Minimum wages and inequality: the effects of artificial intelligence and technological upgrading

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Artificial intelligence and the future of work

- central policy question: effect of AI on the future of jobs
- Frey and Osborne (2017): 47% of total US emp at high risk of being automated in the next two decades
- Nedeloska and Quintini (2018, OECD): of total jobs in OECD 14% highly automatable and 32% face substantial changes
- in practice: very hard to predict
- consensus:
  - all jobs will be affected by tech change
  - content of jobs will change
  - potentially large distributional impact
    substitutability $\rightarrow$ low- and middle-skilled lose
    complementarity $\rightarrow$ highest-skilled gain

Historical perspective on technological change

- technological change is the key driver of economic growth
  – more about this later
- and has implications for inequality
  $\rightarrow$ often biased towards certain groups of workers
  - skill biased technological change: since the 1950s

    supply and wages of high-skilled workers increased relative to low-skilled
  - structural transformation: since the 1850s

    employment and economic activity has been shifting away from agriculture to manufacturing and to services
  - occupational job polarization: since the 1980s

    employment share of low- and high-earning occupations have been increasing at the expense of middle-earning occupations, similar patterns for relative wages

Job polarization and structural change

in Bárány and Siegel (2018, AEJ Macro & 2018, wp) we show that

- job polarization started in the 1950s in the US
- coincides with start of structural shift away from manufacturing
- significant part of occupational employment share and relative wage change driven by between industry forces
- show that routine employment contracted only in goods, and vice versa

$\Rightarrow$ two phenomena closely linked

$\rightarrow$ what type of technological change is driving these patterns of emp reallocation across sec and occ?

important for policy: active labor market vs industrial policies

Sources of recent technological change I.

in Bárány and Siegel (2018, wp) we

- propose a model where tech evolves at the sec-occ cell level
- allows us to quantify the bias of tech across sec-occ cells

$\rightarrow$ decompose it into diff components

  - sector and occupation components jointly explain almost 75%
  - general purpose technologies (TFP) hardly explain anything
  - most is explained by occupation specific growth
  - some role for sector specific growth

$\Rightarrow$ most of the employment reallocations and part of the faster prod growth in goods are due to occ-specific tech change

$\Rightarrow$ heterogeneity across occupations is more important than across sectors for employment changes (and for aggregate and industrial productivity growth)

Sources of recent technological change II.

Aum, Lee and Shin (2018, wp)

- do industrial linkages overturn this conclusion?
- model: computer capital is used in all industries

$\rightarrow$ prod improvement in comp ind spills over to other ind

$\Rightarrow$ computer ind's prod growth explains third of aggregate growth

$\Rightarrow$ routinization leads to aggregate prod drop

$\Rightarrow$ these two cancel out perfectly until mid-2000s, after which agg prod slowdown driven by comp ind slowdown

$\Rightarrow$ occ heterogeneity is more important, but certain industries may have a large role

going forward:

1. role of other industries, such as AI
2. role of linkages, complete input-output structure
3. where is tech change coming from?

The effects of technological progress I.

- first-round effects: jobs where humans will be displaced by technology

$\rightarrow$ focus on losers who are often concentrated and visible

- a lot of the analysis misses the gainers
- besides distributional impacts, large positive effect on all consumers
- technology is the source of sustained improvement in living standards for everyone
- new tech adopted to lower costs $\Rightarrow$ prices fall $\Rightarrow$ more disposable income $\Rightarrow$ higher demand for goods and serv $\Rightarrow$ higher labor demand
- GE effects are important
  partially offset the reduction in demand for certain types of labor

The effects of technological progress II.

- empirical literature typically unable to assess GE effects, typically compares differentially impacted occupations/workers
- Caselli and Manning (2018, wp)
  - if labor is the only production input in fixed supply
  - then new, productivity increasing technologies
  - increase average wages in the long run
  - as long as the relative price of investment falls

$\Rightarrow$ the average worker likely to benefit from new technologies

- intuition: there must be some gainers from new tech
  labor is the fixed factor of production, and the gains go to the fixed factor
- main caveat: imperfect competition and increasing mark-ups
  - competition in product and labor markets
  - increased privatization of knowledge
- does not rule out substantial distributive effect and no predictions about transition

Is AI fundamentally different?

