AUSTRALIAN JOURNAL OF
LABOUR ECONOMICS
A JOURNAL OF LABOUR ECONOMICS AND LABOUR RELATIONS
Volume 22 • Number 2 • 2019 • ISSN 1328 - 1143

the **CENTRE** *for*
LABOUR MARKET RESEARCH

AUSTRALIAN JOURNAL OF LABOUR ECONOMICS

A JOURNAL OF LABOUR ECONOMICS AND LABOUR RELATIONS

ISSN 1328-1143

Official Journal of the Australian Society of Labour Economists

Subscriptions and payment
Caroline Stewart
Subscriptions Manager
Australian Journal of Labour Economics
Bankwest Curtin Economics Centre
Curtin Business School, Curtin University
GPO Box U1987 Perth WA 6845 Australia

2019 Subscription rates

		*Within Australia**	*International*
1 year	Individual	$146.00	A$182.00
	Students	$95.00	A$130.00
	Institutions	$196.00	A$206.00
3 years	Individual	$358.00	$424.00
	Students	$179.00	$284.00
	Institutions	$513.00	$526.00

* Includes GST

Contact details
Telephone: +61 8 9266 1744
Email: ajle@curtin.edu.au
Webpage: http://businesslaw.curtin.edu.au/our-research/publications/australian-journal-labour-economics/

Contents

AUSTRALIAN JOURNAL OF LABOUR ECONOMICS
Volume 22 • Number 2 • 2019

ISSN 1328-1143

Also available from INFORMIT LIBRARY at: http://search.informit.com.au
and PROQUEST LIBRARY at: http://www.proquest.com

From the Managing Editor

Welcome to the final issue of volume 22 of the *Australian Journal of Labour Economics* for 2019. In order to deliver the journal in a more timely manner the editorial team has decided to issue the *Australian Journal of Labour Economics* biannually. As a gesture of goodwill to our existing subscribers to the journal, subscriptions will be extended to 2020. We hope that with the new publication schedule we will be able to include more articles on issues of immediate interest to readers, particularly as the labour market situation is changing so rapidly at the moment.

This issue contains articles on several different aspects of labour market analysis, of interest to researchers and practitioners. The paper by Alexis Esposto and Juan Agudelo of Swinburne University addresses an issue of casualisation and inequality, an issue which is a subject of debate among unions, employers and governments. Tracey West of Griffith University examines the retirement savings of self-employed tradespeople. Retirement savings, the role of superannuation and pensions promises to be a topic of debate in Australia for some time. It is well-known among labour economists that there is a very big regional dimension to unemployment, and this has been widely explored in previous issues of the *Australian Journal of Labour Economics*. Rohan Best of Macquarie University contributes to this literature with his paper on regional lock-in in unemployment. In the final paper of this issue Lisa Denny of the University of Tasmania makes a valuable and thoughtful contribution to the current, sometimes not so thoughtful, debate on the future of work in Australia.

The *Australian Journal of Labour Economics* requires considerable commitment by our editorial team, ably assisted by Sandie Rawnsley and Julia Humphreys. My thanks go to them and to all those who refereed papers for the journal in 2019 (listed below):

Prof Karen Mumford – University of York, UK
Dr Michael Dobbie – Macquarie Business School
Dr Michael Coelli – University of Melbourne
Dr Sandra Fielden – Alliance Manchester Business School, UK
Dr Bilal Rafi – Department of Industry, Innovation and Science
Prof Roger Wilkins – University of Melbourne
Dr Michael Corliss – Department of Jobs and Small Business
Dr Anne Garnett – Murdoch University
Toan Nguyen – Bankwest Curtin Economics Centre
Dr Yashar Terverdi – Department of Treasury WA

Phil Lewis
Managing Editor

Casualisation of work and inequality in the Australian labour market

Alexis Esposto Swinburne University of Technology
Juan Felix Agudelo Swinburne University of Technology

Abstract

Australia has seen an increase in labour market inequality over recent decades. One driver for this is skill bias in the demand for labour. Another points to the casualisation of employment in Australia and to polarisation of job creation and earnings. To understand these, we conduct a simple analysis by applying data on occupational types, namely, full-time and part-time 'casual' and 'permanent' employment. The findings show polarisation in the labour market. This phenomenon occurs when the labour market experiences an increase in the share of high-paid jobs with decent working conditions, an increase in jobs with poor pay and working conditions, with an accompanying decrease in the share of jobs in the middle of the employment distribution. This outcome, we believe, is accentuated by a process of casualisation of employment. These processes may lead to a different dimension of inequality occurring in the Australian labour market, requiring new government policies to slow such trends.

JEL Codes: J01, J08
Keywords: labour market, casualisation, hours worked, inequality, earnings, polarisation

1. Introduction

The Australian labour market has experienced major transformations over the last four decades. Today the majority of employees work in different types of employment arrangements. These work engagements tend on the whole to comprise jobs that are full-time and part-time 'without leave entitlements' or casual, full-time or part-time 'with leave entitlements' or permanent, and others in conditions of self-employed employment. These new job types have in the long term impacted the wages outcomes of employees, resulting in increasing wage inequality (e.g., Mooi-Reci and Wooden 2017; Borland and Coelli 2016; Chetterjee *et al*. 2016; Preston and Yu 2013).

The reasons identified for the increase in inequality are varied. Some authors (e.g., Esposto 2005, 2011) show that the labour market has upskilled in Australia since 1971. A cause for this upskilling is skill bias in the demand for labour arising out of technological change or, as more formally named, the Skill-Bias Technical Changes (SBTC) hypostasis. In other words, companies prefer to employ more highly skilled employees in order to adapt to rapid technological change. Thus this bias in the demand for labour may create inequality in wages outcomes.

Others have argued that a process of labour market liberalisation has created a rift in terms of wages outcomes. For example, Preston and Yu (2015) show that part-time earners receive comparatively less than full-time earners: "In the case of permanent employees, we observed a part-time/full-time wage gap of around 11 per cent in the basic model falling to 4 per cent in the extended model with industry and occupation" (p. 42). Mooi-Reci and Wooden (2017) show that this can be due to differences between temporary and non-standard jobs: they find that "… casual employment has a much stronger negative association with the long-run earnings prospects of men than of women" (p. 1085).

Yet other research has shown that changes in the structure of the labour market have created a process of job polarisation in employment that may tend to increase earnings inequality (e.g., Healy *et al*. 2017; Coelli and Borland 2016). Polarisation in employment suggests that changes in the composition of employment are characterised by losses "… of middle skill jobs, predominantly in the areas of manufacturing production and clerical work, [that] may also have been intensified by the greater scope for offshoring of such tasks" (Coelli and Borland 2016, pp. 2-3).

This process, according to Coelli and Borland, is believed to generate an increase in the share of employment in high-skill jobs, a fall in the share in middle-skill jobs, and an increase in the share in low-skill jobs. This is also known as the disappearing middle or vanishing bottom hypothesis (Gregory 1996).

In light of these trends, the objective of this paper is to examine whether this process of skill change is generating polarisation in Australian jobs, and if so, to what extent. Furthermore, particular attention has arisen as a result of the casualisation of employment in Australia between 1989 and 2019. Our method is to conduct a simple analysis by applying more up-to-date data using the methodology originally applied by Wooden (2000), Cully (1999) and Esposto (2011). The paper is divided into five parts. The first, the introduction, is followed by a discussion of the literature. Section 3 explains our methodology and data utilised. The remaining two sections provide a discussion and conclusion.

2. Literature Review

The labour markets of many economies have experienced long-term fundamental changes, including in their institutions. In the Anglo-Saxon world, particularly in Australia, New Zealand and the UK, these were characterised by the decentralisation of collective bargaining structures that began in the early 1980s (Wooden and Sloan 1998). A common feature of these countries was that, in relative terms, they had reasonable levels of union participation in their workforce, and trade unions played an important role in negotiating wages outcomes for their members, as well as in national policy matters. The UK began the process of transforming industrial relations after the election of the Thatcher Conservative government in 1979. The government's strategy was to introduce a variety of laws that transformed the industrial landscape. The salient features of this process were the decentralisation of pay determination, the growth of plant and individual bargaining, and the decline in industrial action by unions and their membership (Wooden and Sloan 1998, p. 197).

Deregulation of the labour market in Australia began with the Hawke-Keating governments, which abolished the general right to strike and introduced the concept of "protected industrial action" (Quiggin 2018, p. 7). The most profound deregulation occurred under the Howard government's *Workplace Relations Act 1996*. Prior to these changes, the distinctive feature of the system was compulsory conciliation and arbitration, characterised by independent quasi-judicial industrial tribunals that had the power to stipulate legally binding awards that were required to be arbitrated or certified by these tribunals (Campbell and Brosnan 1999, p. 354). This situation changed considerably in that most of the bargaining prohibited closed shop agreements and extended the scope for non-union agreements. Clearly this was a result of Commonwealth government initiatives, both Labor and Liberal-National, with the introduction of the *Industrial Relations Reform Act 1993* and *Workplace Relations Act 1996,* which saw a push towards enterprise-bargaining structures, with the end result of ensuring that employers and employees negotiated workplace arrangements without intervention by unions or other third parties (Wooden 2001). The role of the Australian Industrial Relations Commission (AIRC) in the arbitration of disputes was reduced considerably. The reforms, no longer had the power to impose arbitrated awards, and was confined to disputes that related to matters of awards and where the operation of essential services was in jeopardy (Wooden 2001, p. 247).

Finally, the changing nature of industrial relations impacted significantly on union membership. Since 1992, the proportion of employees who are members of a trade union has fallen from 40 per cent to 19 per cent in 2016 (ABS 2017). In 2009, the Rudd-Gillard government introduced the *Fair Work Act*, altering some of the Howard Government *Work Choices* legislation. Since then not much has changed. Little legislation has been introduced by the Abbott-Turnbull-Morrison governments due to a hostile Senate (Quiggin 201, p. 8).

2.1 Does SBTC explain labour market inequality in Australia?

SBTC is defined as "a change in the production technology that favours skilled over unskilled labour by increasing its relative productivity and, hence, relative demand" (McAdam *et al*. 2018, p. 33). Therefore, because of technological change, new and

higher levels of skills are required to meet the demand for labour. Thus the wages of the more educated rise faster than those with fewer or lower skill levels, forcing those with relatively lower levels of education and skills to earn lower wages (Esposto 2011). Therefore one aspect of the study of upskilling is to observe which occupations have grown most in terms of the number of employees and hours worked and/or have received better earnings.

The reason for this upskilling is because companies prefer to hire employees with better skills and abilities so that they can be more competitive. These preferences for more skilled workers mean that those workers with lower skill levels found it harder to either find employment or to adapt to the companies' changes, demands and needs.

Barrett has reported that "… the change in the distribution has been associated with an increase in a wage premium paid" (2012, p. 1) to more skilled employees, attributing these changes to innovations in the technology and business distribution. He also found that employees who possessed a high level of cognitive skills had access to better opportunities and wages in the labour market.

Using data from the International Adult Literacy Survey (IALS), Chiswick, Lee and Miller found that "higher levels of education are associated with greater labour market success" (2003, p. 180) as measured by participation and unemployment rates. Similarly, higher levels of numeracy and literacy, excluding schooling or formal education, tend to be associated with higher labour market success. However, Chiswick *et al*. also reported that schooling had a positive relationship with numeracy and literacy and it had a positive impact on performance in the labour market. The findings shown by Chiswick *et al*. (2003) and Barrett (2012) are similar to those reported by Esposto (2011), Cully (1999) and Wooden (2000), despite the use of different methodologies and data.

2.2 Casualisation of the labour market

An important consideration is whether the process of liberalisation driven by casualisation has contributed to increasing labour market inequality. In general, the literature shows that there are adverse equity effects associated with casual, part-time and independent contract employees. These effects are in different spheres, such as earnings per hour (Borland and Coelli 2016; Mooi-Reci and Wooden 2017, Preston and Yu 2013), employment security (McGann 2012) and skill shortage and lack of training (Burgess, Campbell and May 2008). Although some academics highlight the economic benefits and advantages for companies in the existence of casual and non-standard employment, most research points to more negative effects on casual employees than on permanent ones (e.g., Mooi-Reci and Wooden 2017).

These flexible forms of employment may be useful in helping companies adjust to external shocks and deal with uncertainty in a rapidly changing labour market. The benefit from hiring an employee on a casual contract is that Australian law sees each contract as being unique in itself (Owens 2001, p. 120). An advantage is thus that these casual employment laws provide employers and employees with capacity for termination of the contract within a short period, whereas for permanent agreements these procedures tend to be more complex (Burgess and Campbell 1998). In addition, the law does not include the complexity that may exist in the labour market in terms of quality of work that differs between industries or award system structures (Esposto

2011, p. 204). Nevertheless, these types of jobs are also directly related to poor-quality working conditions, such as lower earnings and lesser access to 'decent work conditions' that are commonly associated with standard employment arrangements (Mooi-Reci and Wooden 2017, p. 1065).

In the case of Australia, these different modalities among temporary, non-standard and regular jobs are divided according to the number of hours worked per week. That is, full-time or part-time employment, or the payment of leave entitlements, which is the casual and permanent employment divide. All these forms create different conditions and inequalities, making it more difficult for researchers to analyse them. For this reason, most studies take earnings and income as the most appropriate methods for studying rising inequalities of outcomes in the labour market (Mooi-Reci and Wooden 2017; Borland and Coelli 2016; Chaterjee *et al*. 2016; Esposto 2011).

The most common way in the literature to study the different factors that impact on earnings in the labour market, is through the analysis of earnings per hour. This is arrived at by obtaining the average weekly earnings and dividing these by the number of hours worked. Some authors taking this analytical route recently include Chatterjee *et al*. (2016), Mooi-Reci and Wooden (2017), Esposto (2011), and Booth and Wood (2008). This method offers a powerful tool to make comparisons between the different earnings of employees. This methodology does have some limitations, such as earnings differences between full-time and part-time workers. However, it is seen as the most appropriate (e.g., Booth and Wooden 2008).

The labour market may have other adverse effects that exclude monetary returns. These include lags of employment opportunity, the possibility of obtaining a permanent full-time job, access to occupations with higher remuneration than in others, fewer benefits such as paid leave entitlements, and even more unpaid hours worked (Mooi-Reci and Wooden 2017), and other disadvantages such as lower work-life balance (Lass and Wooden 2019). These conclusions complement the different dimensions of inequality present in the Australian labour market that arise out of a process of casualisation. The literature, however, indicates a variety of opinions and findings with respect to the outcomes of different job types. Most authors agree, however, that those workers with permanent jobs receive higher wages and better employment arrangements than those employed on a casual or temporary basis (OECD 2015).

