

# **Econ 133 – Global Inequality and Growth**

## **Inequality between labor and capital**

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**In the last lecture** we saw that:

- The capital share  $\alpha = r \cdot \beta$
- The long-run wealth-income ratio  $\beta \rightarrow s/g$

**In this lecture** we ask:

- If  $\beta$  rises, does this automatically imply that  $\alpha$  will rise?
- More generally, what are the forces that determine  $\alpha$ ?

## Roadmap

1. Factor shares in a Cobb-Douglas world
2. Factor shares with CES production
3. The role of institutions and bargaining power

# 1 Factor shares in a Cobb-Douglas world

## 1.1 Definition of factor shares

- Capital income = all income flows going to capital owners (independently of any labor input)
- Labor income = all income flows going to labor earners (independently of any K input)
- Caveat: In practice, frontier between capital and labor can be hard to draw

## 1.2 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:

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

- So capital income  $Y_K = rK = \alpha Y$  and labor income  $Y_L = vL = (1 - \alpha)Y$
- Capital and labor shares are entirely set by technology and do not depend on quantities of capital and labor

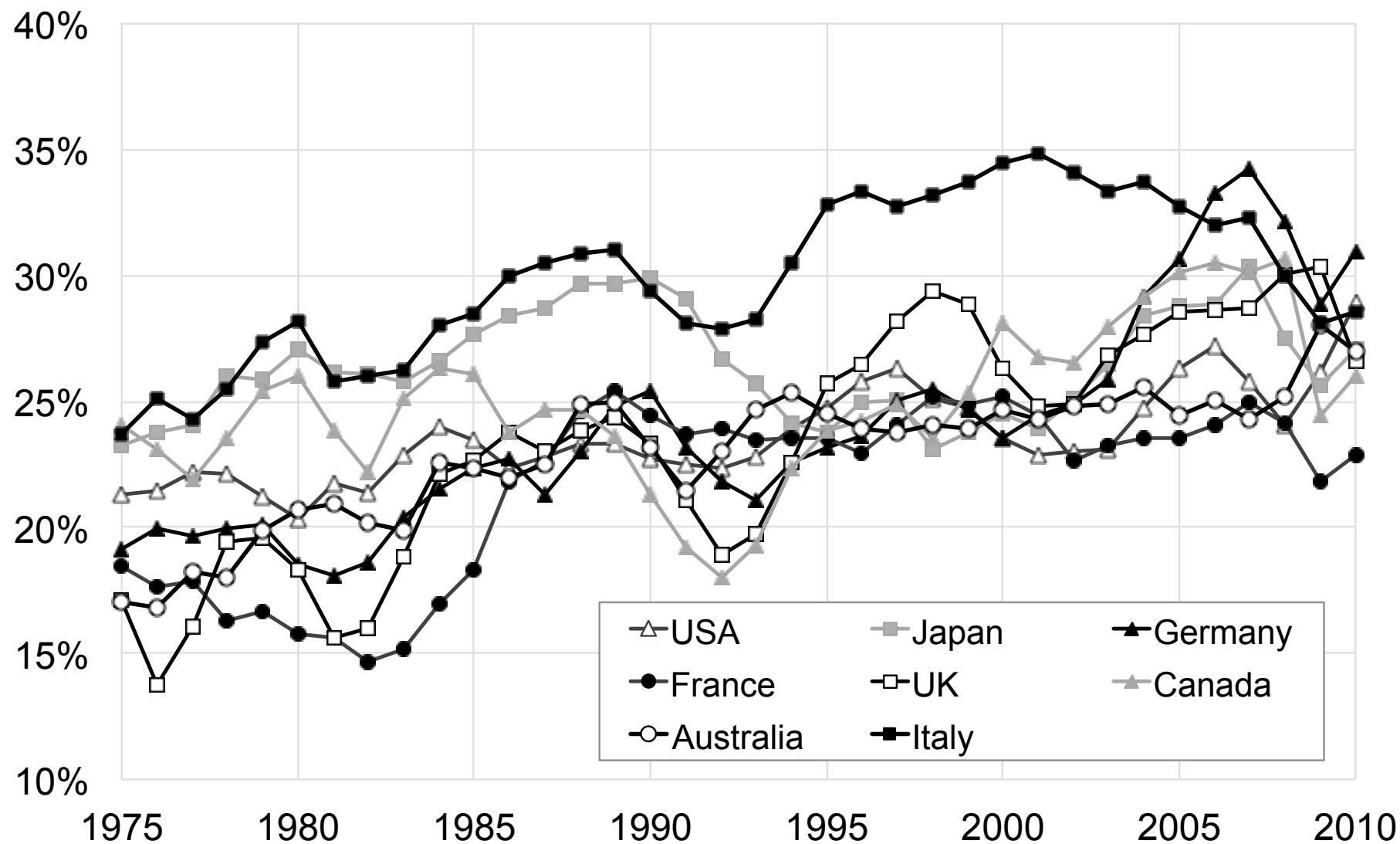
## 1.3 The limits of Cobb-Douglas

- Cobb-Douglas production very popular for a long time
- Writing in the 1920s, Keynes saw stable factor shares; became one of Kaldor's (1957) six stylized facts.

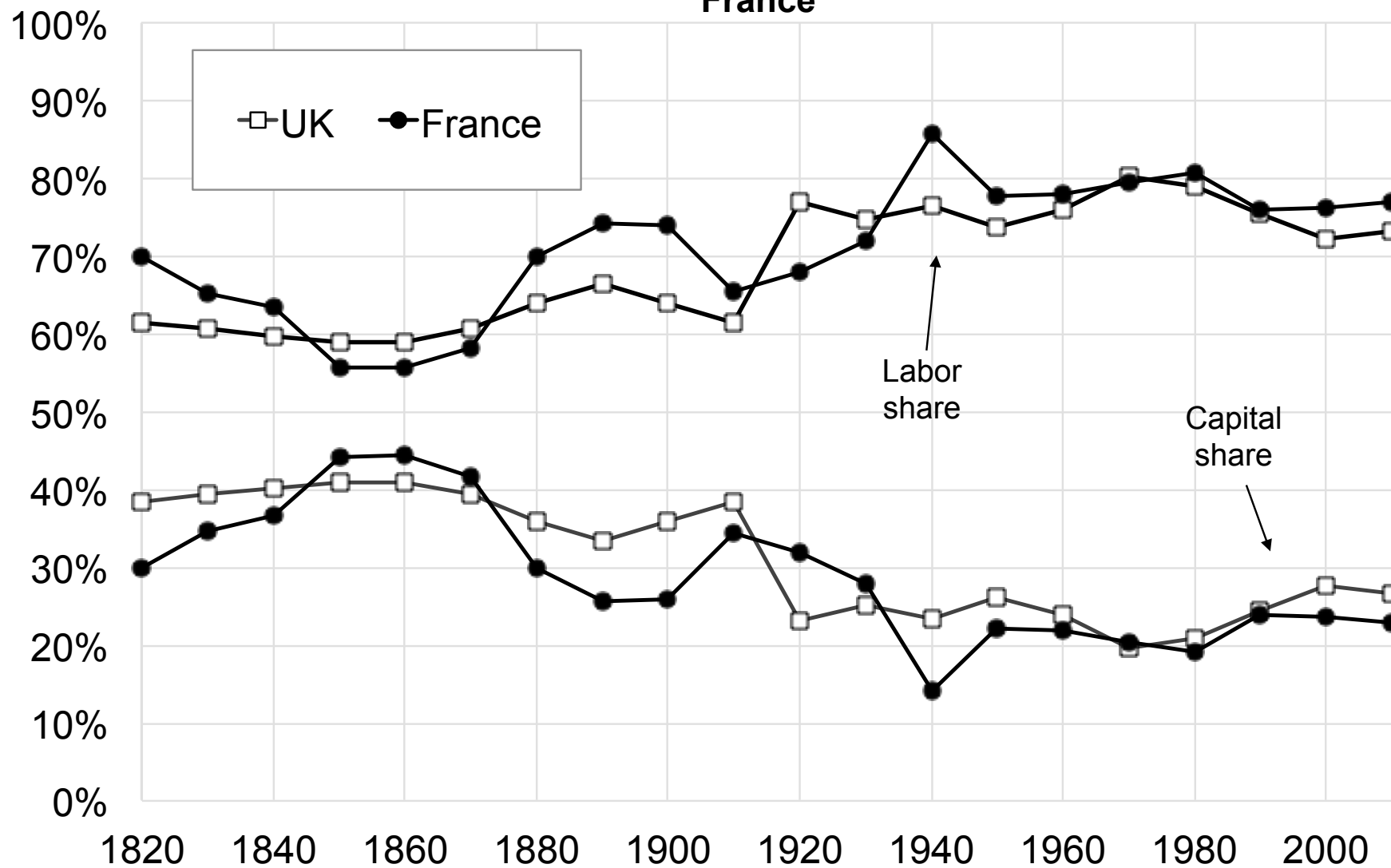
Two problems:

