Robots and Jobs: Evidence from UK Labour Markets

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Outline of presentation

Summary
- Motivation
- Aim of the paper
- Key results

Literature

Empirical Approach

Results
- Baseline
- Robustness Checks

Conclusion

Motivation

"...but I am convinced, that the substitution of machinery for human labour, is often very injurious to the interests of the class of labourers." David Ricardo, 1817

Aim of the paper

- What is the impact of the adoption of robots on labour market outcomes in the UK?
- Use *local labour markets* as unit of observation to measure equilibrium impact of industrial robots

Key results

- Limited impact of robot adoption on overall employment, although some evidence of **productivity effect** on full-time employment rates
- We find that robots substitute for workers in the High-Tech industries in which they were heavily adopted, but had positive spillover effects on employment in other industries, specifically services

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Literature

- Task-based work (Autor, Levy and Murnane, 2003; Acemoglu and Restrepo, 2016; Susskind, 2017; Acemoglu and Restrepo, 2018)
- Productivity growth and the labour share (Karabarbounis and Neiman, 2013; Schwellnus et al., 2017; Autor and Salomons, 2018)
- Polarization (Goos and Manning, 2007; Autor, 2010; Autor and Dorn, 2013; Autor, 2015; Cortes et al., 2016)
- Automation (Graetz and Michaels, 2015; Acemoglu and Restrepo, 2017; Dauth et al., 2017)

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Identification

$$\underbrace{\left(\frac{L_{c,t+h}}{N_{c,t+h}} - \frac{L_{c,t}}{N_{c,t}}\right)}_{\substack{\Delta\text{Employment share from} \\ t \text{ to } t+h \text{ in region } c}} = \beta^L \underbrace{\sum_{i \in \mathcal{I}} \ell_{ci}^t \left(\frac{R_{i,t+h}}{L_{i,t}} - \frac{R_{i,t}}{L_{i,t}}\right)}_{\substack{\text{Exposure to Robots from} \\ t \text{ to } t+h \text{ in region } c}} + \Gamma X_{c,t} + \epsilon_c^L$$

Local Labour Markets

- The unit of observation will be the *local labour market* where we expect adjustment to shocks to take place
- Here we use 348 Local Authorities in England and Wales because 1) they don't change over period of analysis, 2) they have excellent data availability and 3) there is evidence they are a reasonable proxy for local labour markets

Data

- International Federation of Robotics (IFR): robot stock by industry x year x country
- UK Census 1981, 1991, 2011: from NOMIS, for employment, population and controls data by Local Authority
- Gross Disposable Household Income (GDHI): from ONS, for per capita labour and non-labour income by Local Authority
- Eurostat: exposure to Chinese trade by industry x year

