Economics of Inequality

(Master PPD & APE, Paris School of Economics)

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Lecture 4: From capital/income ratios to capital shares

(Tuesday October 14th 2014)

(check on line for updated versions)

Capital-income ratios β vs. capital shares α

- Capital/income ratio $\beta = K/Y$
- Capital share $\alpha = Y_K/Y$

with Y_K = capital income (=sum of rent, dividends, interest, profits, etc.: i.e. all incomes going to the owners of capital, independently of any labor input)

- I.e. β = ratio between capital stock and income flow
- While α = share of capital income in total income flow

- By definition: $\boldsymbol{\alpha = r \times \beta}$

With $r = Y_K/K$ = average real rate of return to capital

- If β=600% and r=5%, then α = 30% = typical values

- In practice, the average rate of return to capital r (typically r≈4-5%) varies a lot across assets and over individuals (more on this in Lecture 6)
- Typically, rental return on housing = 3-4% (i.e. the rental value of an appartment worth 100 000€ is generally about 3000-4000€/year) (+ capital gain or loss)
- Return on stock market (dividend + k gain) = as much as 6-7% in the long run
- Return on bank accounts or cash = as little as 1-2% (but only a small fraction of total wealth)
- Average return across all assets and individuals ≈ 4-5%

The Cobb-Douglas production function

- Cobb-Douglas production function: **$Y = F(K,L) = K^{\alpha} L^{1-\alpha}$**
- With perfect competition, wage rate v = marginal product of labor, rate of return r = marginal product of capital:

$$r = F_K = \alpha K^{\alpha-1} L^{1-\alpha} \text{ and } v = F_L = (1-\alpha) K^{\alpha} L^{-\alpha}$$

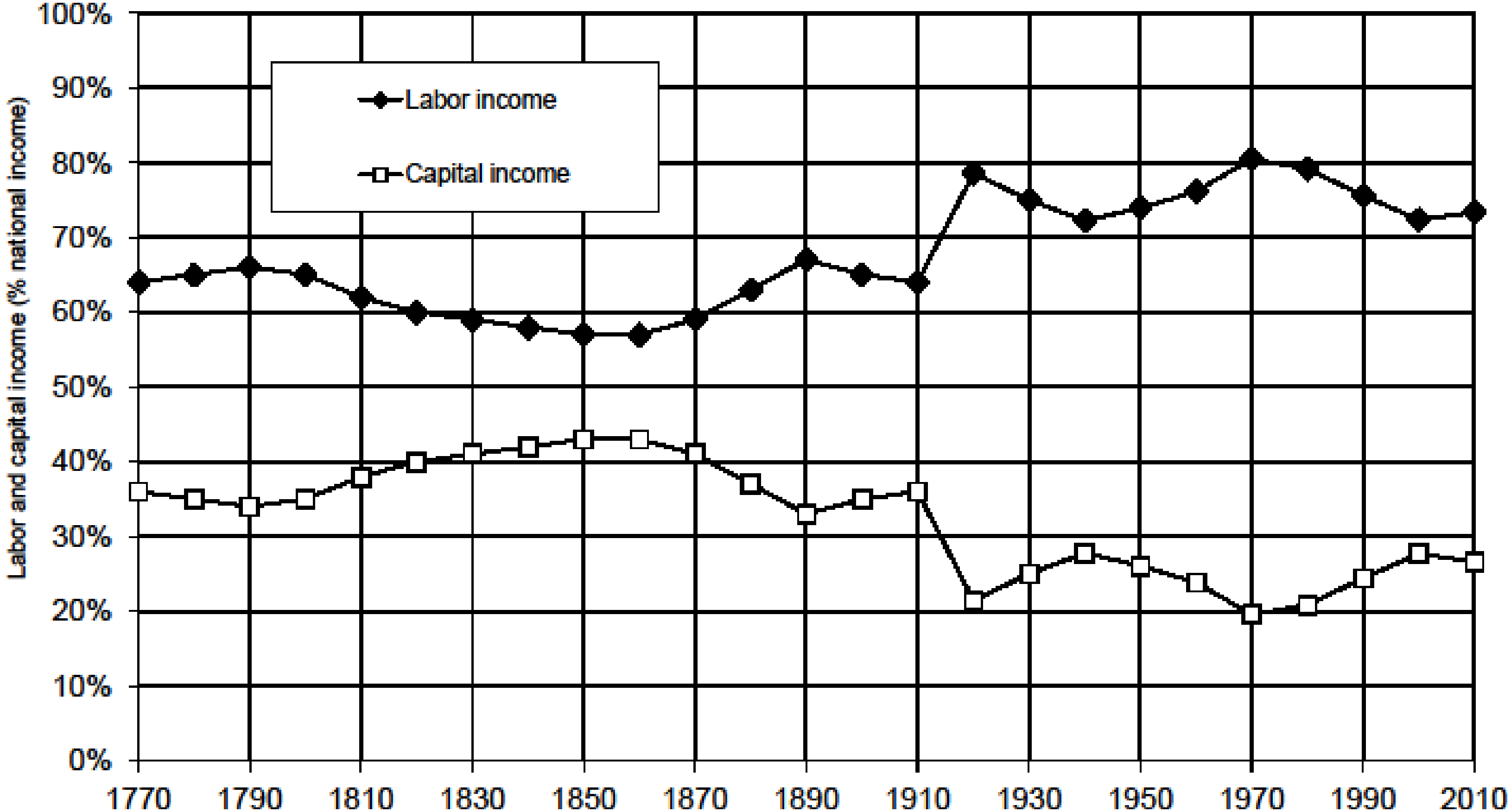
- Therefore capital income $Y_K = r K = \alpha Y$

  & labor income $Y_L = v L = (1-\alpha) Y$
- I.e. capital & labor shares are entirely set by technology (say, α=30%, 1-α=70%) and do not depend on quantities K, L
- Intuition: Cobb-Douglas ↔ elasticity of substitution between K & L is exactly equal to 1
- I.e. if v/r rises by 1%, $K/L=\alpha/(1-\alpha)\, v/r$ also rises by 1%. So the quantity response exactly offsets the change in prices: if wages ↑by 1%, then firms use 1% less labor, so that labor share in total output remains the same as before

