Institute for the Future of Work

Automation, politics and the future of work

A discussion paper

Putting people first
The Institute for the Future of Work (IFOW) has explored the relationship between job automation and voting behaviour. Our analysis reveals a strong correlation between the risk of automation and voting behaviour by region. This suggests that institutional frameworks and policies to promote active engagement with the challenges, as well as the opportunities, of automation should feature prominently in manifestos across the political spectrum.
Key points:

1. **Technological innovation** is the primary driver of growth and job creation but tends to have unequal impacts, and come with social upheaval.

2. **Our analysis suggests** there is a strikingly close relationship between areas at risk of automation and areas that voted “Leave” in the 2016 EU referendum.

3. **This evidence invites** a new focus on the growing number of workers who feel a heightened sense of social and economic insecurity associated with automation.

4. **Some key changes to policy** are needed to maximise and spread the benefits of automation, ease the transition of workers into good jobs and reduce inequalities.

5. **Automation should be redefined** to cover task creation, augmentation and impacts on job quality. Task-level data would improve understanding of the impacts of automation at an individual, firm and local level.

We recommend:

1. **A Work 5.0 Strategy** developed with social partners to shape socially responsible automation. This should cover support for workers in transition alongside creating good work and promoting equality.

2. **Higher levels of investment** in retraining as technology is introduced, including stepping up the National Retraining Programme.

3. **Active labour market policies** to support workers in transition, including the use of data-driven tools for better job and skills matching.

4. **An update of the Equality Act** to require “equality audits” and bring in new protections to counter socio-economic disadvantage.

5. **Improved consultation and transparency** about the introduction and use of different types of technology through the ‘cycle’ of automation, from displacement and leveraging the complementary strengths of humans and machines, to task creation.
The Institute for the Future of Work strongly supports socially responsible automation, which drives growth and offers the potential to improve standards of work and living across the country. However, our analysis suggests that the risks and inequalities associated with automation must be squarely addressed to maximise benefits and avoid exacerbating Britain’s divides.

There have been numerous attempts to explain the outcome of the EU Referendum in 2016. Studies have concluded that older age, white ethnicity, lower educational attainment and low use of digital technologies all positively correlate with a vote to leave the EU. But these findings offer little insight into why these characteristics increased some voters’ appetite to leave the European Union.

Recent studies in other countries have highlighted that the risk of automation was a key determinant of the outcome of the 2016 US presidential election. Likewise, studies across Europe suggest that there are political consequences to automation, as well as economic ones.

The Institute for the Future of Work has examined whether automation risk may have been a determinant in voting behaviour during the EU Referendum. We find that local authorities with the highest risk of automation were significantly more likely to vote leave in the EU Referendum. Indeed, our model suggests that the risk of automation is a stronger predictor of the leave vote than the age, gender or ethnic profile of local authorities in England.

Our findings suggest that, while automation is a source of prosperity in the long term, it is also a growing political challenge. Active policy intervention will be needed to ease the transition of workers into good jobs, increase resilience to change, and spread the gains of technological innovation.
We are optimistic about the future of work, but we must act now.

Naomi Climer CBE
Co-Chair, IFOW
Technology, work and politics

The relationship between technology, work and politics has shaped British history through four industrial revolutions. The power of technology to transform our social and economic life has long been a subject for thinkers of all disciplines. The dystopic novels of H.G. Wells and Aldous Huxley brought to the fore whirring machinery and experiments in bioengineering. But technology is, at its roots, about our ability to invent new ways to produce more from less.¹ In this sense, technological innovation can be seen as the primary driver of long-term growth.

History, however, tells us that the road to riches is bumpy.² The reallocation of capital and labour that marks technological transformations have unequal impacts across regions and demographic groups. Some places and groups are at higher risk of experiencing the adverse consequences of automation, which can compound disadvantage.³ Sure enough, advance of data-driven technologies characteristic of the Fourth Industrial Revolution have generated huge profits for a few large, global firms. There is a growing consensus within the Organisation for Economic Co-operation and Development (OECD), International Monetary Fund (IMF) and World Bank that this concentration of market power is associated with lower levels of local innovation and job creation, labour’s diminishing share of income and increasing inequalities.⁴ The propensity of technological transitions to create “winners” and “losers” is reflected in the results of our research.

