

Impact Objectives

- Explore how automation improves workplace safety
- Demonstrate how the automation of manually-intensive tasks can be inhibited by immigration inflow

The socio-economic drivers of automation

Building on a background in labour economics and social sciences, Associate Professor Masahiro Yoshida is working on a project looking at the adoption of industrial robots at high risk workplaces under demographic change



How did your curiosity in social sciences and empirical economics develop?

My interest in empirical economics, especially labour economics, grew while I was studying for my PhD in economics in St. Louis, a mid-sized city in the Midwest US. At that time, the manufacturing industry was fading, the crime rate remained high and deaths from suicide, alcoholism and drug abuse were on the rise. In 2015, during my studies, an influential paper was published by Case and Deaton which framed these three causes of death as 'deaths of despair'. Then, in 2017, a state of emergency was declared by the then-President Donald Trump, which was related to the opioid crisis in America. Throughout this period, my interest in socio-economic problems developed and was nurtured across subsequent years. I have long thought that the US offers many intriguing questions from the point of view of social sciences, which is the background to my current research.

One of your research themes centres on technological progress and demographic change. Can you talk about your thoughts on the links between these?

My long-standing view, which probably stemmed from my PhD dissertation, is that demographic change influences

technological progress. For example, an ageing population in rich countries facilitates the automation of manual tasks from the imminent need to compensate for the lack of a young labour force. In another ongoing project, my co-author and I found that climate change, especially global warming, facilitated the adoption of labour-saving technology, particularly automation by industrial robots. This has since come to be referred to as climate-induced automation and stems from the simple observation that climate change raises the relative cost for labour.

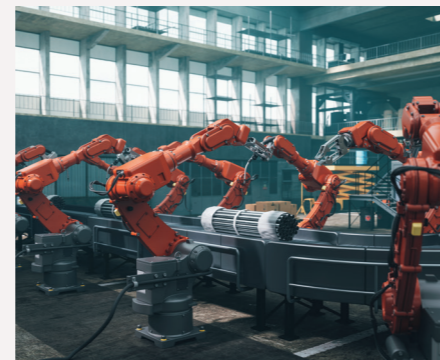
How does your current research progress our understanding of these links? What is the biggest challenge you have faced in your research?

As demographics affect the progress of technology as I outlined, the admittance of less-educated immigrants can often inhibit the incentives of automating manual-intensive, dangerous tasks, for example, in construction and agriculture, that might otherwise be performed by industrial robots. This belief is a key working hypothesis of the project and one I hope to be able to conclusively demonstrate. As an empirical economist, I take a scientific approach of causal inference. The biggest challenge, which is probably common to all social scientists, is how to identify causality from correlation; immigration is far from random events. To tackle this, I use well-established econometric methods, such as instrumental

variable methods as a first step. I am looking for some more credible natural experiment scenarios of the immigration inflow to better aid my research.

You are also working on a series of climate-related projects. How are you hoping to explore the impact of climate change in your future research?

In another pillar of my research theme, I explore the impact of climate change on various economic outcomes: labour market outcomes (wages, employment and unemployment) and labour shares (a ratio of labour income in GDP) in the macroeconomy. In a recent project, I have found that global warming has inhibited labour force participation of prime-aged males since the 1970s. The impact of climate change is primarily centred around the science field, but I think climate impact on other socio-economic outcomes is a largely unexplored frontier. ●



Robots at work on the conveyor belt in a factory

Reducing workplace injury through automation

A researcher based within the Department of Political Science and Economics at Waseda University in Japan is investigating the impact of the introduction of industrial robots on workplace injury and mortality risk

For over 200 years, the labour force has been protesting the use of new machinery and technology in the workplace. The Luddites are famous for their machine-breaking activities which significantly disrupted the wool and cotton industries in England in the early part of the 19th century. The reasons for their protests and activities were rooted in the belief that the introduction of new technology would reduce the overall quality of their work and reliance on their skills, and in turn lower their pay. Such concerns were not without foundation, but ultimately their employers were successful and new machines such as power looms were introduced.