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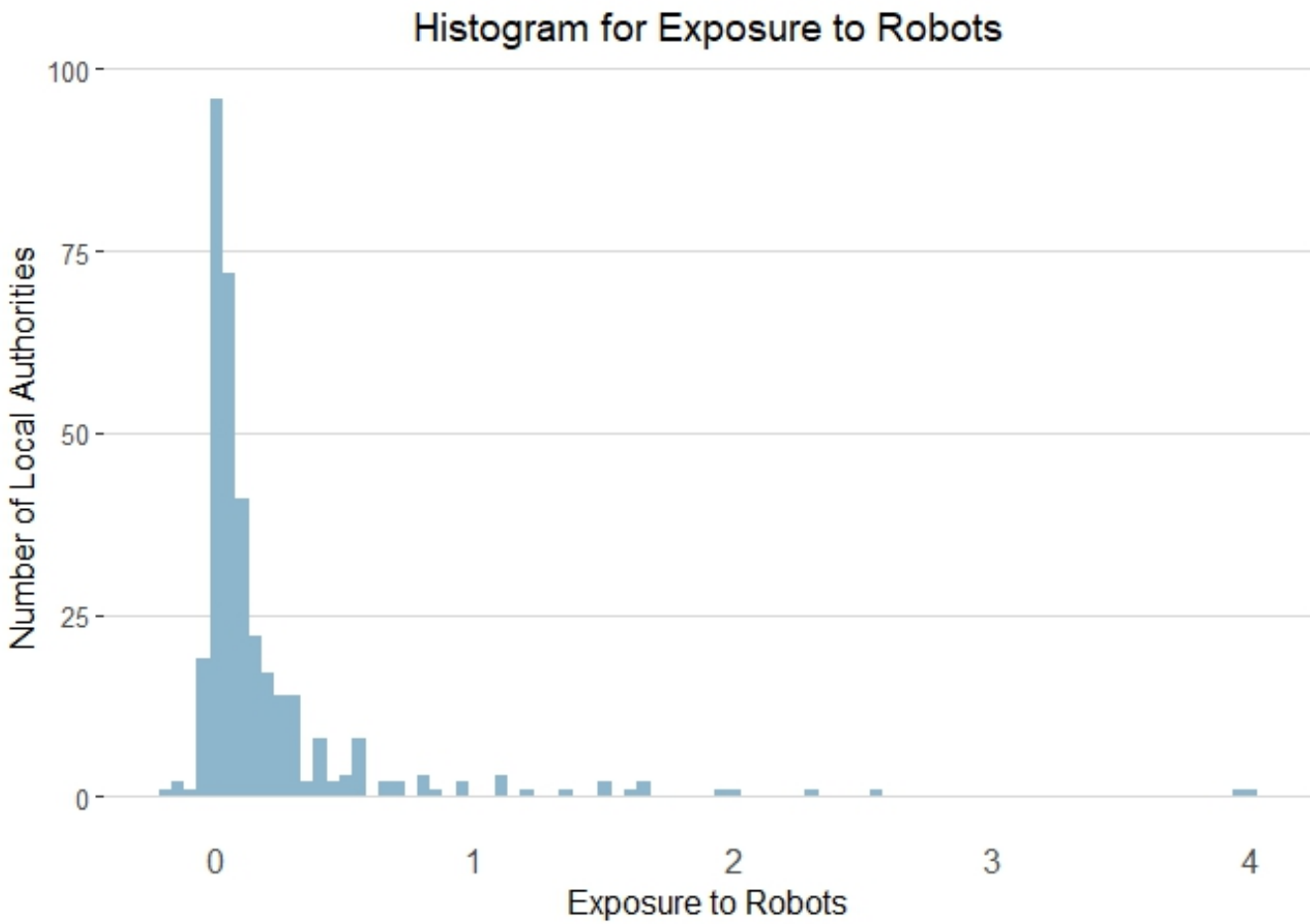
Baseline Results

- All regressions repeated with five specifications (growing set of controls). We perform OLS, 2SLS and GMM (using a new robot-related patents dataset)
- **Employment:** four employment rates tested. Some evidence of positive coefficient for full-time employment rates
- **Wages:** two measures of income tested. No evidence of a relationship between robot adoption and wages

