Technological progress, employment, and living standards in the long run

ECONOMICS

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UCL

Lecture 16

Context

Long-run technological change improves living standards

short-run causes short-run unemployment as current jobs get destroyed and new jobs are created

(Units 1-2)

However, *long-run patterns of unemployment* across countries are not explained by national differences in *innovation* or *productivity growth* over time.

- Can *institutions* and *policies* explain these differences?
  - What is the effects of *institutions* and *policies* on *long-run unemployment* and *economic growth*?

What have we learnt so far

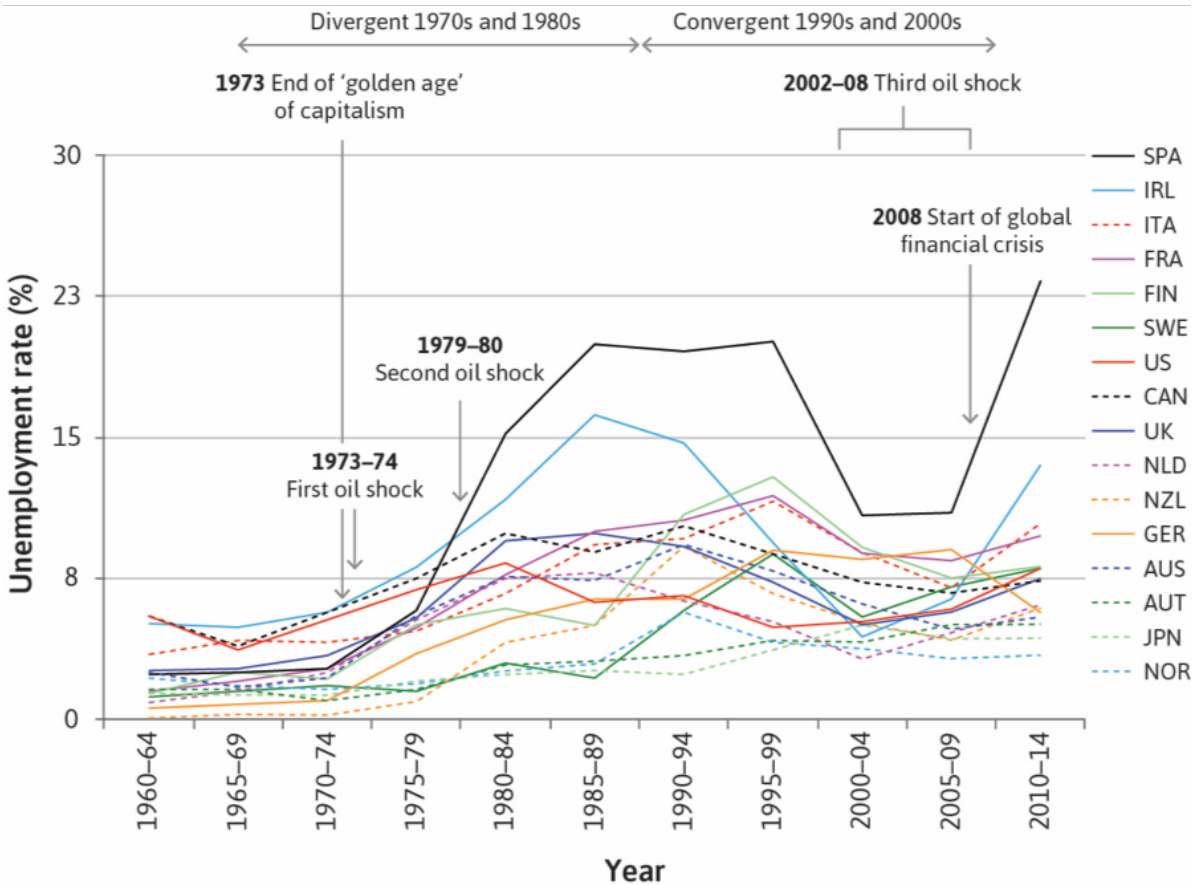
Foundation of prosperity: increasing use of machinery (*capital per worker*) and knowledge (*ideas*) in the long-run

Creative Destruction: new production methods destroy old ways of production

Puzzle: why doesn't the continuous process of *job creation* and *job destruction* lead to higher unemployment?

Unemployment

	Unemployment	*across countries*
1960s	Low	similar
1970s	High	divergent



Unemployment

	Unemployment	*across countries*
1960s	Low	similar
1970s	High	divergent

Production has become *more capital intensive* over time

What has this *not resulted in mass unemployment*?

> Why hasn't labour been replaced by capital leading to rise in the rate of unemployment?

Patterns of unemployment across countries reflect differences in *institutions* and *policies*.

KEEP UNEMPLOYMENT LOW

Economic institutions: ability to ensure *sustained increase in real wages* while *keeping involuntary unemployment low*

Insurance against change: citizens welcome technological change and trade if the country provides **insurance** against job losses from creative destruction and competition from other economies

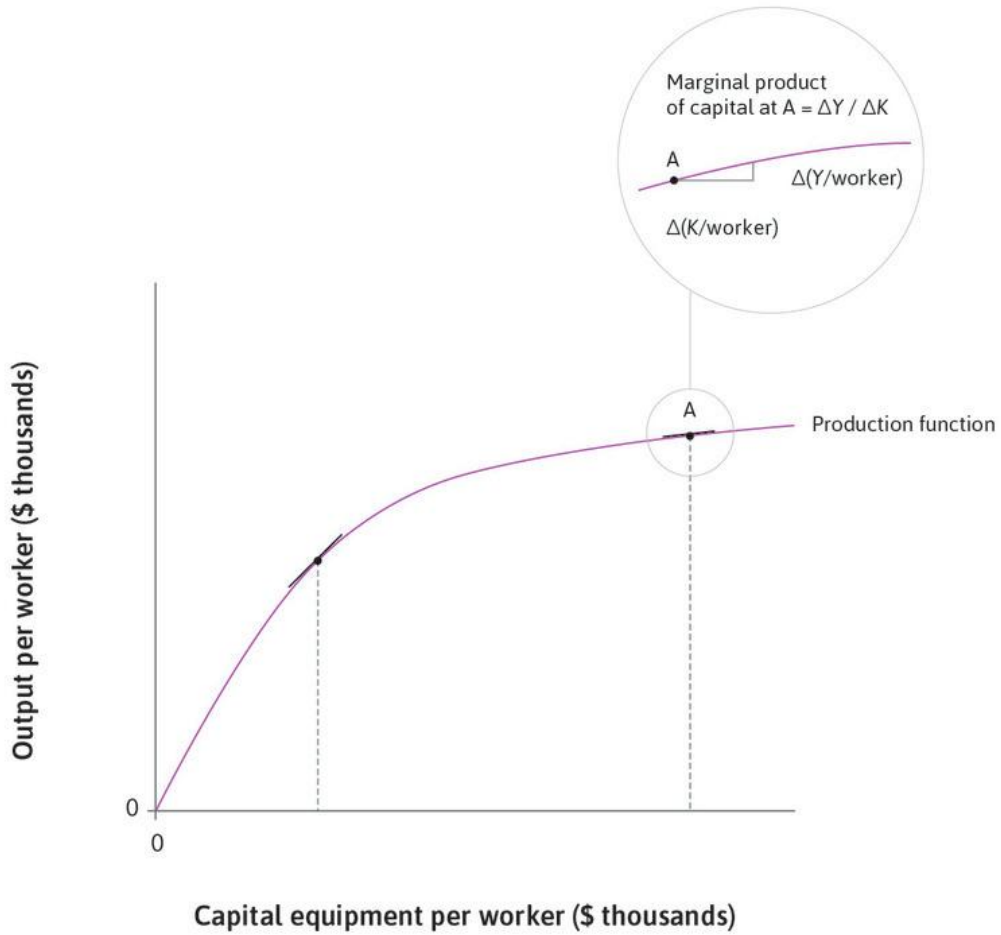
Incentive to cooperate: incentive for main actors in the country to **increase size of the pie** and not fight with each other for their own share

GDP per worker

As entrepreneurs invest, capital per worker increases and *GDP per worker* and *marginal product of capital falls*

