

Polarisation(s) in Labour Markets: Synthesis and Perspectives

Alan Manning

Centre for Economic Performance, LSE



RISE OF

"No one who cares about the future of human dignity can afford to skip this book."

— Jason Lanier

Author of You Are Not a Gadget and UPPER CASE: THE FUTURE

THE

TECHNOLOGY
AND THE THREAT
OF A JOBLESS FUTURE

ROBOTS

Polarisation and the impact of technology/globalisation has caught people's attention

- Research is moving beyond simple description of polarisation to try to understand why it is happening and what are its consequences
- Widespread fears that these trends are causing problems in our societies
- Papers presented today represent that broadening out of the literature.
- Will present my views on some of these questions:
 - Is polarisation a change or a continuation of past trends?
 - What does polarisation mean for inequality?
 - What does polarisation mean for individuals?
 - What does globalization imply for polarisation?
 - What is the general equilibrium effect of polarisation?
-

Polarisation: Change or Continuity?

- Barany paper shows that some elements of polarisation were present before it attracted much attention from mainstream economists.
- My view is that some elements of it are newer than others.
- The replacement of craft workers in manufacturing (middling jobs) started a very long time ago
- But the replacement of clerical workers (also middling jobs) is more recent
- What about the future? Is the pace of change faster now?

Current Fears are around the impact of AI/Robots

- Frey-Osborne work was earliest and creative in trying to predict future trends
- Tried to answer the question “Can the tasks of this job be sufficiently specified, conditional on the availability of big data, to be performed by state-of-the-art computer-controlled equipment”
- Produced estimates of probability of automation “over some unspecified number of years, perhaps a decade or two”
- Controversy about the estimates of numbers affected but I think these are probably better measures of relative rather than absolute probability of automation
- It is now almost 5 years since the exercise so perhaps we might begin to look for evidence – though might be future acceleration in change

Data

- US Occupational Employment Survey
- Provides data on employment and earnings for 700+ occupations
- Aligned with Frey-Osborne measures of probability of automation

Results: change in employment 2012-17

Dependent Variable	Change Log Employment	Change Log Employment
Sample Period	2012-2017	2012-2017
	Unweighted	Weighted
Probability of Automation	-0.018 (0.004)	-0.015 (0.003)
R2	0.016	0.015

- Is evidence that those with higher probability of automation have slower employment growth
- But explanatory power is very low
- Impact is not large relative to the changes seen e.g. 10th percentile of decadal change is -22%, 90th percentile is +53%

And other pieces of evidence do not line up

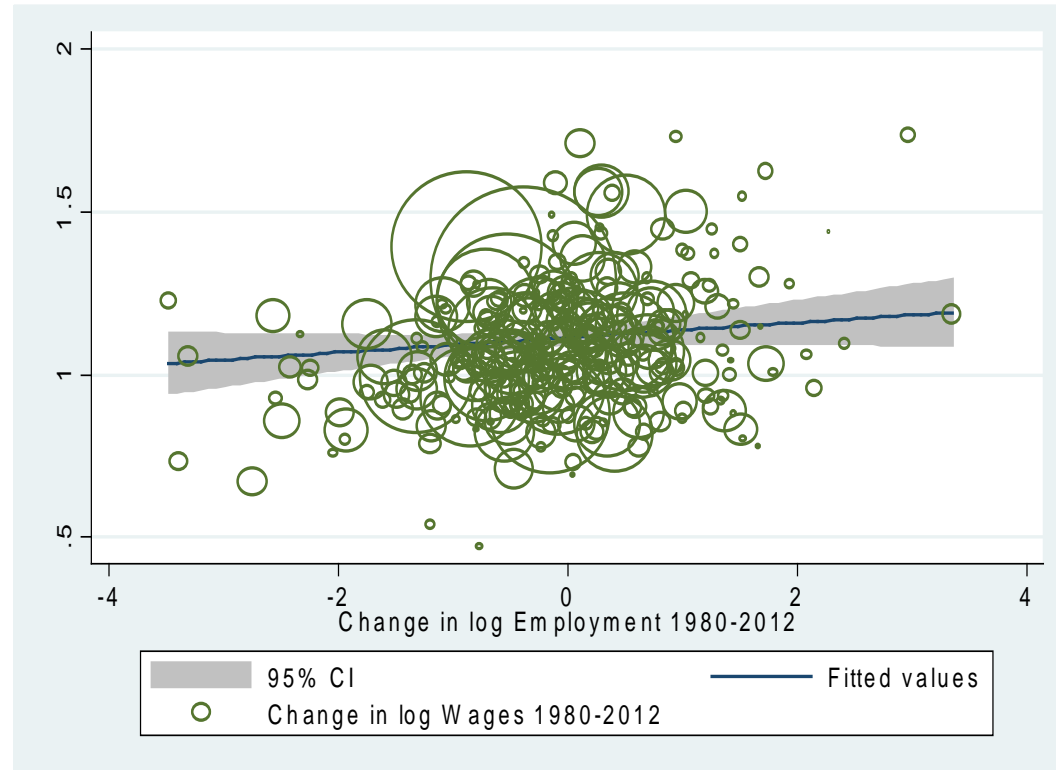
Dependent Variable	Change Log Employment	Change Log Employment	Change in Log Wages
Sample Period	2000-2011	2000-2004	2012-2017
Probability of Automation	-0.036 (0.004)	-0.033 (0.006)	0.003 (0.001)
R2	0.069	0.026	0.067