Remove most-exposed regions

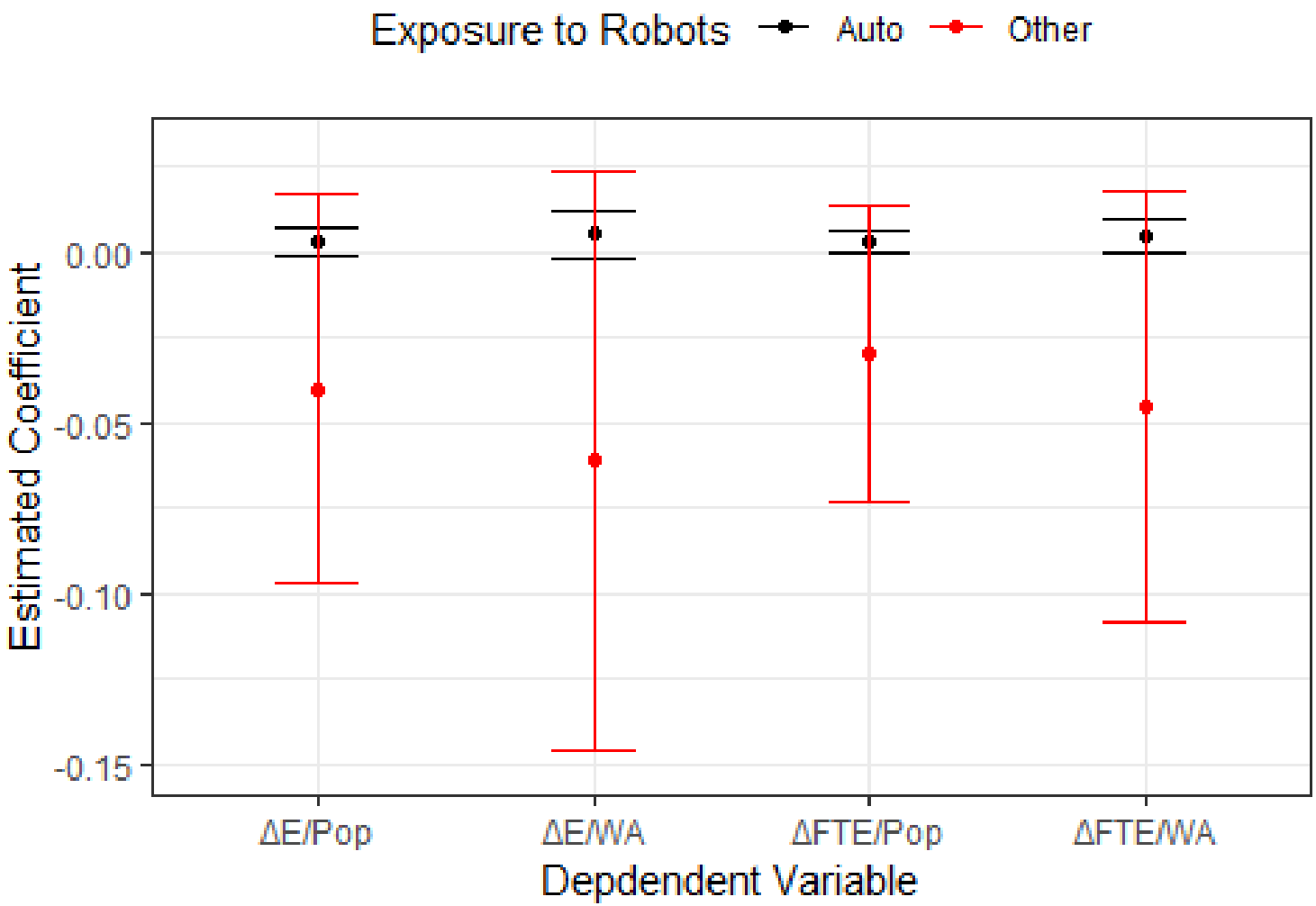


Remove most-exposed regions

- We remove observations with exposure above the 95^{th} percentile and repeat our analysis
- **Employment:** estimated coefficients on Exposure to Robots are consistently negative and there is statistical significance across many specifications
- **Wages:** no evidence to suggest a relationship