- probably no, but
- but there is some evidence that tech change is becoming more and more specific to occupations rather than to industries

$\rightarrow$ all similar occ affected approx at the same time

$\rightarrow$ labor market and individual workers have less time to adjust

$\rightarrow$ is policy needed?

Evidence on the effect of automatability

Frey-Osborne framework: 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?

	Δ log emp	Δ log emp	Δ log emp	Δ log wage
period	00-11	00-04	12-17	12-17
prob of auto	-0.036	-0.033	-0.018	0.003
	(0.004)	(0.006)	(0.004)	(0.001)
R^2	0.069	0.026	0.016	0.067

- those with higher prob of auto have slower emp growth, but very small impact, decadal Δ 10th percentile -22%, 90th 53%
- very poor explanatory power
- better predictor earlier than in more recent years
- wages are increasing, but even smaller impact

data: US Occupational Employment Survey

Some facts about labor market adjustments

- suggestive evidence about the supply of labor to occupations: 1980-2012 Δ in log employment and Δ log wages
  - small, marginally significant relationship ▸ graph
  - $\rightarrow$ very elastic supply in the long run
- huge changes in employment shares and modest changes in relative wages over long periods
- occupational mobility
  - gross flows much larger across occ than net flows
  - high churning of individuals across occupations
    20% of workers in the UK change occupations each year
- minimum wages
  - studies focus on short run & effects on teenagers
  - very small neg or no emp effect
  - $\rightarrow$ min wages improve welfare of lowest earners

Minimum wages in general equilibrium

in Bárány (2016, JOLE) I show that

- need to look at longer run & GE effects
- if min wages impact the rel wages of different types of workers
- and these types are endogenous

$\rightarrow$ change incentives of people to sort into these types and

$\rightarrow$ change incentives of firms to dev/adopt technologies for types

$\Rightarrow$ not only the lowest end, but entire distr of wages affected

- if types = occupations and
  technologies = automate tasks

$\rightarrow$ min wages induce firms to automate tasks and replace workers most impacted by min wage

The effect of minimum wages on automatable jobs

Lordan and Neumark (2017, NBER wp)

- effect of min wages on low-skilled workers in automatable jobs
- easier to substitute by machines than other jobs

$\rightarrow$ min wage $\Rightarrow$ inv by firms to implement such substitutions

- analyze CPS data 1980-2015: increases in min wage
  - decreases automatable emp of low-skilled workers
  - increases likelihood of non-emp or emp in worse jobs
  - negative effect is heterogeneous
    largest impact on older & manufact, female and black workers
    larger later on in the sample

$\Rightarrow$ adverse effects of min wages

- does not imply min wages should be scrapped, but monitoring needed

The role of education and other policies

hard to predict affected occupations/industries

- Autor and Dorn (2013): taxi drivers, cashiers, bricklayers, fruit pickers all non-routine
- current investments: Uber and driverless cars, Amazon GO, Fastbrick, Ocado

for current cohorts facing large changes

- retraining people facing difficulties: most vulnerable low-skilled workers least likely to participate
- minimum wages: good for wages, bad for employment
- redistribution

