounts) [income = interest]

**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

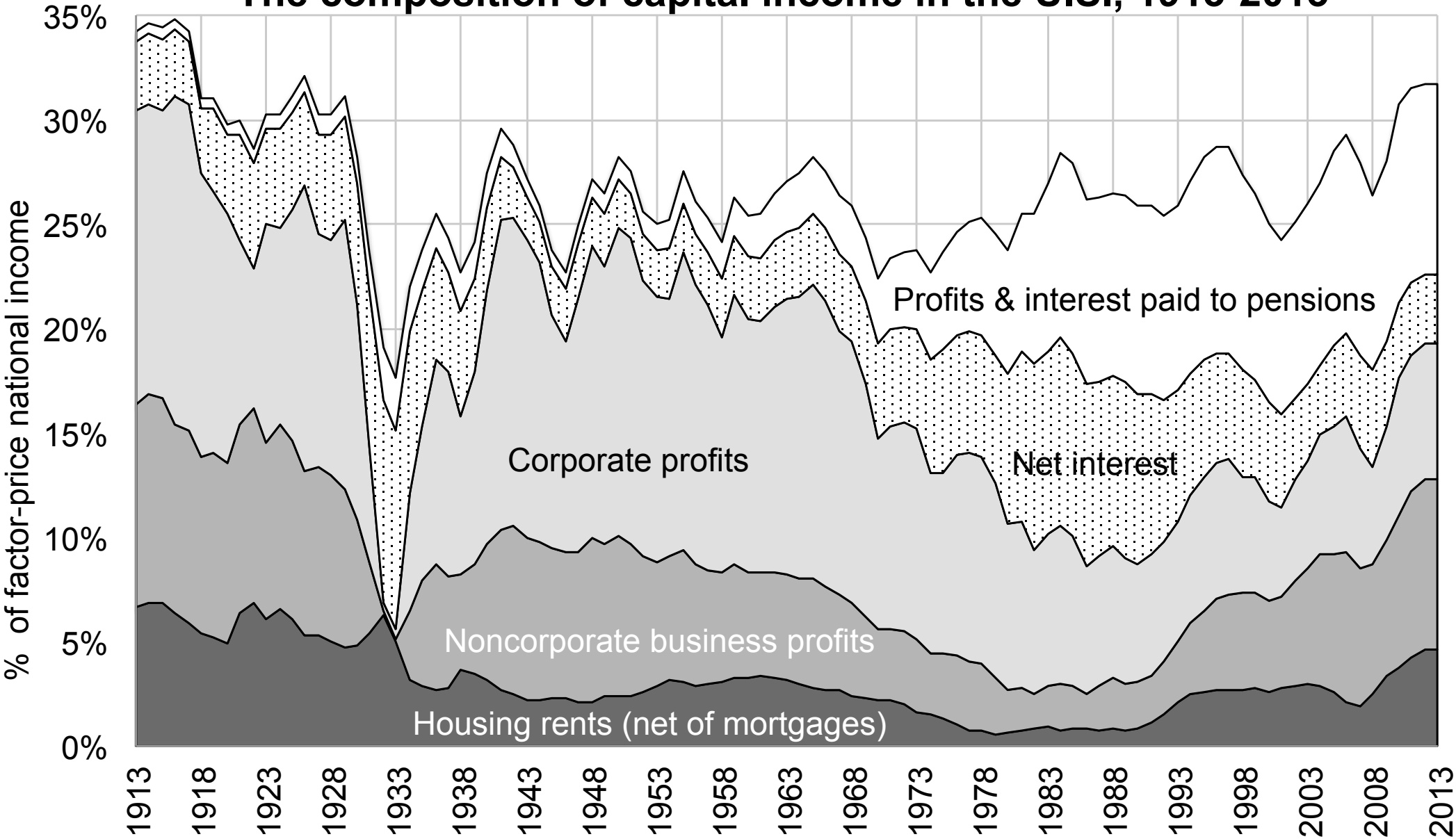
Source: Saez and Zucman (2014)

# The composition of household wealth in the U.S., 1913-2013



Source: Saez and Zucman (2014)

# The composition of capital income in the U.S., 1913-2013



# 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

US public underestimates extent of wealth inequality and thinks the ideal wealth distribution should be a lot less unequal [Norton-Ariely '11]

Source: Norton and Ariely 2011



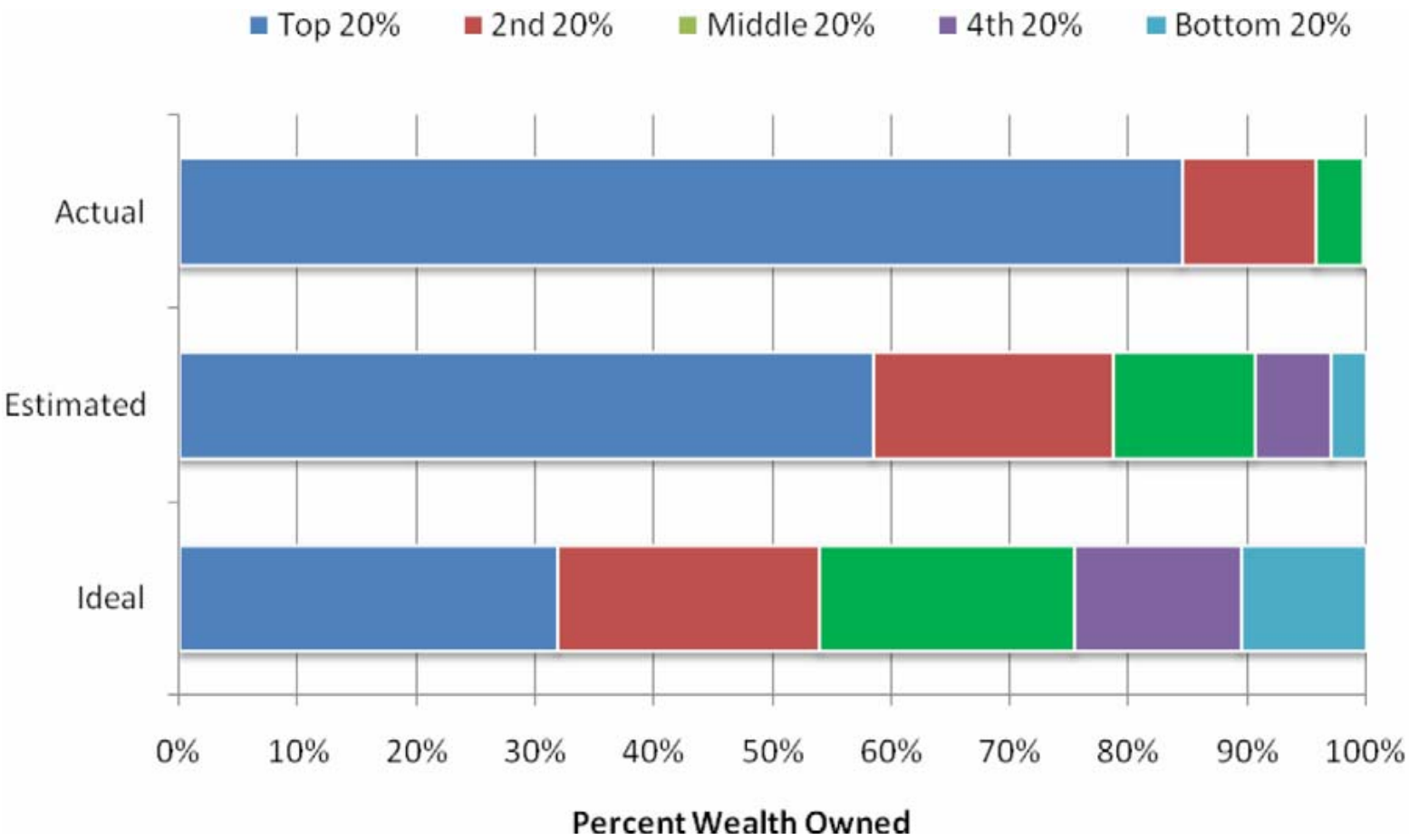



**Fig. 2.** The actual United States wealth distribution plotted against the estimated and ideal distributions across all respondents. Because of their small percentage share of total wealth, both the "4th 20%" value (0.2%) and the "Bottom 20%" value (0.1%) are not visible in the "Actual" distribution.

# 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]

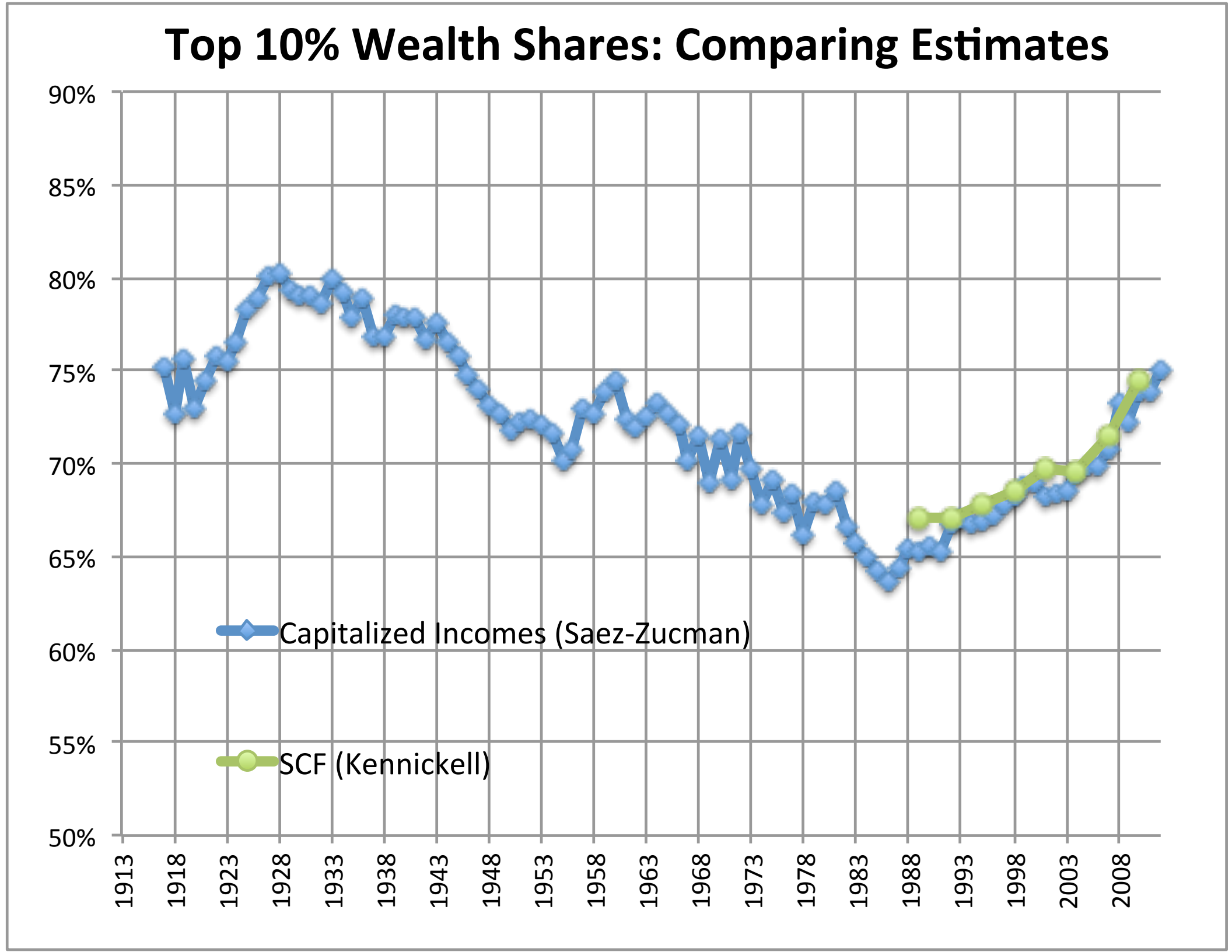
Problems: small sample size, measurement error, only every 3 years, starts in 1989