According to the Fair Work Commission (2018), casual employees are entitled to receive a 'casual loading', that is, a higher hourly pay rate than equivalent permanent employees. The reason for this premium rate is because they do not obtain the benefits such as paid leave when they are either sick or on holidays (Australian Council of Trade Unions 2017). However, a downside to this is that these premium rates are not applied in the Australian labour market evenly or fairly. For example, Borland and Coelli (2016) find that there is a penalty for casual and part-time jobs in receiving a lower hourly wage rate compared to that of permanent and full-time employees. There may also have been a technology effect, because the repetitive tasks performed by these employees may have been replaced by machinery.

The results from the Mooi-Reci and Wooden's (2017) study are similar to those discovered by Borland and Coelli (2016). Their research finds a penalty for casual

employment in the long-term wage. This penalty is more visible for men than for women, rising as high as 10 per cent. However, for most age groups of men, this wage penalty eventually declines, but by a small amount. In contrast, the effect for women is smaller: less than half the size of that for men, and is less robust. They also found that those who decided to wait to obtain a permanent job, in the long-term had a more significant higher hourly wage than those who chose to accept a casual position at the beginning of their careers.

McGann (2012, p. 79) found that the effect of casualisation and part-time work was strongly associated with independent contracting employees. Among the negative impact of these types of contracts were not working on a regular full-time basis, no benefits under paid leave entitlements, or protection against unexpected contract termination or even unfair dismissal. Preston and Yu (2013) arrived at similar conclusions. They reported that, on average full-time employees earned significantly more per hour than part-time workers. For example, they found, that after controlling for human capital characteristics (such as skill, education, occupation and others), the adjusted hourly earnings difference between the highest earnings (men employed full-time) and the lowest earnings (women hired part-time) is equal to 22.5 per cent (2013, p. 24).

Thus, in general, the literature shows, that there is not a premium rate for casual and part-time employees and, furthermore, they do not receive the same salary per hour as full-time permanent workers. Hence we can argue that the SBTC hypothesis and liberalisation argument can be unified through the following idea (Esposto 2005, p.93):

> …Australia may be experiencing a different scenario of the SBTC hypothesis. It is clear that if wages are inflexible downwards in the Australian labour market, but there exists a flexibility of job types (i.e. full-time and part-time permanent employment, and full-time and part-time casual employment, including fixed term employment), one way in which employers may reduce wage costs is by opting to employ workers on a part-time or casual basis.

This behaviour may, inadvertently cause or exacerbate increasing inequality of earnings.

2.3 Polarisation: A potential reason for rising earnings inequality

Job polarisation is a condition in which the labour market experiences an increase in the share of high-paid jobs with decent working conditions, an increase in jobs with poor pay and working conditions, and an accompanying decrease in the share of jobs in the middle of the employment distribution (Maxted 2016; Coelli and Borland 2016; Goos, Manning and Salomons 2014; Esposto 2011; Autor *et al*. 2006).

Analysis by Autor *et al*. (2006) found that the labour markets in the US have undergone substantial job polarisation, with employment 'polarising' into relatively high-skill, high-wage jobs and low-skill, low-wage jobs (p. 189). Goos *et al*. (2014) go further and document the pervasiveness in polarisation in 16 Western countries between 1993 and 2010. They document this polarisation with rising shares for high-paid professionals and managers as well as low-paid personal service workers, and

declines in shares of middle-income earners (p. 2524).

In trying to understand Australian labour market polarisation, Coelli and Borland (2016) investigated changes in the occupation structure of Australia for the 1966 to 2011 period. They analysed the effect of changes on earnings distribution. Their work found that the Australian labour market was experiencing employment polarisation: growth in high- and low-skill jobs and declines in middle-skilled employment distribution. A main finding was that job polarisation was a male phenomenon (p. 24).

Healy *et al*. (2017) examined different labour market scenarios and found that Australia might conceivably face future polarisation of the labour market, indicating that (p.5):

> Australia has not drifted far in this pessimistic direction, but there are signs of significant problems emerging, with persistent low wage growth, destruction of routine occupations, and extensive casualisation of the youth workforce.

3. Data and Methodology

Our primary aim is to identify whether the labour markets in Australia have undergone a process of job polarisation, with employment 'polarising' into relatively high-skill, high-wage jobs and low-skill, low-wage jobs, with reductions in the share of middle-skilled jobs.

In trying to understand the impact of labour market change on inequality our simple analysis uses the following data from the Australian Bureau of Statistics (ABS): (1) the Employee Earnings, Benefits and Trade Union Membership, Australia EEBTUM (ABS cat. no.6310.0); (2) Characteristics of Employment, Australia CEA (ABS cat. no. 6333.0); and (3) the Labour Force Survey, Australia, Detailed, Quarterly LFADQ (ABS cat. no. 6291.0.55.003).

From these data, it is possible to obtain information about the number of employees, weekly and hourly earnings, and hours worked. However, these data show one important limitation: there have been changes in the occupation classification over time, making it difficult to compare across different classifications. To solve this problem, we apply the partial match methodology of occupations suggested by the ABS to our data (2013, cat. no. 1220.0 ANZSCO, pp. 779-810).

The tables given by the ABS (2013, cat. no. 1220.0 ANZSCO, pp. 779-810) show the match or partial match between job title across the classifications: from ASCO 2 to ANZSCO and ASCO 1 to ASCO 2. Using these tables at the four-digit level, we were able to match the data from one classification to the other, choosing ANZSCO as the standardisation base.

The first partial match made was between ASCO 2nd Edition and ANZSCO using ABS cat. no. 1220.0 ANZSCO (pp. 779 to 810). In this catalogue, there are partial matches from ANZSCO to ASCO 2nd Edition, and vice versa, at the four digit level. This correspondence allowed for the partial matches to be made. Table 1 provides an example of the process conducted.

Table 1: Example of partial match between ASCO 2nd Edition and ANZSCO

ASCO 2nd Edition		*ANZSCO*		
Code	*Name of Occupation*	*Code*		*Name of Occupation*
2381	Dental Practitioners	2523		Dental Practitioners
2382	Pharmacists	2515		Pharmacists
2383	Occupational Therapists	2524		Occupational Therapists
2384	Optometrists	2514	p	Optometrists and Orthoptists
2385	Physiotherapists	2525		Physiotherapists
2386	Speech Pathologists	2527	p	Speech Professionals and Audiologists
2387	Chiropractors and Osteopaths	2521		Chiropractors and Osteopaths
2388	Podiatrists	2526		Podiatrists
238	Miscellaneous Health Professionals	252		Midwifery and Nursing Professionals

Notes: p = partial match
Source: Authors' assignment from ABS cat. no. 1220.0 ANZSCO.

The same process was made for ASCO 2 for the following years: 1997, 2001, 2003 and 2005. For years before 1996 the same method was used to match ASCO 1 to ASCO 2 occupations, and the final partial match was made with ANZSCO.

Measuring skill change and polarisation of the labour market in Australia
To measure skill change we utilise the Australian and New Zealand Standard Classification of Occupations (ANZSCO) (ABS, 2006, p. 21). Table 2 below shows the relationship between the groups and skill level. The first three tables (Major Groups, Major and Sub-Major Groups, and Major, Sub-Major and Minor Groups) show the predominant skill levels applying to each group.

Table 2: ANZSCO occupational and predominant skill level

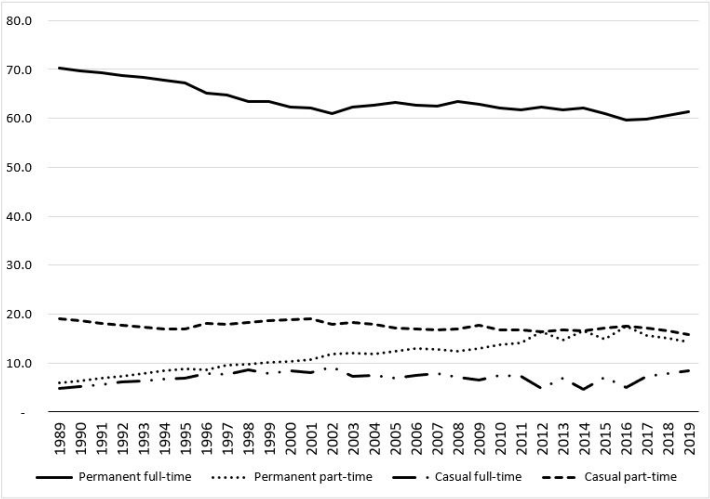
Major Group Code	*Major Groups*	*Skill level*
1	Managers	1,2
2	Professionals	1
3	Technicians and Trades Workers	2,3
4	Community and Personal Service Workers	2,3,4,5
5	Clerical and Administrative Workers	2,3,4,5
6	Sales Workers	2,3,4,5
7	Machinery Operators and Drivers	4
8	Labourers	4,5

Source: ABS cat. no. 1220.0 ANZSCO, p. 21.

4. Findings: Changes in the Occupational Composition of Employment

We begin our analysis by comparing changes to the share of job types between 1989 and 2019. These periods are sufficient to conduct a long-term analysis because it takes into account the period of casualisation that took place in Australia.

Figure 1. Change in the share of employment by job type, 1989-2019.



Source: Employee Earnings, Benefits and Trade Union Membership, Australia EEBTUM (ABS cat. no.6310.0) and Characteristics of Employment, Australia (ABS cat. no. 6333.0).

Figure 1 shows a steady decline in the share of permanent full-time employment from 70.2 to 61.3 per cent, in contrast to a gradual increase to 14.4 per cent in the share of permanent part-time work. The share of casual employment rose steadily in full-time employment from 4.8 per cent to 8.4 per cent. Part-time casual employment declined from around 19.0 per cent to 15.9 per cent.

Tables 3 and 4 provide a comparison of the growth in full-time and part-time permanent and casual work for men and women. Table 3 shows growth in full-time male and female employment. Total full-time employment grew by almost 2.2 million jobs between 1989 and 2019, or a total increase of 41.8 per cent. Of interest is the growth of higher-skilled work (occupations 1 and 2) for men, with corresponding declines in permanent work in less-skilled jobs at the bottom of the occupational distribution. Women experienced similar trends in these occupational categories.

Table 3: Growth in full-time employment, by occupation and type of contract casual or permanent, 1989-2019

Occupation	*Male full-time*			*Female full-time*		
	1989	*2019*	*Growth p.a. (%) 1989-2019*	*1989*	*2019*	*Growth p.a. (%) 1989-2019*
Permanent employees ('000s)						
1 Managers	310.5	524.6	2.3	77	368.9	12.6
2 Professionals	591	848.4	1.5	329.1	1,111.6	7.9
3 Technicians and Trades Workers	754.5	826.4	0.3	58.6	169.9	6.3
4 Community and Personal Service Workers	410.2	130.5	-2.3	126.4	330.3	5.4
5 Clerical and Administrative Workers	314.8	274.4	-0.4	736.1	715.9	-0.1
6 Sales Workers	110.9	130.6	0.6	158.1	213.4	1.2
7 Machinery Operators and Drivers	328.8	421.5	0.9	56.6	55.6	-0.1
8 Labourers	483.1	273.8	-1.4	116.1	149.0	0.9
Total	*3,303.8*	*3,430.2*	*0.1*	*1,658.0*	*3,114.6*	*2.9*
Casual employees ('000s)						
1 Managers	26.2	21.9	-0.5	5.7	15.4	5.7
2 Professionals	34.9	56.8	2.1	10.9	74.5	19.4
3 Technicians and Trades Workers	30.4	145.5	12.6	2.8	29.9	32.3
4 Community and Personal Service Workers	35.7	32.9	-0.3	8.4	83.2	29.7
5 Clerical and Administrative Workers	2.5	23.4	27.9	24.8	61.2	4.9
6 Sales Workers	6.2	23.7	9.4	11.6	38.6	7.8
7 Machinery Operators and Drivers	28.7	116.8	10.2	2.6	15.4	16.4
8 Labourers	44.1	104.5	4.6	12.5	56.9	11.8
Total	*208.7*	*525.6*	*5.1*	*79.3*	*375.1*	*12.4*

Sources: ABS1989-2019, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations.

Growth in full-time casual work exhibited different trends to those seen in permanent employment arrangements, where the bulk of the growth for men and women was in the middle and lower end of the distribution (occupations 3 to 8).

In the case of part-time work (Table 4), permanent employment grew at a much faster rate than casual work, but the growth was more evenly spread. Of interest, are the occupations sales workers and machinery operators and drivers, where permanent part-time work for men increased considerably, while for women the growth was

concentrated in more skilled occupations (1, 2 and 3). Casual part-time workers exhibited the same trends.

Table 4. Growth in part-time employment, by occupation and type of contract casual or permanent, 1989-2019

Occupation	*Male part-time*			*Female part-time*		
	1989	*2019*	*Growth p.a. (%) 1989-2019*	*1989*	*2019*	*Growth p.a. (%) 1989-2019*
Permanent employees ('000s)						
1 Managers	1.4	39.2	89.9	5.7	27.5	12.8
2 Professionals	4.5	190.0	137.4	82.8	248.9	6.7
3 Technicians and Trades Workers	2.7	59.4	70.0	5.2	12.2	4.5
4 Community and Personal Service Workers	2.3	80.8	113.7	54.1	204.4	9.3
5 Clerical and Administrative Workers	3.2	78.6	78.5	75	204.9	5.8
6 Sales Workers	1.4	78.9	184.5	50.2	128.9	5.2
7 Machinery Operators and Drivers	0.5	27.2	177.8	4.5	3.6	-0.7
8 Labourers	9.6	98.4	30.8	44.5	53.6	0.7
Total	*25.6*	*652.3*	*81.6*	*322.0*	*884.0*	*5.8*
Casual employees ('000s)						
1 Managers	2.8	22.0	22.8	8.4	15.5	2.8
2 Professionals	13.3	80.6	16.9	60.9	105.7	2.4
3 Technicians and Trades Workers	13.7	82.3	16.7	16.3	16.9	0.1
4 Community and Personal Service Workers	43.5	119.5	5.8	124.8	302.5	4.7
5 Clerical and Administrative Workers	160.1	45.2	-2.4	95.6	117.9	0.8
6 Sales Workers	44.6	145.6	7.6	195.8	237.9	0.7
7 Machinery Operators and Drivers	9.1	78.7	25.5	8.5	10.4	0.7
8 Labourers	68.2	207.5	6.8	103.7	113.0	0.3
Total	*355.3*	*781.5*	*4.0*	*614.0*	*919.7*	*1.7*

Sources: ABS1989-2019, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations.