Previous analyses of voting behaviour have identified a wide range of factors correlated with voting behaviour. These include the relationship between political preferences and life satisfaction,⁵ adverse health outcomes,⁶ income,⁷ class and social origins,⁸ and the ability to manage uncertainty.⁹ Existing research suggests that older age, white ethnicity, lower educational attainment and low use of digital technologies all positively correlate with those voting to leave the EU.¹⁰ Many of the factors listed above are associated with economic and social insecurity and an individual’s ability to respond to economic change. In short, voter preferences may long have been influenced by response to labour market threats and shocks. In the wake of the 2008 financial crisis, austerity policies rolled back substantial elements of public spending and social safety nets as Government aimed to reduce the budget deficit. That heightened a sense of uncertainty and increased perceptions of vulnerability to future shocks.
Technology, work and politics continued

The Fourth Industrial Revolution is such a ‘shock’. Response to past shocks help us understand the nature, stages and impacts of the structural transformation we are experiencing today. In pre-industrial societies, economic growth originated in reforms that reorganised food production, freeing labour to move off the land and pursue other activities. With hindsight, it is easy to see the benefits of transitioning away from exclusively agrarian economies and forget that the historic movement of labour off land was often contested. Critical junctures in the transformation of economies throughout British history, including the industrial revolutions of the late Sixteenth and early Nineteenth centuries, have all generated resistance and anxiety about the destructive power of technology, expressed in different ways.¹¹

The transition of labour from old tasks to new, driven by new technologies, causes uncertainty, social fragmentation, resistance and periods of halting adjustment. As a result, periods of rapid technological change are associated with higher levels of social and economic insecurity. How an individual, firm or community responds is likely to be determined by their resilience during that change process.

It follows that people’s experience and response to work as it transforms are likely to be important in determining their personal preferences and voting behaviour. This is not surprising: work is a key determinant of living standards and of human flourishing, connecting the economic health and wellbeing of families and individuals to that of the nation; and technology is the main driver of the transformation. At critical times, when work is lost or threatened, or when the terms or quality of work are diminished, this is likely to affect factors correlating with voter behaviour such as economic insecurity, ability to manage uncertainty, and satisfaction with the status quo.

At critical times, when work is lost or threatened, or when the terms or quality of work are diminished, this is likely to affect factors correlating with voter behaviour such as economic insecurity, ability to manage uncertainty, and satisfaction with the status quo.
Against this background, we explored the relationship between automation risk and voter behaviour in the 2016 Referendum. We ask what lessons can be drawn and consider some immediate and wider policy implications. We do so by:

i) exploring who is at risk of automation;

ii) describing voting behaviour in the 2016 Referendum;

iii) suggesting a framework to explain the correlation we have identified.

We explored whether there is a correlation between automation risk and voter selection. For automation risk, we use the Office for National Statistics’ (ONS) analysis of the probability of automation by local authority regions.¹² Consistent with current practice globally, the ONS use information on tasks, occupations and employment to construct a measure of automation probability.¹³ Tasks are classified by ease of automation. A worker’s job consists of a set of tasks and the extent to which their job can be automated depends on the classification of these tasks. The ONS use task level data from the OECD’s PIAAC database to build a predictive model of vulnerability to automation based on an individual’s demographics.¹⁴ They then apply this model to data from the Annual Population Survey to build a large sample of working adults for whom the probability of their job being automated can be estimated. The average probability of automation for local authorities is then estimated by taking the average probability of automation of all adults in the sample that live within a local authority.

To examine the relationship between this ONS measure of the probability of automation and the percentage of people in each local authority that voted Leave in the EU Referendum, we obtained data on the EU referendum result and calculated the Spearman’s rank correlation coefficient between the percentage of voters within each local authority that voted to leave the EU, and the average probability of automation in that local authority, as calculated by the ONS.¹⁵ Having established a relationship between these two variables, we explored this further by estimating an Ordinary Least Squares (OLS) regression model that controls for the percentage of people in each local authority identifying as white ethnicity, the percentage of individuals over 65 years old, the gender split (expressed as a percentage of female inhabitants), and the median wage. These controls were selected on the basis of prior evidence of their impact on the vote to leave the EU.¹⁶ Other relevant factors such as education level and the share of workers in the manufacturing sector were not controlled for as they were used in the construction of the ONS automation statistics.¹⁷ The automation measure therefore captures the total role of occupational risk that incorporates education and the type of occupation.