Investment incentive

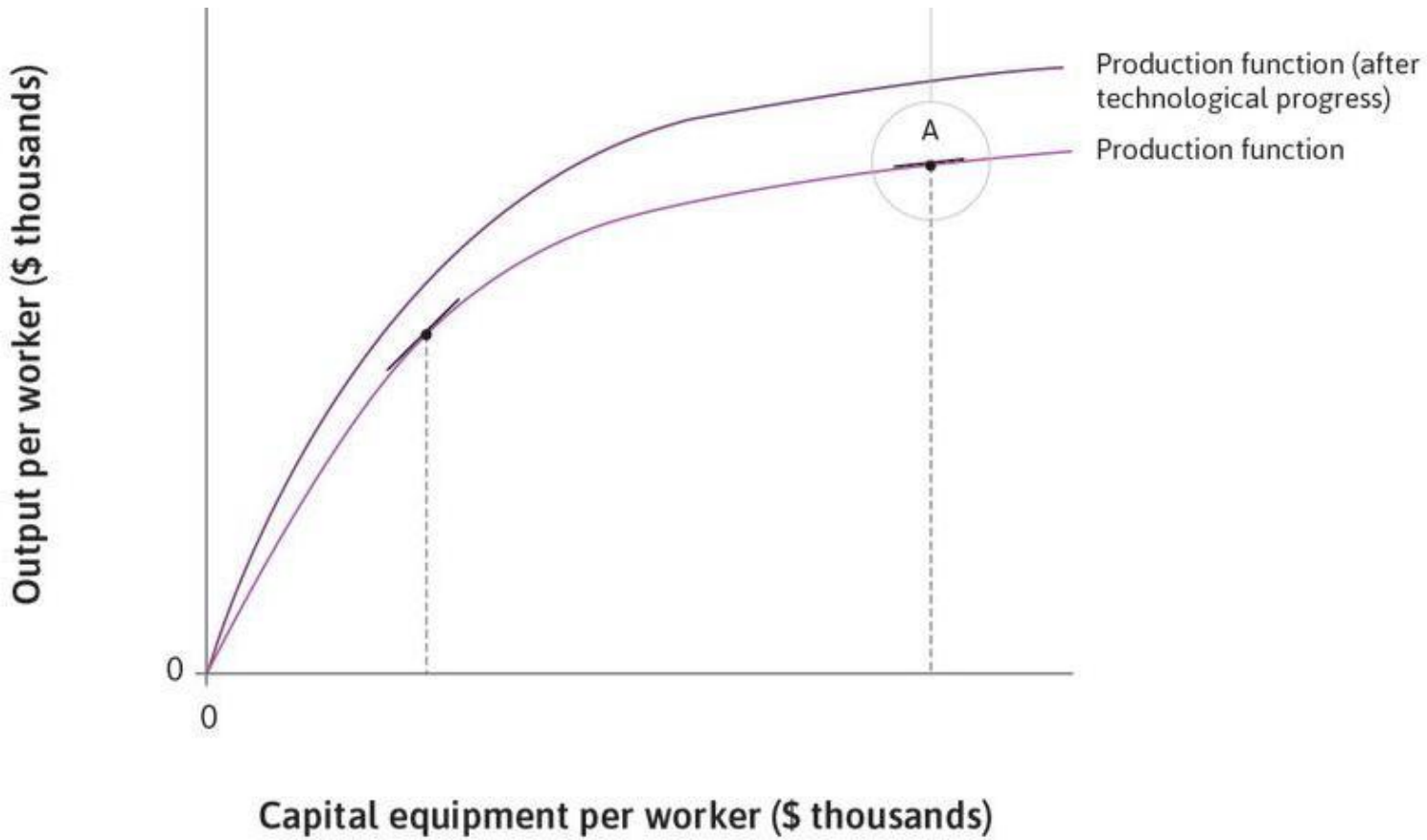
Does this reduce incentive for entrepreneurs to invest across the economy and increase capital per worker?



Technological progress rotates the production function upward thus increasing output per worker for a given capital per worker

Technological progress production function rotating upwards

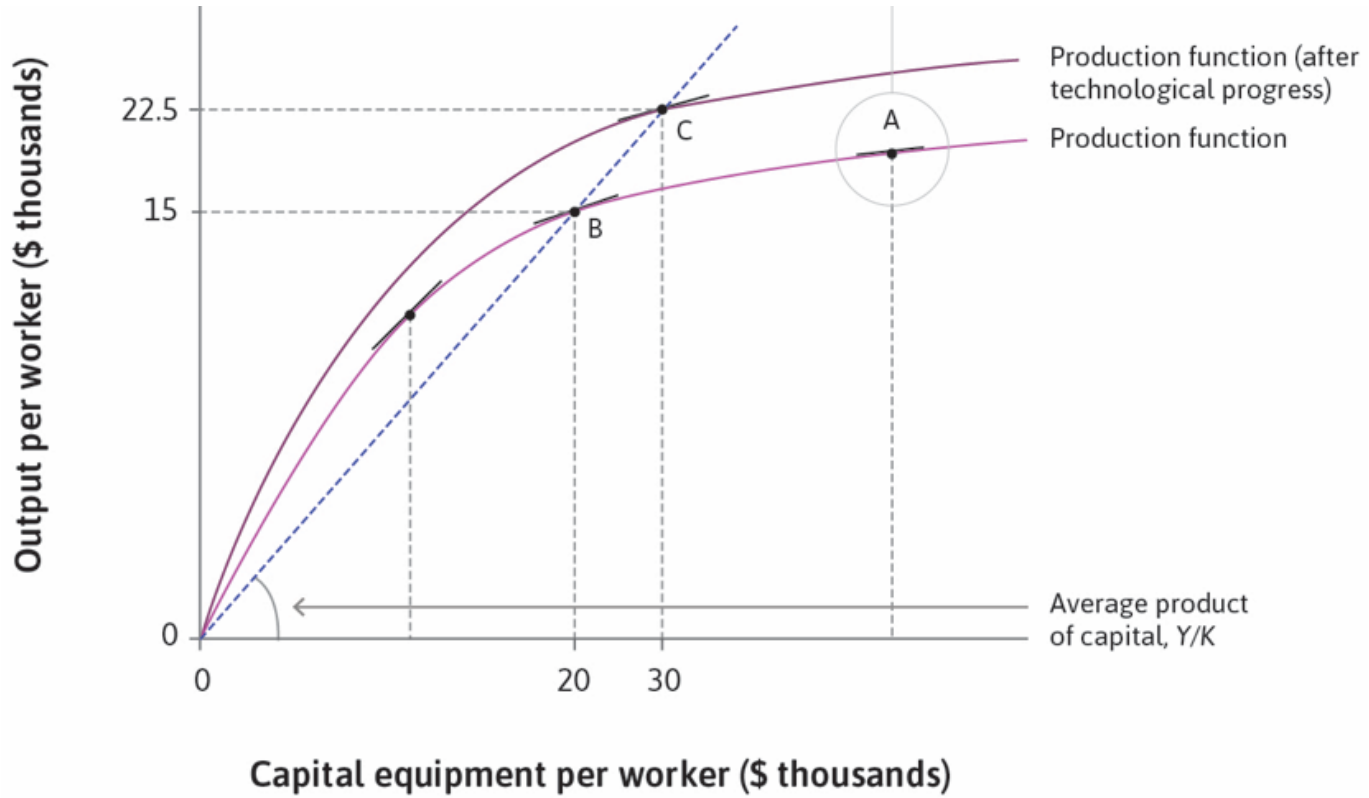
Capital goods accumulation increases in capital per worker



Incentive to Innovate

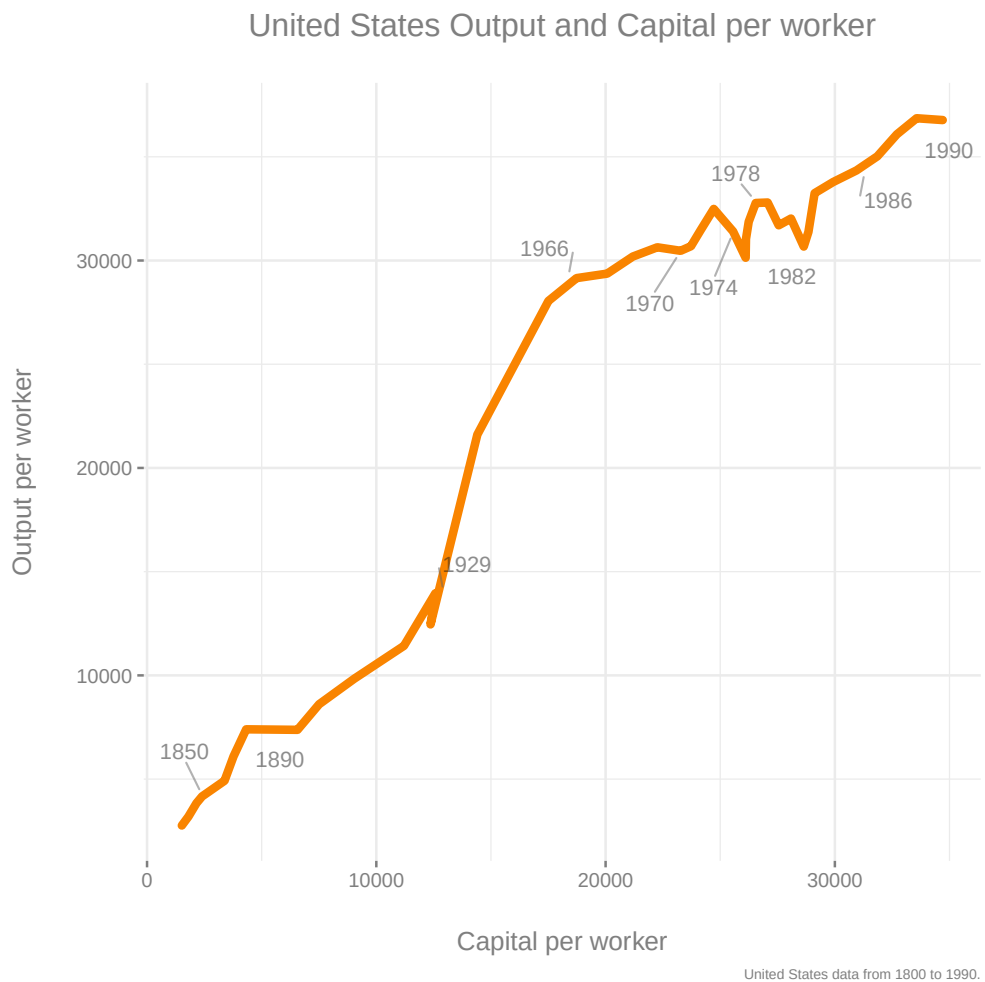
Innovation technological progress *counter-acts* the *fall in marginal product of capital* due to *increase in capital intensity* ($20 \rightarrow 30$)

Incentive to innovate because technological progress keeps marginal product of capital high