- Better predictor of employment change in earlier than recent years
- Not surprising because underlying task variables from O*NET are similar to those used to explain earlier technical change
- Wages are moving in the opposite direction though small impact

Polarisation and Inequality

- It is much easier to find evidence for polarisation in changes in employment shares than it is in wage inequality.
- But it is important to measure wages correctly (Breda)
- Some occupations can decline in size by 90%+, others can grow by 100%+.
- But movements in relative wages are much more muted
- Obvious hypothesis for this is that people can change occupations: supply of labour to occupations is not inelastic, especially in the longer-run (Cortes).
- Some evidence for this is that the long-run relationship between changes in occupational wages and employment is weak
 - Tiny and not significantly different from zero in weighted regression
 - significantly different from zero in unweighted regression but only 0.052

The Long-Run Relationship between Changes in Wages and Employment, US 1980-2012



Polarisation and Individuals

- What does polarisation mean for individuals? (Cortes)
- For older workers with scarce specific skills replaced by technology the impact may be particularly bad
- But gross flows are so much bigger than net flows that it is not clear that any impact on labour reallocation will be very large – 20% of workers in UK are changing jobs every year
- And occupations may decline more by lower entry of labour market entrants than higher exit by older workers – especially if labour force is growing in size

Polarisation and Globalisation

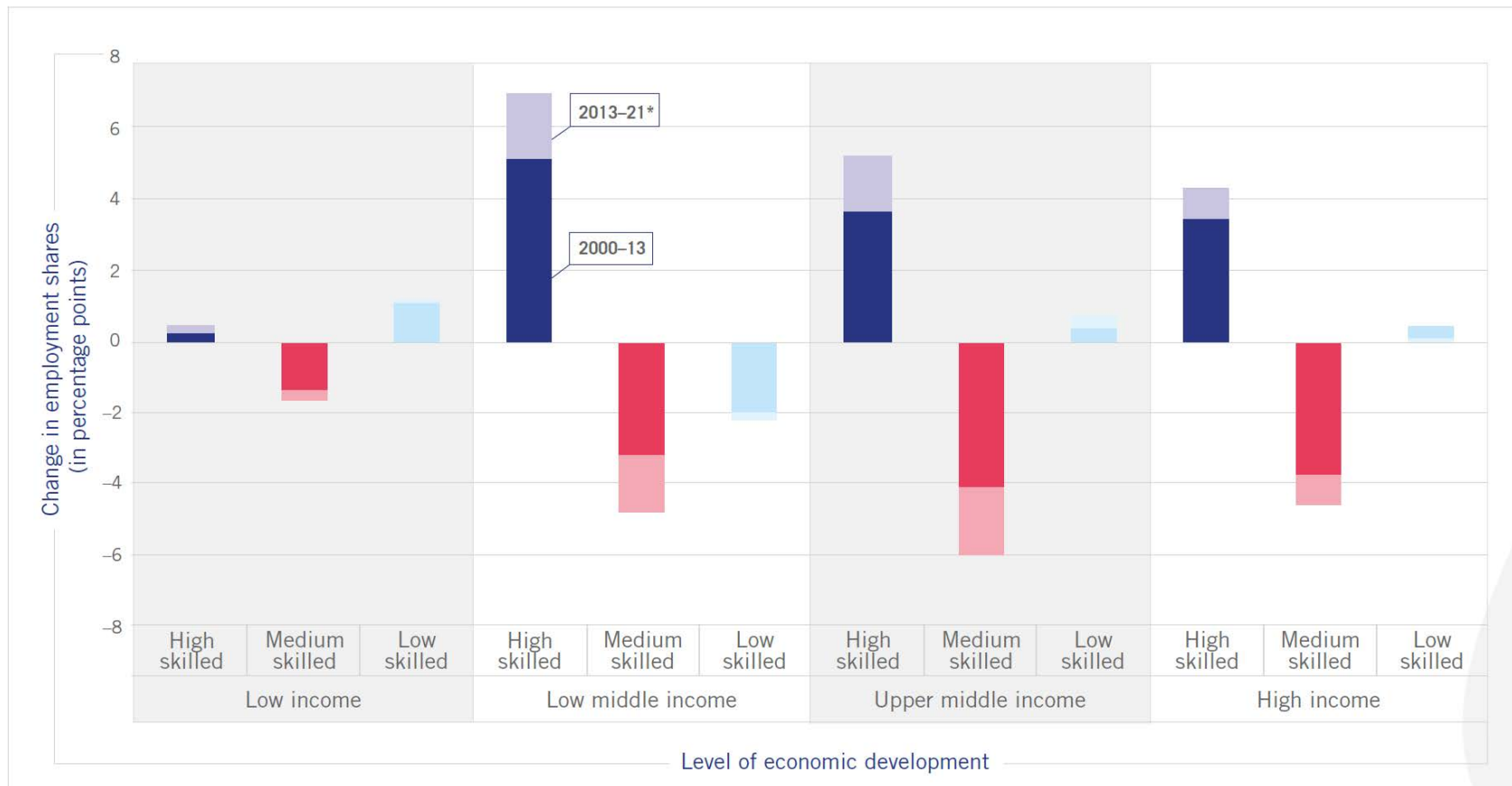
- Several papers (Heyman, Reshef, Malgouyres and Utar) have touched on the interaction between globalisation and polarisation
- But they all raise the question “how much of polarisation as experienced in high-income countries is simply the movement of some jobs to low- and middle-income countries?”
- Is what is happening in these countries the mirror image of what is happening in high-income countries
- Reminiscent of debates 20 years ago about the relative importance of trade and technology in skill-biased technical change.