- Recent data show increase in capital share at global level.  
Reference on this: Karabarbounis and Neiman (2014)
- Evidence that  $\alpha$  was higher in the 19th century than today

### Capital shares in factor-price national income 1975-2010



**Factor shares in factor-price national income 1820-2010: UK and France**





## 2 Factor shares with CES production

### 2.1 The elasticity of substitution

- The elasticity of substitution  $\sigma$  captures the response of the capital-labor ratio  $K/L$  to a change in relative factor prices  $v/r$ :

$$\sigma = -\frac{d\log(K/L)}{d\log(F_K/F_L)} = \frac{d\log(K/L)}{d\log(v/r)}$$

- In the Cobb-Douglas case,  $\sigma$  is exactly equal to 1.

- Ex: if wages rises by 1% relative to  $r$ , then firms use 1% less labor relative to  $K$ , so that labor share in output remains constant
- However, there is no reason why  $\sigma$  should be equal to 1 (Keynes: “a bit of miracle”)

## 2.2 The CES production function

- In the CES production function, the elasticity of substitution can take any value
- With CES production, factor shares are not necessarily constant → useful to think about real world

- A CES production function is given by:

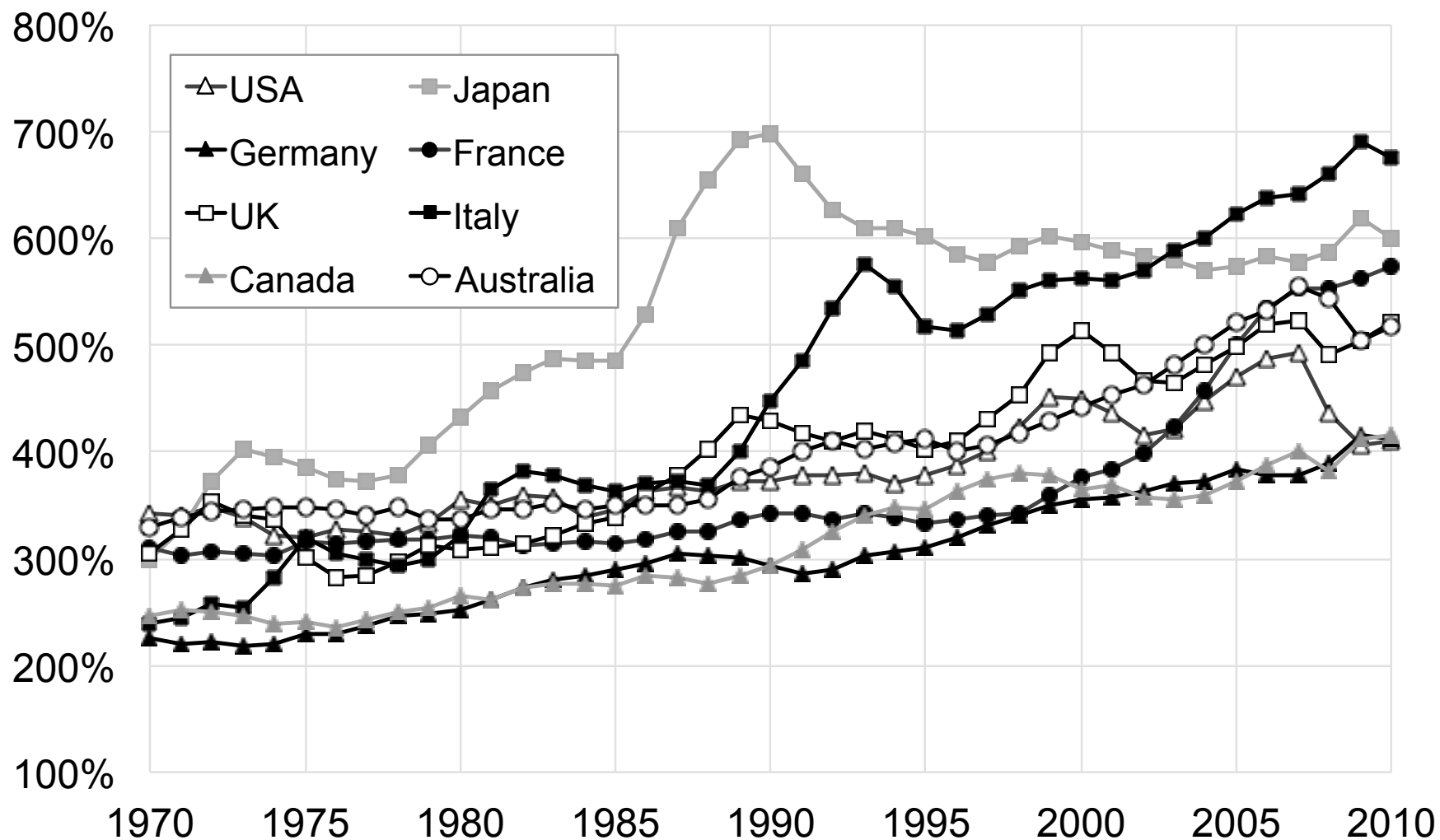
$$F(K, L) = (a \cdot K^{\frac{\sigma-1}{\sigma}} + (1 - a) \cdot L^{\frac{\sigma-1}{\sigma}})^{\frac{\sigma}{\sigma-1}}$$