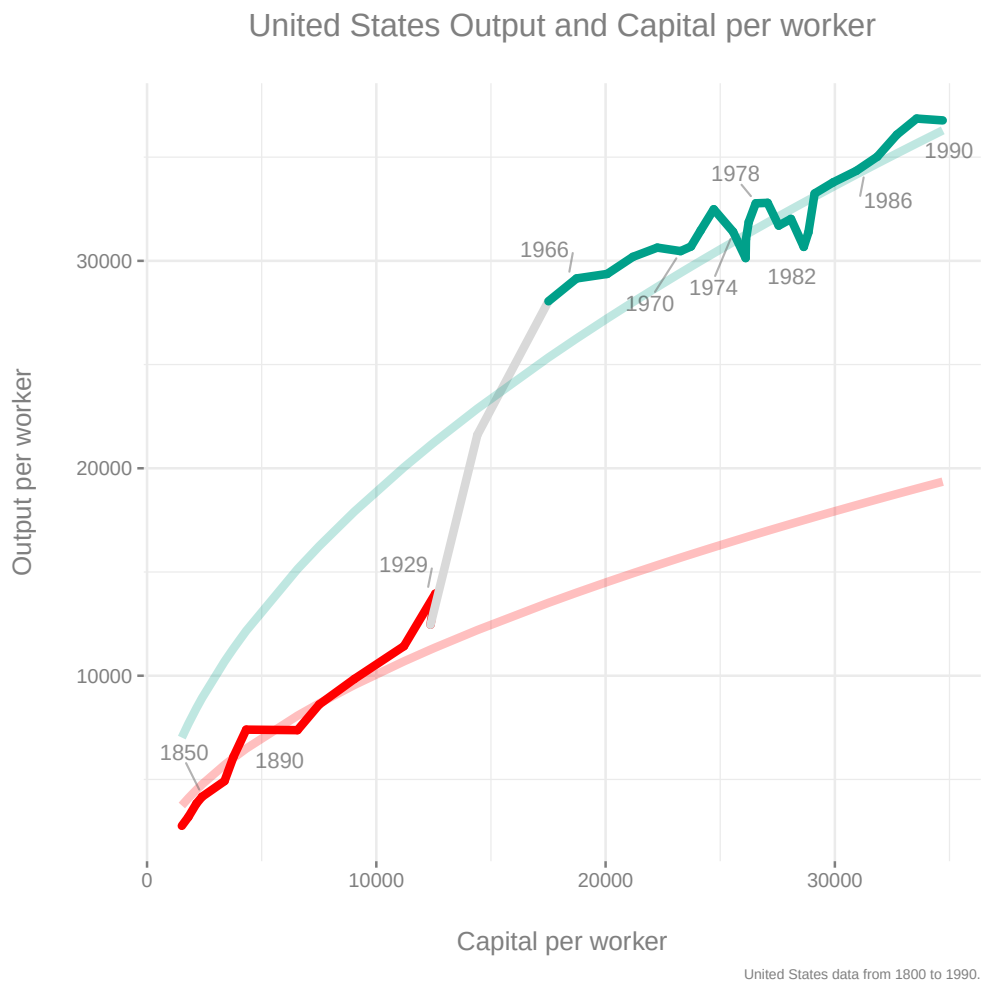
US Production Function

US: Output per worker versus *capital per worker*



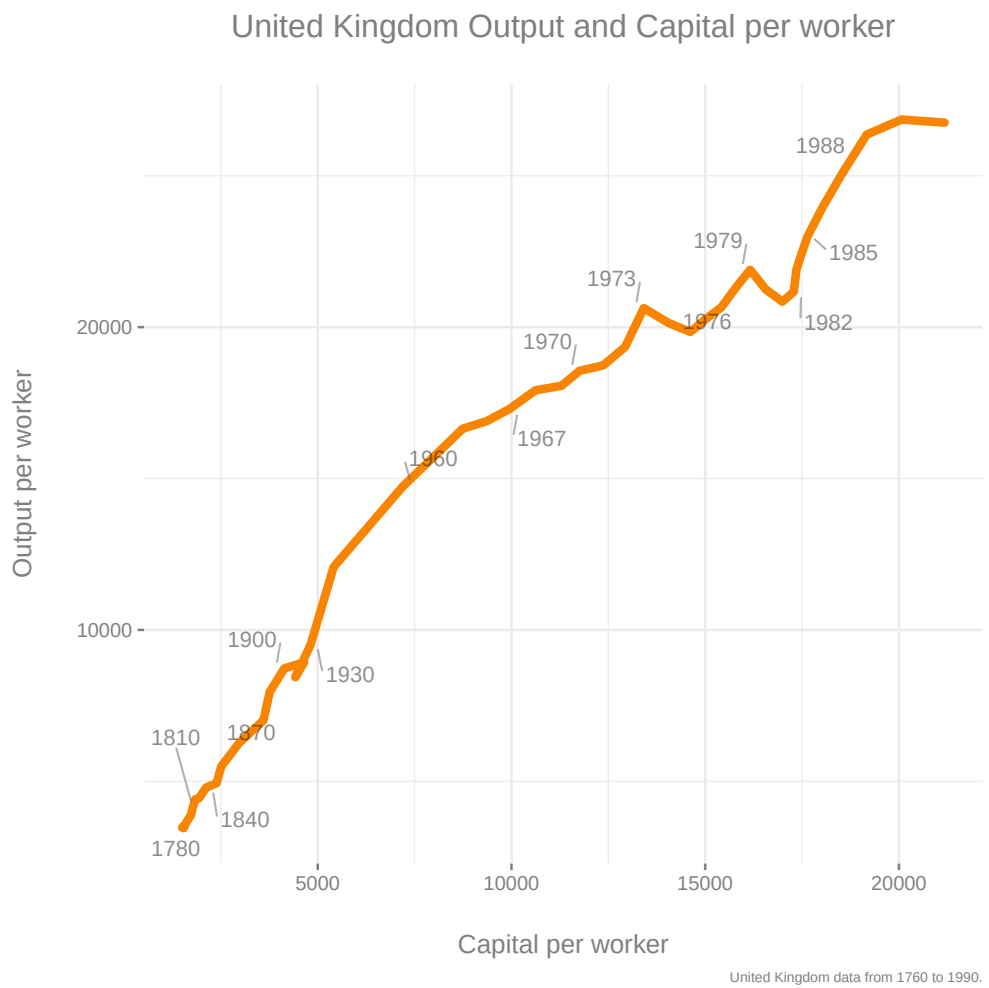
US Production Function

US: Production function shifted up in **1929** and **1966**



UK Production Function

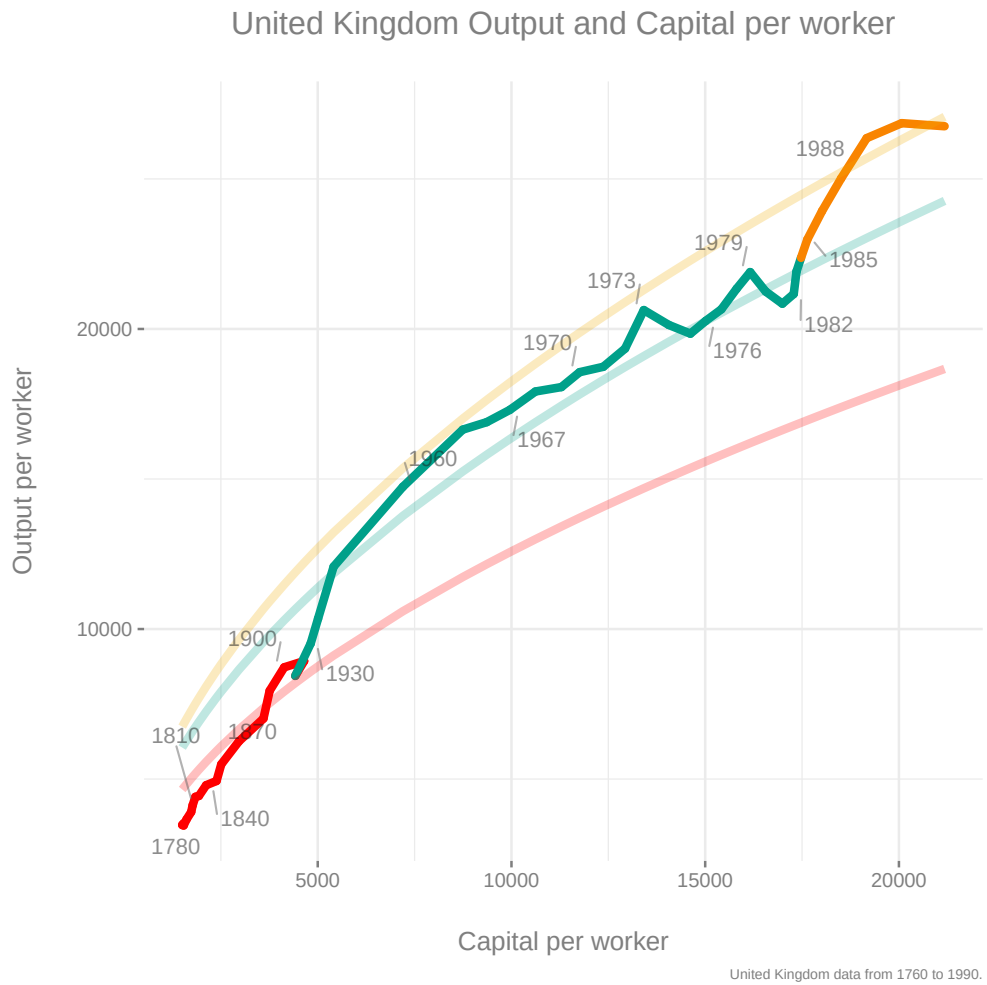
UK: Output per worker versus *capital per worker*