Since then, 'Luddite' has become a blanket term which is used to describe anybody who dislikes new technology. However, while the term has broadened in its meaning, the specific fear that new machinery or technology poses a threat to jobs and the workforce in general is something that has not gone away and is arguably more prominent now than ever before. The development of artificial intelligence (AI) could lead to the automation of certain tasks

which would reduce the reliance on a human workforce.

However, while some of the fears expressed by the original Luddites and now contemporary members of the workforce are well founded, this does not mean that there is no place for automotive technologies in the workplace. Nor does it mean that there are not significant benefits to be had by the introduction of such technologies, benefits which include significantly reducing workplace injuries and even death.

THE PUZZLE OF STAGNANT INJURY RISK

It is with the idea that industrial robots have an important part to play in reducing local workplace injury and mortality risk that Associate Professor Masahiro Yoshida has embarked on his latest research project. Based within the Department of Political Science and Economics at Waseda University in Japan, Yoshida has a background in economics and having studied in the US, has developed a keen interest in the socio-economic drivers and impact of injuries in the workplace. He introduces

an alarming contextual background in the US - the nationwide injury rate had been improving before the Great Recession but after that the injury rate had become virtually stagnant. 'Given that the period had seen accelerated investment in industrial robots, I found this particularly puzzling,' Yoshida outlines. He is interested in asking why this might be, and so wanted to dig deeper into this. Through that work he discovered that most industrial robots are implemented in innately safe sectors, such as automotive, electronics and warehouses, as opposed to riskier sectors, such as agriculture, mining and construction. 'The overall investments to robots appear to be profit-seeking and not for workplace safety. Intriguingly, these riskier sectors typically have higher dependency on immigrants - both legal and illegal,' Yoshida clarifies. 'Remarkably, in the 2019 American Community Survey, the immigrant share has already exceeded 40 percent and 30 percent in the riskiest sectors of agriculture and construction, respectively.' He observes that given the presence of undocumented immigrants these ratios are presumably underrated. ▶



This research shows that automation proceeds where automation generates profits, but automation is biasedly delayed where it is needed to protect workers

SOURCING RELIABLE DATA

Given the nature and scope of the project, being able to obtain reliable data is an essential part of Yoshida's approach.

Workplace injury is central to his empirical work. The data was cleaned and organised from public archives of nationwide employer surveys from the Bureau of Labour Statistics (BLS). A big appeal of the data Yoshida gathers is that it records injuries by citizenships, split by natives or immigrants from at least 2011. This is particularly informative of how immigration inflow affected injury rates of native workers. For earlier years, he has been thinking of using Hispanic workers as a proxy for immigrants, which he believes is a plausible approximation in risky industries.

Although the quality of data in recent years has presumably improved, it is subject to potential measurement errors, which Yoshida believes stems from reporting biases of employers. He offers an example where small non-incorporated employers who may hire illegal immigrants would not be incentivised to report all injury cases. 'Illegal immigrants are supposed to be recorded, but might be underrepresented in the data,' states Yoshida. The potential measurement errors, particularly on injuries of immigrants, would give a caveat on the treatment of the data. 'The important thing here is that we are keenly aware of the potential pitfalls of the data when analysing what we have available.'

RISKY WORKPLACES AS GATEWAYS TO THE OPIOID CRISIS?

Intriguingly, Yoshida's findings centred on work-related accidents have some implications to health care and the opioid drug disaster in the US. The US nationwide workplace injury risk is almost the same as traffic accidents of drivers and pedestrians. For some occupations in agriculture and mining, the risk matches the COVID-19 infection rate in 2020-2021. Then there is the suggestion that workplace injuries could be a significant driver behind the opioid crisis, where such medication is prescribed as pain relief before snowballing out of control across individuals and pockets of society, which Yoshida has investigated previously. 'Indeed, the opioid crisis is typically framed as a supply-side disaster by pharmaceutical companies and federal- and state-level medical regulation,' he outlines. 'My initial results in some aligned research carried out indicate the opposite demand side of the opioid crisis, as chronic pain and non-fatal injuries might have been gateways to medical opioid prescription.'