Our methodology

We explored whether there is a correlation between automation risk and voter selection. For automation risk, we use the Office for National Statistics’ analysis of the probability of automation by local authority regions.
Results

Our research has produced some striking results. There is a strong positive correlation between the probability of automation and the percentage of votes for 'Leave' in an area. That is, areas where automation is predicted to have a stronger impact on jobs are also areas that had a higher propensity to vote for Brexit.

Perhaps most importantly, this result holds even when controlling for key sociodemographic variables that others have suggested were key determinants of voting behaviour such as ethnicity, employment sector, age, gender and wage. Our model suggests that vulnerability to automation is a powerful – and underappreciated – tool through which to evaluate likely behaviour in this General Election and look to address underlying challenges.

Figure 1 maps the probability of automation in each local authority across England, while Figure 2 shows the percentage of votes for Leave in each authority. In both cases, darker shading corresponds to a higher percentage. It is worth noting at this point that the risk of automation is unequally distributed around England.

Figure 1 suggests that London and the South East have the lowest risk of automation while the North East, South West and parts of the Midlands face a higher automation risk.

The maps also suggest a possible correlation between automation risk and voting behaviour. For example, London and the surrounding area typically has low values for the automation index as well as low vote Leave shares, while the North East and South West have high exposure to automation and high Leave vote percentages.
Figure 1: Probability of automation across England local authorities

Probability of automation (%)

- 54–58%
- 50–54%
- 46–50%
- 42–46%
- 38–42%
- 30–38%

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Figure 2: Leave vote share across England local authorities

Leave vote (%)
- 60–80%
- 55–60%
- 50–55%
- 45–50%
- 20–45%

Interactive Leave vote map prepared by Dr Jonny Clarke
Homing in on the local authorities most vulnerable to automation, Table 1 lists the 10 areas with the highest probability of automation measures as well as their corresponding Leave vote shares. Interestingly, of all 324 local authorities in England, Boston has both the highest probability of automation and the highest vote share for Leave. Table 2 lists the least vulnerable areas to automation, a list that is heavily dominated by local authorities in London. Indeed, we observe larger cities are in general less vulnerable to automation than smaller towns.

### Table 1: The top 10 local authorities most vulnerable to automation

<table>
<thead>
<tr>
<th>Rank</th>
<th>Local authority</th>
<th>Probability of automation</th>
<th>Leave vote</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boston</td>
<td>56.8%</td>
<td>75.6%</td>
</tr>
<tr>
<td>2</td>
<td>Mansfield</td>
<td>56.8%</td>
<td>70.9%</td>
</tr>
<tr>
<td>3</td>
<td>Great Yarmouth</td>
<td>53.8%</td>
<td>71.5%</td>
</tr>
<tr>
<td>4</td>
<td>Harlow</td>
<td>53.1%</td>
<td>68.1%</td>
</tr>
<tr>
<td>5</td>
<td>South Holland</td>
<td>52.9%</td>
<td>73.6%</td>
</tr>
<tr>
<td>6</td>
<td>Newark and Sherwood</td>
<td>52.1%</td>
<td>60.4%</td>
</tr>
<tr>
<td>7</td>
<td>Castle Point</td>
<td>51.7%</td>
<td>72.7%</td>
</tr>
<tr>
<td>8</td>
<td>Doncaster</td>
<td>51.5%</td>
<td>69.0%</td>
</tr>
<tr>
<td>9</td>
<td>Tamworth</td>
<td>51.4%</td>
<td>67.5%</td>
</tr>
<tr>
<td>10</td>
<td>West Lancashire</td>
<td>51.3%</td>
<td>55.3%</td>
</tr>
</tbody>
</table>