The limits of Cobb-Douglas

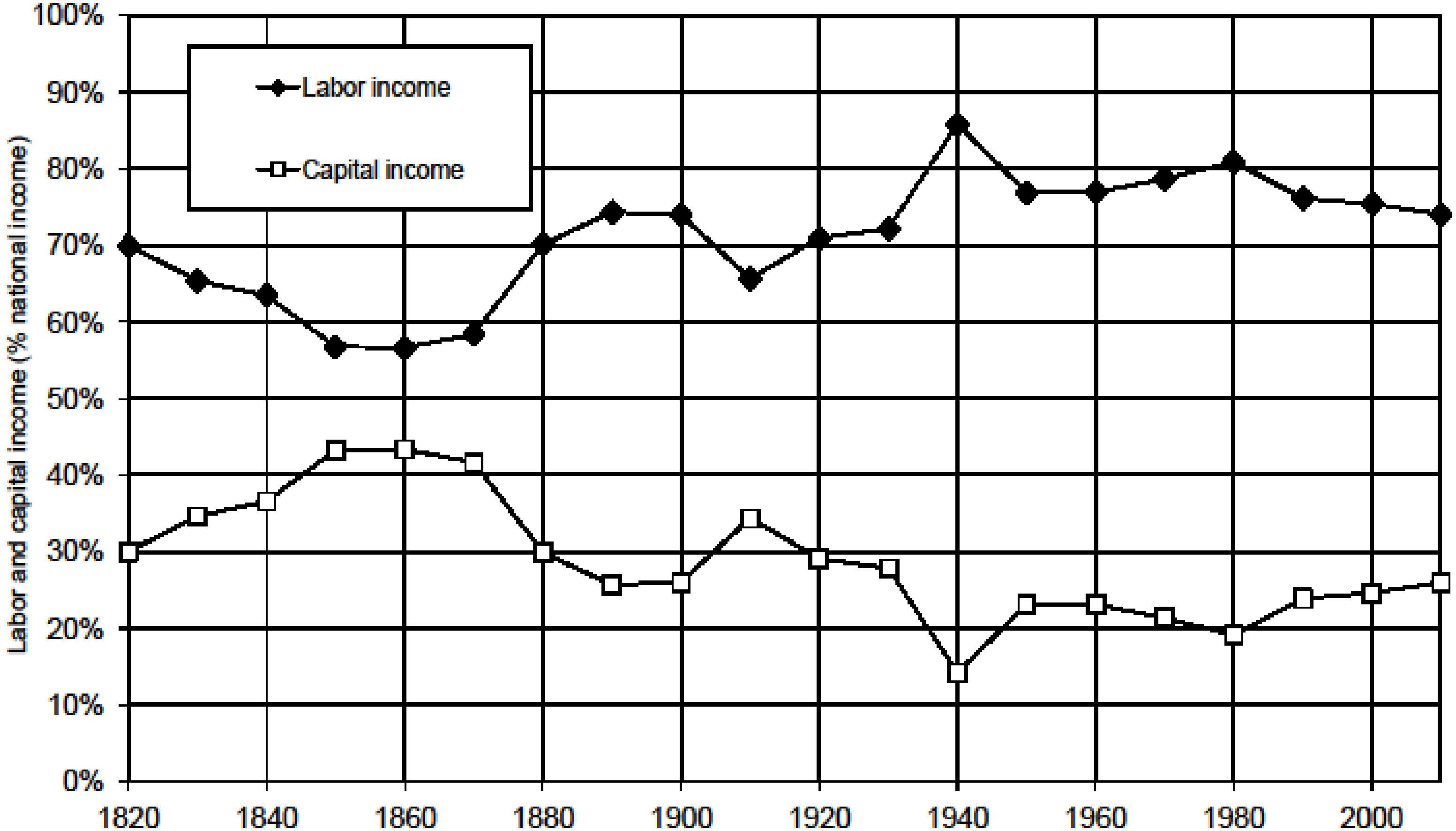
- Economists like Cobb-Douglas production function, because stable capital shares are approximately stable
- However it is only an approximation: in practice, capital shares α vary in the 20-40% range over time and between countries (or even sometime in the 10-50% range)
- In 19c, capital shares were closer to 40%; in 20c, they were closer to 20-30%; structural rise of human capital (i.e. exponent $\alpha\downarrow$ in Cobb-Douglas production function $Y = K^{\alpha} L^{1-\alpha}$?), or purely temporary phenomenon ?
- Over 1970-2010 period, capital shares have increased from 15-25% to 25-30% in rich countries : very difficult to explain with Cobb-Douglas framework

Figure 6.1. The capital-labor split in the United Kingdom, 1770-2010



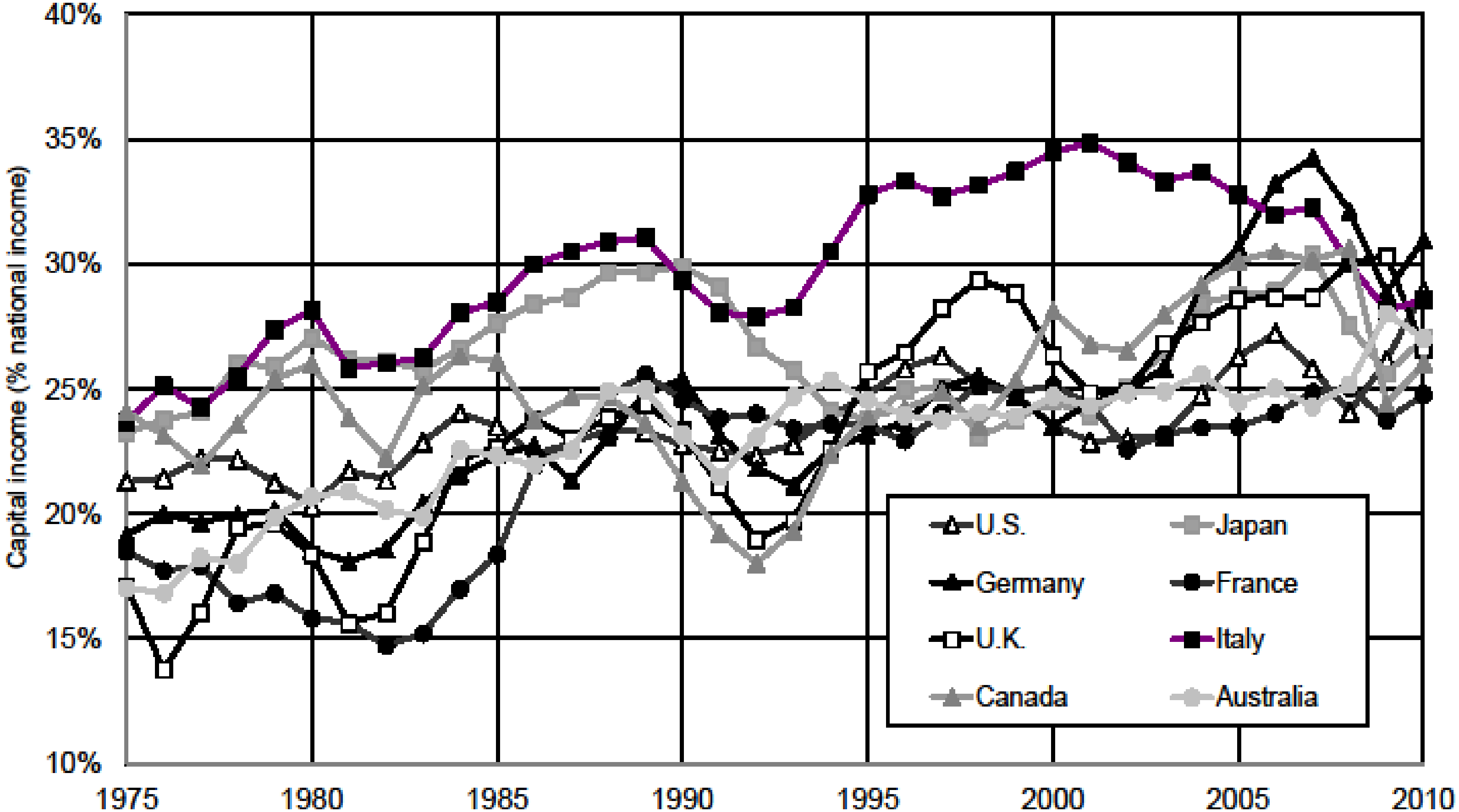
During the 19th century, capital income (rent, profits, dividends, interest,..) absorbed about 40% of national income, vs. 60% for labor income (salaried and non salaried). Sources and series: see piketty.pse.ens.fr/capital21c.

Figure 6.2. The capital-labor split in France, 1820-2010



In the 21st century, capital income (rent, profits, dividends, interest,..) absorbs about 30% of national income, vs. 70% for labor income (salaried and non salaried). Sources and series: see piketty.pse.ens.fr/capital21c.