**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

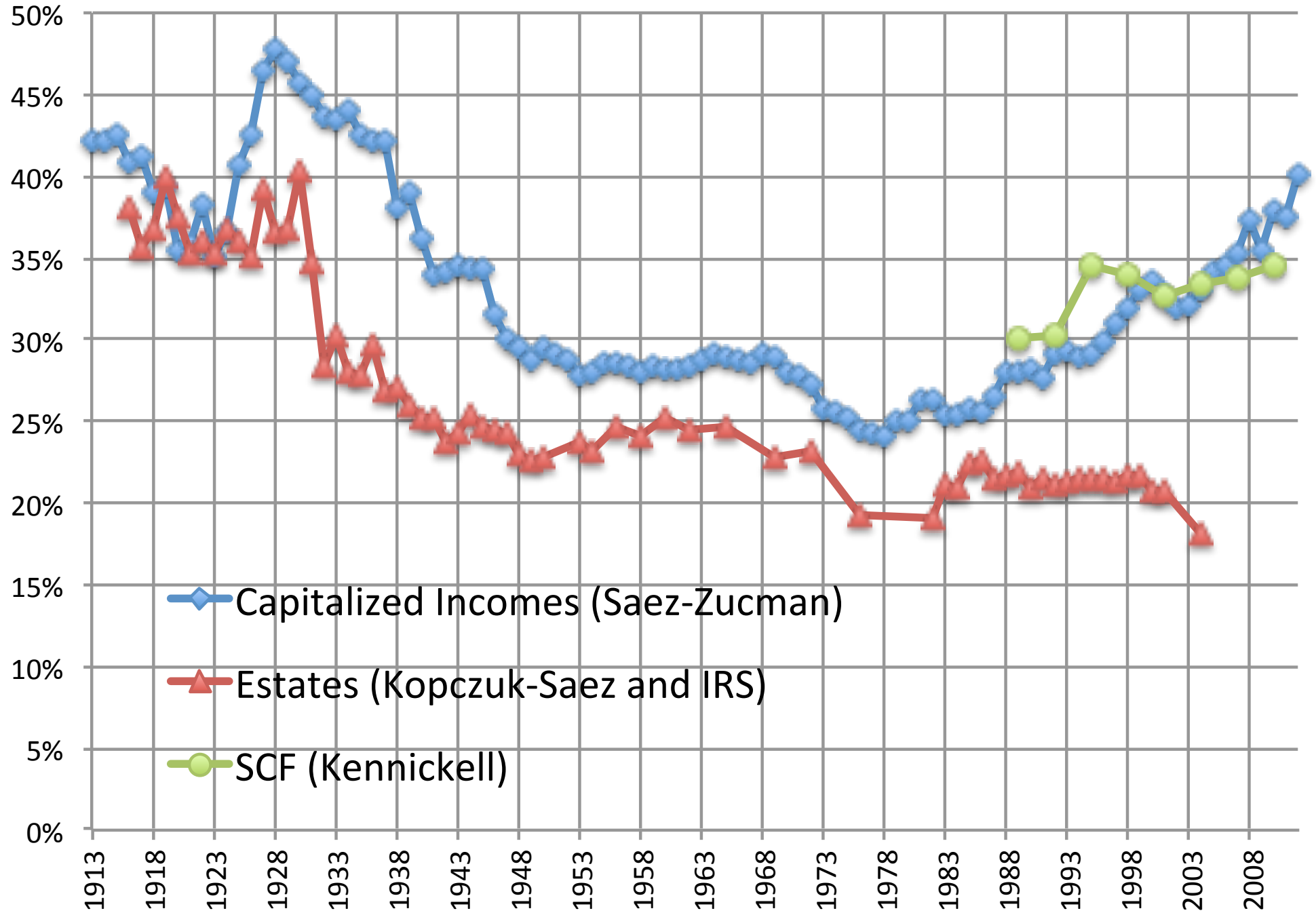
Problems: social class effect on mortality not well known, significant estate tax avoidance, noisy measure of "young wealth", estates cover only the super rich (top .1% in recent years)

**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 '14 in progress]

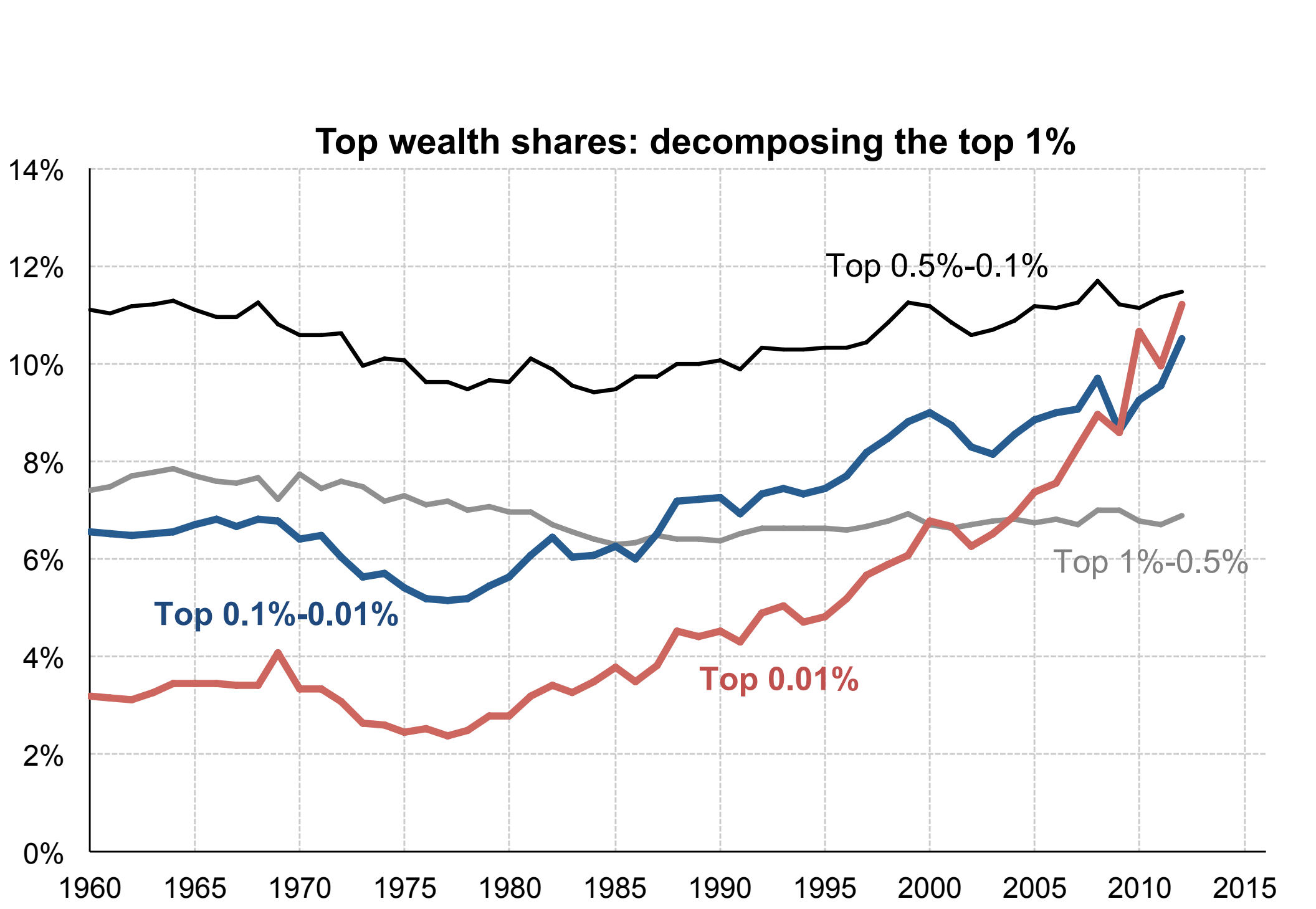

Top 10% Wealth Shares: Comparing Estimates
90%
85%
80%
75%
70%
65%
60%
55%
50%
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
1968
1973
1978
1983
1988
1993
1998
2003
2008
Capitalized Incomes (Saez-Zucman)
SCF (Kennickell)

Source: Saez and Zucman (2014)

# Top 1% Wealth Shares: Comparing Estimates




Top 0.1% wealth share in the U.S., 1913-2012
30%
25%
20%
15%
10%
5%
0%
1913
1918
1923
1928
1933
1938
1943
1948
1953
1958
1963
1968
1973
1978
1983
1988
1993
1998
2003
2008
2013


Top wealth shares: decomposing the top 1%
14%
12%
10%
8%
6%
4%
2%
0%
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Top 0.5%-0.1%
Top 1%-0.5%
Top 0.1%-0.01%
Top 0.01%

Source: Saez and Zucman (2014)