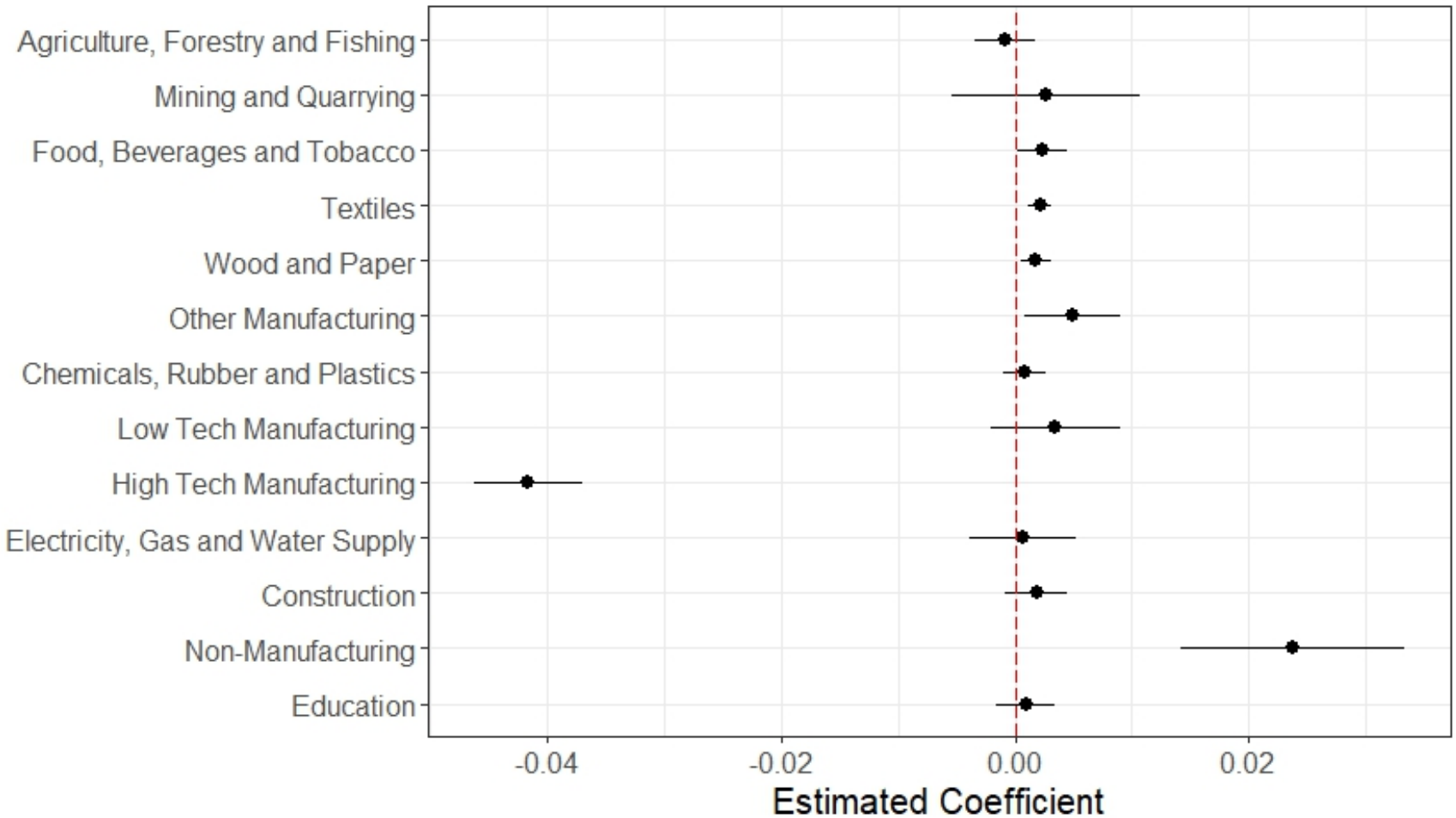
Isolate automobile industry

Positive effect on full-time employment rates is driven by robot adoption in Automobile industry