Based on this simple data analysis, we can see a strong increase in part-time work for both men and women. Similarly, we can say that there is a process of casualisation in full-time work.

Table 5: Change in Share of employees by skill level, 1989-2019

Skill Level	*Employees ('000s)*			*Share (%)*		
	1989	*2019*	*Growth p.a. (%)*	*1989*	*2019*	*Changes*
I Managers/Professionals	1,498.5	3,414.1	4.3	22.8	32.0	9.1
II Associate Professionals	847.7	1,096.1	1.0	12.9	10.3	-2.6
III Skilled vocations	1,240.7	1,310.8	0.2	18.9	12.3	-6.6
IV Intermediate skills	1,550.6	3,008.2	3.1	23.6	28.2	4.5
V Elementary skills	1,428.8	1,853.8	1.0	21.8	17.4	-4.4
Total	*6,566.3*	*10,683.0*	*2.1*	*100.0*	*100.0*	

Sources: ABS1989-2019, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations.

Table 5 compares the number of employees by skill level over the same 30 years. Although all skill levels experienced important growth in the number of persons employed, when shares are compared the only growth is seen at the highest skill occupational level, that is, *Managers and professionals* and in Skill level IV, *Intermediate skills*. The second level, *Associate professionals*, experienced a reduction in its share, while skills levels III and V experienced sharper reductions. These results imply a polarisation of the labour market, where high and low skilled occupations have declined in middle skills and elementary skills.

When we disaggregate skill levels in Table 6 between total permanent and casual work, we find that casual employment grew faster in all skills levels compared to permanent employment. The only exception is *Managers and professionals*. For permanent skills, the highest skill level had a higher increase than the other four categories, three of which experienced declines in their share. These changes in employment support the notion of polarisation of job creation. The picture is different for casual work, indicating that job growth in terms of shares favoured jobs requiring the two lowest skill levels. This indicates a strong trend of downskilling in casual full-time work.

Table 6: Change in share for male and female employees by skill level, 1989-2019

Skill Level	*Employees ('000s)*		*Employment*	
	1989	*2019*	*Growth p.a. (%)*	*Change in share (%)*
Full-time Permanent				
I Managers/Professionals	1,304.2	2,481.4	3.0	13.1
II Associate Professionals	731.0	770.6	0.2	-2.2
III Skilled vocations	1,136.2	828.1	-0.9	-9.0
IV Intermediate skills	1,176.6	1,710.7	1.5	3.7
V Elementary skills	903.4	757.4	-0.5	-5.6
Total	*5,251.4*	*6,548.2*	*0.8*	
Full-time Casual				
I Managers/Professionals	68.1	121.3	2.6	-8.2
II Associate Professionals	32.3	50.1	1.8	-4.7
III Skilled vocations	56.2	99.8	2.6	-6.8
IV Intermediate skills	76.1	310.2	10.3	10.3
V Elementary skills	82.0	318.0	9.6	9.3
Total	*314.6*	*899.3*	*6.2*	

Sources: ABS1989-2019, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations.

4.1 The demand for Skills and Hours worked in Permanent and Casual Jobs

This section considers aggregate hours worked as a means of analysing the impact of the liberalisation of the labour market. While the number of employees responds to conditions of both demand and supply, hours worked is more related to demand conditions. According to Wooden (2000, p. 194), there are two reasons for this difference. Firstly, some demand may not be satisfied, because there may be not enough employees with the requisite skills and qualifications to do the job. Secondly, hours worked may vary depending on the job. For example, *Managers and Professionals* may do additional hours of unpaid work, while other occupations with fewer skill levels may work fewer hours.

We now proceed with an analysis of changes in the demand for labour by looking at changes in the number of hours worked in occupations and skills. Table 7 shows the growths of employment and growth in aggregate hours worked per week by occupation at the one-digit level between 1989 and 2019. In both years, *Professionals* contributed the most extensive participation of employment and aggregate hours. These workers also had a pronounced change in terms of total numbers and share (6.8 per cent share growth). *Managers* and *Technicians and Trade workers* also experienced

similar trends. The groups with lower skill level, such as *Labourers* and *Clerical and administrative* workers, had less growth, and for this reason, their participation appears rather moderate. These trends indicate polarisation in the Australian labour market. This is because the demand for hours worked is higher in occupations with higher-skill levels compared to those with lower-skill levels.

Table 7: Growth of employment and growth in aggregate hours worked per week by occupation, 1989 to 2019

ANZSCO major group	*Employment ('000s)*		*Aggregate hours (millions)*		*Net change p.a. (%)*		*Share change (%)*	
	1989	*2019*	*1989*	*2019*	*P*	*H*	*P*	*H*
1 Managers	437.6	1,035.0	16.5	37.7	4.6	4.3	3.0	2.1
2 Professionals	1,127.30	2,716.4	34.1	86.1	4.7	5.1	8.3	6.8
3 Technicians and Trades Workers	884.1	1,342.6	22.8	51.2	1.7	4.2	-0.9	2.7
4 Community and Personal Service Workers	805.4	1,284.0	23.5	33.4	2.0	1.4	-0.2	-2.9
5 Clerical and Administrative Workers	1,412.00	1,521.5	31.5	46.6	0.3	1.6	-7.3	-3.4
6 Sales Workers	578.9	997.6	16.5	26.0	2.4	1.9	0.5	-1.3
7 Machinery Operators and Drivers	439.3	729.1	15.1	27.8	2.2	2.8	0.1	0.0
8 Labourers	881.7	1,056.8	24.6	32.1	0.7	1.0	-3.5	-3.9
Total	*6,566.3*	*10,683.0*	*184.6*	*340.8*	*2.1*	*2.8*		

Notes: P = persons. *H* = hours.

Sources: ABS1989-2019, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations.

Table 8 shows the growth in total hours worked for Australian workers by skill level for the 30 year period in question. The significance of this Table is the growth in the share change in aggregate hours for Skill I, indicating that the demand for labour favours higher rather than lower skills levels. These changes seem to indicate that the labour market is polarising in terms of skills, a finding already noted by Esposto (2011).

Table 8: Total Employment and Total Aggregate Hours per week Growth by Skill Level Category, 1989 to 2019

Skill category	*Employment growth (%)*	*Aggregate hours growth (%)*	*Change in employment share (%)*	*Share change in aggregate hours (%)*
I Managers/Professionals	127.8	152.1	9.1	8.9
II Associate Professionals	29.3	72.9	-2.6	-0.8
III Skilled vocations	5.6	52.4	-6.6	-3.0
IV Intermediate skills	94.0	90.5	4.5	0.9
V Elementary skills	29.7	26.8	-4.4	-6.1
Total	*62.7*	*84.4*		

Sources: ABS1989-2019, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations.

Table 9 groups the growth in hours worked in terms of skilled job types: permanent, casual and full-time and part-time work. For permanent full-time work, the demand for labour shows clear signs of favouring occupations that possess higher-skill levels, namely, skill level I, where the share increased. However, the share declined in all other skill categories, indicating clear signs of upskilling in employment. Similar trends are seen in part-time permanent work, except that the share grew in the middle of the skill distribution. On the other hand, casual full-time employment shows opposite trends. For example, the growth in the demand for hours worked favours occupations with lower-skilled levels, where the share for the demand for labour grew principally in the two lowest-skilled categories. In terms of part-time casual work, the share in the demand for labour fell considerably in the lowest skilled occupation.

Table 9: Growth in Permanent and Casual Full-time and Part-time Employment and Aggregate Hours Worked per Week by Skill Level Category, 1989 to 2019

	Employment ('000s)		*Aggregate hours (millions)*		*Net change p.a. (%)*		*Share change (%)*	
	1989	*2019*	*1989*	*2019*	*P*	*H*	*P*	*H*
Full-time Permanent								
I Managers/Professionals	1,304	2,481.4	40.7	85.9	3.0	3.7	13.1	11.5
II Associate Professionals	731	770.6	19.8	28.1	0.2	1.4	-2.2	-0.3
III Skilled vocations	1,136	828.1	28.7	32.2	-0.9	0.4	-9.0	-4.1
IV Intermediate skills	1,177	1,710.7	43.0	60.7	1.5	1.4	3.7	-0.8
V Elementary skills	903	757.4	27.8	25.6	-0.5	-0.3	-5.6	-6.4
Total	*5,251*	*6,548.2*	*160.0*	*232.6*	*0.8*	*1.5*		
Full-time Casual								
I Managers/Professionals	68.1	121.3	2.5	2.6	2.6	0.1	-8.2	-9.9
II Associate Professionals	32.3	50.1	1.1	1.3	1.8	0.4	-4.7	-4.0
III Skilled vocations	56.2	99.8	1.9	2.8	2.6	1.6	-6.8	-2.7
IV Intermediate skills	76.1	310.2	2.5	7.0	10.3	5.9	10.3	13.7
V Elementary skills	82.0	318.0	2.5	4.9	9.6	3.2	9.3	2.8
Total	*314.6*	*899.3*	*10.6*	*18.5*	*6.2*	*2.5*		
Part-time Permanent								
I Managers/Professionals	53.3	582.5	1.0	20.2	33.1	65.6	25.2	23.2
II Associate Professionals	57.6	180.9	1.0	6.6	7.1	19.2	-1.9	-1.7
III Skilled vocations	11.5	194.4	0.2	7.6	52.8	100.0	9.9	10.4
IV Intermediate skills	126.7	401.6	2.1	14.2	7.2	19.1	-4.0	-3.8
V Elementary skills	171.9	177.8	2.8	6.0	0.1	3.9	-29.3	-28.1
Total	*421.1*	*1537.1*	*7.1*	*54.6*	*8.8*	*22.4*		
Part-time Casual								
I Managers/Professionals	72.9	229.0	0.9	4.9	7.1	14.9	0.9	1.3
II Associate Professionals	26.8	94.5	0.3	2.4	8.4	21.1	0.9	2.2
III Skilled vocations	36.8	188.5	0.6	5.3	13.7	27.4	4.7	7.0
IV Intermediate skills	171.2	585.8	2.2	13.1	8.1	16.6	4.9	6.5
V Elementary skills	271.5	600.6	3.1	9.3	4.0	6.7	-11.5	-17.0
Total	*579.2*	*1698.4*	*7.1*	*35.0*	*6.4*	*13.2*		

Notes: P = persons. *H* = hours.
Sources: ABS1989-2019, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations.

These trends suggest that the labour market is polarising. The reason might be that employers are employing highly-skilled workers in permanent work, while in terms of casual employment, the demand for labour favours those occupations requiring lower-skill levels.

4.2 Increasing Inequality in Earnings by Skill level in Full-Time Jobs

We now turn to look at whether there is any evidence of inequality in full-time earnings. We analyse increasing inequality in full-time earnings in terms of skill levels at a highly aggregated level, using the respective ASCO 2nd edition and ANZSCO definitions of skill. Thus, we measure the earnings variability across skills between the periods of 1989-1995 (ASCO 1st edition), 1997-2005 (ASCO 2nd edition) and 2007-2019 (ANZSCO)[1]. There are two reasons for choosing these different periods for the analysis. Firstly, it is important to learn whether changes in earnings inequality in terms of skill levels have been consistent over the last 30 years. The second is to find out whether changes in skill inequality have been consistent across different skill distributions (i.e., ASCO 1st edition, ASCO 2nd edition and ANZSCO). To do this, we measure the level and change over these two periods in skill earnings inequality by using the respective skill definitions of each of the three distributions. Furthermore, real earnings are calculated by deflating nominal earnings by using the Consumer Price Index (CPI).

For all periods, the wages of casual workers were higher in permanent work compared to casual work. The only exception was Skill I in 2005. Between 1989 and 1995 the hourly rate of permanent employees grew at a greater level than for casual employees at all skill levels, with the exception of Skill II, which increased by over 25.3 per cent for casuals (first panel in Table 10). Earnings in Skill III for casual employment declined by 9.7 per cent. For the other two periods (second and third panels), we find that wages as arranged by skill level grew faster in casual work as opposed to permanent work. This was more pronounced in the 1997-2005 period compared to the 2007-2019 period, where all wages grew faster in casual work compared to permanent work. The only exceptions were Skill IV between 1997-2005 and Skill III between 2007-2019.

An interpretation of the results is that labour market reforms over recent decades have provided firms with more scope to reduce their use of permanent labour by creating more employment opportunities for casual workers, at lower wages. These types of recruitment decisions by employers has potential implications for exacerbating wages inequality in the Australian labour market, which continue to grow, particularly at a time when wages growth has been very low in the last few years.

1 In 2006, ASCO 2nd edition was replaced by ANZSCO; hence we do not use 2006 for the period of analysis. This is to avoid large fluctuations occurring from the changes in occupational and skill distributions arising from new measures and definitions of skill.

Table 10: Change in full-time permanent and casual hourly earnings, 1989-1995, 1997-2005 and 2007 and 2019

	1989		*1995*		*Change in earnings*	
	Permanent	*Casual*	*Permanent*	*Casual*	*Permanent %*	*Casual %*
ASCO I						
Skill I	31.9	24.8	33.7	25.8	5.6	4.1
Skill II	31.7	25.3	32.6	31.7	3.0	25.3
Skill III	24.0	25.5	24.1	23.0	0.7	-9.7
Skill IV	24.8	22.1	26.3	22.9	5.8	3.5
Skill V	22.5	20.0	23.5	20.8	4.3	4.4
	1997		*2005*		*Change in earnings*	
	Permanent	*Casual*	*Permanent*	*Casual*	*Permanent %*	*Casual %*
ASCO II						
Skill I	37.6	31.2	41.7	43.6	10.8	39.9
Skill II	31.5	21.5	34.0	26.9	7.8	25.0
Skill III	27.2	24.4	30.0	30.6	10.0	25.5
Skill IV	28.0	23.8	29.4	24.7	5.2	4.0
Skill V	24.5	20.4	25.5	23.3	4.3	14.6
	2007		*2019*		*Change in earnings*	
	Permanent	*Casual*	*Permanent*	*Casual*	*Permanent %*	*Casual %*
ANZSCO						
Skill I	43.8	39.1	47.9	42.9	9.4	9.7
Skill II	33.4	26.6	36.3	29.7	8.7	11.7
Skill III	29.4	26.1	31.4	27.4	6.8	5.0
Skill IV	28.3	24.1	30.3	26.8	7.1	11.2
Skill V	23.9	20.5	25.0	23.3	4.6	13.7

Sources: ABS1989-2018, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations. Using Consumer Price Index, base 2019 = 100.