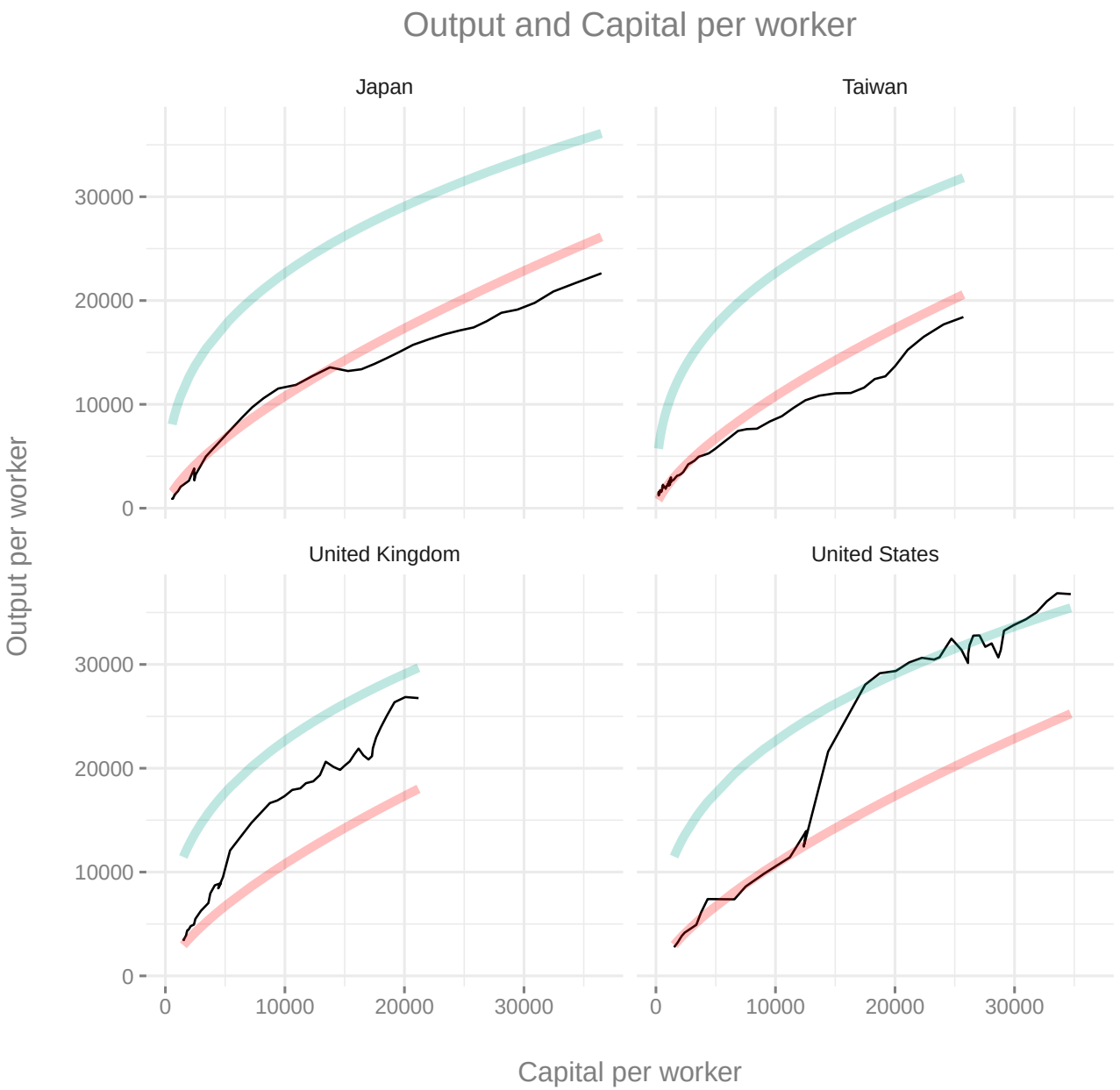
United Kingdom data from 1760 to 1990.

UK Production Function

UK: Production function shifted up in **1930** and **1985**



United Kingdom data from 1760 to 1990.



ntry has its own scale. The production functions are drawn to fit the United States data for period 1800 to 1929 and from 1964 to 1990

Technological progress and living standards

Innovation rents	firms can earn innovation rents by introducing new technology
Creative destruction	firms that cannot keep up with innovation eventually fail and exit the market leaving behind innovative firms

Technological progress and *capital goods accumulation*

are complementary process:

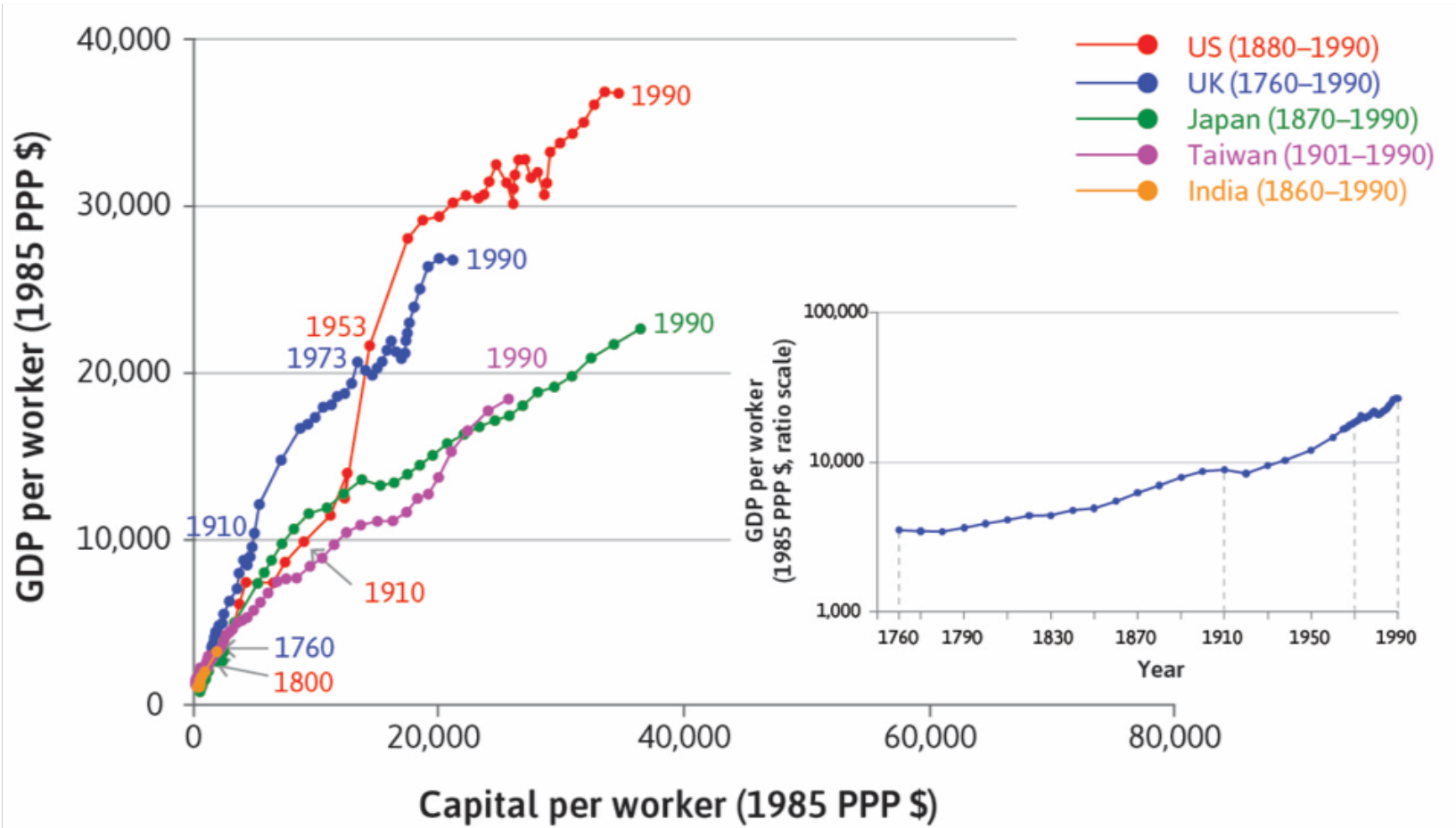
New technologies require new machines

Technological advance is needed for increasingly capital-intensive methods of production to be profitable.

lead to a sustained increase in average living standards.

Technological progress over time

High-income countries have had *labour productivity rise* over time as they became more *capital intensive*



Technological progress over time

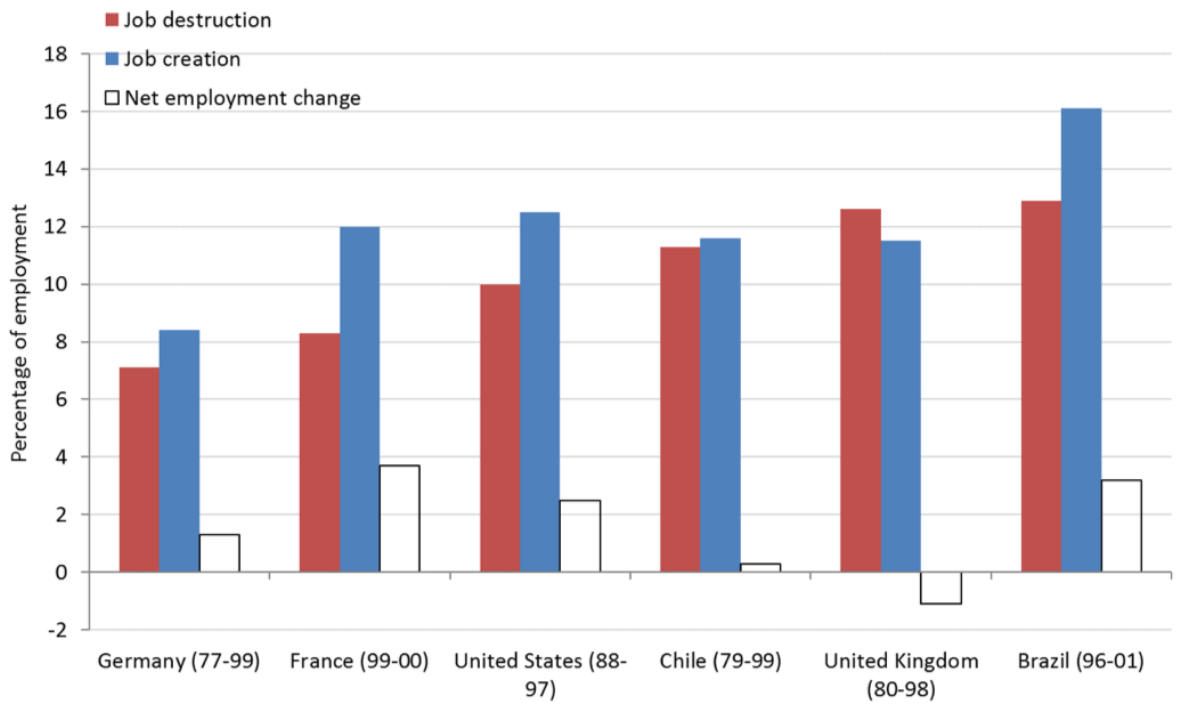
Countries	
High income	*labour productivity* rose concomitantly with *capital accumulation* over time due to *technological progress*
	Unlike the concave production function, capital productivity remained roughly constant over time in the technology leaders because capital accumulation was accompanied by and technological progress
Middle income	*some capital accumulation* but lagged behind in *technological progress*
Low income	lacked both *capital accumulation* and *technological progress*

Job creation & destruction

New technology destroys jobs associated with *old technology* and *creates jobs* associated with new technology

Net employment change is *job created* minus *jobs destroyed* in long-run

Figure 16.4. Job destruction, job creation, and net employment across countries.