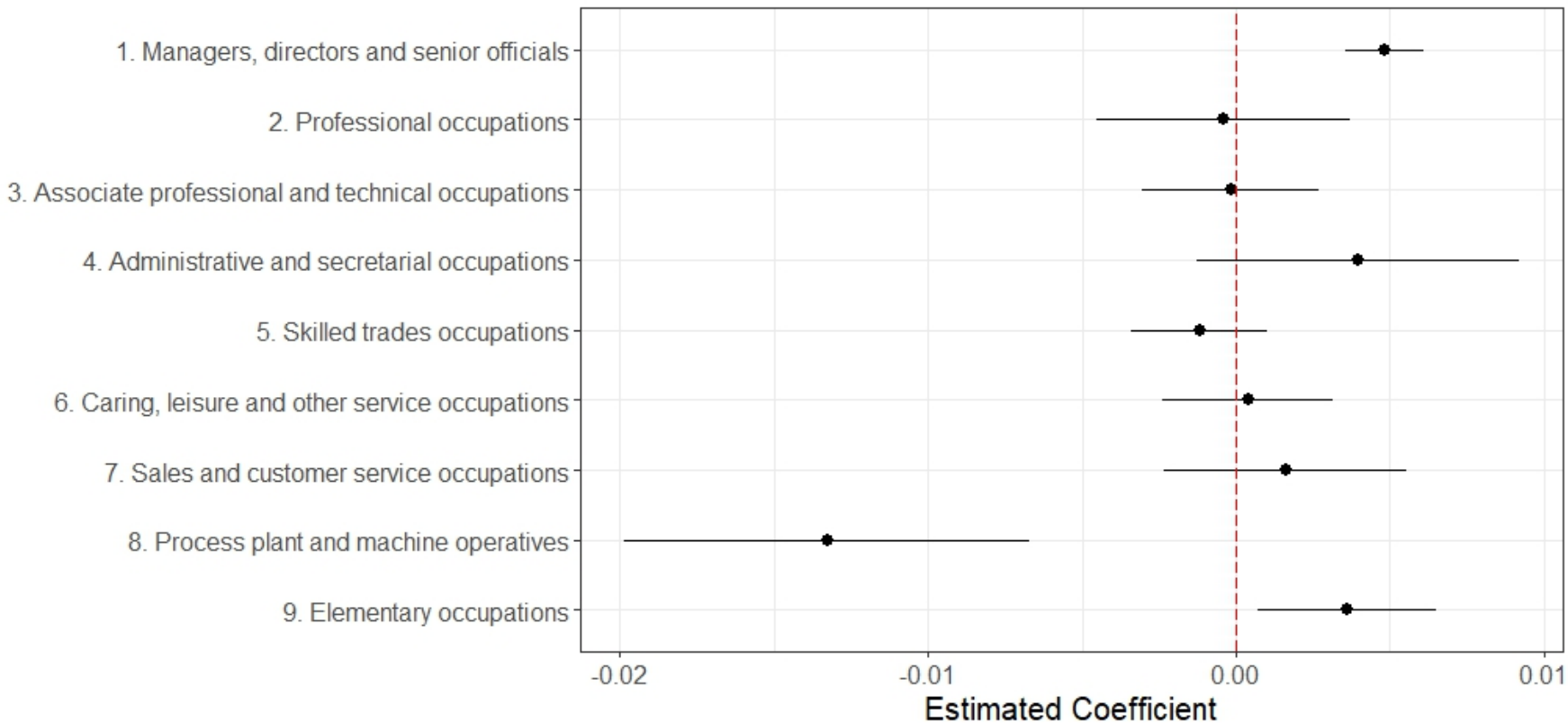
Heterogeneity by industry

Evidence of displacement in High Tech Manufacturing, but positive spillovers to Services



Heterogeneity by occupation type

Evidence of displacement of machine operators, but boost in employment for managers and "elementary occupations"



Control for prior trends

- Check if uptake of robots is related to prior labour market performance
- Regress employment variables from 1981 - 1991 on Exposure to Robots
- Fully-specified model with all regions has *no statistical significance*

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Conclusion-

- Evidence of displacement effect for specific occupations in certain industries, but also spillovers and an overall productivity effect on full-time employment rates
- No evidence of effects on wages
- Identification at level of Local Authority may miss heterogeneous effects *within* local labour markets