Table 11 provides a long term view of inequality in the longer term. When hourly earnings are examined, we can confirm that permanent jobs receive higher hourly wages than casual employees in 2019 as compared to 1989. According to the literature, casual employees earn less regardless of Australian law and Fair Commission determinations. Also, when growth is observed, only *Managers* had a higher increase in permanent jobs than in casual jobs. With this result, we can confirm the inequality that the Australian market has shown in recent decades.

Table 11: Hourly earnings for full-time Permanent and Casual employment from 1989 to 2019

	1989		*2019*		*Growth p.a.*	
	Permanent	*Casual*	*Permanent*	*Casual*	*Permanent*	*Casual*
1 Managers	28.4	23.5	48.0	30.6	2.3	1.0
2 Professionals	29.1	18.7	46.2	42.6	2.0	4.3
3 Technicians and trades workers	23.5	18.8	31.6	27.6	1.2	1.6
4 Community and personal service workers	24.0	20.2	29.7	26.0	0.8	1.0
5 Clerical and administrative workers	24.1	16.3	32.9	29.0	1.2	2.6
6 Sales workers	19.0	13.7	26.3	22.5	1.3	2.1
7 Machinery operators and drivers	22.6	19.0	30.8	27.5	1.2	1.5
8 Labourers	21.0	11.5	25.5	24.0	0.7	3.6

Sources: ABS1989-2019, cat. no. 6310.0 and ABS cat. no. 6333.0. Authors' calculations. Hourly earnings were standard with Customer Price Index ABS Cat 6401.0 -, Australia, Dec 2019. Using Consumer Price Index, base 2019 = 100.

5. Conclusion

In general, our data analysis shows that the labour market has experienced a process of polarisation consistent with that found overseas by Autor *et al*. (2006) and Goos and Salomon (2014), as well as Coelli and Borland (2016) for Australia.

Our findings indicate polarisation in Australia's labour market, that is, an increase in jobs with poor pay and working conditions, with an accompanying decrease in the share of jobs in the middle of the employment distribution. This is not too dissimilar to the disappearing middle or vanishing bottom hypothesis first highlighted by Gregory (1996). These findings pose strong challenges for policy makers in terms of the negative impacts that the casualisation of employment is causing in the Australian labour market. One such challenge is its negative impact on family income units. Further research work is required in this area, in order to generate government policies that will assist in alleviating the problem income inequality in households. Another important finding in this work is that disaggregating employment into job types, (full-time, part-time casual and permanent work for men and women), provides a broader understanding into the types of inequality that Australia is facing. Households whose members possess low skill levels and are dependent on part-time and casual work are likely to experience long-term increasing inequalities. To reverse these trends it may be required to generate a more equal distribution of labour skills. This could be done through the creation of more effective and targeted training and retraining education policy schemes and programmes.

While research that is more detailed is required in the area of skills inequality and job polarisation, particularly with the use of more disaggregated data, the findings show a very concerning long-term trend. Our analysis highlights two already existing themes. The first is that the Australian labour market has been unable to create long term full-time permanent jobs. The other, was captured by Borland, Gregory and Sheehan at the beginning of the century, when they identified that the Australian labour market had been unable to "… generate an adequate supply of jobs paying a living wage, and hence supporting full and independent involvement in the Australian community" (2001, pp. 19-20). Sadly, these trends appear to be increasing.

References

Australian Council of Trade Unions (ACTU) (2017), Rising Inequality: An Australian Reality, Australian Council of Trade Unions, viewed 26 April 2018, https://www.actu.org.au/media/1033439/actu-ineqaulity-report-2017.pdf

Australian Bureau of Statistics (ABS) (2018), *Characteristics of Employment*, Australia, cat. no. 6333.0.004, Canberra.

Australian Bureau of Statistics (ABS) (2012) 1989-2012, *Employee Earnings, Benefits and Trade Union Membership*, cat. no. 6310.0, Canberra.

Australian Bureau of Statistics (ABS) (2014), *Employee Earnings, Benefits and Trade Union Membership*, cat. no. 6310.0, Canberra.

Australian Bureau of Statistics (ABS) (2006), *Consumer Price Index, Australia*, cat. no. 6401.0, Canberra.

Australian Bureau of Statistics (ABS) (2017), *Australian and New Zealand Standard Classification of Occupations, Australia*, cat. no. 1220.0, Canberra.

Autor, D., L. Katz and M. Kearney, (2006), The polarization of the US labor market. *American Economic Review*, 96(2): 189–194.

Barrett, G. (2012), The Return to Cognitive Skills in the Australian Labour Market, *The Economic Record*, 88: 1–17.

Booth, A. & Wood, M. (2008), 'Back-to-Front Down Under? Part-Time/Full-Time Wage Differentials in Australia', *Industrial Relations*, 47(1): 114-141.

Borland, J. & Coelli, M. (2016), Labour Market Inequality in Australia, *Economic Record*, 92 (No. 299): 517–547.

Borland, J., Gregory, B., and Sheehan, P. (2001), 'Inequality and economic change', in Borland, J., Gregory, B. and Sheehan, P. (eds) *Work Rich, Work Poor: Inequality and Economic Change in Australia*, Victoria University, Melbourne.

Breemersch, K., Damijan, J.P. and Konings, J. (2017), Labour Market Polarization in Advanced Countries. OECD Social, Employment and Migration Working Papers, No. 197.

Burgess, J. and Campbell, I. (1998), 'Casual Employment in Australia: Growth, Characteristics, A Bridge or a Trap?' *Economic and Labour Relations Review* 9 (June): 31-54.

Burgess, J., Campbell, I. and May, R. (2008), 'Pathways from Casual Employment to Economic Security: the Australian Experience', *Social Indicators Research*, 88(1): 161-178.

Chatterjee, A., Singh, A. and Stone, T. (2016), 'Understanding Wage Inequality in Australia', *Economic Record*, 92 (298): 348-360.

Chiswick, B., Lee, Y. and Miller, P.W. (2003), 'Schooling, Literacy, Numeracy and Labour Market Success', *The Economic Record*, 79(245): 165–181.

Campbell, I., and Brosnan, P. (1999), 'Labour Market Deregulation in Australia: The slow combustion approach to workplace change', *International Review of Applied Economics*, 13(3): 353-394.

Coelli, M. and Borland, J. (2016), 'Job polarisation and earnings inequality in Australia', *Economic Record*, 92(296): 1-27.

Cully, M. (1999), 'A More or Less Skilled Workforce? Changes in the Occupational Composition of Employment, 1993 to 1999', *Australian Bulletin of Labour*, 25: 98-104.

Esposto, A. (2005), 'Dimensions and earnings inequality in Australia', PhD thesis, Centre for Strategic Economic Studies Victoria University, Melbourne.

Esposto, A. (2011), 'Upskilling and Polarisation in the Australian Labour Market: A Simple Analysis', *Australian Bulletin of Labour*, 37(2): 191-216.

Fair Work Commission (2018), Casual employees, Fair Work Commission Ombudsman, viewed 30 April 2018, https://www.fairwork.gov.au/employee-entitlements/types-of-employees/casual-part-time-and-full-time/casual-employees

Goos, M., Manning, A. and Salomons, A. (2014), 'Explaining job polarization: Routine-biased technological change and offshoring', *American Economic Review*, 104(8): 2509–2526.

Gregory, R. (1995), 'Disappearing Middle or Vanishing Bottom? – A Reply', *Economic Record*, 72: 294-296.

Healy, J., Nicholson, D. and Gahan, P. (2017), The future of work in Australia: Anticipating how new technologies will reshape labour markets, occupations and skill requirements. Department of Education, New South Wales Government.

Lass, I. and Wooden, M. (2019), 'Temporary Employment and Work-Life Balance in Australia', Melbourne Institute Working Paper No. 11/19, October 2019, pp. 1-29.

McAdam, P., Willman, A., Di Bartolomeo, G., and Saltari, E. (2018), 'Unraveling the Skill Premium', *Macroeconomic Dynamics*, 22(1): 33-62.

McGann, M. (2012), 'Recognition and Work in the Flexible Economy', Journal of Australian Political Economy, 69(1): 59-85.

Mooi-Reci, I. and Wooden, M. (2017), 'Casual Employment and Long-Term Wage Outcomes', *Human Relations*, 70(9): 1064-1090.

OECD (2015), In It Together: Why Less Inequality Benefits All, OECD Publishing, Paris.

Owens, R. (2001), 'The "Long-term or Permanent Casual" – An Oxymoron or "a Well Enough Understood Australianism" in the Law?', *Australian Bulletin of Labour*, 27: 118-136.

Preston, A. and Yu, S. (2013), 'Is there a part-time/full-time pay differential in Australia?', *Journal of Industrial Relations*, 57(1): 24–47.

Quiggin, J. (2018), 'Labour market policy and the future of work', *Senate Select Committee on the Future of Work and Workers Submission 8*, Parliament of Queensland, Brisbane, accessed 18/09/2018, available on https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Future_of_Work_and_Workers/FutureofWork/Submissions

Wooden, M. (2000), 'The Changing Skill Composition of Labour Demand', Australian *Bulletin of Labour*, 26(3): 191-198.

Wooden, M. (2001), 'Industrial Relations Reform in Australia: Causes, Consequences and Prospects', *Australian Economic Review*, 34(3): 243-262.

Wooden, M. & Sloan, J. (1998), 'Industrial Relations Reform and Labour Market Outcomes: A Comparison of Australia, New Zealand and the United Kingdom,' in: G. Debelle and J. Borland (eds.), *Unemployment and the Australian Labour Market*, Reserve Bank of Australia, Sydney.

Understanding the retirement savings of self-employed tradespeople in Australia

Aaron Elkhishin[a] Griffith University
Tracey West[b] Griffith University
Kirsten MacDonald[c] Griffith University

Abstract

Over the last decade, the Australian Building and Construction Commissioner (ABCC) together with the Association of Superannuation Funds Australia (ASFA) have raised concerns over the exclusion of self-employed tradespeople from Australia's compulsory contribution system for employed people. We use logit models to compare the superannuation investment, as well as other assets, of self-employed tradespeople to employed tradespeople. We find self-employed tradespeople are less likely to hold superannuation assets and more likely to hold business assets, the family home, other property and equities. Self-employed tradespeople therefore save for retirement through investment in these alternative assets but are exposed to market uncertainty if they are reliant on the sale of the business to fund retirement consumption. We argue that, while self-employed tradespeople are relatively wealthier, superannuation exclusion has wider impacts related to the property industry, such as higher construction costs, increased demand for investment properties and associated tax advantages, and automation risk.

JEL Codes: J180, J780, G51
Keywords: Superannuation, retirement, business owners, tradespeople, investment property

[a] Griffith University, Gold Coast Campus QLD 4222 Tel: +61 7 5552 8539 Fax: +61 7 5552 8060 Email: aaron.elkhishin@griffithuni.edu.au
[b] Corresponding author Griffith University, Gold Coast Campus QLD 4222 Tel: +61 7 5552 9769 Fax: +61 7 5552 8060 Email: t.west@griffith.edu.au
[c] Griffith University, Gold Coast Campus QLD 4222 Tel: +61 7 5552 7287 Fax: +61 7 5552 8068 Email: k.macdonald@griffith.edu.au

1. Introduction

Compulsory superannuation was introduced in 1992 via the *Superannuation Guarantee Charge (SGC) Act* to shift much of the retirement funding burden from the public to the private purse (McDonald 2016). From July 2014, 9.5 per cent of an employee's income is deposited into a superannuation fund and employers are fined if they are not compliant with the SGC legislation. However, not all Australians are eligible for SGC. In other words, employees earning less than $450 per month, or employees aged under eighteen or over the age of seventy, as well as people not in the workforce or on government allowances are excluded (Chomik and Piggot 2016). Therefore, self-employed people are excluded from the SGC.

Independent contractors (ICs), as defined by the Australian Bureau of Statistics (ABS), are persons who operate their own business (self-employed) and who are contracted to perform services for others without having the legal status of an employee (Australian Bureau of Statistics, 2016). This means that ICs are engaged under a contract *for* service (a commercial contract), while employees are engaged under a contract *of* service (an employment contract). Problematically, the distinction for classifying ICs is not always clear and there have been cases where this has been subject to manipulation (Australian Building and Construction Commissioner 2010). It is in this area that small business operators such as self-employed tradespeople may be taken advantage of by other (often larger) businesses. The larger businesses force or attempt to create the impression of a 'contractor' relationship rather than one of employment of the operator—this is known as 'sham contracting' (Gunasekara 2011). Therefore, 'contractors' (as opposed to employees) of larger businesses could be inadvertently excluding themselves from their superannuation entitlement and undermining an important pillar of Australia's retirement system (Gunasekara 2011).

However, there are provisions for contractors to be entitled to SGC if the contract is principally for labour, known as 'personal services income' (Australian Taxation Office 2017). Specifically, if someone derives their income from contracting labour, then by law they should be paid superannuation by the person(s) contracting them.

Furthermore, the Association of Superannuation Funds Australia (ASFA) has highlighted for many years the exclusion of the SGC has resulted in low superannuation balances for independent contractors (ASFA 2017). Using data from the Australian Taxation Office (ATO), this paper finds that during the 2014–15 period, only one-quarter of ICs made tax-deductible contributions to their superannuation accounts (ASFA 2017). As a result of this low contribution rate, the average superannuation balance for self-employed males was approximately $155,000 compared with $386,510 for male wage and salary earners. For self-employed women, it was $86,000 compared with $159,000 for female wage and salary earners (ABS 2014). The result of this finding maintained that, without SGC, self-employed people will have lower superannuation balances compared with employees across the entire age distribution (ASFA 2017). This research follows an earlier report by the Construction, Forestry, Mining and Energy Union (CFMEU) in 2011 which highlighted the issue by stating that 'avoidance of superannuation associated with sham contracting reduces workers'

retirement incomes and will result in a heavier reliance on taxpayer-funded pensions as workers with inadequate retirement income leave the workforce' (CFMEU 2011, p. 2).