- $\sigma =$  constant elasticity of substitution
- As  $\sigma \rightarrow \infty$ , the production function becomes linear:  
 $Y = rK + vL$ . Robot economy
- As  $\sigma \rightarrow 0$ , the production function becomes putty-clay, i.e.  
 $F(K, L) = \min(rK, vL)$ : no substitution possibility

## 2.3 Factor shares in a CES world

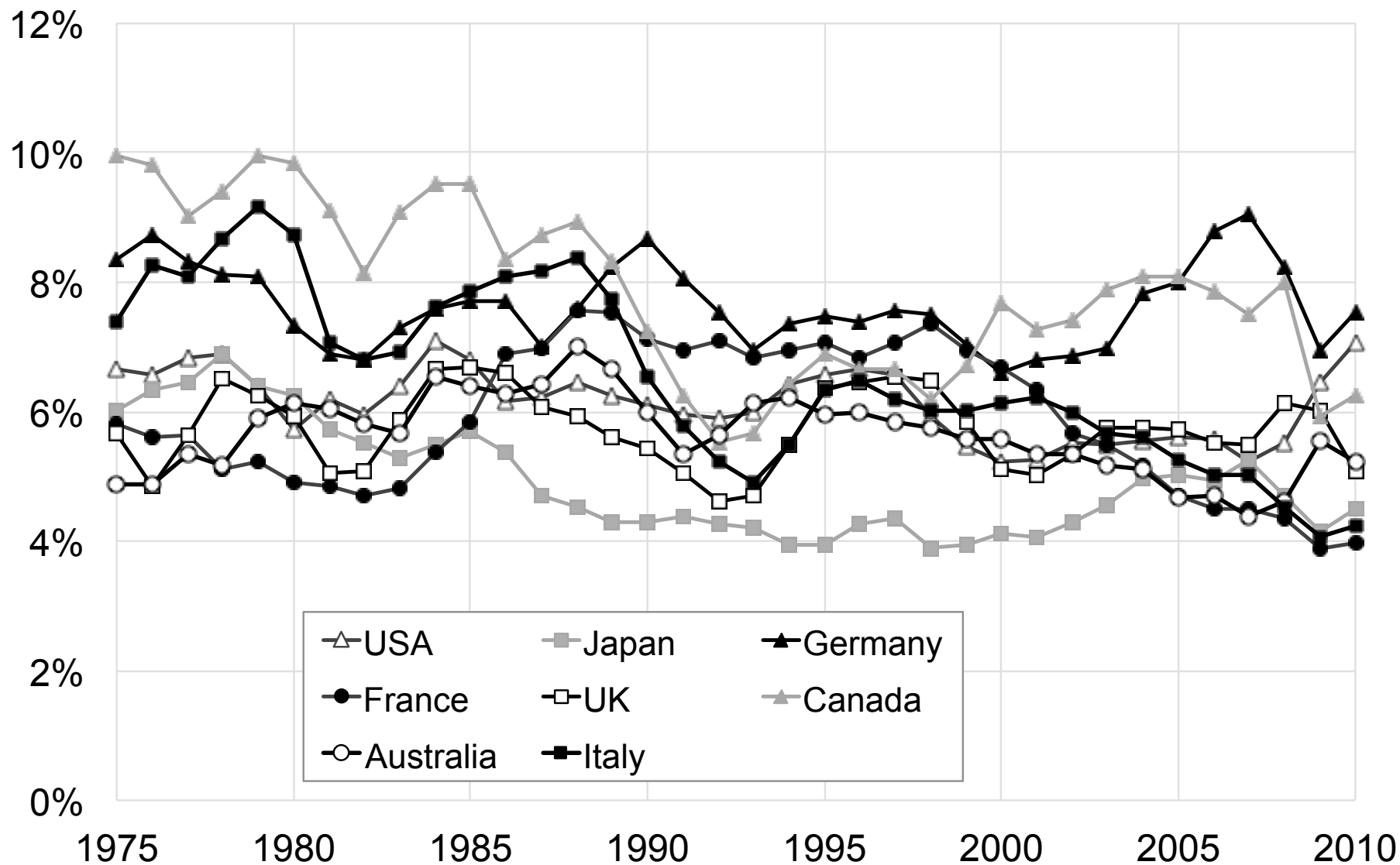
- The CES function helps think about the rise of the capital share
- Theorem:  $\alpha$  is a rising function of  $\beta$  iff  $\sigma > 1$
- Remember the accounting identity:  $\alpha = r \cdot \beta$
- $\sigma$  links the capital/income ratio  $\beta$  and the capital share  $\alpha$ : it determines how much the rate of return  $r$  falls when  $\beta$  rises