Beveridge curve

Beveridge curve shows the *inverse* relationship between the *unemployment rate* and the *job vacancy rate*

Recessions firms post fewer vacancies and lay off more workers due to lower demand

Booms firms post more vacancies and need more workers to cope with rising demand

Labour Market Matching

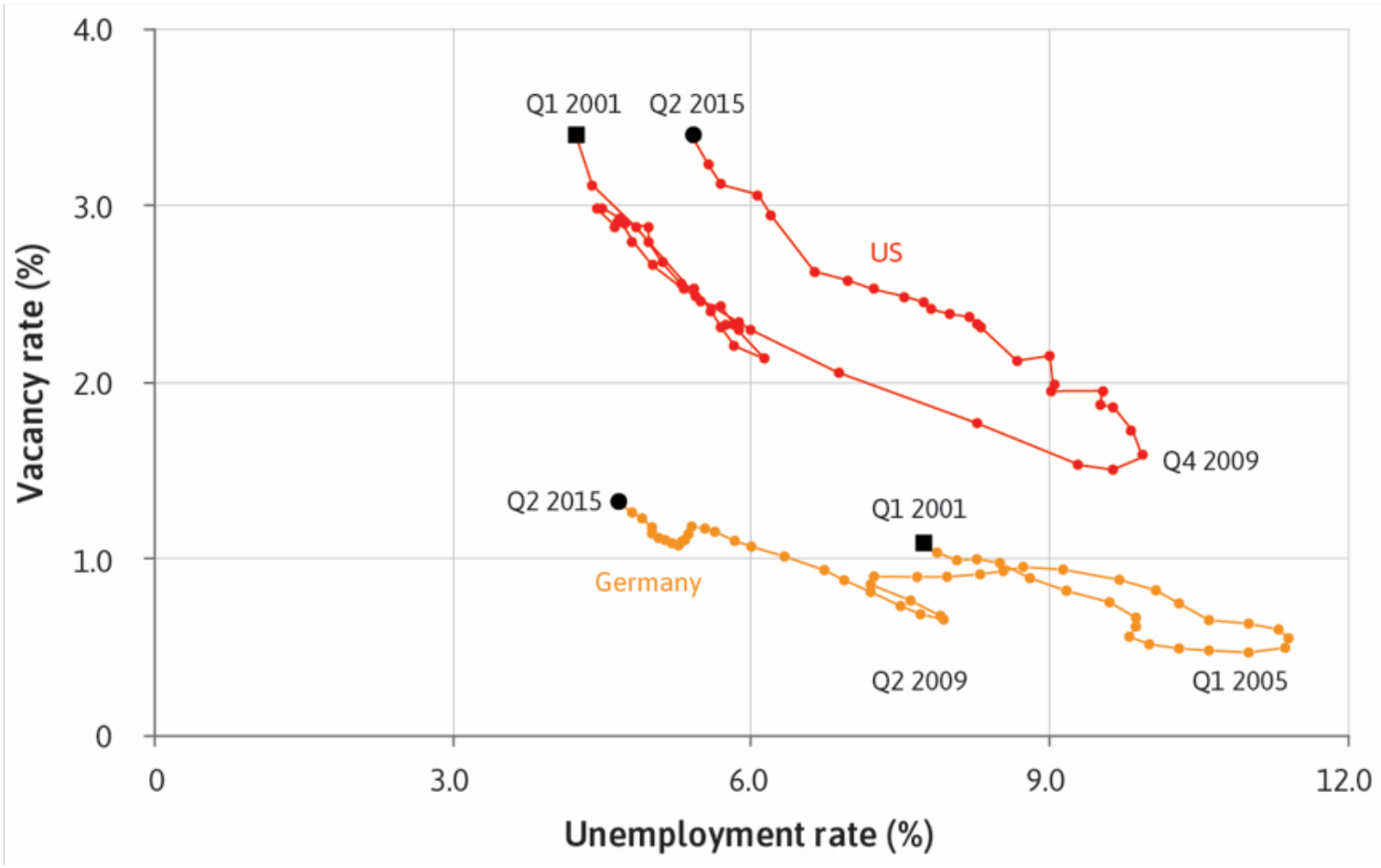
Mismatch unemployed workers unable to match up with vacancies due to *location* and *skill mismatch*

Information unemployed workers unable to match with vacancies due to *lack of information*

US and German Beveridge Curve

German labour market better at matching worker with jobs

German curve *shifts in after 2005* US curve *shifts out after 2008*



Why did the US Beveridge Curve Shift up?

Beveridge curve shifting out means

a *higher unemployment* for a given *vacancy rate*

US Beveridge curve shifted up after 2008-09

due to *skill mismatch* and *location mismatch*

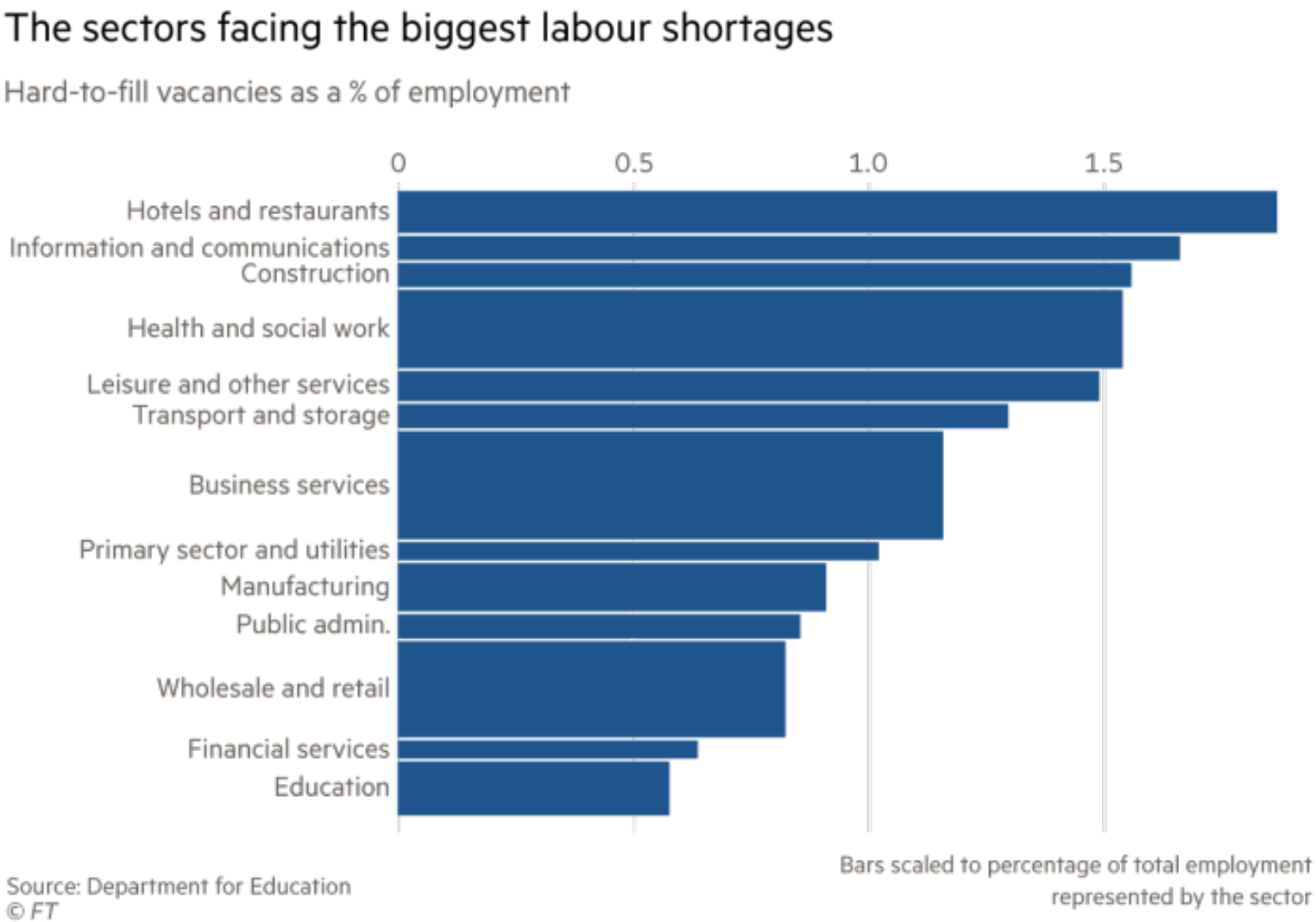
Skill mismatch

Increased mismatch between the skills of the unemployed and skills required in the advertised vacancies after the 2008-09 recession, driven largely by the *construction industry* (construction industry account for *40% of the mismatch*).