In 2016, there were just over one million persons who were ICs with almost three quarters (72 per cent) of all ICs being males and more than half (55 per cent) aged forty-five years and over (ABS 2016). One third of ICs are in the construction industry. Taking into account that superannuation is an important source of private retirement savings in Australia and accounts for a significant proportion of household wealth, we hypothesise that self-employed tradespeople are disadvantaged compared with employed tradespeople in accumulating wealth for retirement. We use a logit model for each of the eleven asset classes as the dependent variable to determine the likelihood of ownership if a self-employed tradesperson, with a set of control variables. This analysis provides information as to how this cohort is making financial decisions in response to public policy (tax and superannuation) and the economic climate. It is an increasingly important issue to understand the financial implications of SGC exclusion given the rise in other types of IC work (e.g., that seen in the gig economy).

The remainder of this paper is organised as follows. The next section briefly reviews the literature on retirement savings and the related financial decisions of Australian households. The subsequent section explains the empirical methodology and the data used in the analysis. Finally, presentation of the results and a discussion of the findings is provided.

2. Literature review

Globally, household finance studies find overwhelming evidence to support the significance of age, gender, education, income and household structure on retirement decisions. For example, females are shown to have a higher probability of participating in a retirement savings plan (see, Huberman, Iyengar, and Jiang 2007; and Papke and Poterba 1995) while males are more active in managing retirement savings by making extra savings and choosing investment strategies (Mitchell *et al*. 2006). Higher levels of education and higher income are positively associated with voluntary retirement savings (see, Chatterjee and Zahirovic-Herbert 2009; and Gough and Niza 2011). Married couples are more likely to save for retirement due to having more resources and household production in comparison to single persons (Shuey 2004), but having dependent children reduces the funds available for saving due to the costs associated with raising children (Shuey and O'Rand 2006).

In Australia, research on retirement adequacy, voluntary contributions and other investment decisions of households is emerging. Burnett *et al*. (2013) use the Household, Income and Labour Dynamics in Australia (HILDA) Survey to estimate whether Australians are on track to achieve a comfortable standard of living in retirement. The amount needed to achieve a comfortable retirement was taken from the ASFA 2019 retirement standard benchmark, where an amount of $43,225 and $61,061 per year for singles and couples, respectively, was found (ASFA 2019). Burnett *et al*. (2013) found significant shortfalls in all projections, and some involving utilising additional sources of money and investments outside of superannuation. They found

half of the Australian population are expected to run out of savings before reaching their life expectancies, with approximately nine out of ten Australians expected to receive the age pension either partially or fully at some stage during retirement. On average, the age pension would still contribute to approximately 42 per cent of the target consumption level during retirement. The research concluded that, without any changes, Australians will continue to be heavily dependent on the age pension to fund their retirement (Burnett *et al*. 2013). Additional work on retirement adequacy conducted by Bianchi *et al*. (2016)—also using the HILDA Survey—found the adequacy of retirement savings in superannuation is especially low for Indigenous Australians and female employees. Recommendations to address this concern included increasing the SGC rate and provision of improved education to increase financial literacy skills.

An important study by Feng (2018) demonstrated that the compulsory superannuation system discourages voluntary contributions to superannuation funds. Feng (2018) surveyed employees and found participation rates in voluntary retirement savings as an addition to Australians' compulsory superannuation savings was substantially lower than countries with a purely voluntary direct contribution system. Those that did participate in voluntary savings were found to be older, financially secure individuals, as these individuals are able to afford more and, thus, are more likely to make additional savings. Non-participants in voluntary savings involved young, low-income earners, or workers without job stability who face affordability issues in retirement savings. Affordability issues were a result of competing saving priorities such as repaying debt for education, mortgages, or emergency savings, since superannuation preservation rules do not allow withdrawals except under very strict conditions. Additionally, tax incentives and retirement policies were also found to have a significant influence in participation decisions into superannuation. Higher-income earners had a higher chance of making substantially more voluntary pre-tax contributions into superannuation in order to reduce their tax liabilities. Alternatively, as owner-occupier properties do not attract capital gains tax at disposal and are exempt from the age pension asset test, housing was found to make a competing demand for funds as mortgagees and renters prioritise cash flows to properties instead of making voluntary contributions to superannuation.

Much of the household finance literature important for this study focuses on holdings of risky financial assets such as equities, as well as the interaction of risky asset holdings by those with other risks (e.g., uncertain income) such as business owners. Cardak and Wilkins (2009) used HILDA data to quantify the level of participation in equities by Australian households and found 44 per cent of households have direct holdings. However, Cardak and Wilkins (2009) found those with labour income uncertainty and health risks are less likely to directly own equities. In other contexts, age, home ownership and highest level of education attained are positively associated with risky asset holdings (see, Bertaut 1998; Bertaut and McCluer 2002; Guiso, Jappelli, and Terlizzese 1996; and Polkovnichenko 2005). Additionally, labour income risk was found to have a negative effect (Bertaut 1998). Additional factors associated with willingness to undertake more financial risk and invest in a broad range of asset classes include good health and couple households (Polkovnichenko 2005).

More recently, West (2017) used HILDA data to compare the equity ownership and equity portfolio share of baby-boomer households in the pre-retirement lifecycle phase and found the average level of equity investment and portfolio share of equities had declined over time. However, a detailed analysis showed that wealthier baby boomers had increased direct equity holdings in 2014, while lower-wealth baby boomers had reduced equity exposure. Higher levels of financial literacy and willingness to take financial risks were significant determinants of these financial decisions.

This brief overview of empirical literature shows a growing body of work emerging from household survey data on household financial decisions abroad, as well as retirement savings decisions in Australia. Tradespeople comprise one third of independent contractors and, thus, are an important labour market in the Australian economy. Although several studies investigate the retirement savings of Australians, much of this research samples individuals who are employees. There is a lack of academic research on the retirement savings of independent contractors in general, and self-employed tradespeople more specifically. This identified gap in the literature together with concerns raised by industry provided the impetus for this study.

3. Methodology

Our primary hypothesis is that, due to SGC exclusion, self-employed tradespeople have lower superannuation balances compared with employed tradespeople and, on this basis, we argue this cohort is financially disadvantaged. However, other asset classes may be used to smooth consumption in retirement and, therefore, we look more broadly across asset class holdings for greater insight. For tradespeople generally, it is predicted they attribute more portfolio weight to property assets due to familiarity with the property market and can easily utilise their own skills and tradesperson networks to improve property assets. For self-employed tradespeople, we expect to see higher portfolio weight to business assets. There may also be higher ownership of equities given the dominance of male tradespeople and the healthy literature on male financial risk-taking (see, West and Worthington 2018; Dvorak and Hanley 2010; and Hung *et al*. 2012).

We draw on the Life Cycle Hypothesis (LCH) to inform our sample selection. The LCH model is a prominent savings theory that suggests that where an individual is at in their life-cycle provides a predictable indicator of when individuals accumulate or divest assets to satisfy savings functions (Modigliani and Brumberg 1954). The model recognises that individuals needs change over the course of their lifetime and therefore assumes that the consumption and saving decisions of the household at each point of time reflects a conscious attempt at achieving a preferred distribution of consumption. When the savings of individuals over their life is modelled, a 'hump-shaped' pattern illustrates where wealth accumulation is low during youth and old age, and high during middle age.

There are three distinct phases: early career, accumulation, and post retirement. The early years (twenties to thirties) are characterised by relatively low earnings due to being early career, however their consumption is high as individuals cover expenses such as rent or mortgage payments. During this phase it is expected that individuals

will start with a negative savings rate as their income is expected to be lower than their consumption. People aged in their late forties to fifties are generally characterised by positive savings when incomes peak, and consumption is lower than income. During this period, individuals accumulate the most wealth, with saving for retirement being an important motive (Modigliani 1966). Post retirement, individuals are likely to have a negative savings rate again as income is drawn from the accumulated savings.

Therefore, the LCH model finds that age has the biggest influence on retirement savings behaviour over the life-cycle stages of an individual. Like many theories, however, the LCH omits heterogeneous human behaviour and circumstances. Empirical work in behavioural economics highlight deficiencies individuals have with retirement planning. For example, Benartzi and Thaler (2007) find that many people misjudge the amount needed for retirement and use simple heuristics when saving (Benartzi and Thaler 2007). Other people find themselves in positions of involuntary retirement due to health or economic downturns (Knox 2003). Further, part-time transitions to retirement were often needed but not planned, especially for blue-collar workers with physical jobs (Warren 2008).

Accordingly, it is highly likely that many tradespeople in the construction industry will retire at 65 and/or may switch to part time pre-retirement, thus earning less income. Following the assumption of the LCH where individuals' saving behaviour occurs during the accumulation phase (late forties and fifties), tradespeople have a shorter period of time to accumulate assets for retirement compared to other industries. For self-employed tradespeople in particular, exclusion from the SGC means that they face a shortened accumulation phase without the benefit of the compulsory superannuation savings safety net. In the event that self-employed tradespeople do not accumulate enough assets at retirement to self-fund consumption, they will defer to public pensions. On this basis, this study focuses on tradespeople in the accumulation phase, that is, aged 45 to 64.

We utilise the HILDA Survey as it is a nationally representative household-based longitudinal social and economic survey. HILDA aims to follow the initial sample in 2001 (Wave 1) which comprised 7,682 households and 13,969 individuals, with changes in their lives captured over time. Heady (2003) found that, when looking at household wealth, the Wealth Module of the HILDA Survey (Waves 2, 6, 10 and 14) provides a good source of household wealth data as it satisfactorily matches the national aggregate statistics from the Australian Bureau of Statistics and Reserve Bank of Australia (RBA). The wealth module survey questions relate to householders' assessments of their investment in eleven assets such as bank accounts *(BNK)*, cash investments *(CSH)*, equities *(EQT)*, superannuation *(SPR)*, cash-in values of life insurance policies (INS), trust funds *(TST)*, the family home *(HOM)* and other property *(OPR)*, business assets *(BUS)*, vehicles *(VEH)* and collectibles *(COL)*. We use a binary variable of ownership of assets in these asset classes as a dependent variable in eleven regressions. A description of asset classes provided in the Wealth Module and used for analysis in this study are provided in Table 4.2. We apply the population weights provided by HILDA.

Limitations exist in using the data collected from the Wealth Module. First, asset values are recorded at the household level, and not at the individual level. To

simplify the analysis, we ascribe the household asset values to the cohort of interest if one is identified in the household, but ignore financial contributions from other household members. We add household structure to the regression model as a control variable to help address this issue. Second, the accuracy of the data relies on respondents being able to correctly record their asset values. Third, only the total amount for the wealth variable is given, and no further details for each asset class (e.g., the data does not specify whether the superannuation fund is a self-managed superfund or SGC superannuation account) are provided. These limitations were identified in the study by Heady (2003), which found that surveys have issues regarding data quality and response rates relating to wealth data.

For ease of classification, this study defines 'tradespeople' as those individuals who work in the construction industry. A comparison of the HILDA data to the ABS data in 2010, based on Australia and New Zealand Standard Industrial Classification codes, shows that tradespeople in the construction industry represent 10 per cent of the working population, while the HILDA construction category is 8.43 per cent of the sample (ABS 2017). To distinguish self-employed and employed tradespeople, we use occupation type and employment type in the HILDA data. Accordingly, we use *SET* and *ET* to differentiate between self-employed tradespeople and employed tradespeople, respectively. The remainder of the population are named *OTHER*. Comparison to ABS data for independent contractors highlights some differences in the HILDA sample to the Australian census data. ABS data shows that 30 per cent of construction workers were independent contractors in 2016, while 48 per cent were classified as self-employed tradespeople in the HILDA sample, leaving 52 per cent as employed tradespeople. Accordingly, reconciliation of the ABS and HILDA data shows some minor differences which should be considered when generalising results.

Descriptive statistics in Table 4.1 provide an overview of the demographic and socio-economic characteristics of each of the self-employed tradespeople *(SET)* and employed tradespeople *(ET)* sample. Many of the variables have been recoded from the HILDA data into a smaller number of categories. We include age categories, level of educational attainment, income and household type. These set of characteristics are important as they are associated with wealth. For example, being older, having a high level of income and being a couple household are associated with higher levels of wealth (West 2017). To address this issue, we use these categories for control variables in the regression model.

The descriptive statistics presented in Table 4.1 show differences in the composition of the *SET*, *ET* and *OTHER* samples for those aged 45 to 64. Across the Wealth Modules spanning twelve years, there are 534 people in the *SET* category, 525 people in the *ET* category, and 18,118 people in the remaining *OTHER* category. For *SET*, approximately 28 per cent of the sample comprises 45 to 54 year-olds, 64.4 per cent have a vocational qualification, 36.1 per cent have a personal income between $20,000 to $49,999, and 62.7 per cent are in couple with children households. Conversely, the *ET* is younger, with 17.3 per cent aged 45-54, 52.4 per cent have a vocational qualification, 48.0 percent have an income between $20,000 to $49,999, and most are also in a couple with children household (57.0 per cent). Overall, the *SET* sample have higher levels of wealth than the *ET* sample, and twice as many people in

the highest wealth category (15.7 per cent compared with 8 per cent). Both *SET* and *ET* are mostly male (90.3 percent and 86.9 percent, respectively). For comparison, the typical person in the same age range in the *OTHER* category is female (55 percent), in a couple with children household (50.2 percent), has a school level qualification (40.5 percent), earns $20,000-$49,999 (33.4 percent) and has net wealth of less than $500,000.

We quantify the investment decisions first with an inspection of the descriptive statistics and then with a logit model that will analyse the direction and magnitude of the likelihood of investment in each asset class. The dependent variable in each set of regressions is the dummy variable for the asset class (i.e., for bank accounts, (1) if the respondent has more than $0 in *BNK*, else (0)). The logit individual-effects model specifies that:

$$\Pr(y_{it}=1 \mid x_{it}, \beta, \alpha\_i) = \Lambda(\alpha\_i + x\_it^{\wedge\prime} \beta) \qquad (3.1)$$

where α_i may be a fixed effects or a random effects estimator (Cameron and Trivedi 2009). In each model, the control variables of age (continuous), gender, household type, income and net wealth are included to control for known associations with wealth.