REAL-WORLD IMPLICATIONS

Once the project has been completed, it follows that Yoshida wants to translate his findings into real-world applications that ultimately reduce the risk of injury and death. To achieve this, he considers it important to inform and influence policy. 'The most immediate real-world impact would result from the US Government's big push towards research and development in robotics technology and subsidies in robot investments, especially for manual-intensive and risky industries,' he comments. 'This research shows that automation proceeds

where automation generates profits, but automation is biasedly delayed where it is needed to protect workers. In the recent policy arena, robots are sometimes a potential target for taxation, but my research suggests that the opposite should be true.' There is of course a second possible implication of this research, which is a hotly debated political issue. For Yoshida, there needs to be greater regulation of low-skilled immigration, especially illegal immigrants. 'These people provide great appeal for some employers as they are 'off the books' and, as such, can be treated with disdain and be tasked with performing the riskier tasks in the workplace,' he explains. Until enough deterrents are put in place, the adoption of robots and automated technologies will not be as widespread as Yoshida's research suggests it should be if we are to reduce the threat of injury and death in the workplace. ●

IMMIGRATION VS. ROBOT ADOPTION

Guided by the apparent reluctance to introduce robots in risky sectors and strikingly high dependency on foreign labour, Yoshida formulated a hypothesis that an increase in labour supply due to the influx of low-skilled immigrants would slow investment in labour-substituting robotics technology. Clearly, if an employer can obtain cheap labour from immigrants, they will be less inclined to invest in automated technology. 'I have found that dependency on immigrants is negatively correlated with the progress of robot adoption across industries,' he describes. 'This is because abundant inflow of cheaper labour hinders incentives for investments in robots. I aim to rigorously demonstrate that this is causal, that the entry of immigration would inhibit robot adoption in the long run, from five to 10 years in the future.'

'Rather disturbingly, a combination of employment data from the US census and industrial accident records from the Bureau of Labour Statistics by industry to create panel data from 1992 to 2019 showed that an increase in the immigrant dependency rate reduces the number of industrial accidents, including injuries and deaths of native workers.' From this it appears that the people being injured and killed simply moved from native workers to immigrant workers. Clearly

this further bolsters the case for introducing robots into the workplace, particularly dangerous industries such as agriculture and construction, where automation is not progressing.

THE CASE FOR WORKPLACE ROBOTS

Indeed, when looking at the impact of the introduction of industrial robots on local workplace injury and mortality risk, Yoshida made some reassuring findings which he believes should encourage the introduction of robot investments. 'By combining industrial robot investments data from the International Federation of Robotics and

results suggest that robots are effective to reduce injury rates, but a rising dependency on immigrants has hindered the adoption of robots.

DID IMMIGRANTS PRESERVE WORKPLACE RISKS?

Put simply, Yoshida's findings are a set of correlations, but the overall bigger picture they offer is that immigration entry hinders automation, which contributes to the stagnant improvement of workplace injuries rate, including natives and immigrants, especially after the Great Recession. 'As I pointed out earlier, I found a clear cross-

I have found that dependency on immigrants is negatively correlated with the progress of robot adoption across industries

workplace injury rate across industries in the new century, I found a strong negative link - that the introduction of robot investments significantly reduced both fatal and non-fatal injury rates,' he highlights. Using some econometric methods, Yoshida plans to show that the safety impact of robots is causal and that if his recommendations are adopted, the impact would be seen in its drastic policy implications. He points out that his current

industry positive correlation between dependency on immigrants and injury rates in 2019; industries with a higher employment ratio of immigrants exhibit higher workplace risk,' highlights Yoshida. The project still has some way to go. At this stage, he cannot say that immigration causally heightens workplace injury risk, but he believes this current research will demonstrate this.



Immigrant workers at the food factory

Project Insights

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BIO

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