RAE Presentation: Charles Jordan

Hi everyone, so my undergraduate dissertation looks at the impact of the COVID-19 pandemic on the digital skill wage premium in the USA. So in terms of why I thought this was an interesting question to look at, the COVID-19 pandemic has obviously led to national lockdowns, stay-at-home orders and increased remote working around the world and this has increased the emphasis on digital skills and digital technologies in the workplace. So what I was interested in is whether this increased use of remote working technology has been skill-biased in favour of those workers with digital skills.

The aim of my dissertation is to identify to what extent a US worker with digital skills can expect to earn higher wages than an otherwise identical worker without those skills, as well as looking at whether the COVID-19 pandemic has augmented any wage premium that might exist. In terms of why this is an important question to look at, I think the topic area has implications for government skills training policies for the unemployed or for national curriculums as well as implications for policies to tackle inequality. So in terms of the literature on this topic area, Kruger pioneered the literature with his 1993 paper which found a 10-15% wage premium for occupational computer use in the USA and Asplund added to this work, finding an 8-9% wage premium using Finnish microdata. However, DiNardo and Pischke disputed the findings of Kruger and pointed out the fact that in their analysis the wage premium for using pencils at work looked very similar to the wage premium for using computers. So what this paper argued was that the apparent computer use wage premium and pencil use wage premium is actually driven by unobservable heterogeneity between workers and heterogeneity between occupation characteristics, so these effects aren't causal.

In terms of my contribution, what I seek to do in my paper is move away from basic computer use towards looking at more granular and interesting measures of digital skills as well as obviously looking at the effects of the COVID-19 shock. And the data I use, which I'll talk about in a minute, addresses some of the issues of unobserved worker heterogeneity and occupation characteristic heterogeneity causing omitted variable bias. So the data I use combines two data sets: the United States CPS, which is the US labour force survey, with O*NET occupation data. So the CPS gives me rotating panel data following the same individuals over several periods of time and gives me information on their wages and their individual characteristics, but not data on their digital skills. So I combine this at the occupation level with O*NET data which gives me information on the tools, skills and work activities of every occupation in the USA. So the digital skill variables I look at are Computer, which is the importance of occupational computer use, and I standardise this so it's mean 0 and standard deviation 1 to improve the interpretability of results. And I then have 9 digital skill cluster dummy variables. So I take 125 different digital skills in the O*NET data and manually recategorise these into 9 clusters which are things like data analysis skills, digital design skills or occupation-specific software skills. In terms of my empirical model, I analyse the computer use wage premium and digital skill wage premium separately and build increasingly demanding specifications to assess the robustness of my results.

So I start with a pooled OLS model where I regress the natural log of hourly wages on a digital skill variable which is either computer use or the digital skill clusters, and also on a vector of individual characteristic control. I then add occupation characteristic controls. So these are things asides from computer use which might drive wage premiums in an occupation, and they include the importance of critical thinking skills, problem-solving skills, or the importance of having a bachelor's degree in a job.
I then move to a fixed effects model which better controls for the confounding effects of time-invariant unobserved heterogeneity between workers, and then again add the occupation controls. In my final model, I look at the COVID effects. So I interact the digital skill variables with linear and quadratic time trends, as well as a post-COVID dummy which takes a value of 1 if an observation is

after March 2020. So this beta 4 coefficient here is the difference-in-difference estimator, which compares workers with and without digital skills after COVID to before COVID, controlling for linear and quadratic time trends in the wage premium, individual characteristic controls, occupation characteristic controls and individual fixed effects.

So in terms of my results, these specifications are the OLS model with the controls the fixed effects model with the controls. So I find that an apparent 6.9% wage premium for a standard deviation increase in the importance of occupational computer use isn't robust to these controls and that when we add the occupation characteristic controls, the wage premium disappears. This is partly driven by critical thinking skills, which are fairly highly correlated with occupational computer use and the coefficient on critical thinking is very significant in the specifications with these controls. So it appears that worker A might use computers more at work than worker B and earn higher wages than worker B, but this isn't a causal effect and these workers are being paid different wages because of other ways in which their occupations differ.
Moving to the fixed effects model the 3.6% point decrease in the wage premium between models 1 and 3 again suggests that some of the apparent 6.9% wage premium is driven by unobservable heterogeneity between workers. So yes, worker A uses computers more at work than worker B and yes they earn higher wages, but worker A and B might also be very different in terms of unobservables. So worker A might be more motivated or hard-working or enthusiastic, they might have better teamwork skills or a natural sort of creative flair for their job. All of these things are time-invariant over a 12-month sample which I'm looking at, and fixed effects better control for these.

So turning now to the digital skill wage premium, again moving across from the pooled OLS specification, adding the occupation controls, then moving to the fixed effects specification with the occupation controls. If we just focus on the fourth specification which is the most demanding one, what we see here is that there are more statistically significant and robust wage premiums, which are more robust to those controls. So for basic productivity software skills, these coefficients need interpreting slightly differently because there's a log on the left-hand side of the equation but not on the right-hand side of the equation. So for basic productivity software skills, there is a wage premium for workers with these skills compared to those without of 29.8%, for digital design skills, there's a wage premium of 33.1% and for customer relationship management skills there's actually a negative wage premium of -5.2%, when these are transformed to be reflected as percentage changes. So what we see is that there are digital skill wage premiums and that there are different returns to different clusters of digital skills.

Looking at the COVID effects, I find statistically significant COVID effects for two of the wage premiums. So the first one is for customer relationship management skills, which is to do with using software to analyse sales patterns, interact with customers, deliver customer service and try and boost sales essentially and this increased during the pandemic. So I think this can likely be explained by the stay-at-home orders causing an increase in online shopping and e-commerce. So the sorts of workers with skills to analyse sales patterns online and interact with customers online saw an increase in the returns to that skill cluster. Then looking at programming and software development skills, the wage premium for this skill cluster actually falls, which is a more surprising result because these are the sorts of skills required to build and maintain the digital infrastructure which is being used more during the pandemic. However, COVID also obviously had broader effects in creating a general recession for the economy, it adversely affected different sectors of the economy and some of the literature I look at identifies the fact that this skill cluster sees lower versatility of skills and the workers paid higher average wages. So I think this can potentially be explained by the fact that certain companies in certain sectors in a recessionary environment weren't willing to pay high wages for workers with less versatile skills.

So overall, what I find is that there is no statistically significant and robust causal effect of occupational computer use on wages in the USA, however there are several statistically significant digital skill wage premiums or digital skill penalties in the case of CRM skills. There are differential returns to different clusters of digital skills, so not all digital skills are made equal and are rewarded the same way in the labour market and there's also some evidence of COVID effects especially for those CRM skills and for those programming and software development skills. However, these effects are limited to those two skill clusters and are predominantly short term in their nature. In terms of the implications of my work, I think this paper has implications for government skills training policies. It's clear that certain digital skills do yield positive wage premiums, especially that basic productivity software cluster which has a wage premium for workers with those skills compared to those without of 29.8%. So I think this is quite a significant result when it comes to governments devising education policies or training policies for unemployed workers if you want to help workers upskill and maximise their potential in modern-day labour markets, there are significant positive returns to these most basic digital skills