### Table 2: The bottom 10 local authorities most vulnerable to automation

<table>
<thead>
<tr>
<th>Rank</th>
<th>Local authority</th>
<th>Probability of automation</th>
<th>Leave vote</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wandsworth</td>
<td>33.1%</td>
<td>25.0%</td>
</tr>
<tr>
<td>2</td>
<td>Kensington and Chelsea</td>
<td>33.3%</td>
<td>31.3%</td>
</tr>
<tr>
<td>3</td>
<td>Three Rivers</td>
<td>33.6%</td>
<td>51.3%</td>
</tr>
<tr>
<td>4</td>
<td>Hammersmith and Fulham</td>
<td>33.9%</td>
<td>30.0%</td>
</tr>
<tr>
<td>5</td>
<td>Oxford</td>
<td>34.0%</td>
<td>29.7%</td>
</tr>
<tr>
<td>6</td>
<td>Camden</td>
<td>34.6%</td>
<td>25.0%</td>
</tr>
<tr>
<td>7</td>
<td>Lambeth</td>
<td>34.7%</td>
<td>21.4%</td>
</tr>
<tr>
<td>8</td>
<td>Islington</td>
<td>34.7%</td>
<td>24.8%</td>
</tr>
<tr>
<td>9</td>
<td>Richmond upon Thames</td>
<td>34.8%</td>
<td>30.7%</td>
</tr>
<tr>
<td>10</td>
<td>Woking</td>
<td>35.1%</td>
<td>43.9%</td>
</tr>
</tbody>
</table>
Areas more vulnerable to automation were more likely to vote to leave the EU.

Figure 3 plots the relationship between the probability of automation and the percentage of votes to leave the EU, where each point represents a local authority. The fitted line demonstrates a clear positive correlation between exposure to automation and the Leave vote. Areas more vulnerable to automation were more likely to vote to leave the EU.

To test whether this relationship may be explained by other demographic or economic characteristics, we then conducted a regression analysis which controlled for other variables are obtained from the ONS Annual Population Survey and correspond to the 12 months before June 2016. We obtained the median wage for full-time workers for the year 2015 from the ONS Annual Survey of Hours and Earnings. The results of the regression analysis are in Annex 1.

The ONS definition of ‘automation’ focuses on the narrower, traditional concept of displacement of tasks and jobs, rather than the creation or augmentation of new tasks and jobs. It does not extend to an assessment of the adjustment process, or to the outcomes for individuals, and it is currently limited only to England. Further, as we note above, the ONS measure is not constructed at task-level for individuals. We therefore restrict our empirical analysis to this definition and to local authorities in England. Moving forward, the Institute for the Future of Work is keen to redefine automation to include augmentation, task creation and the impacts of technology on work quality. The concept and measurements of automation should reflect its full ‘life cycle’ and include its positive and productivity enhancing impacts.
The risk of automation was more predictive of voting behaviour in the 2016 EU Referendum than any other factor measured in our model. Consistent with other studies that have attempted to explain the referendum outcome, we find that share of voters with white ethnicity and birth in the UK was also a strongly significant determinant of voting behaviour in the 2016 Referendum. But the strongest correlation, by some distance, was between risk of automation and voting leave. This is likely to offer insight into past and future voting behaviour, as well as the wider challenges for society associated with technology and the future of work.

In this section, we consider why the risk of automation played such an important part in the 2016 EU Referendum, whether or not automation has been specifically identified. We move on to use our understanding of this risk-response phenomenon to suggest policy levers to reduce the risks, and perception of risks, associated with automation.

Our analysis is consistent with research that demonstrates diverse occupations are at varying risks of automation as routine, and increasingly cognitive, tasks are automated. People undertaking these roles correctly anticipate a range of impacts from the tasks, type and quality of work to be undertaken to job displacement. The Institute for the Future of Work concurs with an emerging international consensus that approximately 20% of jobs will be lost as a result of automation within the next 10–15 years, but changes to the nature of work will be more common.¹⁹

However, more research is needed to understand the technologies introduced, their use and pervasive impacts at an individual, firm and regional level across the country.