# Composition of the bottom 90% wealth share

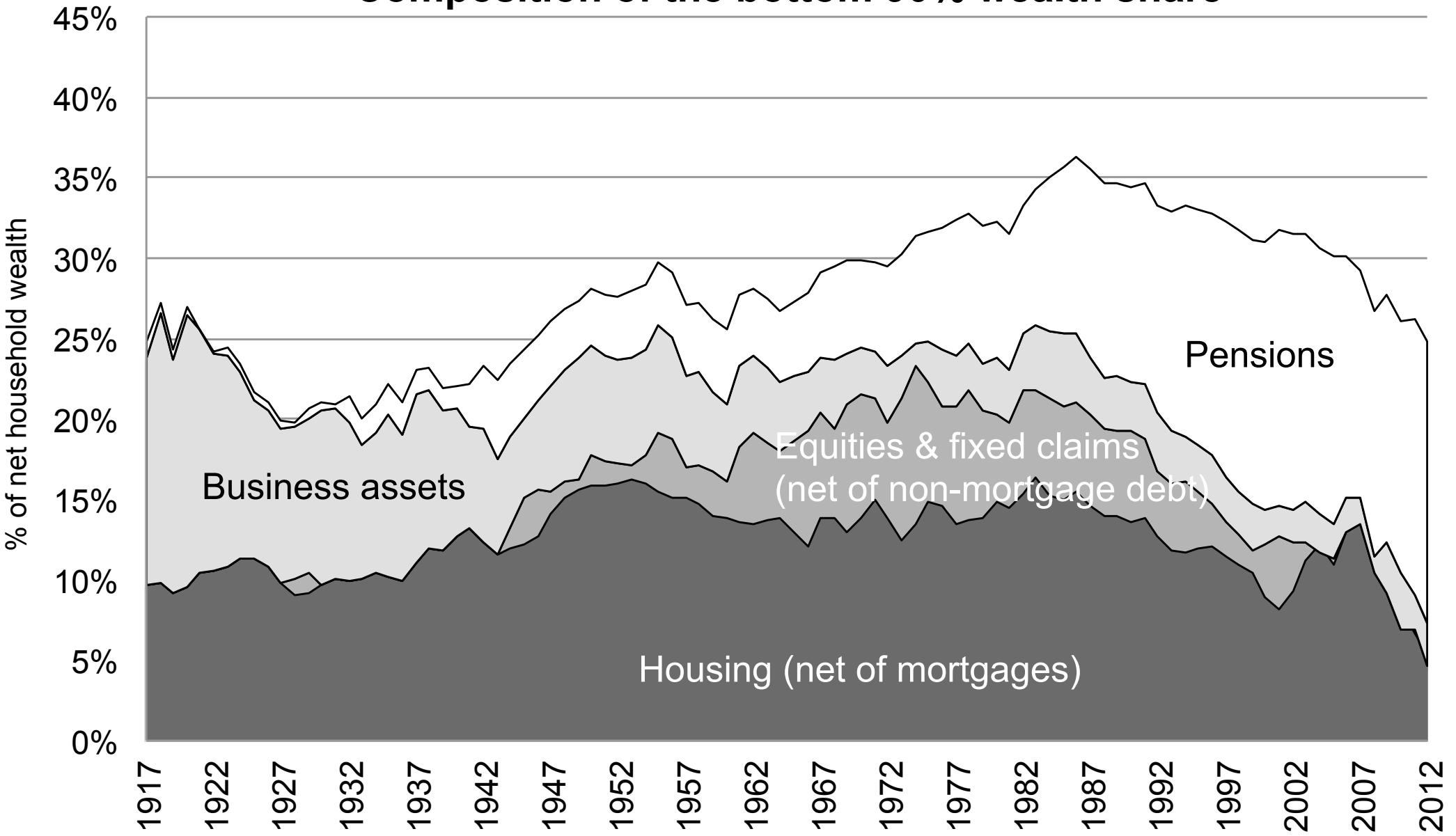
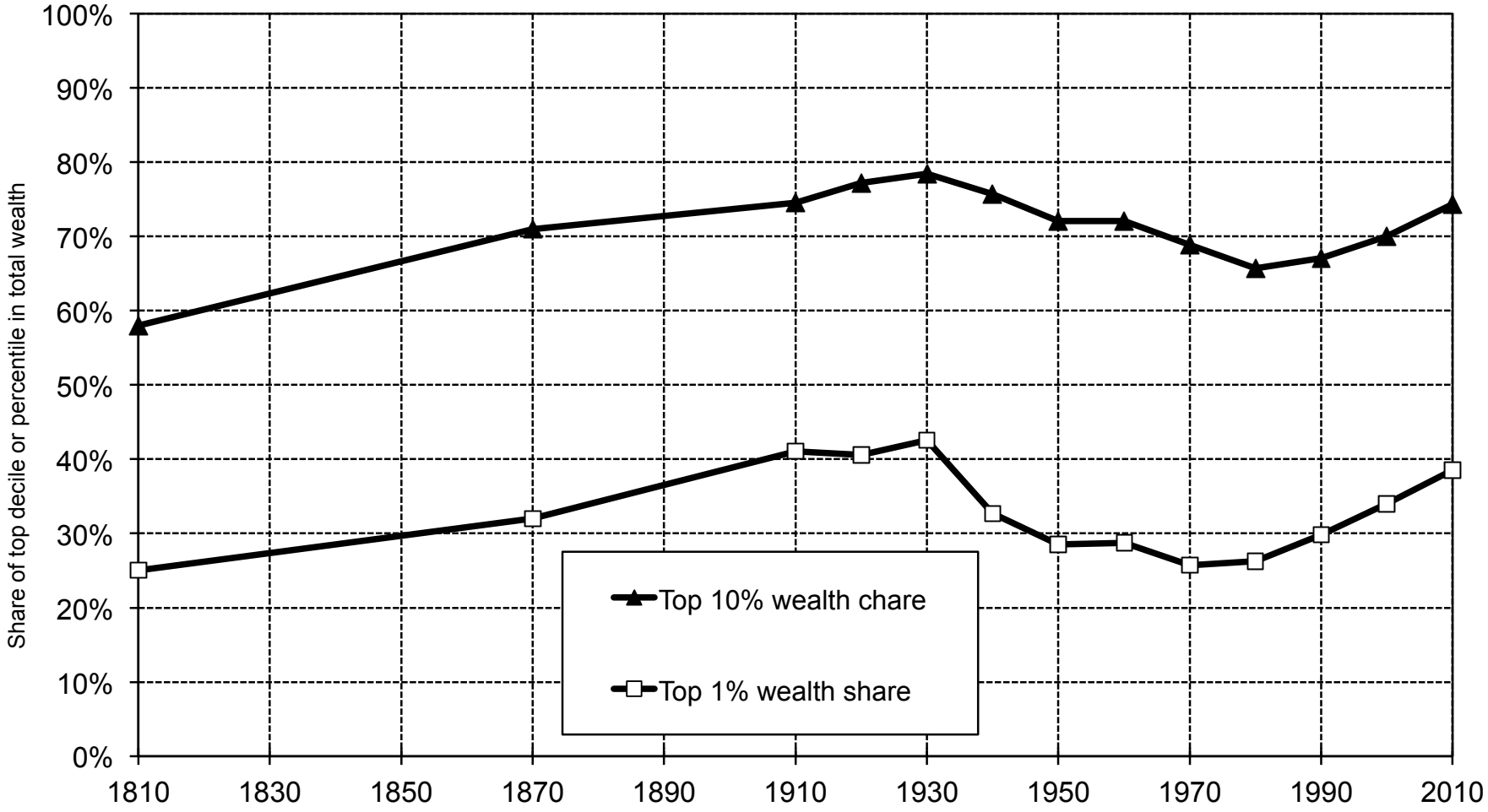
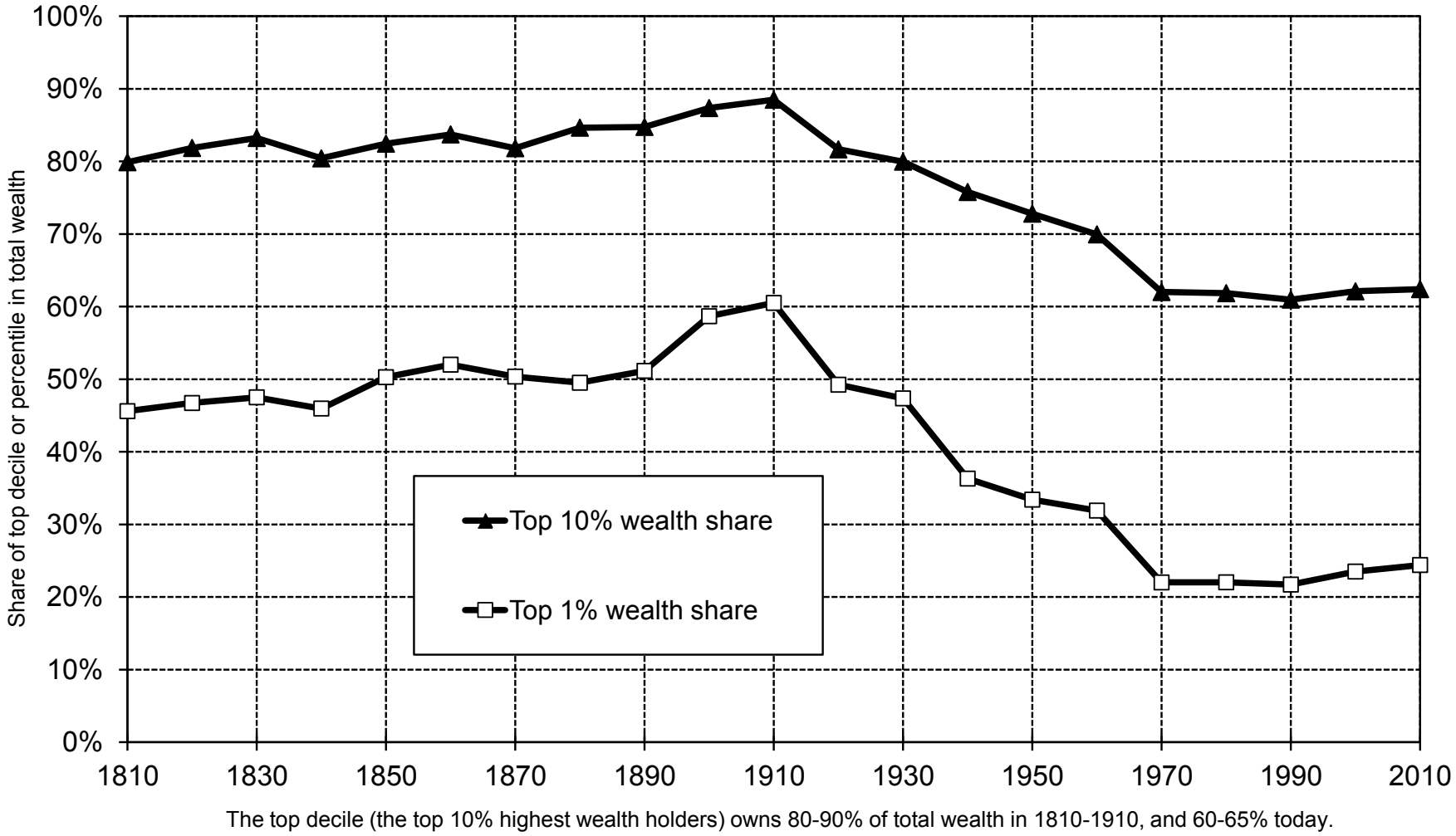


**Figure 3.5. Wealth inequality in the U.S., 1810-2010**




The top 10% wealth holders own about 80% of total wealth in 1929, and 75% today.

