The Risk of Automation of Work in Ireland
Both Sides of the Border

Introduction

- "There are big obstacles in the way of physical robots taking over many of the physical jobs that people do in their everyday lives." (Robert Gordon, Economist)

- "The rise of artificial intelligence is likely to extend this job destruction deep into the middle classes, with only the most caring, creative or supervisory roles remaining." (Steven Hawking, Physicist)

- "Marx and Engels may again become relevant." (Mark Carney, Governor of the Bank of England)

Technological Innovation

- Technological innovation may lead to increased substitution of captial for labour.

  The Displacement Effect

- However, these innovations may also generate new types of employment.

  The Job Creation Effect

- Automation may reduce prices, increasing real incomes and generating demand.

  The Income Effect

- The overall outcome of these opposing effects is unclear

The Displacement Effect

- How is this measured?

- How many jobs could potentially be destroyed?

- What are the characterisitcs of those losing out?

Estimation of the displacement effect

- **Two ways of measuring the effects of automation**

- Occupation based
- Assumes homogeneous task structure across firms, workers and geographic localities

- Task based
- Accounts for heterogeneity

Occupation measure

- Pioneered by Frey & Osborne
- F&O state that despite emergence of AI, machine learning and big data, there are a number of bottlenecks to automation:
- Manual dexterity
- Negotiation and Persuasion
- Originality
- Jobs which have a large proportion of task requiring these elements are more difficult to automate given current technological capabilities.

- O*NET database
- Generalised description of the tasks completed within an occupation
- 702 occupations in total
- Those which the authors *believe* are certainly automatable given current technology are marked 1
- Classification algorithm trained on a small subset of the 702 occupations
- Then used to classify all other occupations along a 0, 1 interval.

O*NET, an example

- Example: Economist
- Teach theories, principles, and methods of economics.
- Study economic and statistical data in area of specialization, such as finance, labor, or agriculture.
- Conduct research on economic issues and disseminate research findings through technical reports or scientific articles in journals.
- Compile, analyze, and report data to explain economic phenomena and forecast market trends, applying mathematical models and statistical techniques.
- Study the socioeconomic impacts of new public policies, such as proposed legislation, taxes, services, and regulations.

Occupation based measure in Northern Ireland

- Crosswalk American occupation classification to European classification ISCO08
- Match four digit occupation code with three digit occupation in Labour force survey NI.
- Occupatations in LFSNI are associated with multiple automation scores
- Average to get a single score

Measure	Risk Level	Jobs (percent)
Occupation	HIGH	23.84
Occupation	MED-HIGH	35.22
Occupation	LOW-MED	8.58
Occupation	LOW	32.36

Table 1: Our estimates of jobs at high risk

And in the Republic...?

- Similar approach
- Except Quarterly National Household Survey only provides occupation codes at the 1 digit level
- This means taking averages compresses the distribution substantilly - in reality there is even more polarisation.

Measure	Risk Level	Jobs (percent)
Occupation	HIGH	29.68
Occupation	MED-HIGH	29.15
Occupation	LOW-MED	11.28
Occupation	LOW	29.58

Table 2: Our estimates of jobs at high risk

Is this the best we can do?

- This assumes a degree of uniformity of occupations which in reality does not exist.

- It assumes that both across firms and geographies, task structures within occupations are the same.

- Is it realistic that 702 occupations would accurately describe the task structures of each individual in Ireland. Probably not...

A (true) Task Based approach

- Takes similar approach to Arntz et al. (2016)
- Accounts for heterogeneity in task structure
- Uses the OECD's PIAAC database also known as the Survey of Adult Skills.
- Surveys people about what they *actually* do at work.
- Do they do heavy lifting, think analytically, use percentages etc. regularly.
- Demographic information too - age, income level, occupation.
- Numeracy and Literacy scores
- Decent sample size for Republic AND N.I.

First...

- Use crosswalked Automation score
- Merge this with the PIAAC database for NI (1873 observations)
- Majority of PIAAC database is 4 digit ISCO codes, however some is old 3 digits
- Generates a larger data set (4447 observations)
- Assign a weight to ISCO codes matched to more than one automation score

$$W_i = \frac{1}{count(SCORES_i)}$$

- Regress the occupation score upon various job and individual characteristics
- Quasi-binomial distribution to account for 0, 1 continuous interval
- Generate most predictive model for NI using stepwise techniques
- AIC and BIC measures of interest
- Generate predicted values for automation and recalculate weights
- Repeat until convergence $W_{t+1} - W_t < 0.0001$
- Generates the most likely value of automatation for an observation conditional on the characteristics of the job

What's the outcome?