4. Results

We begin with an inspection of the average balances and portfolio share, noting the participation rates, presented in Table 4.2. Participation rates reflect the proportion of the population that have more than $0 in the asset class. There are notable differences in participation rates for the *SET* cohort, with higher rates for equities (45.71 per cent versus 35.81 per cent), trusts (5.00 per cent versus 2.03 per cent), family home (83.57 per cent versus 78.38 per cent), other property (41.43 per cent versus 32.42 per cent), businesses (57.14 per cent versus 6.08 per cent), and collectibles (17.86 per cent versus 10.14 per cent). Conversely, *ET* have marginally higher rates of ownership in superannuation (96.62 per cent versus 91.43 per cent) and insurance assets (12.84 per cent versus 9.29 per cent). In comparison to the remainder of the population, rates of superannuation ownership is slightly higher than *ET* (97.88 per cent), family home ownership is lower (70.07 per cent), other property ownership is lower (26.91 per cent), business ownership is lower than *SET* (16.88 per cent) and collectibles are lower (1.50 per cent). In Australia, participation rates are high for bank accounts and vehicle ownership (West 2017).

The mean balances for the asset classes show *SET* have higher average balances in many asset classes than *ET*. For example, *SET* have an average of $579,117 in family home assets and $642,225 in other property assets, compared with $488,928 and $544,774 for *ET*. *SET* also have an average of $82,685 invested in equities compared with *SET*s $74,957. Not surprisingly, *SET* have much higher average balances in businesses ($288,376 versus $200,556). An inspection of differences in average superannuation balances shows that *ET*s do have more favourable average

Table 4.1: Descriptive statistics of demographic and socioeconomic variables, aged 45-64

			SET			*ET*			*OTHER*		
			N	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*	*Mean*	*SD*
Age	45-54	AGE4	150	0.280	0.449	91	0.173	0.378	7,108	0.392	0.488
	55-64	AGE5	121	0.226	0.418	59	0.112	0.314	6,279	0.347	0.645
Gender	Female	FEM	52	0.097	0.297	69	0.131	0.338	9,958	0.550	0.498
	Male	MAL	482	0.903	0.297	456	0.869	0.338	8,160	0.450	0.050
Household type	Couple with children	CWC*	335	0.627	0.484	299	0.570	0.496	9,102	0.502	0.500
	Couple	CPL	113	0.212	0.409	128	0.244	0.429	4,496	0.248	0.432
	Lone parent	LPC	21	0.039	0.193	33	0.063	0.243	1,845	0.102	0.302
	Lone person	LNP	56	0.105	0.314	77	0.147	0.354	2,355	0.130	0.336
	Multiple family/other	MFO	6	0.011	0.106	4	0.008	0.070	312	0.017	0.130
Educational attainment	Degree and above	DEG	46	0.086	0.808	50	0.095	0.294	4,889	0.270	0.444
	Vocational qualification	VOC	344	0.644	0.479	275	0.524	0.500	5,887	0.325	0.468
	Year 11 and Year 12	Y12*	144	0.270	0.444	200	0.381	0.486	7,342	0.405	0.491
Income	Less than $19,999	INC1	64	0.120	0.325	25	0.048	0.332	4,176	0.230	0.421
	$20,00-$49,999	INC2	193	0.361	0.481	143	0.272	0.446	6,056	0.334	0.472
	$50,000-$99,999	INC3*	186	0.348	0.477	252	0.480	0.501	5,598	0.309	0.462
	Above $100,000	INC4	91	0.170	0.376	105	0.200	0.400	2,288	0.126	0.332
	Less than $500,000	NW1	221	0.414	0.493	283	0.539	0.499	8,580	0.474	0.499
Net Wealth	$500,000-$999,999	NW2	153	0.287	0.453	149	0.284	0.451	4,701	0.259	0.438
	$1,000,000-$1,499,999	NW3*	65	0.122	0.327	39	0.074	0.262	2,036	0.112	0.316
	$1,500,000 and over	NW4	84	0.157	0.364	42	0.080	0.272	2,331	0.129	0.335

balances (i.e., $292,785 compared with *SET*s average balances of $140,552). The mean balances for OTHER shows a high average for cash investments of $111,027, though a small participation rate (1.28 per cent). Average superannuation balances are lower than *ET* but higher than *SET*, at $188,351. Business asset values are also higher than *SET* and *ET*, at $397,791.

Statistical t-tests for difference in means for the eleven asset classes between *SET* and *ET*, *SET* and *OTHER*, and *ET* and *OTHER* provide insight, that is, that balances between the groups were not equal. Statistically significant differences were found between *SET* and *ET* for bank accounts (5 per cent level), cash investments (5 per cent level), superannuation (5 percent level), family home (1 per cent level), other property (5 per cent level), business (1 per cent level), vehicles (1 per cent level) and collectibles (5 per cent level). Between *SET* and *OTHER*, statistically significant differences were found between superannuation (1 per cent level), family home (1 per cent level), other property (5 per cent level), business (1 per cent level), vehicles (1 per cent level), and collectibles (5 per cent level). Between *ET* and *OTHER*, statistically significant differences were found between bank accounts (5 percent level), superannuation (5 per cent level), and business (1 per cent level). Accordingly, superannuation and business balances were statistically significantly different between all groups. *SET* had the most statistically significant differences in balances, providing support for further analysis of this unique cohort.

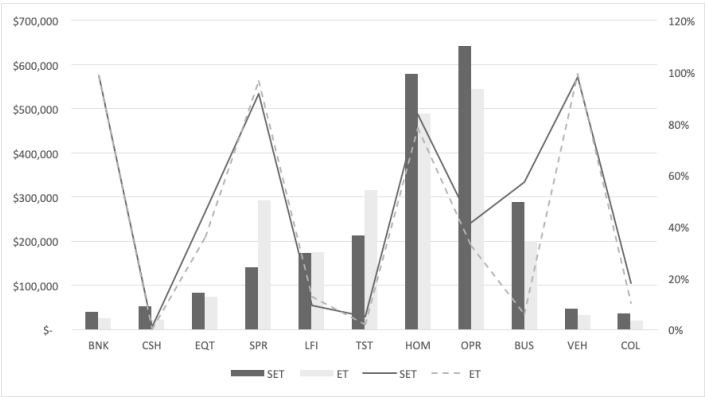
Similarly, we compare portfolio share of each asset class, being the ratio of the balance divided by total assets. For most households, the family home takes the largest proportion of the asset portfolio, for *SET* this is 43.78 per cent, for *ET* this is 37.40 per cent, and for *OTHER* this is 39.68 per cent. The next largest portfolio share for all households is superannuation, for *SET* this is 14.55 per cent, for *ET* this is 27.93 per cent, and for *OTHER* this is 26.29 per cent. For *SET*s, other property (11.05 per cent), business (10.19 per cent) and vehicles (10.19 per cent) follow superannuation. For *ET*, vehicles (13.49 per cent) and other property (8.93 per cent) follow superannuation. For *OTHER*, vehicles (9.58 per cent), other property (9.38 per cent) follow superannuation. Pearson chi-square tests of significance in proportions found positive results for business between *SET* and *ET*, no other asset classes were significantly different. Pearson chi-square tests with the *OTHER* category were not possible due to too many values.

Considering the unavailability in detailed asset data, we make two inferences from the relatively high average superannuation balances of *SET*s compared with *ET*s. First, *SET*s may have been employed previously and have thus accumulated some superannuation through their employment. Second, *SET*s are making voluntary contributions to superannuation, which may be through self-managed-super funds (SMSF). Given the 25 per cent growth in SMSFs in Australia since June 1994 to 2012, this is likely (Australian Prudential Regulation Authority, 2012). Assets held in SMSFs enjoy the same tax advantaged status as mainstream superannuation funds. Unfortunately, HILDA data does not provide disaggregated asset ownership data to provide more insight, and this is an avenue for future research. Figure 4.1 provides a graphical comparison of the participation rates and mean asset values between *SET* and *ET*.

Table 4.2: Participation rates and mean balances for each asset class, aged 45-64

		Self-Employed Tradespeople (SET)			*Employed Tradespeople (ET)*			*OTHER*		
Financial Assets	*Description*	*Participation Rate*	*Mean and (SD) ($)*	*Portfolio Share*	*Participation Rate*	*Mean and (SD) ($)*	*Portfolio Share*	*Participation Rate*	*Mean and (SD) ($)*	*Portfolio Share*
Bank Accounts (BNK)	Own, joint and children bank accounts	98.57%	39,331	5.44%	98.65%	25,731	6.66%	98.61%	35,135	6.59%
			(108,148)			(64,383)			(93,267)	
Cash Investments (CSH)	Bonds, debentures and certificates of deposit	0.71%	52,249	0.10%	0.00%	22,275	0.06%	1.28%	111,027	0.11%
			(66,082)			(27,270)			(186,095)	
Equity Investments (EQT)	Shares, managed funds and property trusts	45.71%	82,685	1.95%	35.81%	74,957	1.50%	39.39%	87,348	2.54%
			(327,315)			(341,088)			(300,606)	
Superannuation (SPR)	Includes retiree and non-retiree superannuation	91.43%	140,552	14.55%	96.62%	292,785	27.93%	97.88%	188,351	26.29%
			(305,717)			(247,091)			(324,603)	
Life Insurance (LFI)	Includes the cash-in value of redeemable insurance policies. Excludes policies only payable on death	9.29%	172,921	1.42%	12.84%	174,340	1.23%	8.16%	160,184	1.11%
			(359,728)			(409,107)			(331,347)	
Trust Funds (TST)	Total share of household wealth in trust fund	5.00%	213,661	0.51%	2.03%	315,282	0.34%	4.28%	330,411	0.59%
			(506,823)			(631,718)			(686,032)	
Family home (HOM)	Household share of the current value of main home	83.57%	579,117	43.78%	78.38%	488,928	37.40%	70.07%	589,570	39.68%
			(482,613)			(400,865)			(437,470)	
Other Property Assets (OPR)	Household share of current value of other property	41.43%	642,225	11.05%	32.43%	544,774	8.93%	26.91%	618,416	9.38%
			(945,697)			(650,027)			(748,662)	
Business Assets (BUS)	Business/farm assets owed by the household.	57.14%	288,376	10.28%	6.08%	200,556	1.74%	16.88%	397,791	3.37%
			(714,260)			(593,231)			(856,198)	
Vehicles (VEH)	Includes transport and recreational vehicles	97.86%	46,951	10.19%	99.32%	33,151	13.49%	95.30%	33,588	9.58%
			(58,986)			(38,505)			(47,074)	
Collectibles (COL)	Antiques, collectibles	17.86%	37,103	0.71%	10.14%	20,232	0.71%	1.50%	26,450	0.76%
			(90,390)			(48,234)			(59,624)	

Figure 4.1 Participation rates and average balances of asset classes (SET vs ET).



The results of the logit regressions are presented in Table 4.3. Model testing showed that the panel data specification is more suitable than a pooled data model (Wald $\chi 2$), and that the random effects specification is appropriate as the Breusch and Pagan Lagrangian multiplier (BPλ) rejects the null hypothesis of homescedasticity, as it confirms the independent variables are jointly significant. We report only on the significant coefficients.

First and unsurprisingly, with a high level of statistical significance, the results show that *SET*s are very likely to hold business assets (3.358), followed by other property (OPR) with a 61.1 per cent likelihood. However, *SET*s are very unlikely to have superannuation accounts (-0.948). In contrast, *ET*s are much more likely to have superannuation accounts (1.897) and vehicles (1.113), and less likely to have businesses (-0.815).

We draw together the regression results and descriptive statistics to provide three insights into the retired preparedness of *SET*s. First, we confirm our hypothesis that *SET*s have lower superannuation balances and are less likely to hold these accounts compared with *ET*s due to SGC exclusion. However, *SET*s have navigated this challenge by finding alternative investments. *SET*s have higher levels of wealth invested in their own businesses (BUS), family homes (HOM), other property (OPR) and equities (EQT). We conclude they are making preparations for retirement outside of SGC, but note that much of *SET* wealth is concentrated in risky assets, such as their own business and equities. *SET*s may rely on the sale of their business to support consumption in retirement. The wealth data illustrates that perhaps *SET*s diversify this risk by investment in the property market (family home and other property). As OPR was significant in the regression analysis we confirm our original inference that tradespeople are more likely to invest in other property due to familiarity with construction and the property market. Interviews with *SET*s may uncover the intentions and motivations behind these financial decisions more clearly and provide an opportunity for future research.

Table 4.3: Odds ratios and standard errors for the random effects logit models on asset ownership