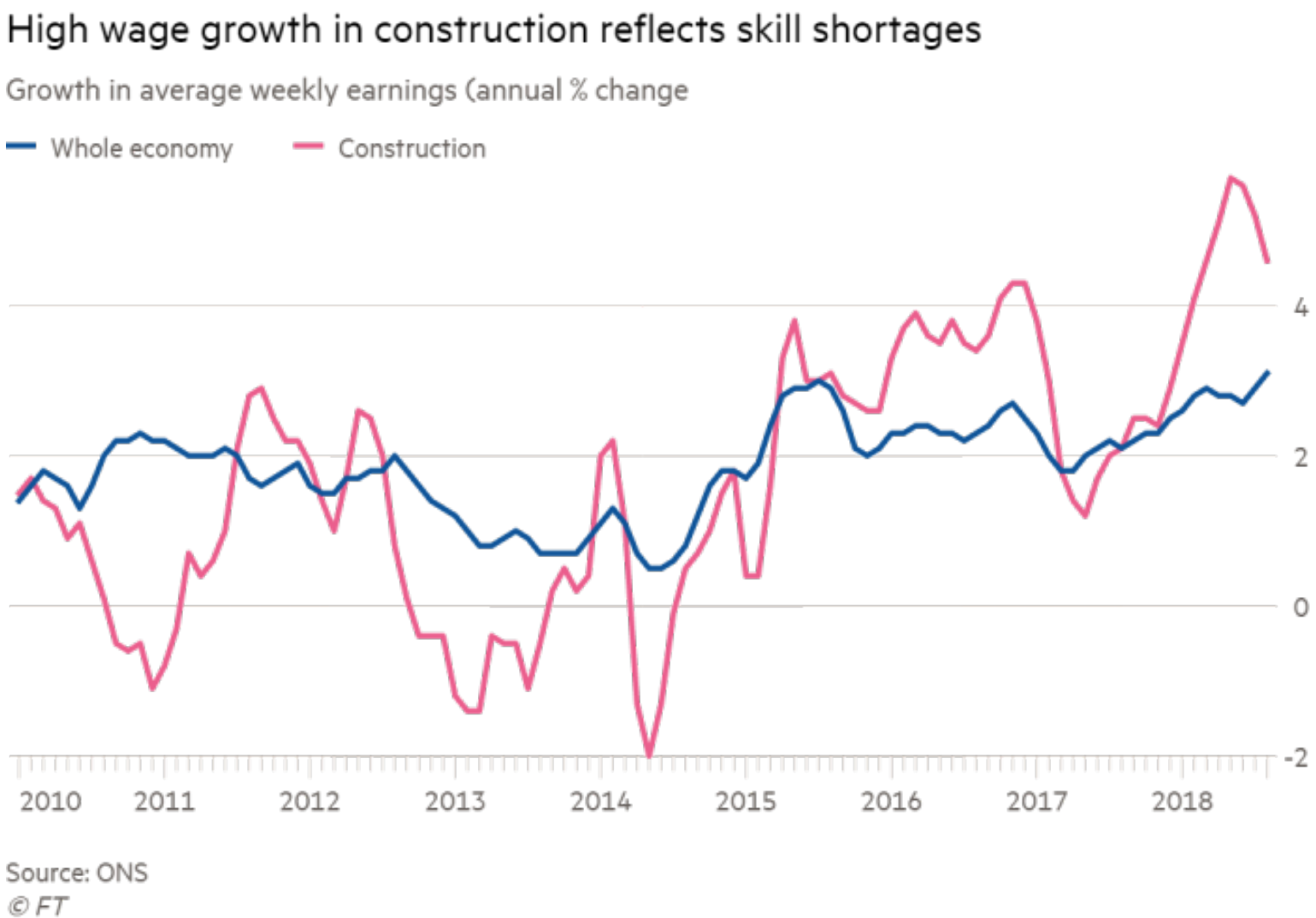
Location mismatch

With falling house prices, many home owners were not able to move to look for jobs because they were trapped in *negative home equity*, i.e., their house was worth less than their home loan

UK's Sectoral Labour Shortages in 2018

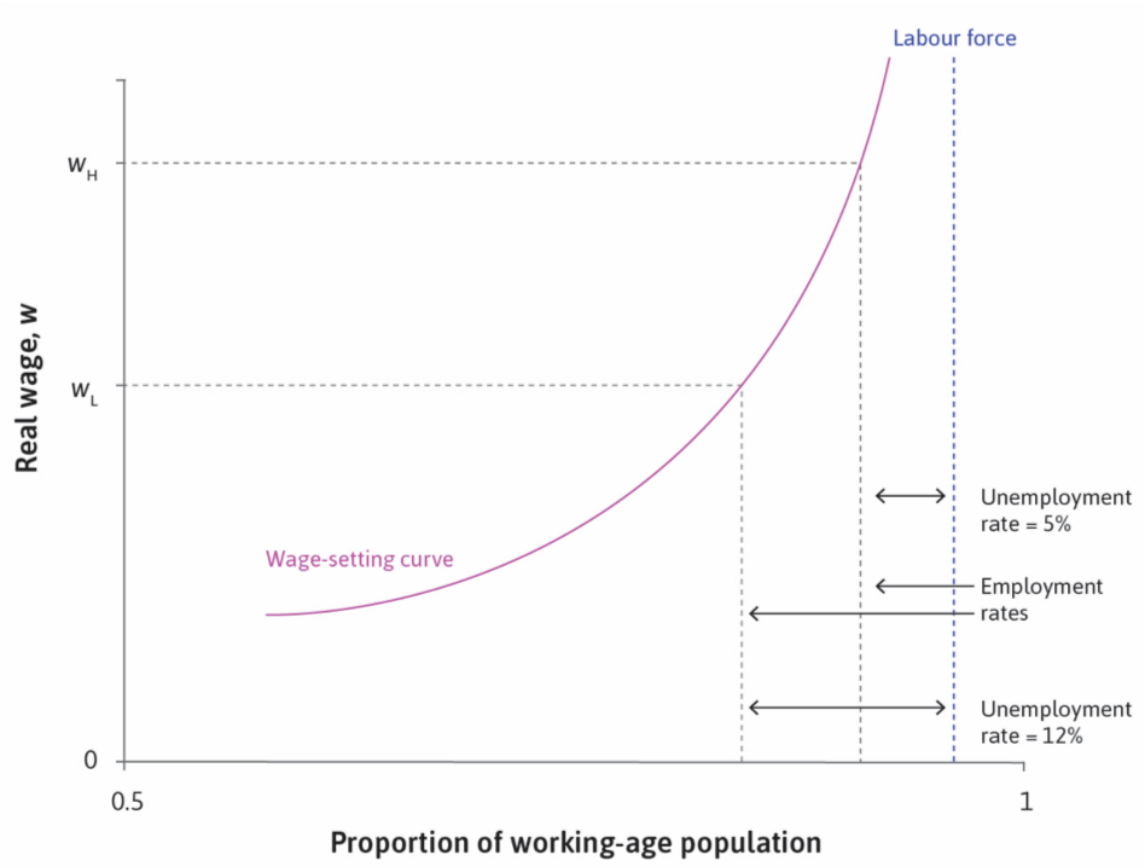


UK's Skill Shortages in Construction



Wage-setting curve

Wage-setting curve gives us the *real wage necessary* at each level of economy-wide employment to provide workers with *incentives to work hard*.

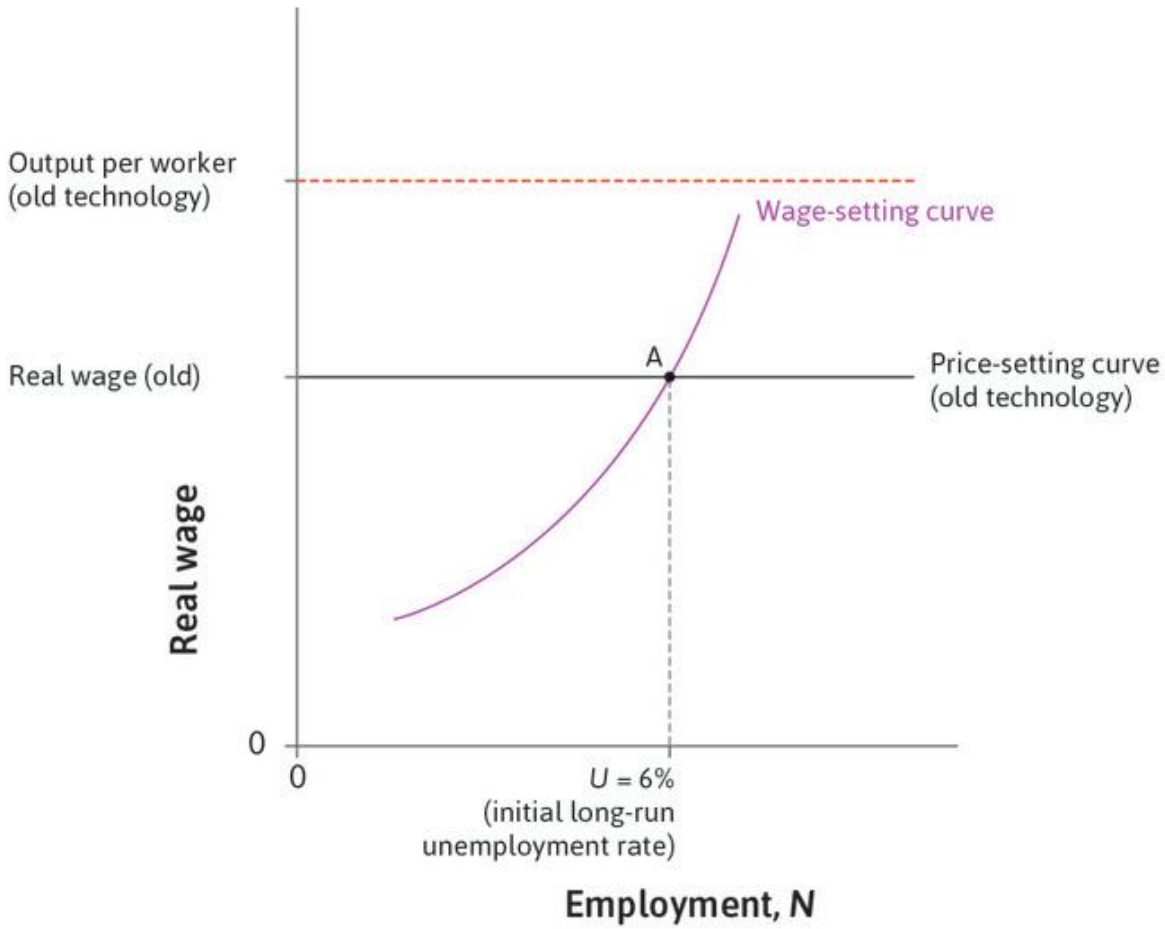


Price-setting Curve

Price-setting curve gives the *real wage paid* when *firms choose their profit maximising price*.