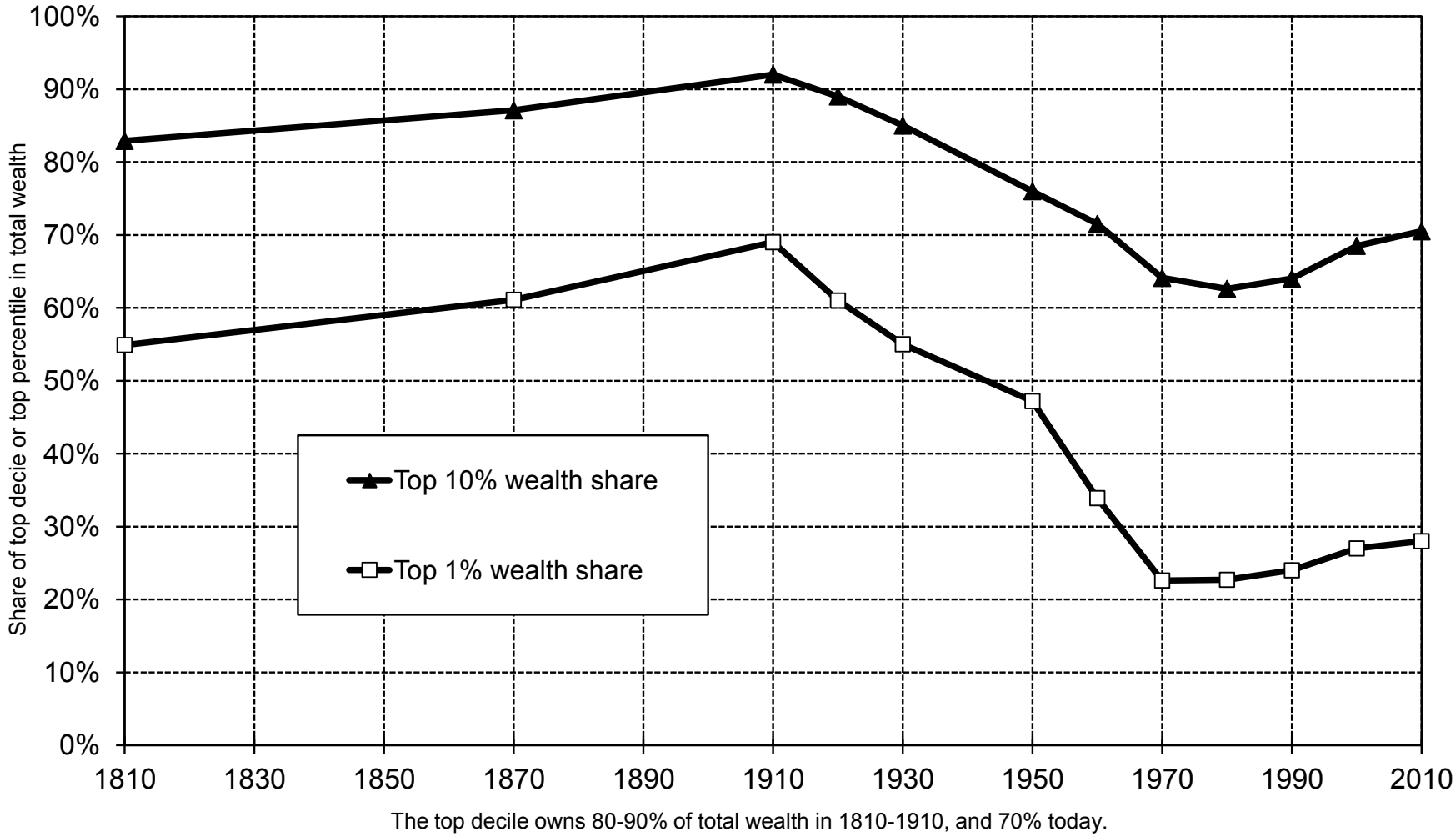
## Figure 3.1. Wealth inequality in France, 1810-2010




The top decile (the top 10% highest wealth holders) owns 80-90% of total wealth in 1810-1910, and 60-65% today.

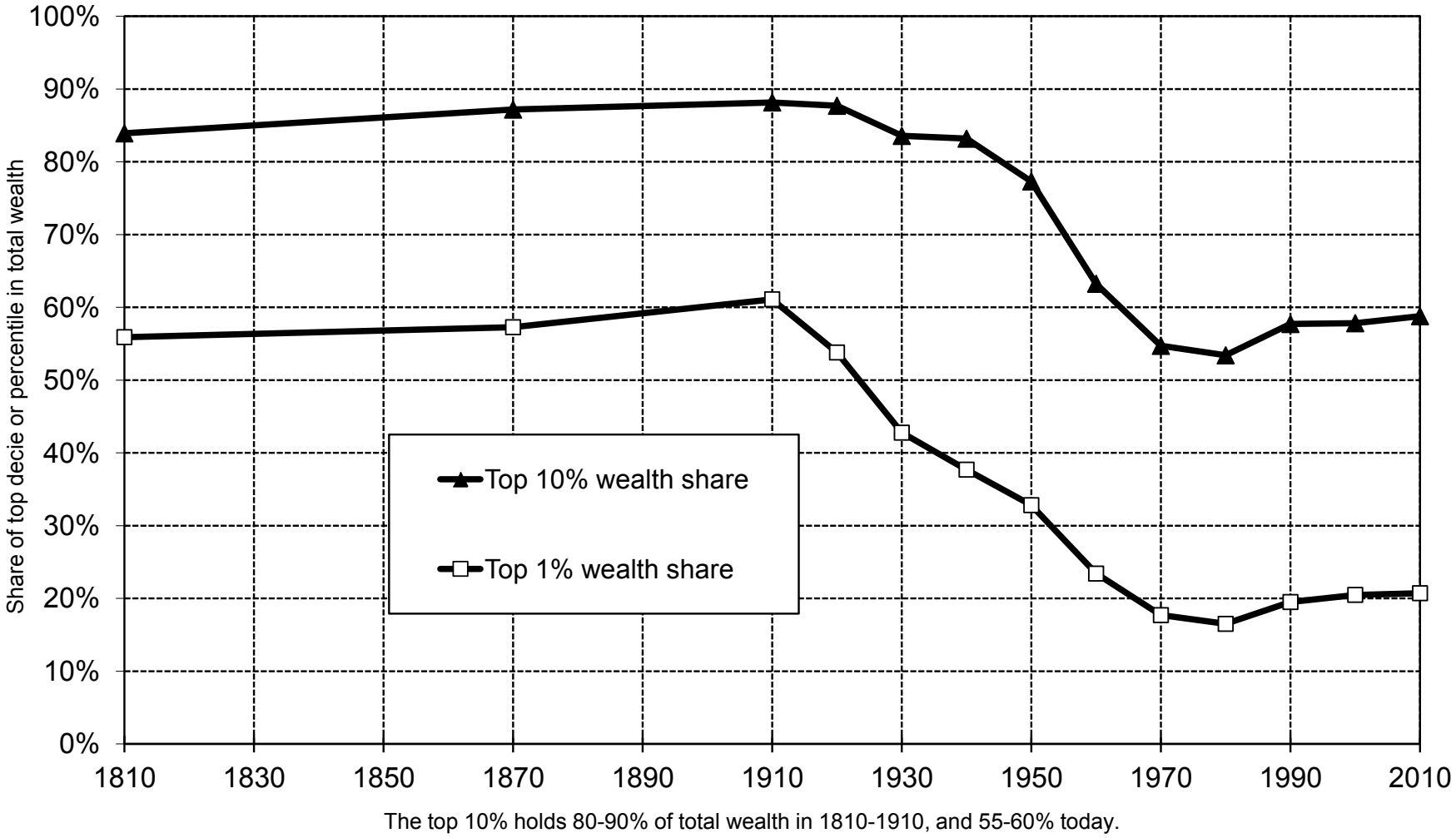
Source: Piketty and Zucman '14, handbook chapter

## Figure 3.3. Wealth inequality in the United Kingom, 1810-2010




Source: Piketty and Zucman '14, handbook chapter

## Figure 3.4. Wealth inequality in Sweden, 1810-2010




The top 10% holds 80-90% of total wealth in 1810-1910, and 55-60% today.

Source: Piketty and Zucman '14, handbook chapter

# CAPITAL TAXATION IN THE US

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

1) **Corporate Income Tax** (fed+state): 35% 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 $5.5M exemption (only .1% of deceased liable), tax rate is 40% above exemption (2013+)

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

# LIFE CYCLE VS. INHERITED WEALTH

Old view: Tobin and Modigliani: life cycle wealth accounts for the bulk of the wealth held in the US. Kotlikoff-Summers JPE'81 challenged the old view (debate Kotlikoff vs. Modigliani in JEP'88)

Why is this question important?

1) Economic Modeling: what accounts for wealth accumulation and inequality? Is widely used life-cycle model with no bequests a good approximation?