### Private wealth / national income ratios 1970-2010

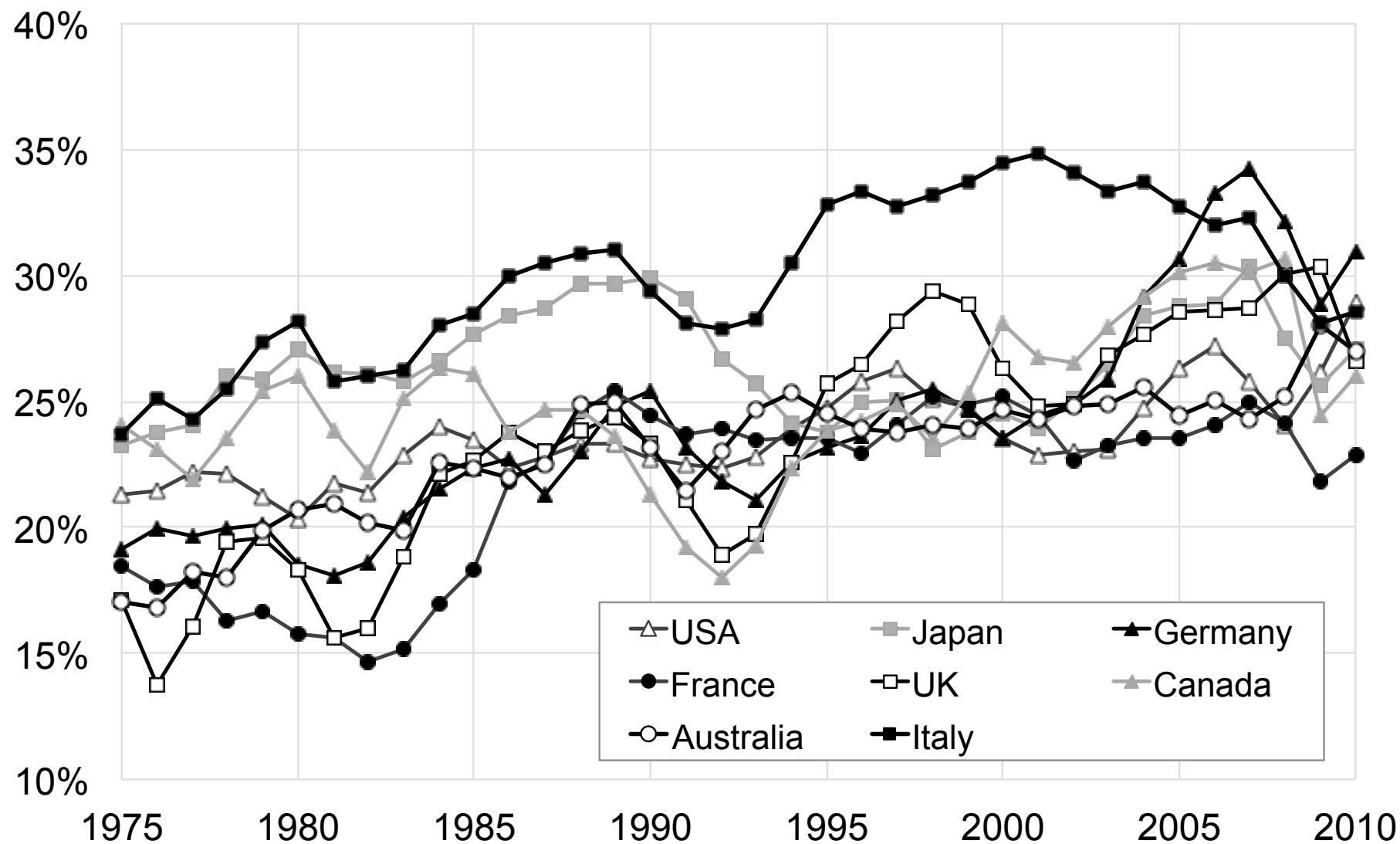


Source: Piketty and Zucman (2014). Authors' computations using country national accounts. Private wealth = non-financial assets + financial assets - financial liabilities (household & non-profit sectors)

### Average return on private wealth 1975-2010



### Capital shares in factor-price national income 1975-2010



- $\sigma$  doesn't have to be much  $> 1$  to account for observed trends
- If  $\sigma = 1.5$ , capital share rises from  $\alpha = 28\%$  to  $\alpha = 36\%$  when  $\beta$  rises from 250% to 500%
- In case  $\beta$  reaches 800%,  $\alpha$  would reach 42%
- In case  $\sigma = 1.8$ ,  $\alpha$  would be as large as 53%



## 2.4 What do we know about $\sigma$ ?

- Micro literature usually finds  $\sigma < 1$
- A recent macro literature finds  $\sigma > 1$ . Example: Karabarbounis and Neiman (2014)
- Possible that  $\sigma$  has increased over time: change in the nature of wealth, globalization

If the elasticity of substitution between labor and capital is  $> 1$ :