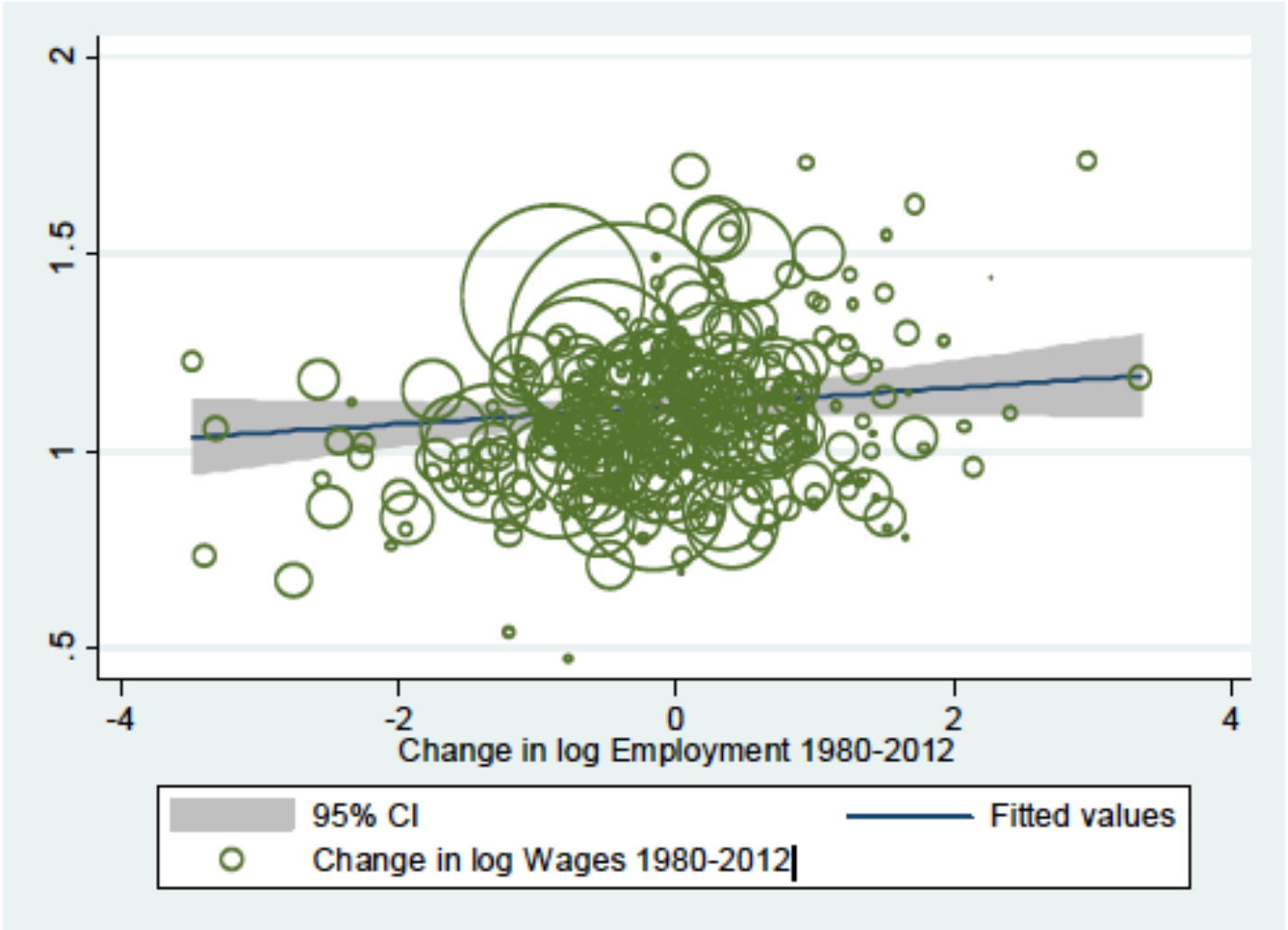
for incoming cohorts

- more higher educ: might be costly and likely small impact due to GE effects
- Autor (2015,JEP): expertise, judgement, creativity needed
- improving primary & secondary educ: reading, math, analytical reasoning, communication, and teamwork

Policies for inclusive growth

- promote technological progress
  - knowledge drives technology, knowledge is a public good
  - markets might be inefficient at providing this public good
- monitor competitiveness of product and labor market
- for older cohorts
  - redistribute more actively
- for incoming cohorts
  - teaching of basic skills should be improved: reading, math, analytical reasoning, communication and teamwork

Relation between Δ employment and Δ wages



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