2) Policy Implications: taxation of capital income and estates. Role of pay-as-you-go vs. funded retirement programs

Key problem is that the definition of life-cycle vs. inherited wealth is not conceptually clean (Modigliani does not capitalize inherited wealth while Kotlikoff-Summers do)

# LIFE CYCLE VS. INHERITED WEALTH

Piketty-Postel-Vinay-Rosenthal EEH'14 (PPVR) propose better definition to resolve Modigliani vs. Kotlikoff-Summers controversy (see Piketty-Zucman Handbook chapter '14)

Individual wealth accumulation:

$$W_t = \sum_{k=1}^{t} (E_k - C_k) \cdot (1+r)^{t-k} + \sum_{k=1}^{t} I_k \cdot (1+r)^{t-k}$$

If $W_t > \sum_{k=1}^{t} I_k \cdot (1+r)^{t-k}$ then individual also saves out of labor income $E_k$ and inherited wealth is $\sum_{k=1}^{t} I_k \cdot (1+r)^{t-k}$

If $W_t \leq \sum_{k=1}^{t} I_k \cdot (1+r)^{t-k}$ then individual consumes part of inheritances (in addition to labor income) and inherited wealth is $W_t$

PPVR requires micro-data for implementation. If we assume uniform saving rate $s$, there is a simplified formula for share of inherited wealth $b_y/[b_y + (1-\alpha) \cdot s]$ with $b_y$ bequest flow/national income and $\alpha$ capital share

# LIFE CYCLE VS. INHERITED WEALTH

How do the shares of inheritance vs. life-cycle evolve over time? First measure is inheritance flow to national income

Inheritance share likely huge in the distant past: class society with rentiers vs. workers [Delong '03]

Inheritance share $\downarrow$ in 20th century but has $\uparrow$ recently in France (Piketty QJE'11, Piketty-Zucman '14 handbook chapter)

Post-war period was a time of fast population growth and fast economic growth $\Rightarrow$ If $n+g$ (growth) large relative to $r$ (rate of return on wealth) $\Rightarrow$ Inheritances play a minor role in life-time wealth

In general $r > n+g$ in which case inheritances play a large role in aggregate wealth and wealth concentration is going back (Western countries moving in that direction, Piketty '14)

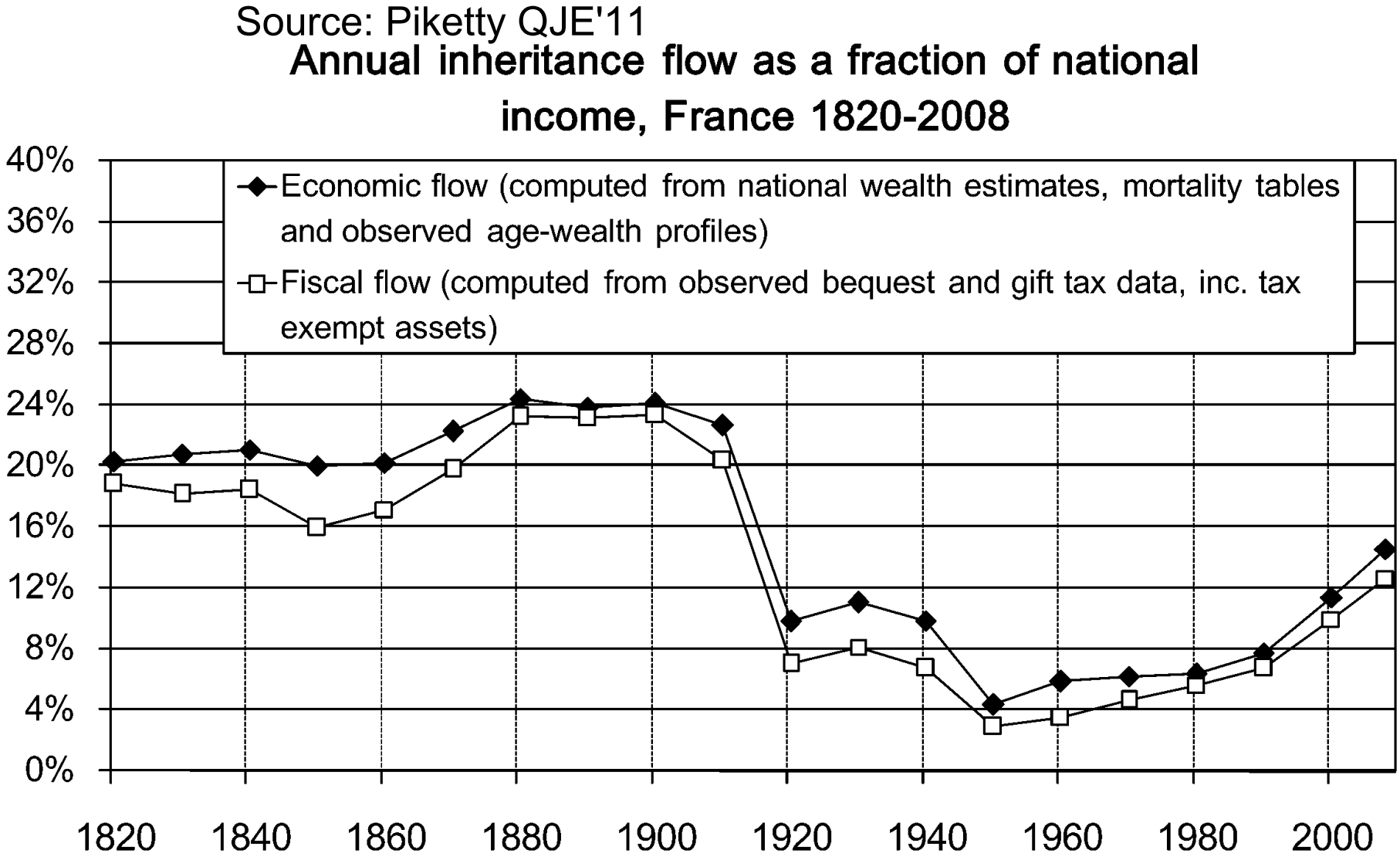
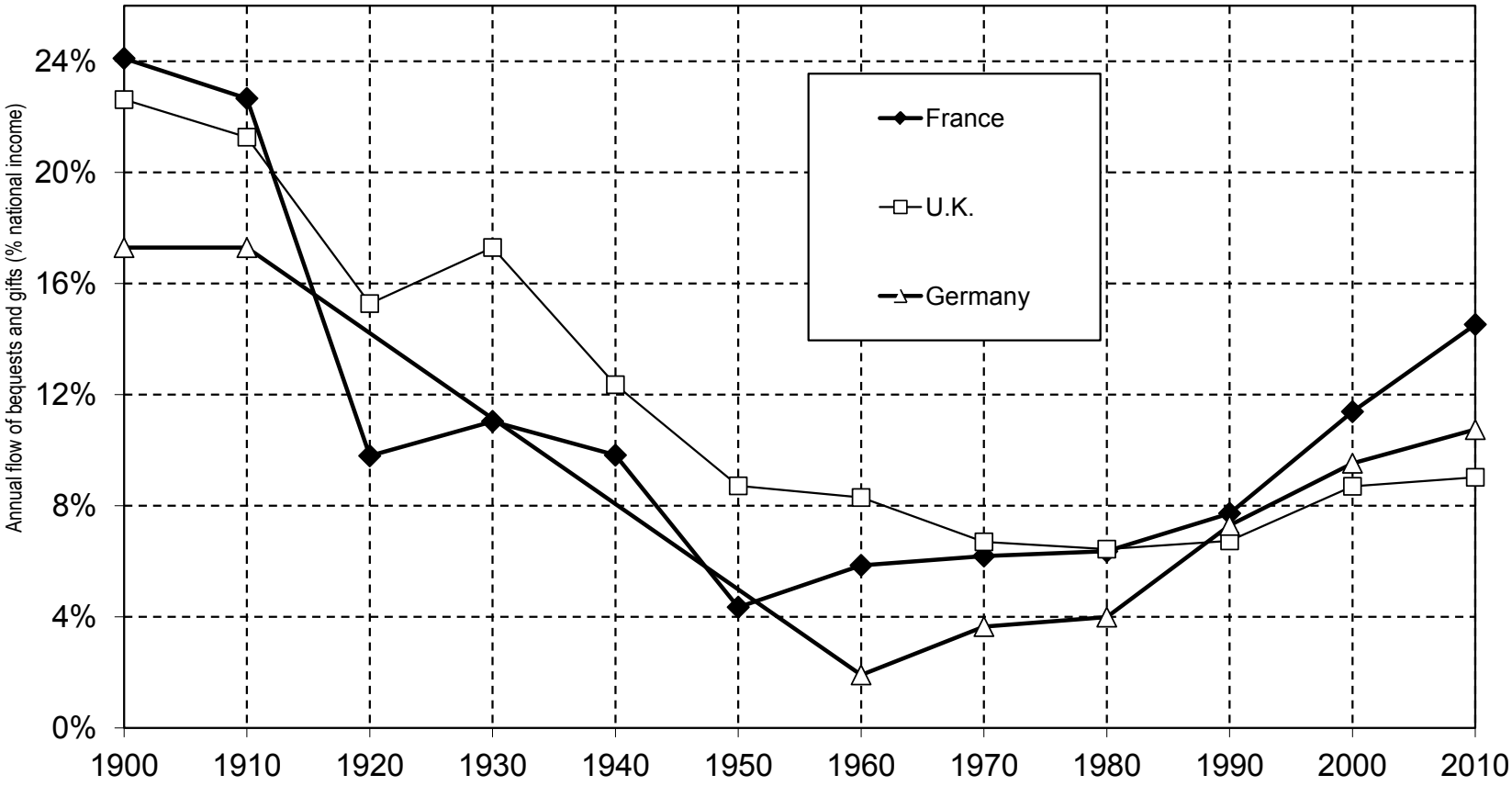