	BNK	*CSH*	*EQT*	*SPR*	*LFI*	*TST*	*HOM*	*OPR*	*BUS*	*VEH*	*COL*
SET	0.090	0.330	0.092	-0.948	0.061	0.200	0.556	0.611	3.358	-0.298	0.131
	-0.200	-0.870	-0.440	(2.95)**	-0.270	-0.700	-1.790	(3.22)**	(16.18)**	-0.710	-0.690
ET	0.428	-1.219	-0.360	1.897	0.167	-0.144	-0.146	0.311	-0.815	1.113	-0.277
	-0.900	-1.610	-1.840	(3.31)**	-0.750	-0.440	-0.560	-1.690	(3.29)**	(2.16)*	-1.410
AGE	0.028	0.046	-0.038	-0.073	-0.041	-0.045	0.062	-0.009	-0.061	0.063	-0.007
	(2.24)*	(3.61)**	(6.07)**	(7.55)**	(5.51)**	(4.73)**	(7.42)**	-1.450	(8.81)**	(5.58)**	-1.270
FEM	0.324	-0.086	0.094	0.272	-0.157	0.048	0.495	0.210	-0.145	-0.116	0.065
	(2.10)*	-0.580	-1.080	(2.08)*	-1.670	-0.410	(4.07)**	(2.61)**	-1.580	-0.770	-0.880
CPL	-1.515	0.153	0.151	-0.857	0.051	-0.373	-0.906	0.392	-0.081	-1.332	0.534
	(7.26)**	-0.930	-1.770	(5.44)**	-0.530	(2.86)**	(7.24)**	(4.87)**	-0.880	(6.68)**	(6.82)**
LNP	-3.100	0.091	-0.934	-2.886	-0.777	-0.974	-3.666	-0.509	-1.050	-4.130	0.228
	(14.08)**	-0.400	(8.09)**	(15.96)**	(5.34)**	(4.48)**	(22.75)**	(4.52)**	(7.50)**	(15.72)**	(2.23)*
LPC	-1.167	-0.147	-1.088	-2.640	-1.004	-0.400	-2.589	-0.846	-1.769	-3.028	-0.243
	(4.21)**	-0.520	(8.61)**	(14.37)**	(5.97)**	-1.950	(16.43)**	(6.66)**	(10.20)**	(12.60)**	(2.06)*
MFO	-1.570	0.360	-0.959	-1.826	-0.381	-0.922	-4.118	-0.296	-0.267	-3.174	0.495
	(3.54)**	-0.720	(3.64)**	(5.62)**	-1.190	-1.690	(12.82)**	-1.140	-0.900	(8.47)**	(2.18)*
VOC	-0.112	0.083	0.152	0.757	-0.131	-0.153	0.476	0.242	0.084	0.500	0.333
	-0.670	-0.480	-1.640	(5.48)**	-1.280	-1.130	(3.77)**	(2.76)**	-0.850	(3.02)**	(4.07)**
DEG	0.050	0.335	0.675	1.582	-0.172	0.034	0.555	0.507	-0.231	0.094	0.778
	-0.240	-1.840	(6.26)**	(7.59)**	-1.490	-0.240	(3.60)**	(5.18)**	(2.04)*	-0.500	(8.56)**
INC1	-0.833	0.644	-0.455	-3.711	-0.080	-0.272	-0.646	-0.582	0.054	-1.016	-0.036
	(4.24)**	(3.30)**	(4.83)**	(18.46)**	-0.720	-1.780	(4.98)**	(6.28)**	-0.530	(5.87)**	-0.410
INC2	-0.482	0.449	-0.319	-1.772	0.087	-0.129	-0.345	-0.359	0.078	-0.322	-0.031
	(2.66)**	(2.58)**	(4.14)**	(9.36)**	-0.950	-1.030	(3.15)**	(4.77)**	-0.910	(2.05)*	-0.410
INC4	-0.140	-0.085	0.073	-0.802	-0.322	0.251	-0.157	0.106	-0.078	-0.179	0.049
	-0.550	-0.390	-0.720	(2.78)**	(2.73)**	-1.860	-1.000	-1.130	-0.720	-0.820	-0.520
NW1	0.132	-0.727	-1.200	-0.789	-0.726	-0.766	-2.093	-1.320	-1.112	-0.106	-0.189
	-0.830	(4.13)**	(16.48)**	(6.16)**	(8.07)**	(5.56)**	(19.51)**	(18.10)**	(12.96)**	-0.760	(2.68)**
NW3	0.461	0.641	1.180	0.879	0.482	0.909	1.172	1.010	0.328	0.726	0.104
	-1.600	(3.37)**	(11.87)**	(3.29)**	(4.41)**	(6.22)**	(6.02)**	(11.12)**	(3.10)**	(2.77)**	-1.090
NW4	-0.094	0.787	1.445	0.611	0.778	2.021	1.897	1.918	1.446	-0.090	0.212
	-0.360	(4.12)**	(13.46)**	(2.29)*	(6.92)**	(14.53)**	(8.20)**	(19.08)**	(13.52)**	-0.380	(2.19)*
CONS	5.822	-8.161	1.501	11.348	-1.138	-2.444	1.988	-1.298	0.465	4.773	-2.733
	(8.70)**	(11.72)**	(4.74)**	(19.29)**	(3.15)**	(5.05)**	(4.69)**	(4.34)**	-1.350	(8.11)**	(9.43)**
Insig2u	1.410	1.172	2.124	1.889	1.692	1.419	2.675	1.746	1.872	2.212	1.251
	(8.87)**	(6.53)**	(38.27)**	(19.53)**	(22.63)**	(13.04)**	(44.69)**	(30.61)**	(29.49)**	(15.96)**	(18.15)**
N	19,177	19,177	19,177	19,177	19,177	19,177	19,177	19,177	19,177	19,177	19,177
lnLR	-181.35	-135.62	-1,452.36	-400.01	-434.80	-778.59	-1,323.60	-1,316.45	-1,161.59	-368.87	-1,025.18
Wald $\chi 2$	61.200	33.560	312.680	109.400	120.770	110.510	674.470	426.010	834.490	91.300	33.800
	0.000	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.019
McFadden pseudo-R2	0.036	0.024	0.125	0.093	0.081	0.053	0.165	0.097	0.104	0.115	0.057
Cox and Snell pseudo-R2	-0.287	-0.278	-4.293	-0.693	-1.571	-0.626	-2.155	-3.302	-2.206	-0.617	-2.364

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5. Discussion

The goal of this study was to understand the retirement savings of self-employed tradespeople in the absence of compulsory superannuation contributions. This is important to policymakers because the lack of SGC coverage may disadvantage some cohorts and put strain on the public purse. Self-employed tradespeople face similar issues to that of people in the 'gig' economy, and on an aggregate level the financial implications for government can be extensive when people do not have access to retirement savings, sick leave, holiday leave, long service and other workplace entitlements taken for granted.

The results demonstrated that financial decisions were distinctly different between self-employed tradespeople and employed tradespeople. We found that the SGC exclusion for self-employed tradespeople was evident from the data, with the regression results showing they are highly unlikely to hold superannuation accounts. The low average superannuation balances shown in the descriptive statistics confirm prior research findings (ASFA 2017).

Instead of superannuation, self-employed tradespeople had higher likelihoods of investing more money in business assets and other property. We consider these asset classes as likely alternatives for SGC as retirement savings products. Self-employed tradespeople are therefore vulnerable to market conditions, regulatory change and taxation policy change regarding both their business and property assets. Furthermore, self-employed tradespeople may charge higher hourly wages than are paid to employed tradespeople, commensurate with risk assumed and missed entitlements. In addition to superannuation, self-employed tradespeople are excluded from annual leave, sick leave and redundancy payments (CFMEU 2011). Moreover, higher wages paid during the construction process contribute to increasing construction costs, which in turn feed into higher property prices (Kohler and van der Merwe 2015). Thus, this issue should be monitored and the wider impacts of SGC exclusion should be carefully considered by policymakers.

Suggestions for future research include investigation into the financial decision-making of cohorts also excluded from compulsory superannuation due to self-employment, like Uber drivers, Airbnb and other participants in the 'gig' economy. For self-employed tradespeople, interviews and focus groups on financial risk-taking would provide a more in-depth investigation into the vulnerabilities associated with this cohort and help inform public policymakers. Further investigation can also be achieved through use of other data sets, such as the recently available Australian Longitudinal Individuals File (Alife) by the Australian Tax Office.

Finally, in the context of the OECD nations, Australians are relatively wealthy and the self-employed tradesperson cohort in particular is not a cohort facing dire financial circumstances. Australia has the fourth highest mean net wealth when superannuation is excluded of the twenty-eight OECD states, behind that of Great Britain, USA and Luxembourg. When superannuation is included, Australia has the fifth highest mean net wealth, with Canada coming fourth place. While many Australians maintain a relatively good standard of living, over the last nine years household savings rates have steadily declined, from 8.87 per cent of disposable income

in 2008 to 3.51 per cent in 2017 (OECD, 2019). Similar declines have been observed in Canada, the United Kingdom, New Zealand, Portugal, Lithuania and Greece. Consequently, public policies like the superannuation guarantee scheme are necessary to provide households with a long-term investment and a safety net to provide a modest lifestyle in retirement. Given declining savings rates and the changing nature of work, reviews and analysis of superannuation efficiency and effectiveness is timely.

References

ASFA. (2019), 'The ASFA Retirement Standard (December 2012)', *Association of Superannuation Funds of Australia*. Retrieved from https://www.superannuation.asn.au/resources/retirement-standard

ASFA. (2017), 'Superannuation and the Changing Nature of Work: Discussion Paper', *ASFA Research and Resource Centre*. Retrieved from https://www.superannuation.asn.au/ArticleDocuments/359/1709_Superannuation_and_the_Changing_Nature_of_Work.pdf.aspx?Embed=Y

Australian Building and Construction Commissioner. (2010), 'Sham Arrangements and the Use of Labour Hire in the Building and Construction Industry: Discussion Paper', *Commonwealth of Australia*, Canberra. Retrieved from https://www.cfmmeu.org.au/sites/cfmeuvic-7-x.com.au/files/uploads/shamcontracting_%20racetothebottom_2011.pdf

Australian Bureau of Statistics. (2014), 'Survey of Income and Housing, 2013–14', *Unit Record File (Catalogue No. 6553.0)*.

Australian Bureau of Statistics. (2016), *'Characteristics of Employment, Australia', 2016 (Catalogue No. 6333.0)*.

Australian Bureau of Statistics. (2017), 'Labour force, detailed, quarterly, Nov 2017', *(Catalogue No. 6291.0.55.003)*.

Australian Prudential Regulation Authority. (2012), 'Quarterly Superannuation Performance Statistics', Retrieved from https://www.apra.gov.au/publications.

Australian Taxation Office. (2015), 'Taxation Statistics 2014–15', Retrieved from https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Taxation-statistics/Taxation-statistics---previous-editions/Taxation-statistics-2014-15/

Australian Taxation Office. (2017), 'Your Tax and Super Obligations', Retrieved from https://www.ato.gov.au/business/employee-or-contractor/your-tax-and-super-obligations/

Benartzi, S., & Thaler, R. H. (2007), 'Heuristics and Biases in Retirement Savings Behavior', *The Journal of Economic Perspectives*, 21(3), 81-104. doi:10.1257/jep.21.3.81

Bertaut, C. C. (1998), 'Stockholding Behavior of US Households: Evidence from the 1983–1989 Survey of Consumer Finances', *Review of Economics and Statistics*, 80(2), 263–275. doi:10.1162/003465398557500

Bertaut, C. C., & McCluer, M. S. (2002), 'Household Portfolios in the United States', *Household portfolios*, 181–217. Retrieved from https://www.federalreserve.gov/pubs/feds/2000/200026/200026pap.pdf

Bianchi, R. J., Drew, M. E., Walk, A. N., & Wiafe, O. K. (2016), 'Retirement Adequacy of Indigenous Australians: A Baseline Study', *Economic Papers: A Journal of Applied Economics and Policy*, 35(4), 359–374. doi:10.1111/1759-3441.12154

Burnett, J., Davis, K., Murawski, C., Wilkins, R., & Wilkinson, N. (2013), 'Measuring Retirement Savings Adequacy in Australia', *JASSA The Journal of Applied Finance*, 2013(4), 28–35. Retrieved from https://www.finsia.com/docs/default-source/jassa-new/jassa-2013/jassa-2013-issue-4/measuring-retirement-savings-adequacy-in-australia.pdf?sfvrsn=5

Cameron, C. A., & Trivedi, P. K. (2009), *Microeconometrics: Methods and Applications*, Cambridge University Press, Melbourne.

Cardak, B. A., & Wilkins, R. (2009), 'The Determinants of Household Risky Asset Holdings: Australian Evidence on Background Risk and Other Factors', *Journal of Banking and Finance*, 33(5), 850–860. doi:10.1016/j.jbankfin.2008.09.021

CFMEU. (2011), 'Race to the Bottom: Sham Contracting in Australia's Construction Industry', Report, March 2011. Retrieved from https://www.cfmmeu.org.au/sites/cfmeuvic-7-x.com.au/files/uploads/shamcontracting_%20racetothebottom_2011.pdf

Chatterjee, S., & Zahirovic-Herbert, V. (2009), 'Retirement Plan Participation in the United States: Do Public Sector Employees Save More?', *European Journal of Social Sciences*, 7(4), 30-40.

Chomik, R. & Piggott, J. (2016), 'Australian Superannuation: The Current State of Play', *Australian Economic Review*, 49(4), 483–493.

Dvorak, T., & Hanley, H. (2010), 'Financial Literacy and the Design of Retirement Plans', *The Journal of Socio-Economics*, 39(6), 645–652.

Feng, J. (2018), 'Voluntary Retirement Savings: The Case of Australia', *Journal of Family and Economic Issues*, 39(1), 2–18. doi:10.1007/s10834-017-9536-5

Gough, O., & Niza, C. (2011), 'Retirement Saving Choices: Review of the Literature and Policy Implications', *Journal of Population Ageing*, 4(1-2), 97. doi:10.1007/s12062-011-9046-4

Government of Western Australia Small Business Development Corporation. (2019), 'Business Advice: Trust'. Retrieved from https://www.smallbusiness.wa.gov.au/business-advice/business-structure/trust

Guiso, L., Jappelli, T., & Terlizzese, D. (1996), 'Income Risk, Borrowing Constraints, and Portfolio Choice', *The American Economic Review*, 158–172.

Gunasekara, C. (2011), 'Independent Contracting in Low Skilled, Low Paid Work in Australia', *International Journal of Employment Studies*, 19(1), 50–69.

Heady, B. (2003), 'How Best To Impute Taxes and Measure Public Transfers?', HILDA Project Discussion Paper Series No. 2/03, October, Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Huberman, G., Iyengar, S. S., & Jiang, W. (2007), 'Defined Contribution Pension Plans: Determinants of Participation and Contributions Rates', *Journal of Financial Services Research*, 31(1), 1–32. doi:10.1007/s10693-007-0003-6

Hung, A., Yoong, J., & Brown, E. (2012), 'Empowering Women Through Financial Awareness and Education', *OECD Working Papers on Finance, Insurance and Private Pensions*, 14. https://doi.org/10.1787/20797117

Knox, G. (2003), 'Retirement Intentions of Mature Age Workers', paper for the *Australian Social Policy Conference*, University of New South Wales, 9—11 July. Retrieved from https://melbourneinstitute.unimelb.edu.au/assets/documents/hilda-bibliography/conference-papers-lectures/2003/Knox_Retirement_intentions_of_mature_age_workers.pdf

Kohler, M. & van der Merwe, M. (2015), 'Long-run Trends in Housing Price Growth', *RBA Bulletin*, September 2015. Retrieved from https://www.rba.gov.au/publications/bulletin/2015/sep/pdf/bu-0915-3.pdf

McDonald, I. M. (2016), 'The Economics of Ageing: Introduction', *Australian Economic Review*, 49(4), 471–473. http://hdl.handle.net/10.1111/1467-8462.12191

Mitchell, O. S., Piggott, J., Sherris, M., & Yow, S. (2006), 'Financial Innovation for an Ageing World', *RBA Annual Conference Volume*, in: Christopher Kent & Anna Park & Daniel Rees (ed.), Demography and Financial Markets Reserve Bank of Australia.

Modigliani, F. (1966), 'The Life Cycle Hypothesis of saving, the demand for wealth and the supply of capital', *Social Research*, 33(2), 160-217. JSTOR, www.jstor.org/stable/40969831

Modigliani, F., & Brumberg, R. (1954), 'Utility analysis and the consumption function: An interpretation of cross-section data'. In: Kurihara, K.K., Ed., Post-Keynesian Economics, Rutgers University Press, New Brunswick, 388-436.