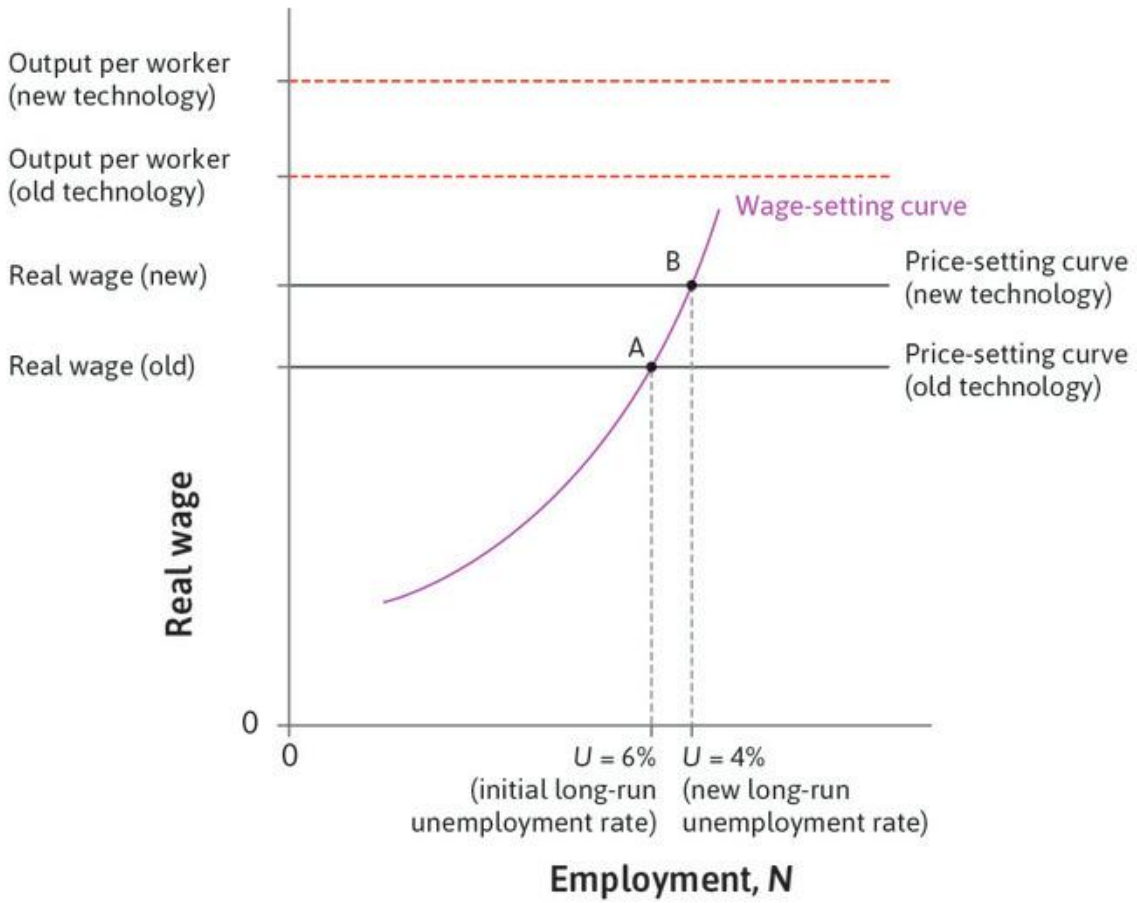
Labour Market Equilibrium: Long-run

Long-run equilibrium at A before new technology is introduced



New Technology: Long-run

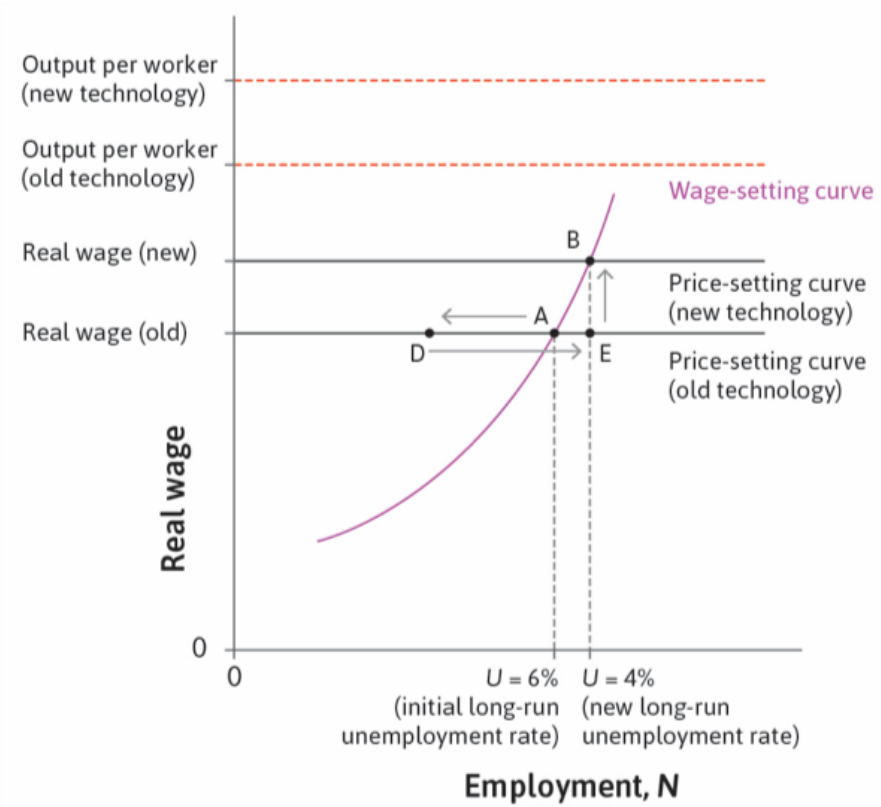
Output per worker and price-setting curve shifts up due to the new productive technology leading to higher wages at B



New Technology: Short-run

job destruction increases unemployment (D) as jobs associated with old technology get destroyed

job creation decreases unemployment (E) as new firms enter and job associated with new technology get created



New technology shifts up output per worker and the price-setting curve

A→D: Introduction of a new technology leads to a rise in unemployment

D→E: High profits encourage new firms to enter

E→B: Lower unemployment leads to rising real wages

B: The new long-run rate of unemployment is 4%

Wage-setting curve: Long-run

Unemployment does not continuously fall with *technological progress* because the *wage-setting curve can shift upwards*

Technological change can *indirectly shift the wage-setting curve* due following reasons:

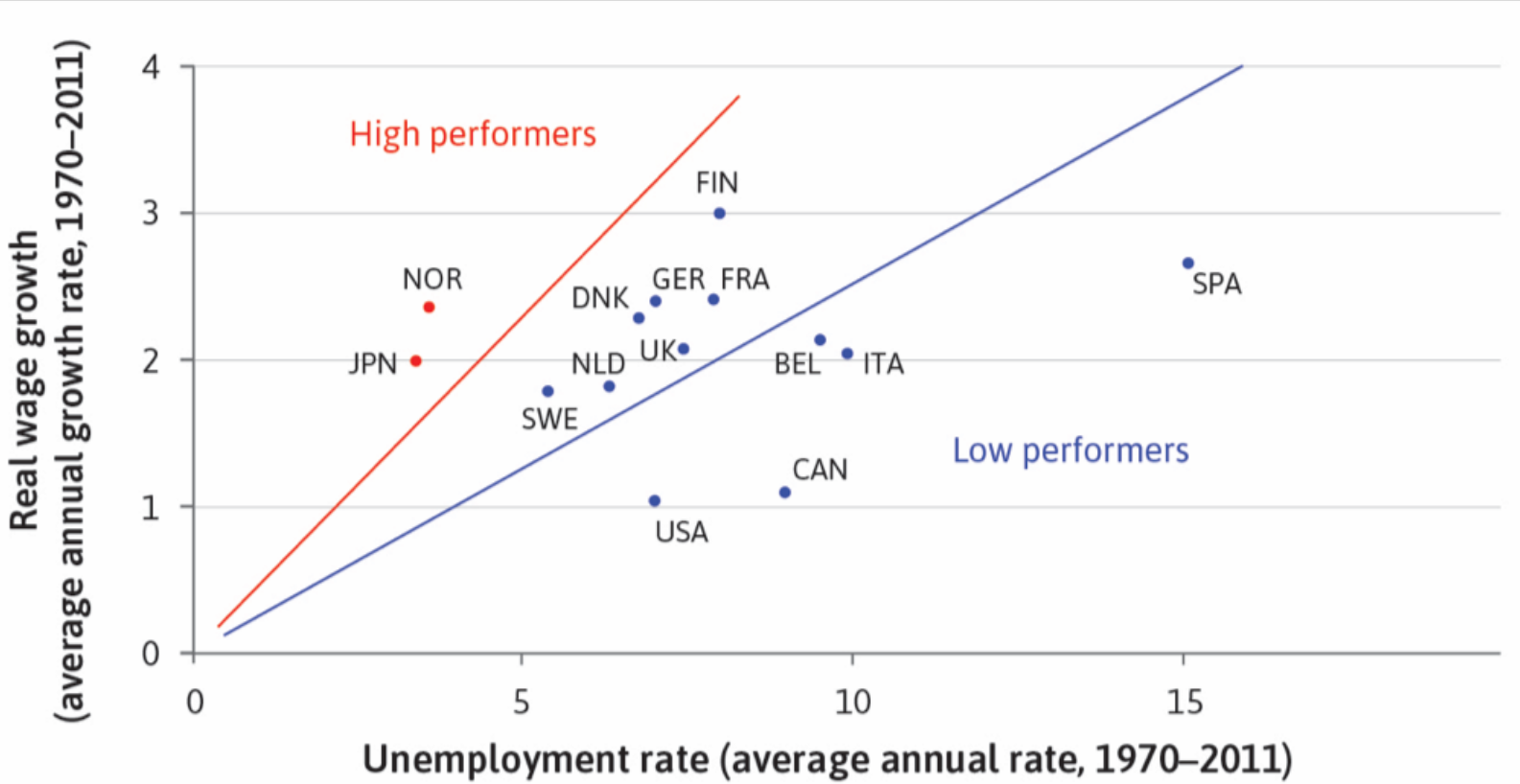
- Fair shares *bargaining by unions*
- *Policies* to help those affected e.g. employment protection laws
- Greater *disutility of effort*
- Improvement in the *reservation wage*

Differences across countries

To achieve *good* economic performance, an economy must:

Ensure *price-setting curve shifts* up *more* than *wage-setting curve*

Adjust rapidly and fully so *whole economy benefits* from tech progress



Important factors

These cross-country differences can be explained by:

Institutions *inclusive trade unions* choose not to exercise maximum bargaining power because wage increases affect job creation in the long run

Inclusive trade unions are ones that represent large proportion of firms and sectors in the country

Policies well-designed *unemployment insurance schemes* and *job placement services* can achieve low unemployment rates.