FIGURE I

Annual Inheritance Flow as a Fraction of National Income, France, 1820–2008

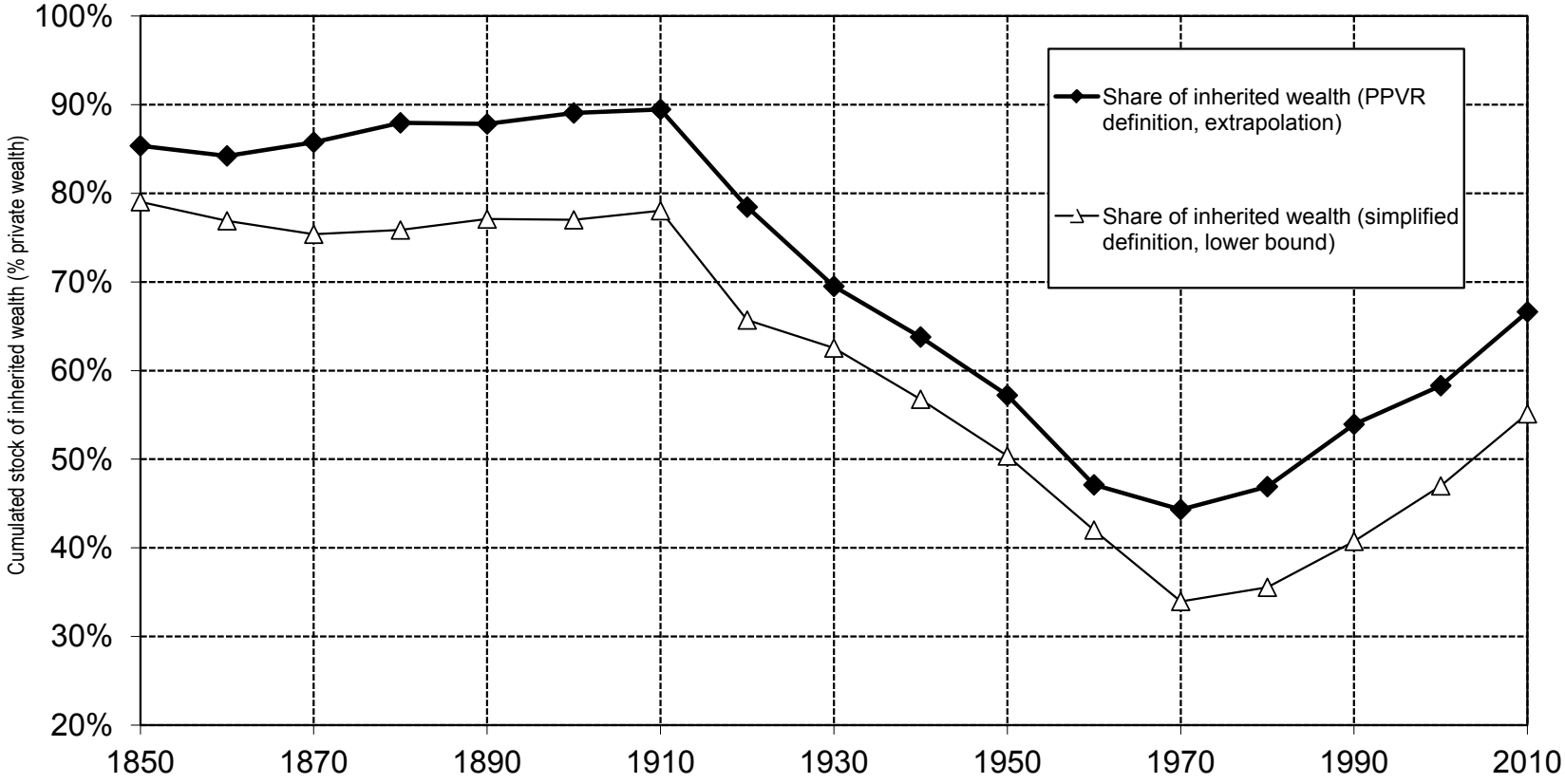
## Figure 4.5. The inheritance flow in Europe 1900-2010




The inheritance flow follows a U-shaped in curve in France as well as in the U.K. and Germany. It is possible that gifts are under-estimated in the U.K. at the end of the period.

Source: Piketty and Zucman '14, handbook chapter

## Figure 4.4. The cumulated stock of inherited wealth as a fraction of aggregate private wealth, France 1850-2010

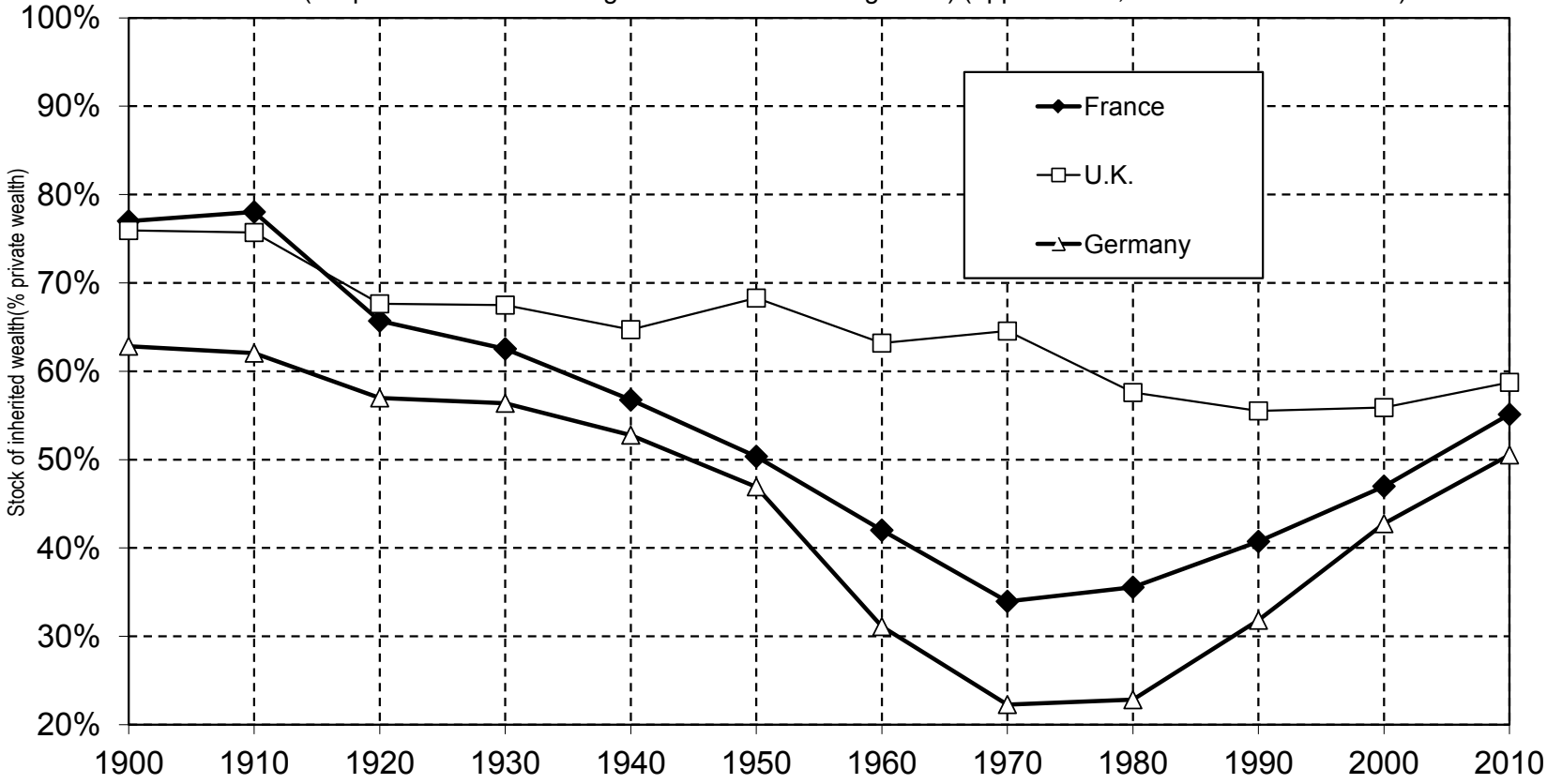



Inherited wealth represents 80-90% of total wealth in France in the 19th century; this share fell to 40%-50% during the 20th century, and is back to about 60-70% in the early 21st century.

Source: Piketty and Zucman '14, handbook chapter

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

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




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

Source: Piketty and Zucman '14, handbook chapter

# 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 $\tau_L$:

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

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 $\tau_K$:

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

$\tau_K$ distorts only inter-temporal consumption choice

Budget with comprehensive income tax $\tau$:

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

$\tau$ distorts both labor-leisure and inter-temporal consumption choices

$\tau$ imposes "double" tax: (1) tax on earnings, (2) tax on savings

## EFFECT OF $r$ ON SAVINGS

Assume that labor supply is fixed. Draw graph. 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 $\tau_L$: $c_1^L = w_1(1 - \tau_L) - s_L$, $c_2^L = (1 + r)s_L$

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

# TRANSITION FROM LABOR TO C TAX

In OLG model and closed economy, capital stock is due to life-cycle savings $s$

Start with labor tax $\tau_L$ and switch to a consumption tax $t_c$

The old [at time of transition] would have paid nothing in labor tax regime but now have to pay tax on $c_2$

For the young [and future generations], the two regimes look equivalent so they now save more and increase the capital stock

However, this increase in capital stock comes at the price of hurting the old who are taxed twice

# TRANSITION FROM LABOR TO C TAX

Suppose the government keeps the old as well off as in previous system by exempting them from consumption tax

This creates a deficit in government budget equal to

$$d = \tau_L w_1 - t_c c_1 = t_c w_1/(1 + t_c) - t_c c_1 = t_c s_L$$

Extra saving by the young is $s_c - s_L = t_c s_L$ exactly equal to government deficit.

**Full neutrality result:** Extra savings of young is equal to old capital stock + new government deficit $\Rightarrow$ no change in the aggregate capital stock

Full neutrality depends crucially on same $r$ for govt debt and aggregate $r$ [in practice: equity premium puzzle]

[Same result for Social Security privatization]

# 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]

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

Recent proof by Laroque EJ '05 or Kaplow JpubE '06.