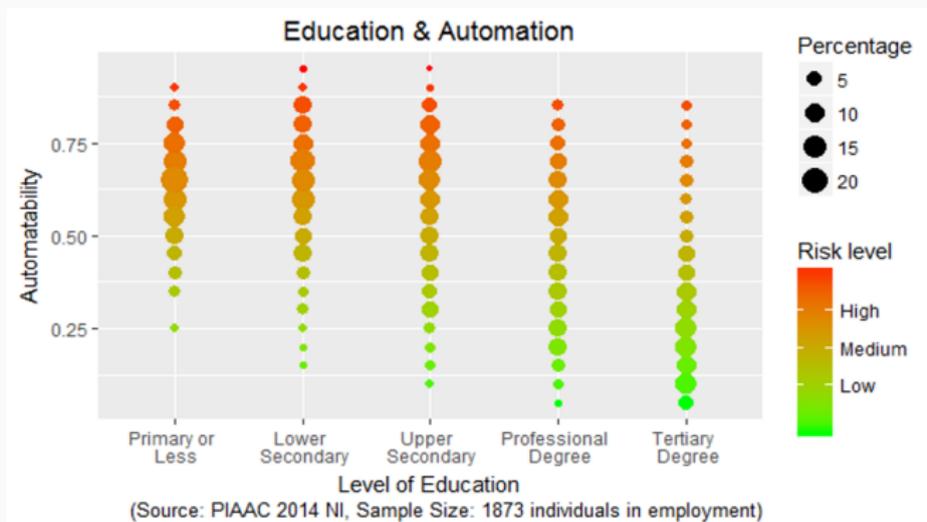| Measure	Risk Level	Jobs (percent)
Task	HIGH	7.16
Task	MED-HIGH	49.18
Task	LOW-MED	33.10
Task	LOW	10.54

Table 3: Our estimates of jobs at high risk

- Individuals are much more likely to be moderately at risk of automation.
- Reflects the fact that many high risk jobs in reality involve tasks which are difficult to automate
- Over time firm reorganisation in response to technological development
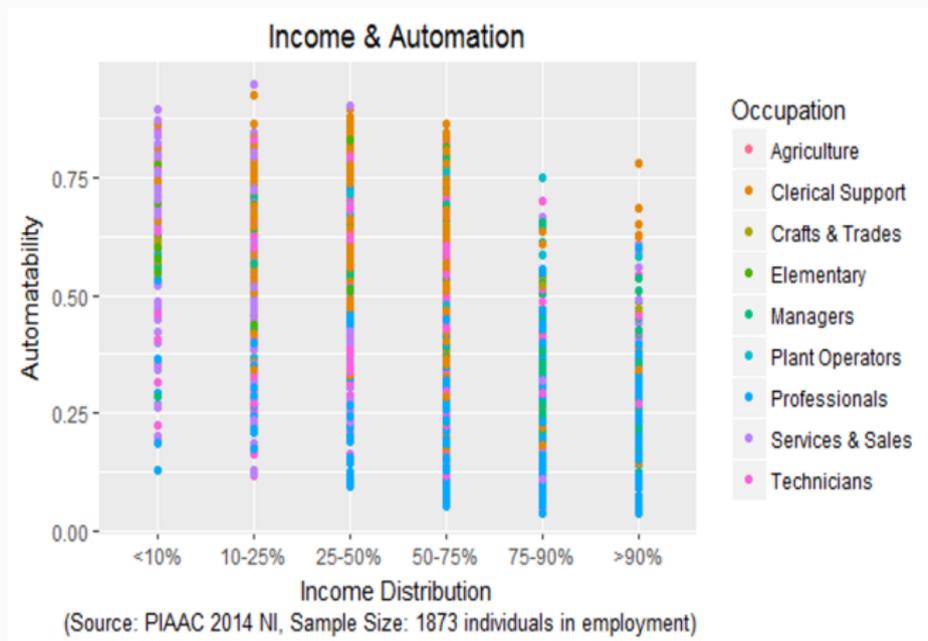- Occupations restructured and thus the number of those at risk rises.

- Identical methodolgy
- **As the QNHS only provides ISCO08 at 1 digit level, merging leads to a severly compressed distribution - all individuals are at moderate risk of automation - slightly more polarized in reality**
- No workers at extremely high or extremely low risk but this is simply a function of data availability in the QNHS.

- Using PIAAC enables us to retreive features of those most at risk of automation

Income & Automation

(Source: PIAAC 2014 NI, Sample Size: 1873 individuals in employment)

Republic of Ireland

- Individuals with lower level of education are more at risk

- High earners are also less susceptible

- Those who were most fulfilled in their jobs were at less risk of automation

So what to conclude?

- Yes technological displacement is certainly feasible
- Could potentially think of effects as similar to those following trade liberalisation
- Large welfare gains spread across the many but extremely detrimental impact for a few
- We don't attempt predict potential new jobs (or sectors)!

So what to conclude?

- Investment is at very low levels - especially in NI
- In NI wages are extremely low
- But, productivity is also extremely low, worse than both GB (poor as well) and the Republic in majority of sectors
- Unclear whether there is the incentive to invest in labour saivng technologies

Questions?