Drawing from ‘insider-outsider’ theory, we propose thinking about the impacts of automation on workers in terms of a spectrum from labour market ‘inclusion’ to labour market ‘exclusion’.²⁰ People’s experience in the labour market ranges from having secure and good quality work (‘included’) to being long term unemployed (‘excluded’), with various stages in between.²¹ As the impacts of automation multiply, those who perceive a risk of experiencing social and economic insecurity are no longer limited to the unemployed (traditional ‘outsiders’). Instead, they include people in new or temporary roles, anticipating lower quality work or other significant change (invisible ‘outsiders’), alongside workers in traditional sectors at risk of job displacement. What is key is the growing number of people who anticipate significant change as work is transformed and feel that their labour market status and prospects are precarious. Recent polling found that approximately 3/4 of people believe that workers face more uncertainty and anxiety about their job then they did a generation ago.²² These invisible outsiders are significant because the voting patterns and preferences of labour market ‘insiders’ and ‘outsiders’ have been shown to differ substantially.²³
Recent studies show that the share of middle skill routine workers has continued to decline in the UK, consistent with country-level polarisation. In this context, we further note research that suggests it was indeed this ‘squeezed middle’ who voted to leave the EU, rather than the traditional working class.

The fact that there is no longer a sharp division between the two suggests that use of a spectrum is more appropriate in the context of automation. The challenges faced by this emerging group of workers, previously invisible to policy-makers, invite a new focus for the attention.

This hypothesis speaks to the theory of routine-biased technological change more than it does to the theories of skills-biased or capital-biased technological change.²⁴ Routine-biased technological change (RBTC) explains that employment growth in high-skill jobs is the result of non-routine tasks that workers perform, often creative or caring tasks. Labour market polarisation – and growth in service sector jobs – is explained by the need for non-routine tasks such as hospitality and caring tasks that cannot be automated. This mechanism influenced Frey and others’ examination of the association between the US Presidential election and automation, which highlighted the plight of millions of workers reallocated from middle-income jobs involving routine tasks to low-income jobs or unemployment.²⁵ Recent studies show that the share of middle skill routine workers has continued to decline in the UK, consistent with country-level polarisation.²⁶ In this context, we further note research that suggests it was indeed this ‘squeezed middle’ who voted to leave the EU, rather than the traditional working class.²⁷ Taken together, these studies lend support to our analysis.

It follows that policy-makers will need to think beyond traditional roles and approaches to the employed versus the unemployed and take a more holistic approach to the challenges and opportunities of automation. A growing number of workers need support through transition where new work may be lower quality or offer less pay than their old work, or may require new skills sets. Better understanding and measurement of the full cycle of automation, and the different types of impacts on work for different groups at a local level, will help decision-makers respond more precisely and boldly to the challenges of automation and spread its benefits.

A growing number of workers need support through transition where new work may be lower quality or offer less pay than their old work, or may require new skills sets.
“If you don’t intentionally include, you’re going to unintentionally exclude.”

Anne-Marie Imafidon MBE
Policy recommendations

All parties should support socially responsible automation by setting out a bold and coordinated response to the challenges, as well as opportunities, of a new human-machine frontier.

We suggest that an appropriate policy response should span the creation of better work, promoting equality and supporting workers through difficult transitions to build individual and community level resilience.

These are our headline policy recommendations:

Initiate a Work 5.0 Strategy to shape socially responsible automation

Prioritising the future of good work across the ‘included-excluded’ spectrum is the best way to put people first through transition and respond to the challenges we have identified in this paper. All parties should develop and prioritise a comprehensive Work 5.0 strategy with a vision for a better and fairer future of work. Constructing a framework of support for all workers transitioning between jobs and sectors or experiencing or anticipating some other significant change, and reducing inequalities between the ‘included’ and new ‘excluded’ should be central to this strategy. The remit of Work 5.0 should extend to infrastructure, institutions and the other recommendations made in this paper to build an enabling environment for future good work.

The UK’s Work 5.0 process would improve on the model of Germany’s Work 4.0, which is characterised by the integration of digital technologies.²⁸ UK Work 5.0 should be built around the principle of social responsible automation: people should come first. Technology should be designed, introduced and used in a human-centred way to promote human-machine complimentarity, recognising the value of human problem solving, social and creative skills. A collaborative Work 5.0 process involving tripartite working across Government, business and trade unions should replace the traditional approach to drawing up White Papers.
Policy recommendations continued

**Investment in people as technology is introduced**

All parties should commit to significantly higher levels of both physical and human investment spread across the country. These should be seen as complimentary: one will help the other, making sure that technology improves the quality of work and benefits as well as productivity.