Figure 6.5. The capital share in rich countries, 1975-2010



Capital income absorbs between 15% and 25% of national income in rich countries in 1970, and between 25% and 30% in 2000-2010. Sources and series: see piketty.pse.ens.fr/capital21c

The CES production function

- CES = a simple way to think about changing capital shares
- CES : $\mathbf{Y = F(K,L) = [a\, K^{(\sigma-1)/\sigma} + b\, L^{(\sigma-1)/\sigma}\,]^{\sigma/(\sigma-1)}}$

  with a, b = constant

σ = constant elasticity of substitution between K and L

- $\sigma \to \infty$: linear production function Y = r K + v L

  (infinite substitution: machines can replace workers and vice versa, so that the returns to capital and labor do not fall at all when the quantity of capital or labor rise) (= robot economy)
- $\sigma \to 0$: F(K,L)=min(rK,vL) (fixed coefficients) = no substitution possibility: one needs exactly one machine per worker
- $\sigma \to 1$: converges toward Cobb-Douglas; but all intermediate cases are also possible: Cobb-Douglas is just one possibility among many

- Compute the first derivative $r = F_K$: the marginal product to capital is given by

$$\mathbf{r = F_K = a\, \beta^{-1/\sigma}} \quad \text{(with } \beta=K/Y\text{)}$$

I.e. r ↓ as β↑ (more capital makes capital less useful),

but the important point is that the speed at which r ↓ depends on σ

- With $r = F_K = a\ \beta^{-1/\sigma}$, the capital share α is given by:

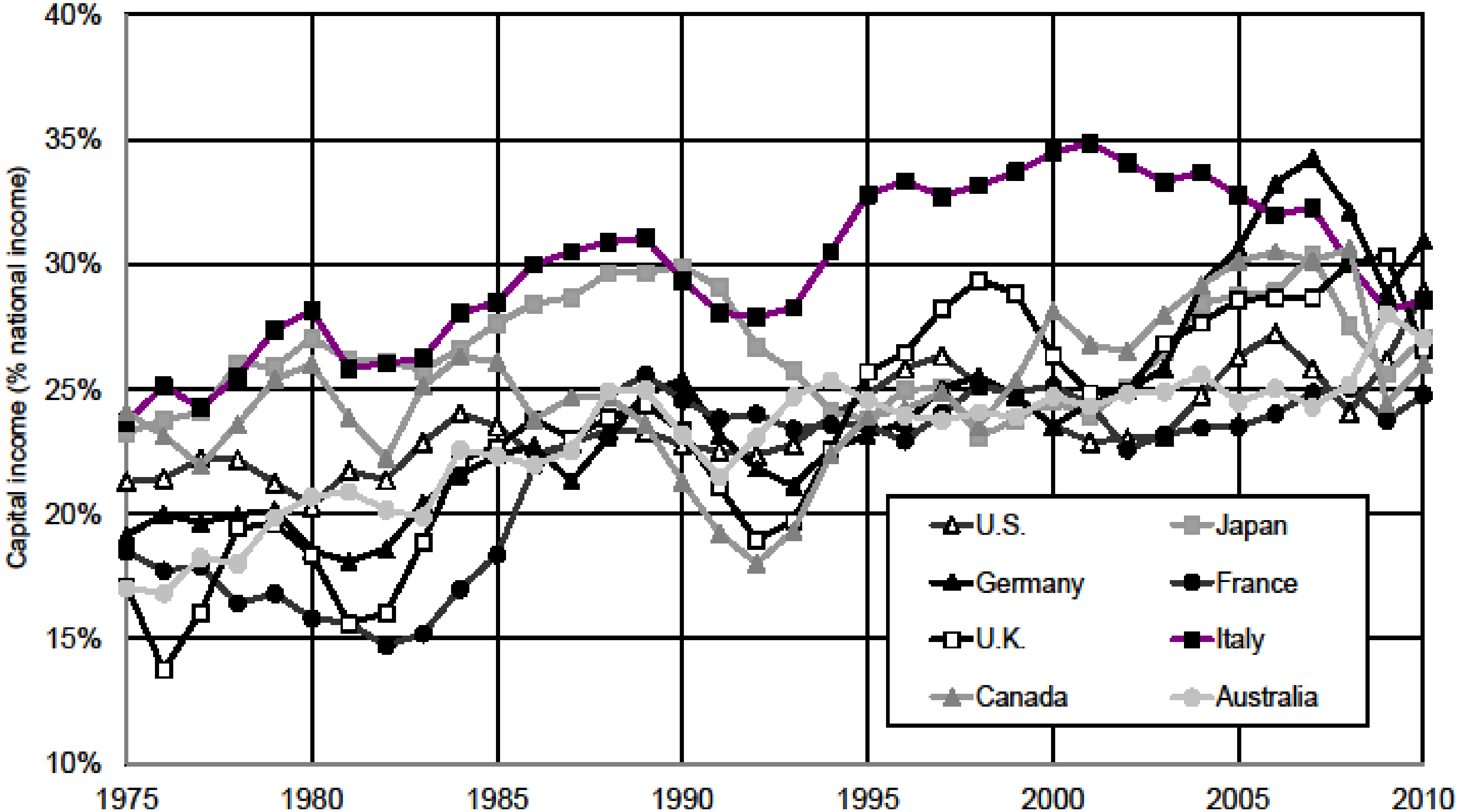
$$\boldsymbol{\alpha = r\ \beta = a\ \beta^{(\sigma-1)/\sigma}}$$

- I.e. α is an increasing function of β if and only if $\sigma>1$ (and stable iff $\sigma=1$)

- The important point is that with large changes in the volume of capital β, small departures from $\sigma=1$ are enough to explain large changes in α
- If $\sigma = 1.5$, capital share rises from $\alpha=28\%$ to $\alpha=36\%$ when β rises from $\beta=250\%$ to $\beta=500\%$