Disentangling globalisation and technology

- If globalisation then might expect to see rising share of middling-jobs in countries where there is increased trade
- But if it is technology then might expect to see similar trends there
- As far as I am aware, there do not seem to be many studies on polarisation outside high-income countries
- But what there is perhaps suggests polarisation is happening there

From ILO: 'The impact of technology on the quality and quantity of jobs'

Figure 2. Job polarization around the globe



Polarisation in General Equilibrium

- Most of the empirical enquiries compare outcomes across occupations/sectors/firms that are more or less affected by the variables of interest.
- These studies are very useful but, by their nature, they cannot say anything about the aggregate impacts which might be subsumed in a general time effect.
- There is quite a lot of misunderstanding about what simple economic models predict would be the consequence of new technology.

Fears about the impact of new technology have a long history

- 3 types of fears about the impact of new technology:
 - Means the 'end of work' – will be bad for all workers
 - Some workers might gain but generally bad for workers and good for capital
 - Will likely have distributional consequences between workers
- Past predictions have always been wrong
 - Over medium to long-run, technology has been the source of the rise in living standards for everyone
 - though there have been big losers at times
- But past is not necessarily a good guide to the future ('this time its different - really')
- It is useful to ask where past predictions went wrong

Where past predictions went wrong

- Analysis focused almost exclusively on jobs where humans were going to be displaced by new technology – the losers who are often very concentrated and visible – ‘first-round’ effects
- But analyses often missed the gainers
- Gainers are not just in new jobs created by new technology, they are mostly dispersed across ‘old’ jobs:
 - Firms adopt new technology because it lowers costs
 - if lower costs lead to lower prices then consumers have more disposable income
 - And spend this on all sorts of stuff leading to higher labour demand in many other areas
- Much the same argument applies to China – lowering prices for consumers

What about current predictions?