No magic formula: Institutions and *policies* used differ across successful countries and over time

Examples

Norway *Inclusive trade unions* and employers' associations set wage demands in accordance with the productivity of labour, and also supported legislation and policies that shifted the wage-setting curve downwards, further expanding long-run unemployment

Japan Employers' associations *coordinate wage setting* across firms

Corporations deliberately do not compete in hiring workers, to avoid raising wages

Spain A combination of *non-inclusive unions* and *government legislation that protects jobs* rather than workers may help to account for Spain's 'poor' labour market performance.

Changing labour market performance

Institutions and *policies* make a big difference for employment and wage growth, but *changing* institutions or policies is difficult because it *creates winners* and *losers*.

Example The Netherlands and the UK both had increased unemployment rates in the 1970s due to the *oil price shocks* and the *increased bargaining power of labour*

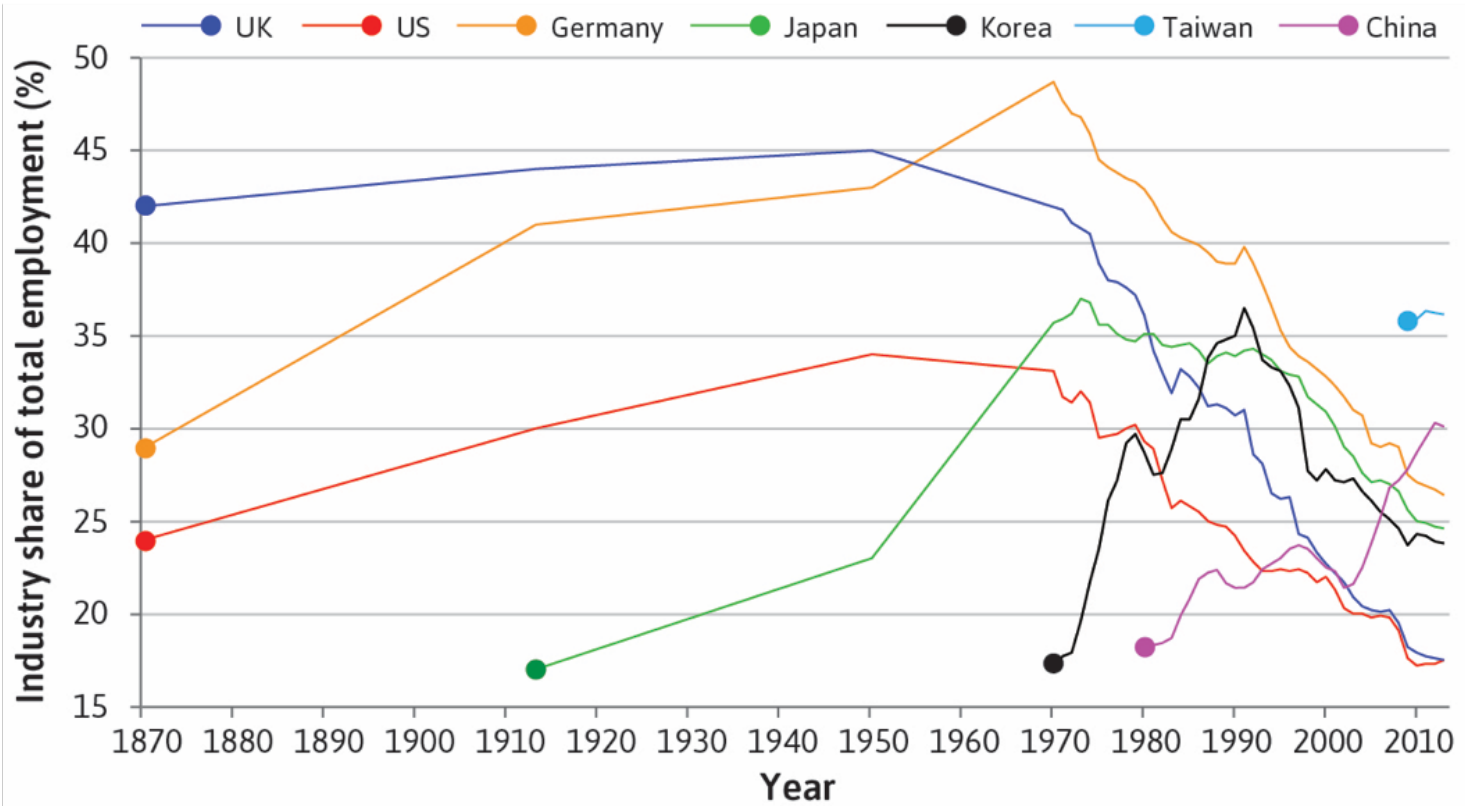
Both countries managed to *shift the wage-setting curve down*:

Netherlands institutions became more inclusive

UK policies reduced the power of non-inclusive unions

Changing nature of work

As countries get richer, the primary source of employment moves from *agriculture* to *manufacturing* and then to *services*



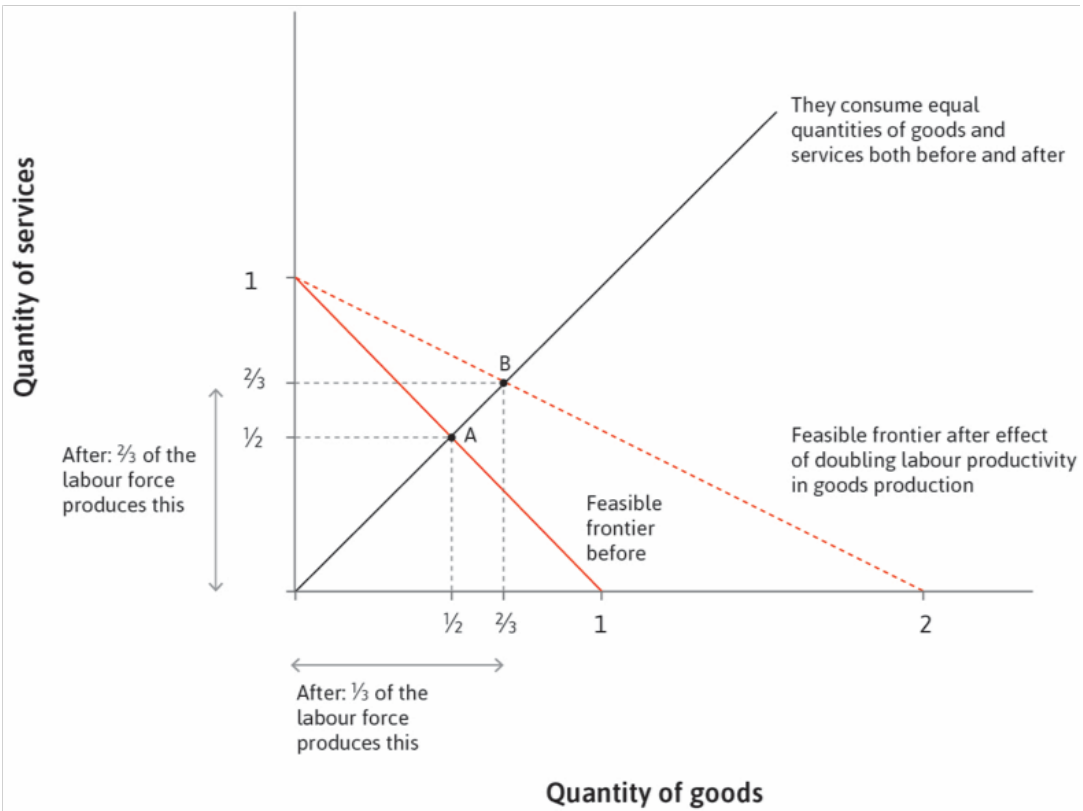
Services has *slower productivity growth* as compared to *manufacturing*

Labour moves: *manufacturing* $\longrightarrow$ *services*

Manufacturing productivity increases, shifting the feasible frontier.

If *consumption patterns don't change*, the economy will move $A \longrightarrow B$

Labour shifts *goods* $\longrightarrow$ *services*



Manufacturing and Services: Reality Check

Some other factors that affect the proportion of *labour force* still employed in *manufacturing*

- *Productivity increases in some services:* productivity advances have been large in music sharing and digital information.
- *Substitution effect:* if the relative price of manufacturing falls, consumers increase its consumption due to substitution effect
- *Income effect:* people may choose to spend more of their budget on services as income rises.
- *Specialisation by countries:* international trade and opportunities for specialisation affect which sectors grow/decline

  If manufacturing is cheaper abroad, then it decimate the manufacturing industry domestically

Summary

Long-run model of *wages* and *unemployment*

- Long-run *price-setting curve* depends on *technological progress*
- Long-run *wage-setting curve* depends on *inclusiveness of unions* and government's *policies*
- *Beveridge curve* illustrates the *dynamics* of long run adjustment

Used model to explain *differences in labour market outcomes* across countries

- *Institutions* and *policies* matter for long-run outcomes
- High income countries are also *technological leaders*