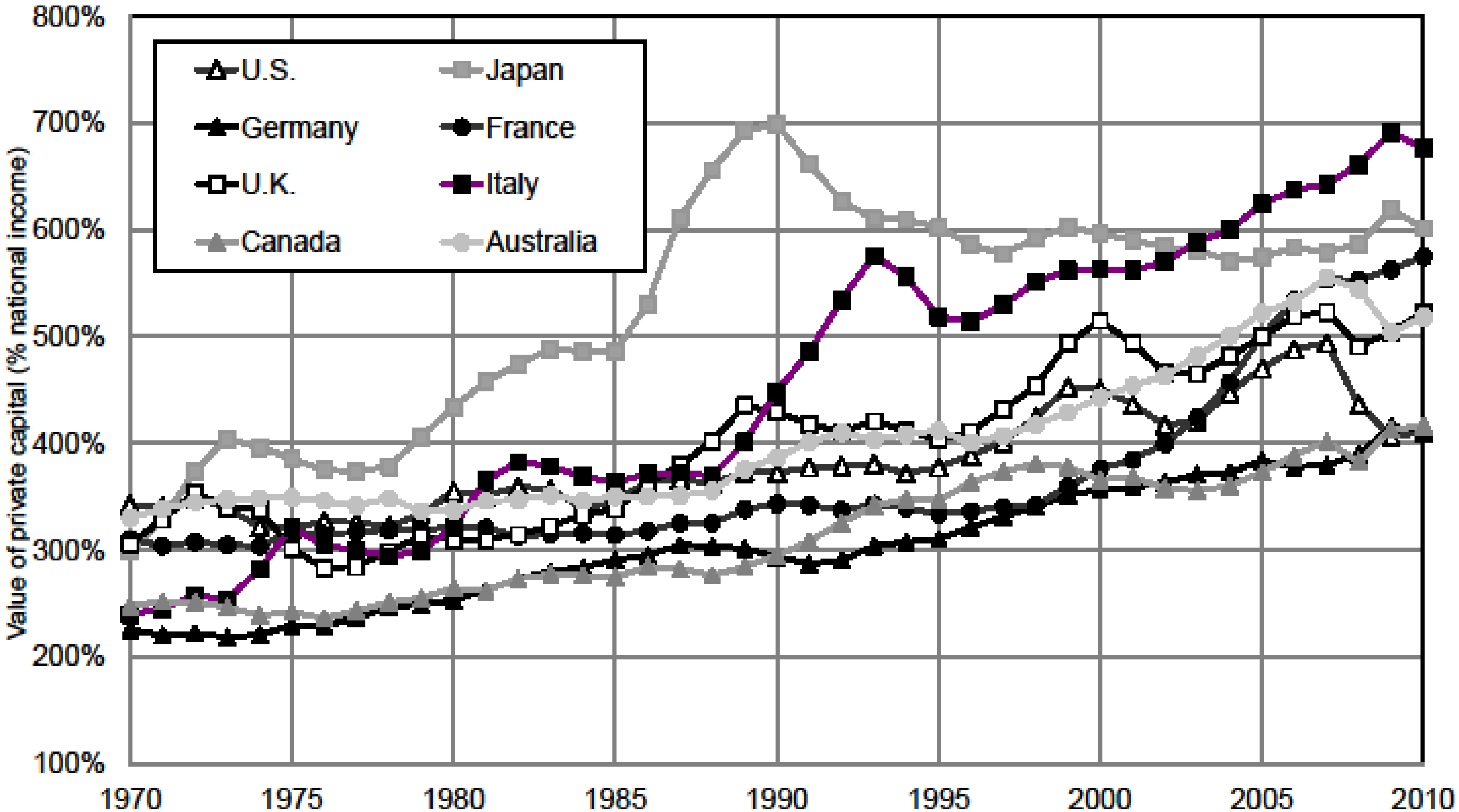
  = more or less what happened since the 1970s
- In case β reaches $\beta=800\%$, α would reach $\alpha=42\%$
- In case $\sigma=1.8$, α would be as large as $\alpha=53\%$

Figure 6.5. The capital share in rich countries, 1975-2010



Capital income absorbs between 15% and 25% of national income in rich countries in 1970, and between 25% and 30% in 2000-2010. Sources and series: see piketty.pse.ens.fr/capital21c

Figure 5.3. Private capital in rich countries, 1970-2010



Private capital is worth between 2 and 3,5 years of national income in rich countries in 1970, and between 4 and 7 years of national income in 2010. Sources and series: see piketty.pse.ens.fr/capital21c.

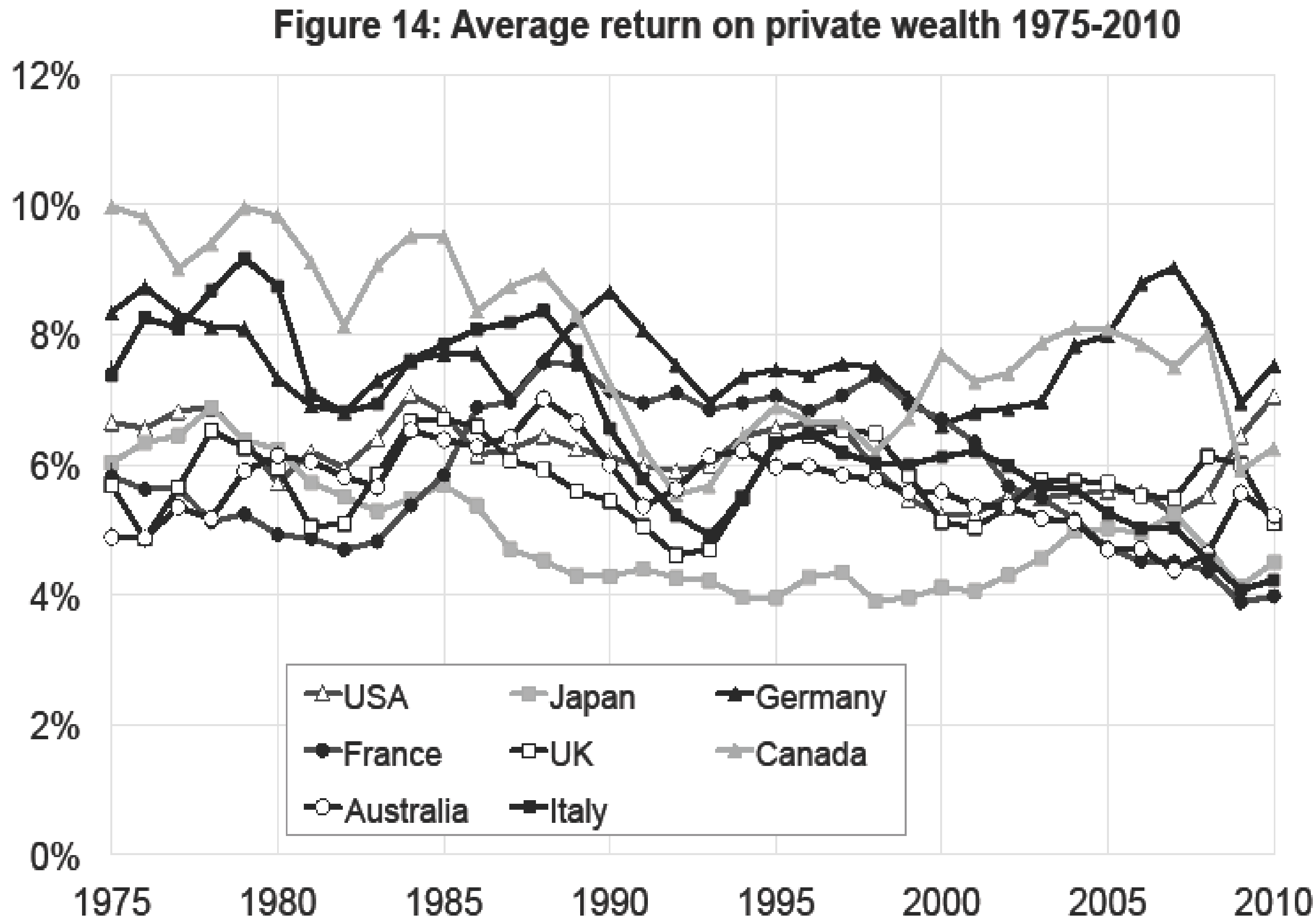
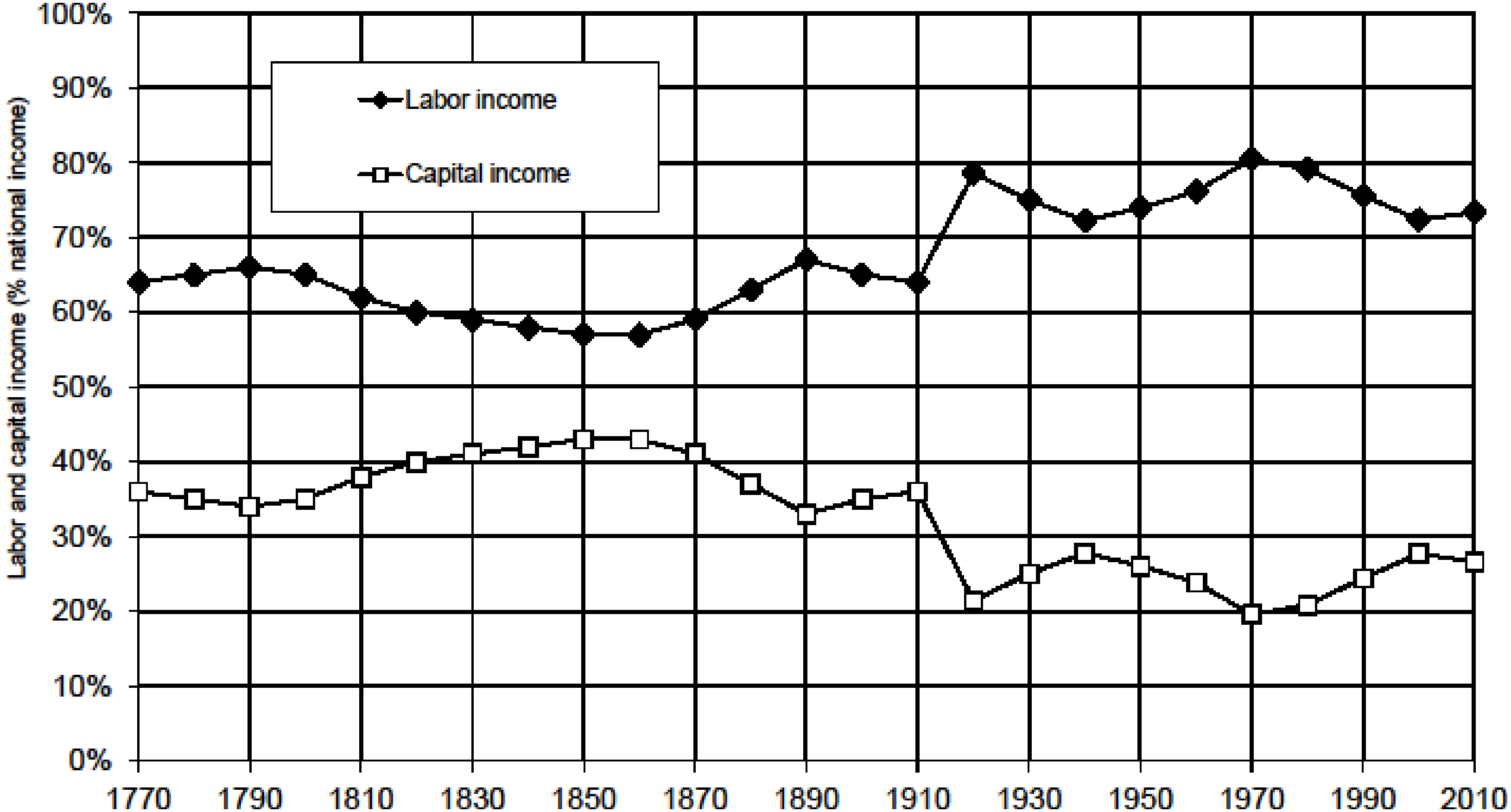