- Almost all analysis focuses again on ‘first-round effects’ ignoring second-round/general equilibrium effects which we know to have been important in the past
- True both of popular discussion and of more sophisticated econometric analyses which compare low- and high-impact jobs/areas without a way to assess aggregate impacts
- There is a real risk that the same mistakes are being made today as were made in the past
- But it is hard to assess aggregate effects – models can be useful here

Caselli and Manning “Robot Arithmetic: New Technology and Wages”

Start with a very simple model

- Output is produced by labour, L , capital, K , and technology, θ according to a production function $F(L, K, \theta)$
- Assume:
 - constant returns to scale
 - perfect competition
 - One type of labour, one capital good
 - Labour supply inelastic – any effect must go into wages
- Will come back to these assumptions but useful starting-point

The Impact of New Technology on the Production Function

- Higher θ means more output given (L, K) so we have

$$\frac{\partial F}{\partial \theta} > 0$$

- Few people will disagree with that
- Possible that new technology reduces marginal product of labour:

$$\frac{\partial^2 F}{\partial L \partial \theta} < 0$$

- Depends on whether technology substitutes for or complements labour – lots of discussion about this

Wages in Equilibrium

- Labour and Capital Earn their 'Marginal Product' i.e.:

$$W = \frac{\partial F(L, K, \theta)}{\partial L}$$

- With fixed capital we get result that wage will change could fall with new technology:

$$\frac{\partial W}{\partial \theta} = \frac{\partial^2 F(L, K, \theta)}{\partial L \partial \theta}$$

- But capital cannot be treated as fixed and that makes a big difference

The Cost of Capital

- Cost of capital is $P^K(r+\delta)$, where:
 - r is interest rate
 - δ is depreciation rate
 - P^K is relative price of capital goods
- Assumes perfectly elastic supply of capital
- Employ capital until point where

$$\frac{\partial F(L, K, \theta)}{\partial K} = P^K (r + \delta)$$

Wages in the Long-Run

- Total income to labour is (from CRS): $WL = F(L, K, \theta) - P^K (r + \delta) K$

- If assume that cost of capital is constant then by envelope theorem:

$$L \frac{\partial W}{\partial \theta} = \frac{\partial F(L, K, \theta)}{\partial \theta} + \left[\frac{\partial F(L, K, \theta)}{\partial K} - P^K (r + \delta) \right] \frac{\partial K}{\partial \theta} - \frac{\partial [P^K (r + \delta)]}{\partial \theta} K$$

- First term is positive
- Second term is zero by envelope condition
- Third term is zero if cost of capital goods relative to consumption goods does not change

Implication

- If relative price of capital does not rise then real wages must rise with improvement in technology
- The nature of new technology is irrelevant
 - Does not matter whether it is a substitute or complement to labour
 - Does not matter whether it is labour- or capital-augmenting
- Intuition is the following:
 - Must be some gainers from new technology
 - 'New' capital gets paid its marginal product so cannot gain
 - 'Old' capital cannot gain unless relative price of capital goods rises
- Simple underlying idea is that labour is the fixed factor and gains go to the fixed factor

How could one get the opposite result?

- Decreasing Returns to scale
 - But this is commonly thought of as an omitted fixed factor
- Imperfect Competition
 - If technology causes mark-up to rise
 - Some concerns about this in both product and labour markets – van Reenen paper
 - Privatisation of knowledge
- Rising cost of capital
 - If investment is weak then rate of return to capital can rise to the disadvantage of workers
 - The problem here is caused by too little investment in robots not too much
- Is this too simple: what about lots of types of goods and workers?

Caselli and Manning 'Robot Arithmetic: New Technology and Wages'

- Any number of types of labour in fixed supply
- Any number of goods: consumption, intermediate and investment
- Technology can affect production possibilities in any way except must weakly increase output
- Constant returns to scale in all sectors, perfect competition, constant interest rate (but impact of relaxing them the same as in simple model)
- Comparative steady states approach – compares wages in steady-state in two economies with different levels of technology