Much higher levels of investment, incentives and experimentation in adult retraining and reskilling are needed to develop effective programmes at all skills levels. Demographic groups and regions at higher risk of automation will need targeted assistance. One option is to develop the National Retraining Programme (NRP), a model of collaborative working between Government, Trade Union Congress (TUC) and Confederation of British Industry (CBI). The most successful training is likely to be co-developed with workers, implemented by business and subsidised by Government. The NRP tripartite model should command cross-government, cross-party support and enable a new wave of pilot programmes to complement retraining, such as mobility allowances and learning accounts.

**Develop active labour market policies**

Those anticipating job loss, or seeking to transition between jobs, should be actively supported, alongside those whose jobs have been displaced. All parties should commit to reviewing the sanction and unemployment insurance system to ensure it serves the updated purpose of enabling workers to transition to the best available job that fits their skills. A package of active labour market policy instruments are needed to increase support and guidance for jobseekers moving through multiple job cycles.

Big data analysis and machine learning should be directed towards identifying people’s skills and matching them to local jobs more accurately, rather than to automate the existing system. Supported by the Centre for Data Ethics and Innovation, Government must play close attention to identifying bias and discrimination by automated systems which can compound disadvantage as the UN Special Rapporteur on Poverty Professor Philip Alston has highlighted.

The government should support a new wave of pilot programmes to complement retraining, such as mobility allowances and learning accounts.

All parties should commit to reviewing the sanction and unemployment insurance system to ensure it serves the updated purpose of enabling workers to transition to the best available job that fits their skills.
We recommend the introduction of a positive obligation to undertake an 'equality audit' to consider the impacts of technology on equality across the private, as well as public sectors.

Update equality and employment frameworks

Active steps to promote equality should mitigate the risk that inequalities are increased along the ‘included-excluded’ spectrum. The UK’s floor of basic labour and equality rights is a good base to support workers through transition and should be maintained by statute. In addition, policy levers should be utilised to actively promote diversity, which is as beneficial to innovation and business as it is for individuals.

We recommend that all parties review the effective operation of the Equality Act as our primary legal framework for promoting equality. For now, we recommend the introduction of a positive obligation to undertake an ‘equality audit,’ along side other audits, to consider the impacts of technology on equality across the private, as well as public sector. Many of the disadvantages experienced by the new ‘excluded’ observed in this paper do not only correlate with existing protected characteristics such as gender or race. We suggest that Section 1 Equality Act is brought into force to counter socio-economic disadvantage, alongside the introduction of socio-economic status as a new protected characteristic. This initiative will need a wide consultation about definition and remit.

Higher levels of transparency about use of technology

Higher levels of worker consultation, transparency and accountability about the use of technology should be encouraged and, in some instances, required. This will help both the included and excluded understand and manage the risks associated with automation and promote socially responsible automation.³¹ It will encourage businesses to keep humans central to the workplace of the future and reduce narrowly cost-based automation programs, which are more likely to fail.³² Further it will also ensure the UK keeps up with developing international principles and standards on the use of artificial intelligence.³³

Implement the Furman Review

All parties are urged to implement the recommendations of the Furman review as a minimum commitment to ensuring that principles of competition law are working properly, and can be enforced, in the age of digital markets.³⁴ These include setting up a new digital markets unit, a code of competition conduct, policies to support portability and data mobility and an update to merger policy. We propose that the impact of mergers on the numbers of good jobs available at a national and local level should be a factor taken into consideration by the Competition and Markets Authority (CMA). The portability of benefits should not be limited to data or ratings.

We recommend the introduction of a positive obligation to undertake an ‘equality audit’ to consider the impacts of technology on equality across the private, as well as public sectors.