Figure 14: Average return on private wealth 1975-2010
12%
10%
8%
6%
4%
2%
0%
1975
1980
1985
1990
1995
2000
2005
2010
USA
Japan
Germany
France
UK
Canada
Australia
Italy

Measurement problems with capital shares

- In many ways, β is easier to measure than α
- In principle, capital income = all income flows going to capital owners (independanty of any labor input); labor income = all income flows going to labor earners (independantly of any capital input)
- But in practice, the line is often hard to draw: family firms, self-semployed workers, informal financial intermediation costs (=the time spent to manage one's own portfolio)
- If one measures the capital share α from national accounts (rent+dividend+interest+profits) and compute average return $r=\alpha/\beta$, then the implied r often looks very high for a pure return to capital ownership: it probably includes a non-negligible entrepreneurial labor component, particularly in reconstruction periods with low β and high r; the pure return might be 20-30% smaller (see estimates)
- Maybe one should use two-sector models $Y=Y_h+Y_b$ (housing + business); return to housing = closer to pure return to capital

Figure 6.1. The capital-labor split in the United Kingdom, 1770-2010



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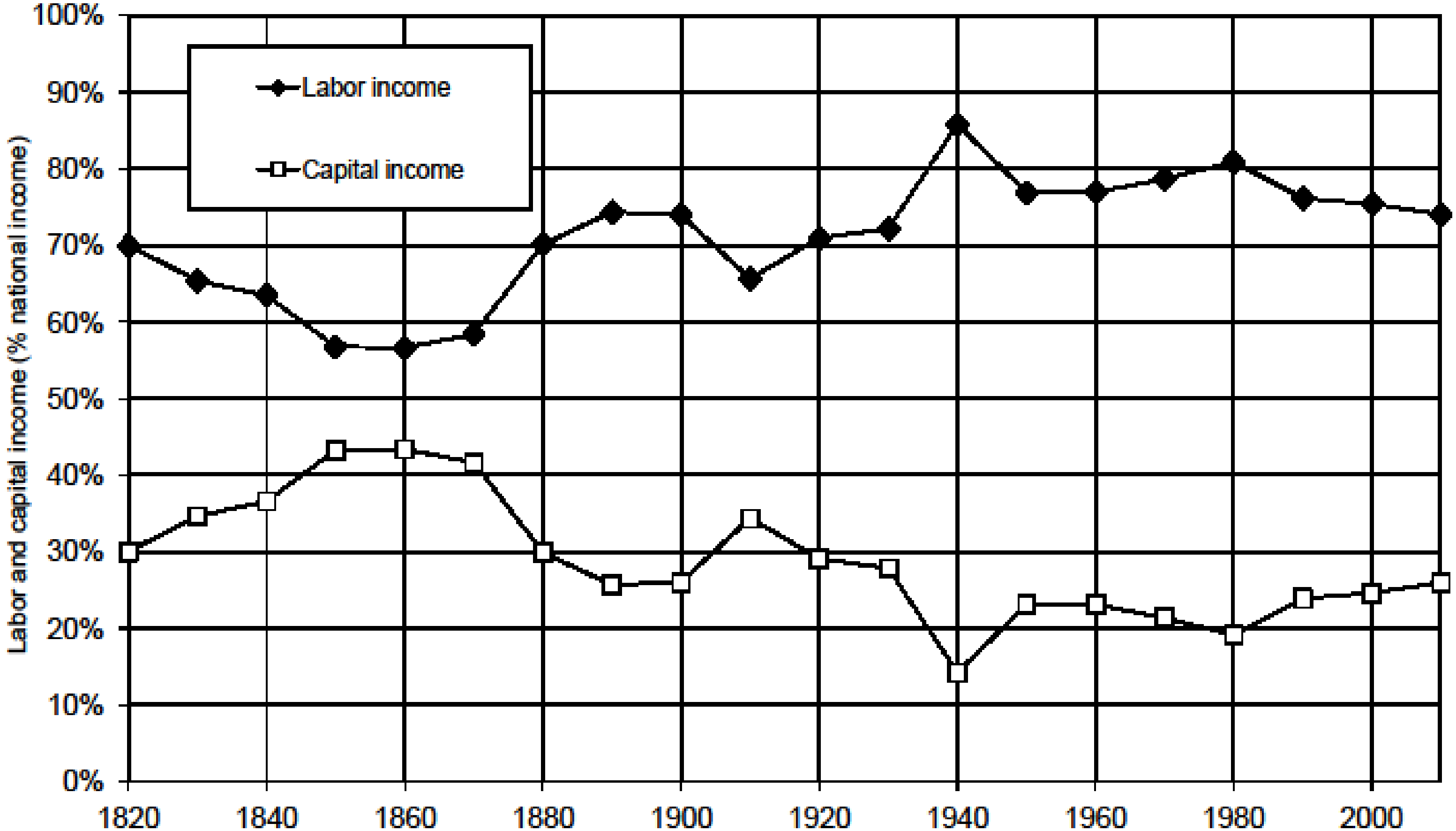
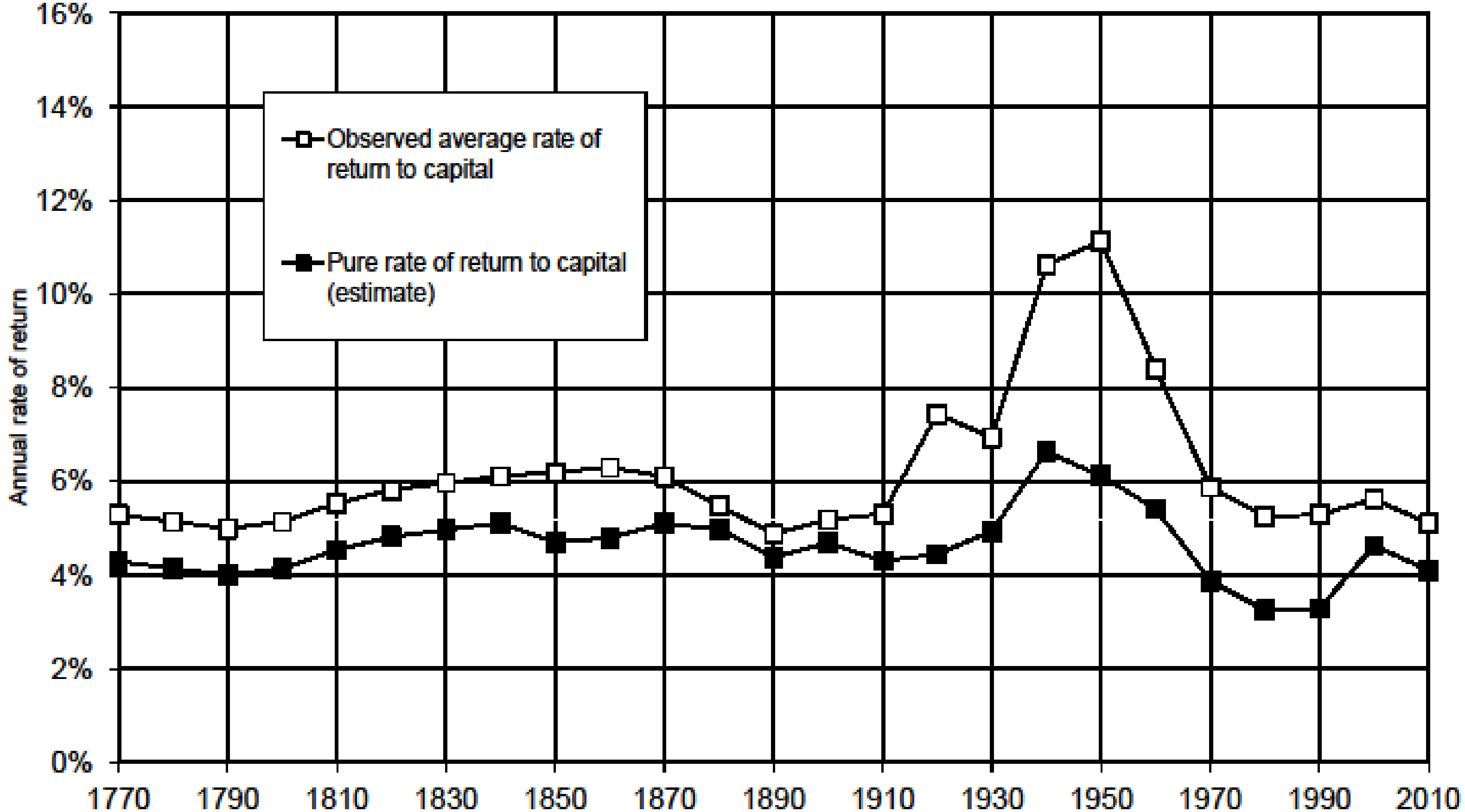


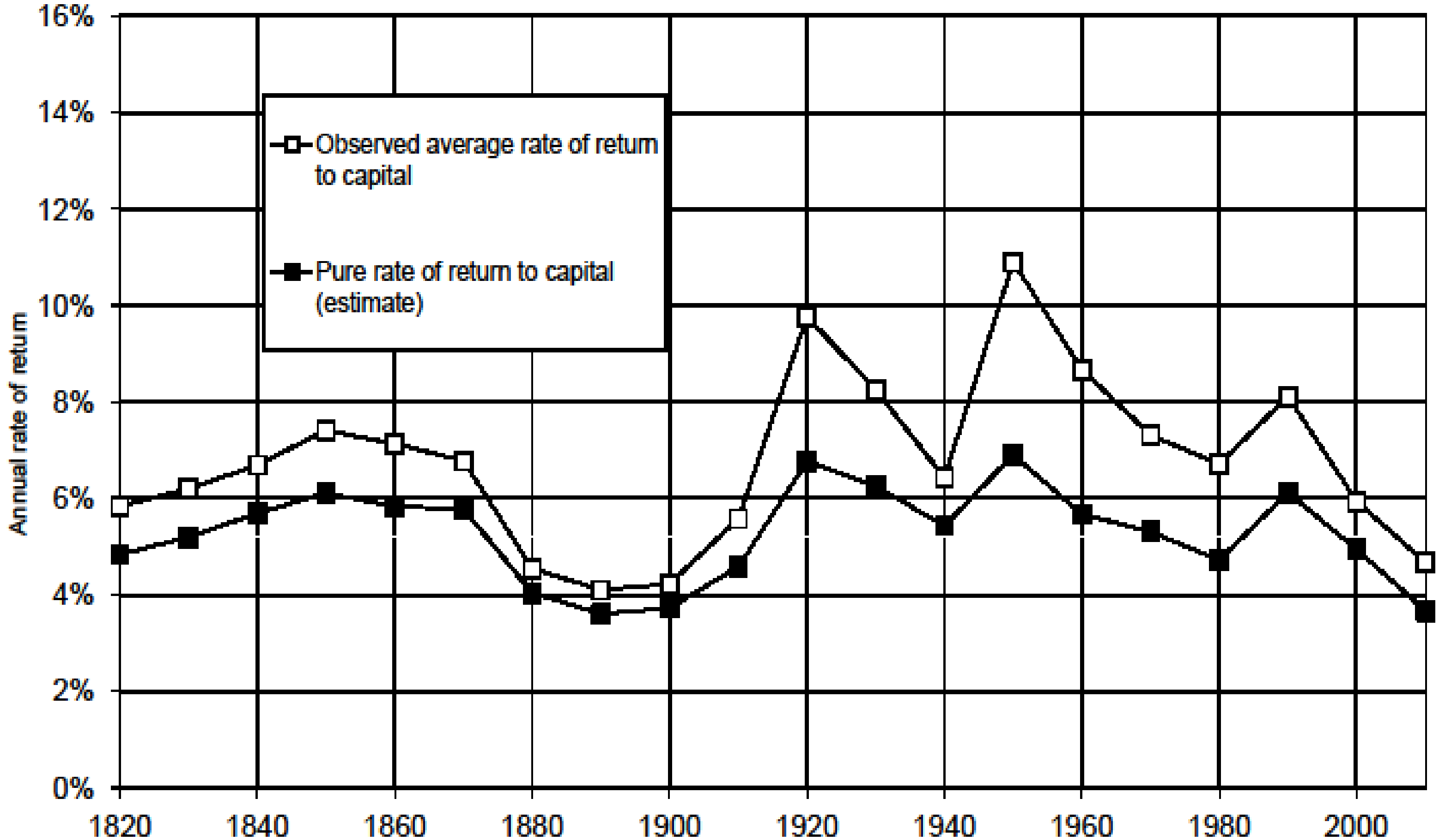
In the 21st century, capital income (rent, profits, dividends, interest,..) absorbs about 30% of national income, vs. 70% for labor income (salaried and non salaried). Sources and series: see piketty.pse.ens.fr/capital21c.