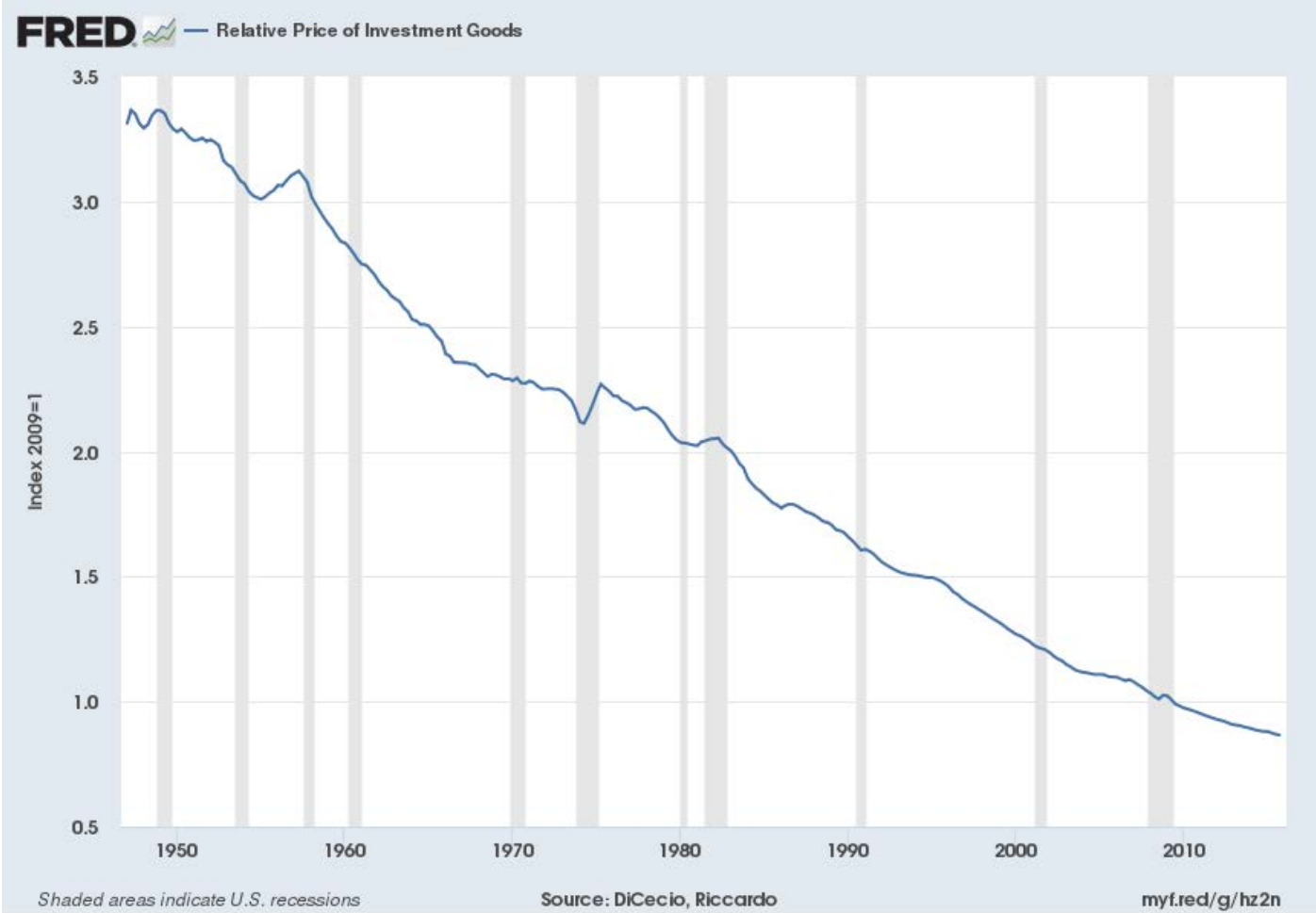
Caselli-Manning: Result 1: New technology cannot make all types of labour worse off

- New technology cannot make all types of labour worse off
- Whatever form new technology takes
- Corollary: if one type of labour then all types must be better off
- But gainers might be a very small group – what about the average worker

Caselli-Manning: Result 2: New technology must raise the average wage if price of investment goods falls relative to consumption goods

- Intuition is the same as in the one good model:
 - New technology allows more output to be produced so someone must gain
 - Any new capital gets its marginal product so gainers must be labour or existing capital
 - If relative price of investment goods falls then it must be labour
- Labour is, in long-run, the only fixed factor so gains must flow to it
- Possible that labour share of total income falls
- And possible that distributional effects are very severe

The relative price of investment goods



case in training, Result 3. If labor of different types is in perfectly elastic supply, then workers of all types must gain from technological progress.

- Intuition is that relative wages of different occupations are fixed
- So effectively one type of labour: Result 1 then implies that new technology will raise wages of all types of labour
- May seem an extreme assumption but changes in relative employment much larger than changes in relative wages
- Occupational mobility is high and entrants stop entering declining occupations
- Have seen this is not a bad model

Conclusion

- The occupational structure of employment does seem to be changing in a way that can be described as polarisation
- There is little evidence for faster change now than earlier – or very different change
- This process can lead to increases in inequality though the evidence for this is less strong than for the changes in structure of employment
- Should not be complacent- policy is needed to deliver inclusive growth.
- Growth part perhaps more difficult at the moment
- We know that:
 - Growth at the frontier is driven by increases in knowledge
 - Knowledge is a public good
 - Market economies do not deliver efficient levels of public goods
- We have a set of tools to make growth inclusive (Lordan, Utar, Breda have discussed some) – we just need to use them