Tax on savings justified if:

(1) High skill people have higher taste for saving (e.g, high skill people have lower discount rate) [Saez, JpubE '02]

(2) $c_2$ is complementary with leisure

## Life-cycle model: linear labor income tax

Suppose the government can only use linear earnings tax: $wl \cdot (1 - \tau_L) + E$

If sub-utility $v(c_1, c_2)$ is also homothetic of degree one [i.e., $v(\lambda c_1, \lambda c_2) = \lambda v(c_1, c_2)$ for all $\lambda$] then $\tau_K = 0$ is again optimal [linear tax counter-part of Atkinson-Stiglitz, see Deaton, 1979]

In the general case $V^h(c_1, c_2, l)$, optimal $\tau_K$ is not always zero

Old literature considered the Ramsey one-person model of linear taxation and expressed optimal $\tau_K$ as a function of compensated price and cross-price elastiticities [Corlett-Hague REstud'54, King, 1980, and Atkinson-Sandmo EJ'80]

# LIMITS OF LIFE-CYCLE MODEL

Atkinson-Stiglitz shows that life-time savings should not be taxed, tax only labor income

From justice view: seems fair to not discriminate against savers if labor earnings is the only source of inequality and is taxed non-linearly

In reality, capital income inequality also due

(1) difference in rates of returns

(2) shifting of labor income into capital income

(3) inheritances

(1) is not relevant if individuals handle risky assets rationally (as in CAPM model), probably not a very good assumption $\Rightarrow$ Tax on lucky returns might be desirable

# SHIFTING OF LABOR / CAPITAL INCOME

In practice, difficult to distinguish between capital and labor income [e.g., small business profits, professional traders]

Differential tax treatment can induce shifting:

(1) US C-corporations vs S-corporations: shift from corporate income (and subsequent realized capital gains) toward individual business income [Gordon and Slemrod '00]

(2) Carried interest in the US: hedge fund and private equity fund managers receive fraction of profits of assets they manage for clients. Those profits are really labor income but are taxed as realized capital gains

(3) Finnish Dual income tax system: taxes separately capital income at preferred rates since 1993: Pirttila and Selin SJE'11 show that it induced shifting from labor to capital income especially among self-employed

## Theory: Shifting of Labor / Capital Income

Extreme case where government cannot distinguish at all between labor and capital income $\Rightarrow$ Govt observes only $wl + rK$ $\Rightarrow$ Only option is to have identical MTRs at individual level $\Rightarrow$ General income tax $Tax = T(wl + rK)$

With a finite shifting elasticity, differential MTRs for labor and capital income taxation induce an additional shifting distortion

The higher the shifting elasticity, the closer the tax rates on labor and capital income should be [Christiansen and Tuomala ITAX'08, see also Piketty-Saez Handbook chapter '13]

In practice, this seems to be a very important consideration when designing income tax systems [especially for top incomes] $\Rightarrow$ Strong reason for having $\tau_L = \tau_K$ at the top

## Taxation of Inheritances: Welfare Effects

Definitions: donor is the person giving, donee is the person receiving

Inheritances and inter-vivos transfers raise difficult issues:

(1) Inequality in inheritances contributes to economic inequality: seems fair to redistribute from those who received inheritances to those who did not

(2) However, it seems unfair to double tax the donors who worked hard to pass on wealth to children

$\Rightarrow$ Double welfare effect: inheritance tax hurts donor (if donor altruistic to donee) and donee (which receives less) [Kaplow, '01]

## Estate Taxation in the United States

Estate federal tax imposes a tax on estates above $5.5M exemption (only about .1% of deceased liable), tax rate is 40% above exemption (2013+)

Charitable and spousal giving are fully exempt from the tax

E.g.: if Bill Gates / Warren Buffet give all their wealth to charity, they won't pay estate tax

Support for estate tax is pretty weak ("death tax") but public does not know that estate tax affects only richest

Support for estate tax increase shots up from 17% to 53% when survey respondents are informed that only richest pay it (Kuziemko-Norton-Saez-Stantcheva '13 do an online Mturk survey experiment)

# Treatment example: Information about the Estate Tax

Besides the income tax, the government can also level the playing field with **the federal estate tax.**

The **Federal Estate Tax** (also known as the **Death Tax**) applies when a deceased person leaves **more than $5 million** in wealth to his or her heirs. Wealth left to a spouse or charitable organizations is exempt from estate tax.

**Only 1 person out of 1000 is wealthy enough to face the estate tax.**

Average Americans do not have anything close to $5 million in wealth, so the estate tax does not affect them and they can pass on their property to their children tax-free.

**Eliminating** the estate tax would allow the very richest families to pass down all of their wealth to their children tax-free. Hence, children of rich people would also start off very rich themselves.

**Increasing** the estate tax is a way to level the playing field between the children of wealthy parents and children of middle-class parents.

## Taxation of Inheritances: Behavioral Responses

Potential behavioral response effects of inheritance tax:

(1) reduces wealth accumulation of altruistic donors (and hence tax base) [no very good empirical evidence, Slemrod-Kopczuk 01]

(2) reduces labor supply of altruistic donors (less motivated to work if cannot pass wealth to kids) [no good evidence]

(3) induces donees to work more through income effects (Carnegie effect, decent evidence from Holtz-Eakin,Joulfaian,Rosen QJE'93)

Critical to understand why there are inheritances to decide on optimal inheritance tax policy. 4 main models of bequests: (a) accidental, (b) bequests in the utility, (c) manipulative bequest motive, (d) dynastic

# ACCIDENTAL BEQUESTS

People die with a stock of wealth they intended to spend on themselves: Such bequests arise because of imperfect annuity markets

Annuity is an insurance contract converting lumpsum amount into a stream of payments till end of life [insurance against risk of living too long]

Annuity markets are imperfect because of adverse selection [Finkelstein-Poterba EJ'02, JPE'04] or behavioral reasons [inertia, lack of planning]

Public retirement programs [and defined benefit private pensions] are in general mandatory annuities

Newer defined contribution private pensions [401(k)s in the US] are in general not annuitized

# ACCIDENTAL BEQUESTS

Bequest taxation has no distortionary effect on behavior of donor and can only increase labor supply of donees (through income effects) $\Rightarrow$ strong case for taxing bequests heavily

Kopczuk JPE '03 makes the point that estate tax plays the role of a "second-best" annuity:

Estate tax paid by those who die early, and not by those who die late $\Rightarrow$ Implicit insurance against risk of living too long

**Wealth loving:** Same tax policy conclusion arises if donors have wealth in their utility function [social status or power, Carroll '98]

Kopczuk-Lupton REStud'07 shows that only 1/2 of people accumulate wealth for bequest motives

## Bequests in the Utility: Warm Glow Or Altruistic

$u(c)-h(l)+\delta v(b)$ where $c$ is own consumption, $l$ is labor supply, and $b$ is net-of-tax bequests left to next generation and $v(b)$ is warm glow utility of bequests

Budget with no estate tax: $c + b/(1+r) = wl - T_L(wl)$

Budget with bequest tax at rate $\tau_B$: $c + b/[(1+r)(1-\tau_B)] = wl - T_L(wl)$

Suppose first that $b$ is not bequeathed but used for "after-life" consumption [e.g., funerary monument of no value to next generation]

$\Rightarrow$ Atkinson-Stiglitz implies that $b$ should not be taxed [$\tau_B = 0$] and that nonlinear tax on $wl$ is enough for redistribution

## Bequests in the Utility: Warm Glow Or Altruistic

Suppose now that $b$ is given to a heir who derives utility $v^{heir}(b)$
$\Rightarrow b$ creates a positive externality (to donee) and hence should be subsidized $\Rightarrow \tau_B < 0$ is optimal

Kaplow '01 makes this point informally

Farhi-Werning QJE'10 develop formal model of non-linear Pigouvian subsidization of bequests with 2 generations and social Welfare:

$$SWF = \int [u(c) - h(l) + \delta v(b) + v^{heir}(b)] f(w) dw$$

The marginal external effect of bequests is $dv^{heir}/db$ and hence should be smaller for large $b$

$\Rightarrow$ Optimal subsidy rate is smaller for large estates $\Rightarrow$ progressive estate subsidy

## A-S Fails with Inheritances In General Equilibrium (Piketty-Saez ECMA'13)

Atkinson-Stiglitz applies when sole source of lifetime income is labor:

$c+b(left)/(1+r) = wl-T(wl)$ ($w$ = productivity, $l$ = labor supply)

In GE, bequests provide an additional source of life-income:

$$c + b(left)/(1 + r) = wl - T(wl) + b(received)$$

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

$\Rightarrow$ Two-dim. inequality requires two-dim. tax policy tool

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

## Piketty-Saez Simplified Optimal Inheritance Tax Model

Measure one of individuals, who are both bequests receivers and bequest leavers (in ergodic general equilibrium)

Linear tax $\tau_B$ on bequests funds lumsump grant $E$

Life-time budget constraint: $c_i + b_i = R(1-\tau_B)b_i^r + y_{Li} + E$

with $c_i$ consumption, $b_i$ bequests left, $y_{Li}$ inelastic labor income, $b_i^r$ pre-tax bequests received, $R = 1 + r$ generational rate of return on bequests

Individual $i$ has utility $V^i(c, \underline{b})$ with $\underline{b} = R(1-\tau_B)b$ net-of-tax bequests left and solves

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

## Piketty-Saez ECMA'13 Optimal Inheritance Tax

Government budget constraint is $E = \tau_B b$ with $b$ aggregate (=average) bequests. Govt solves:

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

with $\omega_i \geq 0$ Pareto weights

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

(e.g., people not responsible for $b_i^r$ but responsible for $y_{Li}$) $\Rightarrow$

$$\textbf{Optimal inheritance tax rate: } \tau_B = \frac{1-\bar{b}}{1+e_B}$$

with $e_B = \frac{1-\tau_B}{b}\frac{db}{d(1-\tau_B)}$ elasticity of aggregate bequests and $\bar{b} = \frac{E[b_i|b_i^r=0]}{b}$ relative bequest left by zero-receivers

## Piketty-Saez ECMA'13 Optimal Inheritance Tax: Proof

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

[NB: removed term $R(1-\tau_B)b_i^r$ because $\omega_i = 0$ when $b_i^r = 0$]

$$0 = \frac{dSWF}{d\tau_B} = \int_i \omega_i \cdot \left( V_c^i \left[ b - \tau_B \frac{db}{d(1-\tau_B)} \right] - Rb_i V_{\underline{b}}^i \right) \Rightarrow$$

$$0 = \int_i \omega_i \cdot \left( V_c^i \cdot b \left[ 1 - \frac{\tau_B}{1-\tau_B} e_B \right] - \frac{b_i}{1-\tau_B} V_c^i \right) \Rightarrow$$

$$0 = b \left[ 1 - \frac{\tau_B}{1-\tau_B} e_B \right] - \frac{1}{1-\tau_B} \cdot \frac{\int_i \omega_i V_c^i \cdot b_i}{\int_i \omega_i V_c^i} \Rightarrow$$

as $\omega_i V_c^i \equiv 0$ for $b_i^r > 0$ and $\omega_i V_c^i \equiv 1$ for $b_i^r = 0 \Rightarrow$

$$0 = 1 - \tau_B - \tau_B \cdot e_B - \frac{E[b_i | b_i^r = 0]}{b} \Rightarrow \tau_B = \frac{1-\overline{b}}{1+e_B}$$

## Piketty-Saez ECMA'13 Optimal Inheritance Tax

**Optimal inheritance tax rate:** $\tau_B = \dfrac{1-\bar{b}}{1+e_B}$

1) Optimal $\tau_B < 1/(1+e_B)$ revenue maximizing rate because zero-receivers care about bequests they leave

2) $\tau_B = 0$ if $\bar{b} = 1$ (i.e, zero-receivers leave as much bequest as average)

3) If bequests are quantitatively important, highly concentrated, and low wealth mobility then $\bar{b} << 1$

4) Empirically $e_B$ small (Kopcuzk-Slemrod '01) but poorly known, $\bar{b} = 2/3$ in US (SCF data) but poorly measured

5) Formula can be extended to other social criteria, elastic labor supply, wealth loving preferences, altruistic preferences [see Piketty-Saez ECMA'13]

## Optimal Capital Stock and Modified Golden Rule

**Modified Golden Rule:** $r = \delta + \gamma \cdot g$
with $r = F_K(K, L) = f'(k)$ rate of return, $\delta$ discount rate, $\gamma$ curvature of $u'(c) = c^{-\gamma}$, $g$ growth rate (per capita).