Figure 6.3. The pure return to capital in the United Kingdom, 1770-2010



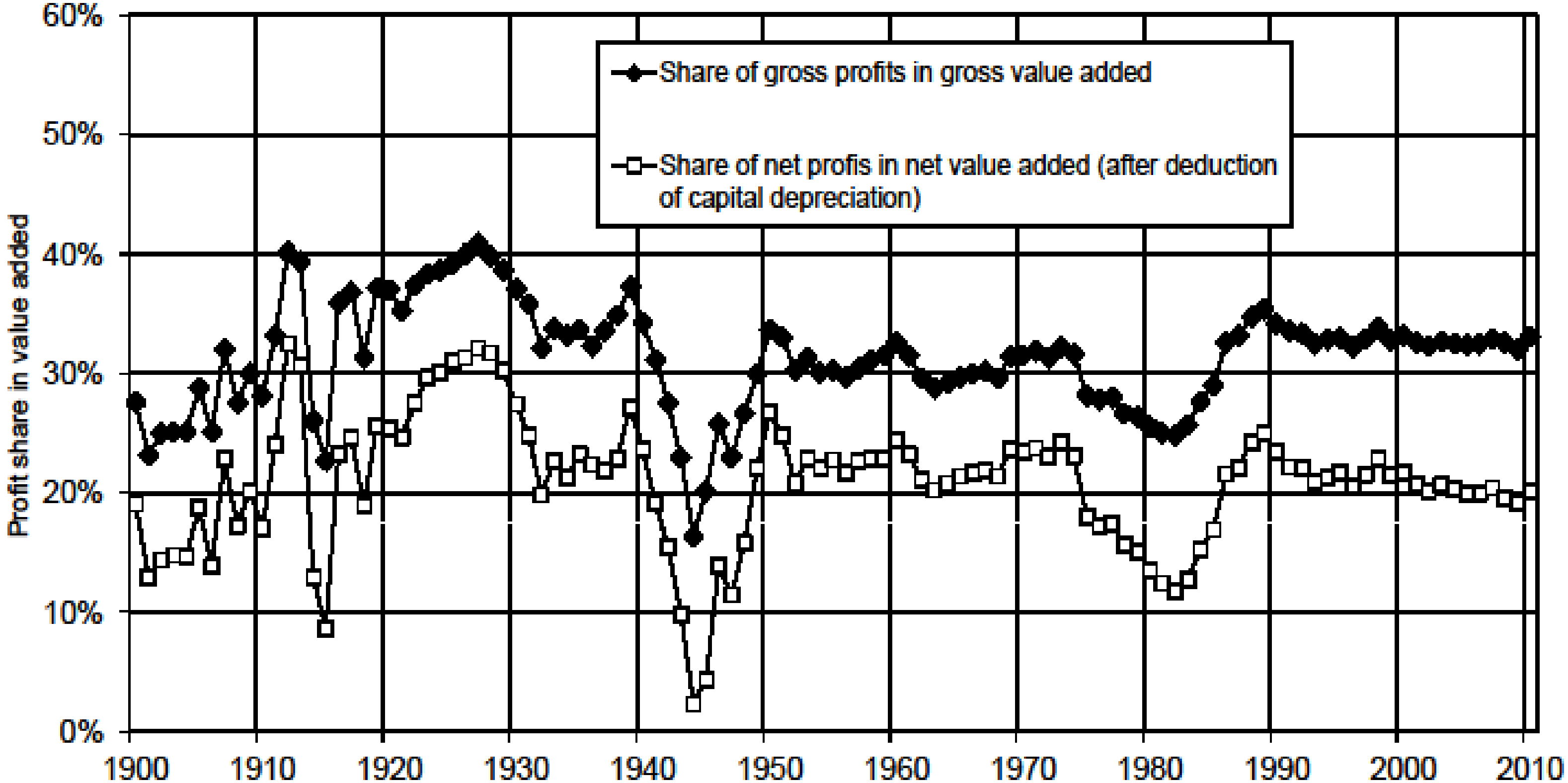
The pure rate of return to capital is roughly stable around 4%-5% in the long run.
Sources and series: see piketty.pse.ens.fr/capital21c.

Figure 6.4. The pure rate of return to capital in France, 1820-2010



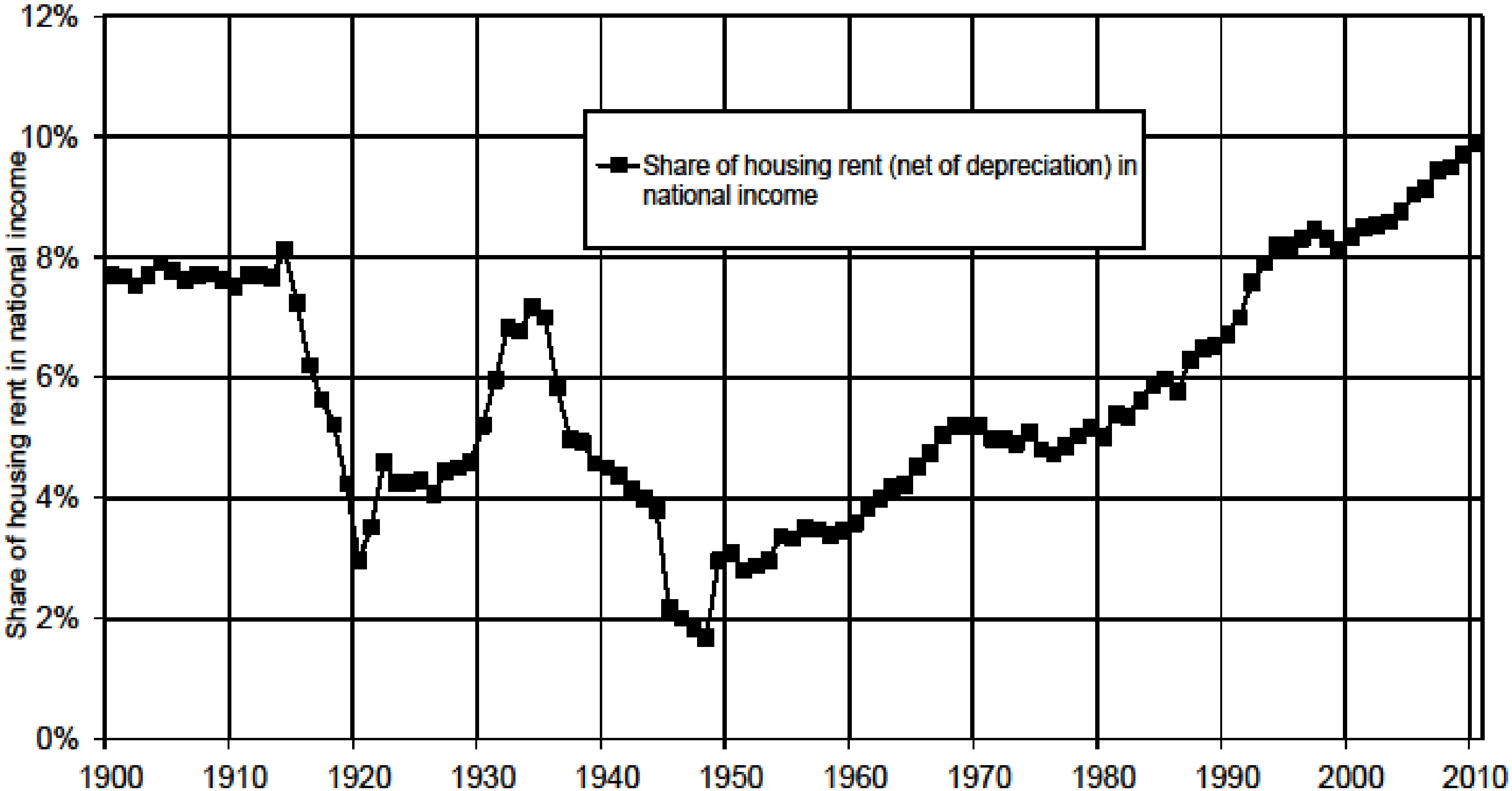
The observed average rate of return displays larger fluctuations than the pure rate of return during the 20th century.
Sources and series: see piketty.pse.ens.fr/capital21c.