Higher levels of transparency about use of technology

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Higher levels of transparency about use of technology

Higher levels of worker consultation, transparency and accountability about the use of technology should be encouraged.
Annex 1: Regression model

Table 3: Linear regression model estimates

<table>
<thead>
<tr>
<th></th>
<th>Leave vote (%)</th>
<th>Leave vote (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of automation (%)</td>
<td>1.427*** (12.48)</td>
<td>0.618*** (12.48)</td>
</tr>
<tr>
<td>White ethnicity, UK born (%)</td>
<td>0.135*** (4.56)</td>
<td>0.225*** (4.56)</td>
</tr>
<tr>
<td>Over 65 years old (%)</td>
<td>0.115 (1.37)</td>
<td>0.0652 (1.37)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>0.396 (1.41)</td>
<td>0.0514 (1.41)</td>
</tr>
<tr>
<td>Log median wage</td>
<td>-3.046 (-0.82)</td>
<td>-0.0403 (-0.82)</td>
</tr>
<tr>
<td>Constant</td>
<td>-24.01 (-0.00)</td>
<td>-1.88e-10 (-0.00)</td>
</tr>
</tbody>
</table>

Observations: 324

Table 3 presents the results from the regression model. The estimated coefficient suggests that a 1 percent higher probability of automation is associated with a 1.4 percent greater percentage of Leave votes. A higher percentage of Leave votes is also positively associated with the percentage of the population that are white ethnicity and born in the UK. The percentage of the population aged over 65 and female was also predictive of a higher Leave vote, but neither effects are statistically significant. Importantly, the magnitude of the effect of automation risk on voting behaviour is far greater than the effect of any of the demographic variables included in the model.

Importantly, the magnitude of the effect of automation risk on voting behaviour is far greater than the effect of any of the demographic variables included in the model.

\( t \) statistics in parentheses
* \( p < 0.05 \), ** \( p < 0.01 \), *** \( p < 0.001 \)

1) Effect of probability of automation on the 2016 Leave vote share at a local authority level, unstandardized coefficients.

2) Effect of probability of automation on the 2016 Leave vote share at a local authority level, standardized coefficients.

Regression model prepared by Josh De Lyons with thanks to Dr Kaat Smets.
Building a future of good work is the most pressing challenge of our time.

Anna Thomas
Director, IFOW
Endnotes

1 In this paper we define ‘technology’ to include robotics, artificial intelligence and data-driven technologies, the internet, internet of things, big data analysis and the human skills needs to create and apply these technologies.


14 Factors found to be predictive of vulnerability to automation were, in order of statistical significance, major occupation group, education level, whether responsible for supervising staff, five-year age band, gender, industry sector, full or part time, public or private sector, firm size, region. See ONS, “The Probability of Automation in England: 2011 and 2017”.

15 EU Referendum Result data available at https://data.gov.uk/dataset/be2f2aec-11d8-4be-800-649e5b8ec044/eu-referendum-results


17 Future analyses from the IFOW will decompose the ONS automation statistics to better understand which the components that have the strongest impact on voting behaviour.


19 Christopher Pissarides, Oral Evidence to the Business, Energy and Industrial Strategy Committee, Wednesday 3rd April 2019. Available at https://www.parliamentlive.tv/Event/Index/5e1d1c27-23f5-424b-9c4e-ba92b42ba9f
Endnotes continued


21 This is related to some versions of insider-outsider labour market theory that have flexible definitions of what constitutes an “outsider”. In these theories, by way of example, both part-time workers and the unemployed might be categorized as labour market outsiders, but the former might be deemed to less “outside” than the latter. For an example of an approach of this type, see Patrick Emmenegger “Barriers to Entry: Insider/Outsider Politics and the Political Determinants of Job Security Regulations”, Journal of European Social Policy, 2009. Vol.19.


24 For an overview of the main theories of how technological change is affecting labour markets and the income distribution, see Maarten Goos, Alan Manning, Anna Salomons “Explaining Job Polarization: Routine-Biased Technological Change and Offshoring”, American Economic Review, 2014. Vol. 104(8).


27 Lorenza Antonucci, Laszlo Horvath, André Krouwel. “Brexit was not the voice of the working class nor of the uneducated – it was of the squeezed middle”. LSE Blogs. (Accessed November 2019). https://blogs.lse.ac.uk/politicsandpolicy/brexit-and-the-squeezed-middle/

28 Available at https://www.bmas.de/EN/Services/Publications/a883-white-paper.html