A — The capital share of income tends to 100% in the long run

B — The capital share of income rises when the capital/income ratio rises

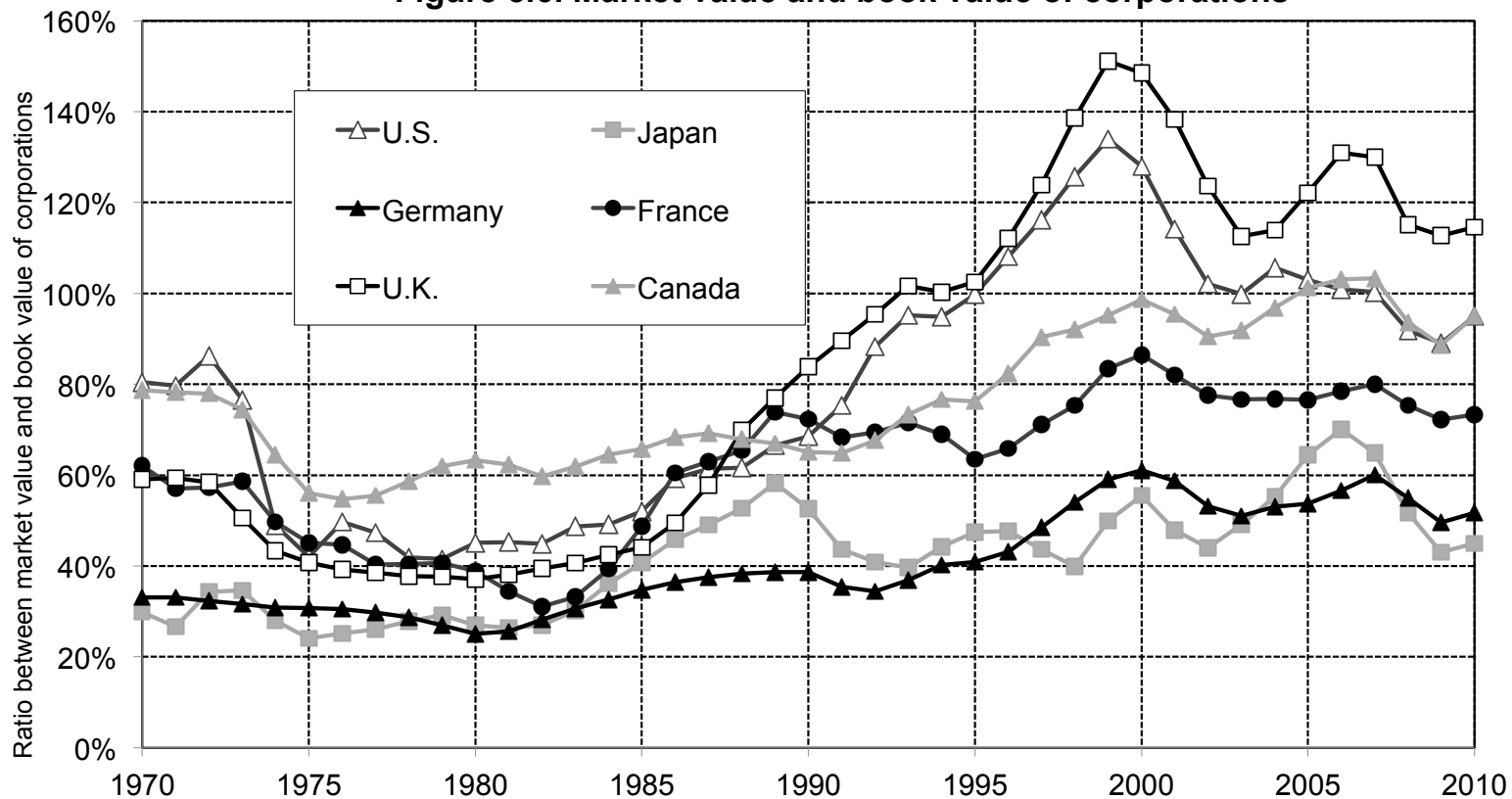
C — The capital share of income is constant

D — The capital share of income is entirely determined by technology

### 3 Change in the market power of capital

- So far we assumed perfect competition: capital and labor are paid their marginal product
- What if capital is paid more (or used to be paid less) than its marginal product?
- Possible channels: decline of unions, globalization, rise of network industries (Facebook, Twitter), change of social norms
- Evidence of change in market power for capital: rise of Tobin's  $Q$

**Figure 5.6. Market value and book value of corporations**



Tobin's Q (i.e. the ratio between market value and book value of corporations) has risen in rich countries since the 1970s-1980s. Sources and series: see [piketty.pse.ens.fr/capital21c](http://piketty.pse.ens.fr/capital21c).

## Summary

- Factor shares are not constant: the capital share  $\alpha$  is rising, the labor share  $1 - \alpha$  falling
- One explanation is that the rise of the capital share of income may be the consequence of the rise of the stock of capital (rising  $\beta$ ).
- If capital and labor are relatively substitutable ( $\sigma > 1$ ), a rise in the wealth-income ratio  $\beta$  will trigger a rise in the capital share  $\alpha$
- Another explanation is that market power for capital may be rising
- Because K income is v. unequally distributed (more than L income),  $\uparrow \alpha$  can have big consequences for interpersonal ineq.

## References

Karabarbounis, Lukas and Brent Neiman, “The Global Decline of the Labor Share”, *Quarterly Journal of Economics*, 2014 (web)

Piketty, Thomas, *Capital in the 21st Century*, Cambridge: Harvard University Press, 2014, Chapter 1

Piketty, Thomas, and Gabriel Zucman, “Capital is back: wealth-income ratios in rich countries 1700-2010”, *Quarterly Journal of Economics*, 2014 (web)