Proof: \$1 extra in period $t$ gives social welfare $u'(c_t)$

\$1 $+ r$ extra in period $t + 1$ gives social welfare $\frac{(1+r)u'(c_{t+1})}{1+\delta} = \frac{(1+r)u'(c_t)}{1+\delta}\frac{u'(c_{t+1})}{u'(c_t)} = \frac{1+r}{(1+\delta)(1+g)^\gamma}u'(c_t) \Rightarrow 1 + r = (1 + \delta)(1 + g)^\gamma$

This is equivalent to $r = \delta + \gamma \cdot g$ when the period is small. QED.

Normatively $\delta = 0$ seems justified. Small capital stock and $r > g$ desirable if $\gamma$ is high [controversy Stern vs. Nordhaus]

## Optimal Capital Stock and Modified Golden Rule

**Modified Golden Rule:** $r = \delta + \gamma \cdot g$

Bequest and capital taxes affect capital stock

However, if govt can use debt, it can control capital stock

If debt used to set optimal capital stock at the Modified Golden Rule) then effects of taxes on $K$ stock can be ignored $\Rightarrow$ Optimal $K$ stock and optimal redistribution are **orthogonal**

If K stock is not at Modified Golden Rule, then optimal K tax formulas include a corrective term

[see King 1980 and Atkinson-Sandmo 1980 in OLG life-cycle model, Piketty-Saez ECMA'13 for models with bequests]

In practice: no reason for MGR to hold, govts do not actively target K stock

# MANIPULATIVE BEQUESTS

Parents use potential bequest to extract favors from children

Empirical Evidence: Bernheim-Shleifer-Summers JPE '85 show that number of visits of children to parents is correlated with bequeathable wealth but not annuitized wealth of parents

$\Rightarrow$ Bequest becomes one additional form of labor income for donee and one consumption good for donor

$\Rightarrow$ Inheritances should be counted and taxed as labor income for donees

# SOCIAL-FAMILY PRESSURE BEQUESTS

Parents may not want to leave bequests but feel compelled to by pressure of heirs or society: bargaining between parents and children

With estate tax, parents do not feel like they need to give as much $\Rightarrow$ parents are made better-off by the estate tax $\Rightarrow$ Case for estate taxation stronger [Atkinson-Stiglitz does not apply and no double counting of bequests]

Empirical evidence:

Aura JpubE'05: reform of private pension annuities in the US in 1984 requiring both spouses signatures when retiring worker decides to get a single annuity or couple annuity: reform $\uparrow$ sharply couple annuities choice

Equal division of estates [Wilhelm AER'96, Light-McGarry '04]: estates are very often divided equally but gifts are not

# DYNASTIC MODEL OR INFINITE HORIZON

Special case of warm glow: $V_t = u(c_t, l_t) + V_{t+1}/(1+\delta)$ implies

$$V_0 = \sum_{t \geq 0} u(c_t, l_t)/(1+\delta)^t$$

$$\text{subject to } \sum_{t \geq 0} c_t/(1+r)^t \leq \sum_{t \geq 0} w_t l_t/(1+r)^t$$

Dynasty with **Ricardian equivalence:** consumption depends only on PDV of earnings of dynasty

Poor empirical fit:

1) Altonji-Hayashi-Kotlikoff AER'92, JPE'97 show that income shocks to parents have bigger effect on parents consumption than on kids consumption (and conversely)

2) Temporary tax cut debt financed [fiscal stimulus] should have no impact on consumption but actually do

## INFINITE HORIZON MODEL: CHAMLEY-JUDD

Govt can collect taxes using linear labor income tax or capital income taxes that vary period by period $\tau_L^t$, $\tau_K^t$

Goal of the government is to maximize utility of the dynasty

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

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

With constant tax rate $\tau_K$ 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 ant increase in $\tau_K$ 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]

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

# NEW DYNAMIC PUBLIC FINANCE: REFERENCES

Dynamic taxation in the presence of future earnings uncertainty

Recent series of papers following upon on Golosov, Kocherlakota, Tsyvinski REStud '03 (GKT)

Principle can be understood in 2 period model: Diamond-Mirrlees JpubE '78 and Cremer-Gahvari EJ '95

Generalized to many periods by GKT and subsequent papers

Simple exposition is Kocherlakota AER-PP '04

Two comprehensive surveys: Golosov-Tsyvinski-Werning '06 and Kocherlakota '10 book

# NEW DYNAMIC PUBLIC FINANCE (NDPF)

Key ingredient is uncertainty in future ability $w$

2 period simple model:

(0) Everybody is identical in period 0: no work and consume $c_0$, period 0 utility is $u(c_0)$

(1) Ability $w$ revealed in period 1, work $l$ and earn $z = wl$, consume $c_1$, period 1 utility $u(c_1) - h(l)$

Total utility $u(c_0) + \beta[u(c_1) - h(l)]$

Rate of return $r$, gross return $R = 1 + r$

Discount rate $\beta < 1$

# STANDARD EULER EQUATION

No govt intervention: $c_0 + c_1/R = wl/R$

Solve model backward (assume $c_0$ given):

Period 1: $c_1 = wl - Rc_0$, choose $l$ to maximize $u(wl - Rc_0) - h(l)$

$\Rightarrow$ FOC $wu'(wl - Rc_0) = h'(l) \Rightarrow l^* = l(w, c_0)$

Period 0: Choose $c_0$ to maximize:

$$u(c_0) + \beta \int [u(wl^* - Rc_0) - h(l^*)] f(w) dw$$

FOC for $c_0$ (using envelope condition for $l^*$)

$$u'(c_0) = \beta R \int u'(c_1) f(w) dw$$

This is called the **Euler equation**

# MECHANISM DESIGN

Government would like to redistribute from high $w$ to low $w$. Government does not observe $w$ but can observe $c_0, c_1, z = wl$ and can set taxes as a function of $c_0, c_1, z$

Equivalently (using revelation principle), govt can offer menu $(c_0, c_1(w), z(w))_w$ and let individuals truthfully reveal their $w$

Govt program: choose menu $(c_0, c_1(w), z(w))_w$ to maximize:

$$SW = u(c_0) + \beta \int [u(c_1(w)) - h(z(w)/w)] f(w) dw \text{ st}$$

1) Budget: $c_0 + \int c_1(w) f(w) dw / R \leq \int z(w) f(w) dw / R$

2) Incentive Compatibility (IC): individual $w$ prefers $c_0, c_1(w), z(w)$ to any other $c_0, c_1(w'), z(w')$

# INVERSE EULER EQUATION

**Inverse Euler equation** holds at the govt optimum:

$$\frac{1}{u'(c_0)} = \frac{1}{\beta R} \cdot \int \frac{1}{u'(c_1(w))} f(w)dw$$

**Proof:** small deviation in menus offered: $\Delta c_0 = -\varepsilon/u'(c_0)$ and $\Delta c_1(w) = \varepsilon/[\beta u'(c_1(w))]$ with small $\varepsilon > 0$

Does not affect individual utilities in any state:

$$u(c_0 + \Delta c_0) + \beta u(c_1(w) + \Delta c_1(w)) = u(c_0) + \beta u(c_1(w))$$

$$+\Delta c_0 u'(c_0) + \Delta c_1(w)\beta u'(c_1(w)) = u(c_0) + \beta u(c_1(w))$$

$\Rightarrow$ (IC) continues to hold and $SW$ unchanged

Deviation must be budget neutral at optimum

$$\Rightarrow -\frac{\varepsilon}{u'(c_0)} + \frac{1}{R} \int \frac{\varepsilon f(w)dw}{\beta u'(c_1(w))} = 0$$

# INTERTEMPORAL WEDGE

Jensen Inequality: for $K(.)$ convex

$$\Rightarrow K\left(\int x(w)dF(w)\right) < \int K(x(w))dF(w)$$

Apply this to $K(x) = 1/x$ and $x(w) = u'(c_1(w)) \Rightarrow$

$$\frac{1}{\int u'(c_1(w))f(w)dw} < \int \frac{f(w)dw}{u'(c_1(w))} = \frac{\beta R}{u'(c_0)}$$

$$\Rightarrow u'(c_0) < \beta R \int u'(c_1(w))f(w)dw$$

$\Rightarrow$ Optimal govt redistribution imposes a positive tax wedge on intertemporal choice

# NDPF DECENTRALIZATION AND INTUITION

**Decentralization:** Optimum can be decentralized with a tax on capital income [which depends on current labor income] along with a nonlinear tax on wage income [Kocherlakota EMA'06]

**Economic intuition:** If high skill person works less (to imitate lower skill person), person would also like to reduce $c_0$ and hence save more, so tax on savings is a good way to discourage imitation

Result depends crucially on rationality in inter-temporal choices + income effects on labor: not clear yet how applicable this is in practice

Would be valuable to explore empirically for example whether DI (disability insurance) cheaters were saving more than non cheaters [would require merging SSA data and tax/wealth data, hard to do]

# NDPF NUMERICAL SIMULATIONS

Farhi-Werning '11 propose numerical calibration and show that, for realistic parameters, the welfare gain of using full nonlinear optimal capital/labor taxation is very small (0.1% in aggregate welfare) relative to using only optimal labor taxation

Golosov-Troshkin-Tsyvinski '11 also find on average small welfare gains and small optimal capital tax rates

$\Rightarrow$ Suggests that the mechanism is not quantitatively important even assuming the theory is right

$\Rightarrow$ Policy relevance of the NDPF for capital taxation likely to be limited

DI/retirement application of NDPF might be quantitatively more important

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