Figure 6.6. The profit share in the value added of corporations in France, 1900-2010



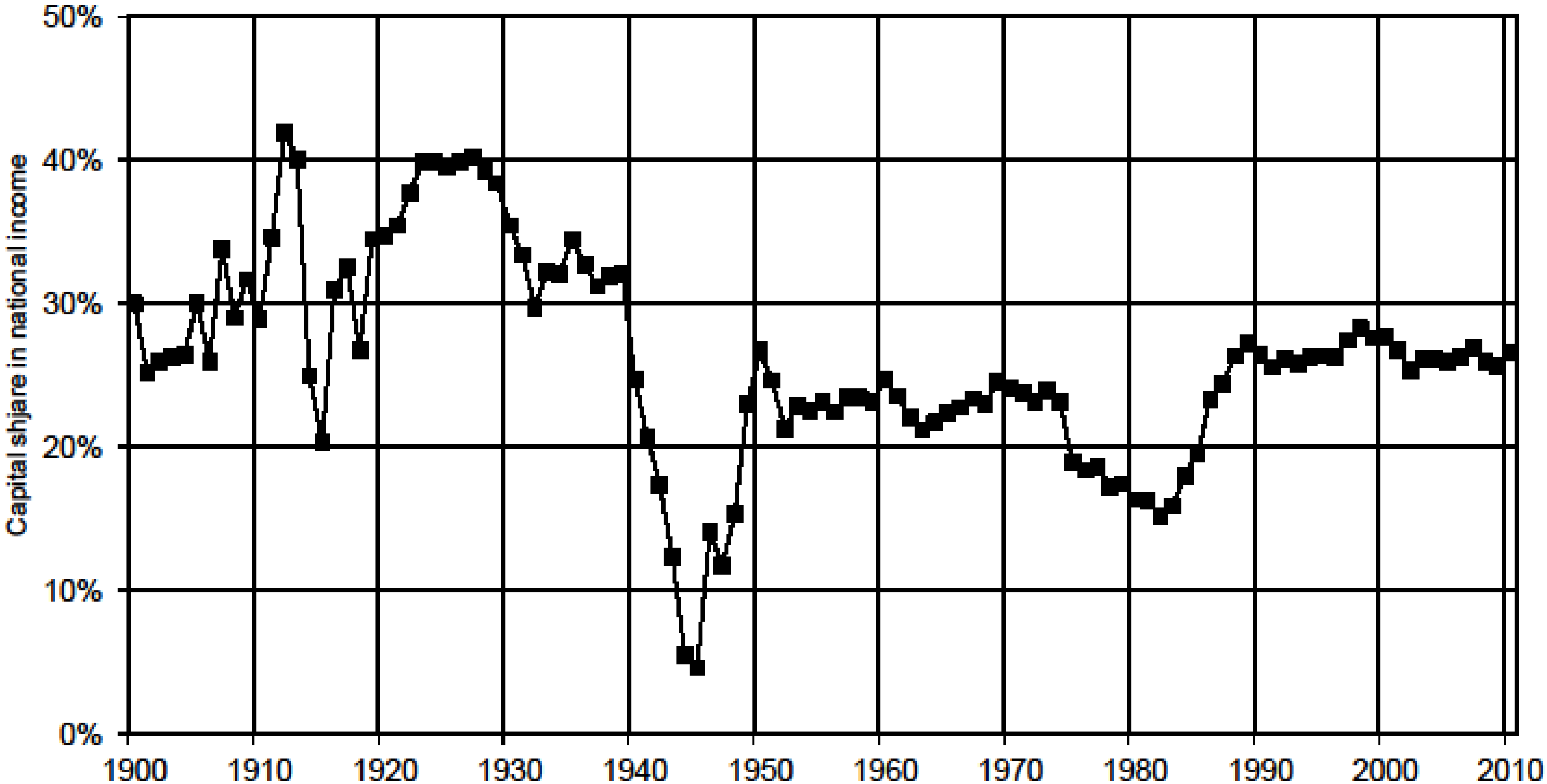
The share of gross profits in gross value added of corporations rose from 25% in 1982 to 33% in 2010; the share of net profits in net value added rose from 12% to 20%. Sources and series: see piketty.pse.ens.fr/capital21c

Figure 6.7. The share of housing rent in national income in France, 1900-2010



The share of housing rent (rental value of dwellings) rose from 2% of national income in 1948 to 10% in 2010.
Sources and series: see piketty.pse.ens.fr/capital21c.

Figure 6.8. The capital share in national income in France, 1900-2010



The share of capital income (net profits and rents) rose from 15% of national income in 1982 to 27% in 2010.
Sources and series: see piketty.pse.ens.fr/capital21c.

Recent work on capital shares

- Imperfect competition and globalization: see Karabarmounis-Neiman 2013 , « The Global Decline in the Labor Share »; see also KN2014
- Public vs private firms: see Azmat-Manning-Van Reenen 2011, « Privatization and the Decline of the Labor Share in GDP: A Cross-Country Aanalysis of the Network Industries »
- Capital shares and CEO pay: see Pursey 2013, « CEO Pay and Factor shares: Bargaining effects in US corporations 1970-2011 »

Summing up

- The rate of return to capital r is determined mostly by technology: $r = F_K$ = marginal product to capital, elasticity of substitution σ
- The quantity of capital β is determined by saving attitudes and by growth (=fertility + innovation): $\beta = s/g$
- The capital share is determined by the product of the two: $\alpha = r \times \beta$
- Anything can happen

- Note: the return to capital $r=F_K$ is dermined not only by technology but also by psychology, i.e. saving attitudes $s=s(r)$ might vary with the rate of return

- In models with wealth or bequest in the utility function $U(c_t,w_{t+1})$, there is zero saving elasticity with $U(c,w)=c^{1-s} w^s$, but with more general functional forms on can get any elasticity

- In pure lifecycle model, the saving rate s is primarily determined by demographic structure (more time in retirement → higher s), but it can also vary with the rate of return, in particular if the rate of return becomes very low (say, below 2%) or very high (say, above 6%)

- In the dynastic utility model, the rate of return is entirely set by the rate of time preference (=psychological parameter) and the growth rate:

  Max Σ $U(c_t)/(1+\delta)^t$, with $U(c)=c^{1-1/\xi}/(1-1/\xi)$

$\rightarrow$ unique long rate rate of return $r_t \rightarrow r = \delta + \xi g > g$

(ξ>1 and transverality condition)

This holds both in the representative agent version of model and in the heteogenous agent version (with insurable shocks); more on this in Lecture 6