OECD (2019), 'Household savings (indicator)'. doi: 10.1787/cfc6f499-en

Papke, L. E., & Poterba, J. M. (1995), 'Survey Evidence on Employer Match Rates and Employee Saving behavior in 401(K) Plans', *Economics Letters*, 49(3), 313–317. doi:10.1016/0165-1765(95)00683-7

Polkovnichenko, V. (2005), 'Household Portfolio Diversification: A Case for Rank-Dependent Preferences', *The Review of Financial Studies*, 18(4), 1467–1502. doi:10.1093/rfs/hhi033

Shuey, K. M. (2004), 'Worker Preferences, Spousal Coordination, and Participation in an Employer-Sponsored Pension Plan', *Research on Aging*, 26(3), 287–316. doi:10.1177/0164027503262476

Shuey, K. M., & O'Rand, A. M. (2006), 'Changing Demographics and New Pension Risks', *Research on Aging*, 28(3), 317–340. doi:10.1177/0164027505285

Warren, D. (2008), 'Retirement Expectations and Labour Force Transitions: The Experience of the Baby Boomer Generation', *Melbourne Institute Working Paper Series* wp2008n24, Melbourne Institute of Applied Economic and Social Research, The University of Melbourne.

West, T. (2017), 'Equity Holdings of Australian Baby Boomers – Comparing Lifecycle Phases', *Financial Planning Research Journal*, 3(2), 87–109.

West, T., & Worthington, A. C. (2018), 'Synthesizing an Index of Financial Literacy Using Not-For-Purpose Survey Data', *Economic Notes: Review of Banking, Finance and Monetary Economics*, 47(2-3), 331–352. Retrieved from https://www.griffith.edu.au/__data/assets/pdf_file/0022/206446/FPRJ-V3-ISS2-pp87-109-equity-holdings-of-australian-baby-boomers-comparing-life-cycle-phases.pdf

Wilkins, R. (2016), 'The Hilda Survey: What's in it for Finance Researchers and Practitioners?' *JASSA The Journal of Applied Finance*, 3, 6–13. Retrieved from https://www.finsia.com/docs/default-source/INFINANCE/jassa-2016-iss-3-the-hilda-survey-pp-6-13.pdf?sfvrsn=0

Is there regional lock-in of unemployment rates in Australia?

Rohan Best Macquarie University
Paul J. Burke Australian National University

Abstract

This paper assesses the persistence of unemployment rates across Australian regions to see if there is evidence of sustained disadvantage for some Australian regions. Using Australian labour market data for statistical area level 4 regions over 1999–2018, the paper finds that lagged regional unemployment rates have substantial explanatory power for current regional unemployment rates. This effect lasts at least 19 years, even after controlling for factors such as average income levels and the industry structure of each region. There is strong persistence in the male unemployment rate across regions, a weaker effect for the female unemployment rate, and no observable effect for the youth unemployment rate. Lock-in effects are even stronger for participation rates. The results suggest that there is a potential role for well-designed place-based policies to combat persistent labour market disadvantages in some regions.

JEL Codes: E24, J60, R10, R38
Keywords: unemployment, participation; region, lock-in

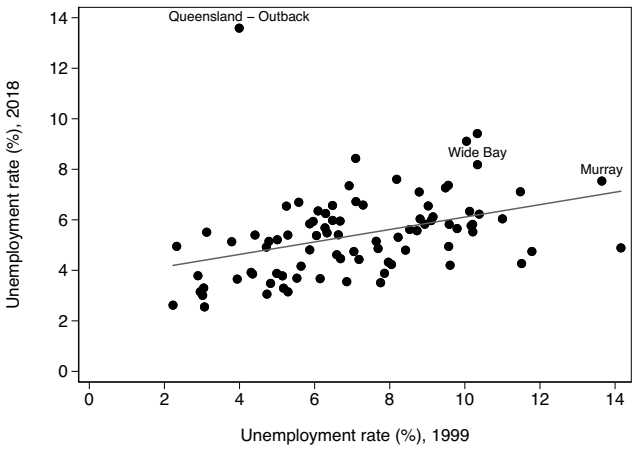
Address for correspondence: Rohan Best, Department of Economics, Macquarie University, NSW, 2109, Australia. Email: rohan.best@mq.edu.au. Acknowledgements: The authors are grateful for insights from Kai Everist and in the journal peer review process, together with financial support from the Australian Research Council (DE160100750).
Note: The online code is available from the authors.

1. Introduction

2019 saw Australia enter its 28th consecutive year without a technical recession, a run unprecedented among developed economies. Since 1998, the national unemployment rate has continuously remained below 8 per cent, averaging 5.6 per cent. Most Australians in the labour force have been able to find work. Yet Australia's labour market performance has not benefited regions uniformly. Among statistical area level 4 (SA4) regions, in 2018 Australia's annual average unemployment rates ranged from 2.6 per cent in Sutherland (Sydney) to 13.6 per cent in the Queensland Outback (ABS, 2019a). If there are persistent differences in unemployment rates across Australian regions, this would provide motivation for a renewed focus on how best to address regionally-concentrated pockets of disadvantage.

Relatively high persistence in unemployment rates across Australian regions is visible in Figure 1, which shows one dot for each of 87 Australian regions. The upward-sloping line of best fit shows a positive relationship between unemployment rates in 87 Australian regions measured nearly two decades apart, suggesting that there is a degree of geographical 'lock in' of unemployment rates. For some regions, such as the Murray region (New South Wales) and Wide Bay (Queensland), unemployment rates were relatively high in both 1999 and 2018. Only one region – Queensland Outback – has shifted markedly between relatively low and relatively high unemployment rates.

Figure 1: Annual average unemployment rates in 1999 and 2018 for the 87 statistical area level 4 (SA4) regions in Australia



Source: Based on ABS (2019a) data.

This paper examines the existence and size of lock-in effects in SA4-level labour market outcomes in Australia. The principal focus is whether relatively high regional unemployment rates persist over time, as would occur if they follow a long-

run autoregressive process. Strong lock-in would reflect geographical agglomeration of disenfranchised members of the working age population.[1] The analysis controls for a range of other factors that could affect regional unemployment rates.

In the 1970s, persistently high unemployment in Europe led to the study of the concept of hysteresis in unemployment: that the effects of previous shocks persist due to relatively fast increases, but slow declines, in unemployment rates. Blanchard and Summers (1986) suggested that unemployment hysteresis can result from disenfranchisement, and that wage adjustment often works to maintain the jobs of those currently employed rather than to bring unemployed labour into employment. Australian studies using national and state data find some evidence of hysteresis in unemployment rates, despite real wage flexibility (Flatau *et al*. 1991; Karunaratne 1995; Smyth 2003).

Large negative shocks have been found to lead to long-term unemployment, which reduces employability, raises welfare dependence, and may increase the social acceptability of being unemployed (Blanchard and Katz 1997; Martin 2012). Shocks from factors such as natural disasters have been found to have persistent economic impacts in other countries in the past (Cavallo *et al*. 2013; Best and Burke 2019). Long-term unemployment began to receive greater attention as a policy priority in Australia in the early 1990s (Chapman 1993a, Chapman 1993b; Lewis 1994). Long-term unemployment could contribute to regional lock-in of unemployment.

The extent of regional lock-in of unemployment rates in Australia is of relevance to debates about managing local economic transitions and about industry, population, and migrant settlement policy. The federal government, and state and territory governments, have made a number of disparate attempts to support regions experiencing high unemployment (Productivity Commission 2017). These have included support for local worker retraining and structural adjustment packages, as well as direct subsidies to encourage firms to remain in areas perceived to be at risk of high unemployment. For example, the Victorian government established a Latrobe Valley Authority following the 2017 closure of the Hazelwood coal-fired power station, and was joined by the federal government in various local spending initiatives (Burke *et al*. 2019). While this paper does not attempt to determine the effectiveness of such interventions, understanding the degree of lock-in in regional unemployment can inform decisions about the extent to which persistent regional disadvantage remains an issue under current policy settings.

Section 2 of this paper provides context and a framework to account for differences in regional unemployment. Section 3 describes the data and regression methodology. Section 4 presents the initial regression results, which are extended in section 5 by adding a series of control variables. Section 6 considers alternative labour market dependent variables. Section 7 provides analysis of subsets of regions

1 'Lock-in' is a term often used in the technology literature, for example lock-in of certain types of electricity generation technologies as a result of persistence emerging from institutions, technological systems, and natural resources (Unruh 2000). The labour economics literature also focuses on the characteristic of persistence when referring to lock-in, often specifically in relation to employment status following implementation of training programs (Fitzenberger and Speckesser 2007; Biewen *et al*. 2014; Doerr *et al*. 2017; Kruppe and Lang 2018).

and a brief case study of Wide Bay in Queensland, an area with a persistently high unemployment rate. Section 8 is the conclusion.

2. Context

International studies

Blanchard and Katz (1992) examined how long it takes for state unemployment rates to converge back to the national average following local employment shocks in the United States (US). Using a model that assesses joint fluctuations in rates of participation, employment, and unemployment, they found that effects of shocks typically dissipate over a period of five to seven years (Blanchard and Katz 1992). They concluded that this does not primarily occur because of recovery in the local economy but because workers leave the state in pursuit of employment opportunities elsewhere. In contrast, the effects of labour demand shocks on regional unemployment in Europe tend to disappear within four years, with changes in participation rates being a dominant adjustment mechanism (Decressin and Fatás 1995). If there is rapid shock dissipation, relatively short-term effects can be seen to be temporary deviations from long-run equilibrium.

Barriers to equilibrium adjustment processes would slow the process. For instance, Blanchflower and Oswald (2013) found that higher home ownership in US states is associated with a higher unemployment rate, possibly on account of reduced labour mobility. Existing residents may also have economic or social ties that slow movement and contribute to lock-in (Glaeser 2007). Dao *et al*. (2017) found that US interstate mobility in response to labour demand variation is not as high as previously thought, with declines in mobility since the early 1990s. Lower mobility should lead to heightened variation in unemployment rates across states. In contrast, Amior and Manning (2018) found evidence that high persistence of employment-population ratios across US regions is due to persistence in labour demand shocks rather than a lack of migration.

Australian context

Some studies have considered regional unemployment at the state/territory level in Australia. Using the Household Income and Labour Dynamics in Australia (HILDA) survey, Kishi and Kano (2017) found a negative relationship between state unemployment rates and the probability of finding permanent employment. Dixon and Shepherd (2011) analysed unemployment rate trends and found that Australia's larger states (Victoria, New South Wales, Queensland, South Australia, and Western Australia) have had similar labour market cycles. Tasmania, Northern Territory, and the Australian Capital Territory have exhibited more independent fluctuations in unemployment rates, as might be expected given that they are smaller jurisdictions. Around half or less of the variation in unemployment in Australian states is due to national effects (Shepherd and Dixon 2002), which leaves substantial scope for studies that focus on lower levels of aggregation. Dixon *et al*. (2001) found a negative correlation between the national unemployment rate and the relative dispersion of state unemployment rates, which suggests that regional variation may be of particular concern when national unemployment rates are low.

Studies of Australian states have found some evidence of persistence in unemployment rates. For example, Groenewold (1997) found that there are long-run equilibrium differences in unemployment rates across Australian states, and that only around half of the adjustment after a shock happens within the first five years. The study by Debelle and Vickery (1999) found evidence of persistent differences between state unemployment rates and that most of the interstate migration in response to labour demand differences occurs within the first four years. The implication of persistence in unemployment rates across Australian states is that there might be scope for greater government involvement to address ongoing labour market imperfections (Smyth 2003). However, a regionally-differentiated fiscal policy from the federal government could cause the unemployment rate to rise in regions receiving federal assistance if there is substantial migration to those regions (Groenewold and Hagger 2008).

Analysis of state-level unemployment rates does not address the issue of unemployment rate lock-in across Australian regional labour markets. Possible regional lock-in of unemployment rates could be caused by labour market adjustment channels (migration, for example) not being strong enough to make the effects of shocks uniformly dissipate over space. For context, statistical area level 4 mobility is approximately 6 per cent per annum, based on the average of departures divided by population in 2017 (ABS 2019b).

There are also some studies that focus on regional lock-in and related issues across regions within individual Australian states. Plummer and Tonts (2013) found evidence of persistence in regional unemployment rates in a study of Western Australia over 1984–2011 that split the state into 13 regions. Trendle (2002) found persistence in unemployment rates across Queensland regions. McGuire (2001) noted that there has been substantial migration to regions with high unemployment rates in Queensland, which highlights the importance of factors other than local labour market opportunities for migration decisions. These are likely to include climatic conditions and local amenities. In contrast to these studies, section 3 details how this paper analyses all 87 regional labour markets ('SA4 regions') across Australia.

Other contributing factors

The sectoral composition of regional economies could influence labour market dynamics. For instance, industrial specialisation could contribute to more efficient labour markets if close proximity of many firms within an industry promotes transmission of knowledge. Alternatively, diversity could spur greater innovation (Beaudry and Schiffauerova 2009). Bradley and Gans (1998) found a negative effect of the government employment share on labour force growth. Whilst the authors noted that this effect could be limited to their period of investigation (1981–1991), it does confirm that sectoral employment composition can be important for labour market outcomes. Employment changes in cyclical sectors such as mining can exacerbate shortages of skilled labour in boom periods (Garnett 2012). There can be either positive or negative indirect effects on employment in non-mining sectors (Fleming *et al*. 2015).

Industries demanding more highly educated workers may have more stable employment patterns, which is one of the reasons why higher education may be

associated with lower unemployment rates (Elhorst 2003). Kishi (2014) found positive effects of education on a binary employment variable in Australia. Similarly, Trendle (2002) found that Queensland regions that have a higher proportion of their population holding at least a bachelor degree have lower rates of unemployment. Other socio-demographic characteristics – such as the proportion of Indigenous Australians – may also affect regional labour market differences (Altman and Daly 1995; Biddle and Hunter, 2006).

Vega and Elhorst (2016) note that analyses of regional unemployment rates may need to account for spatial dependence and control for common factors to avoid biased inference. This approach is used in this paper. Section 3 goes on to explain the estimation approach, including the use of a spatial autoregressive model and climate zone binary variables as controls. The focus is on the dependence of SA4 unemployment rates on their medium-run lagged values.

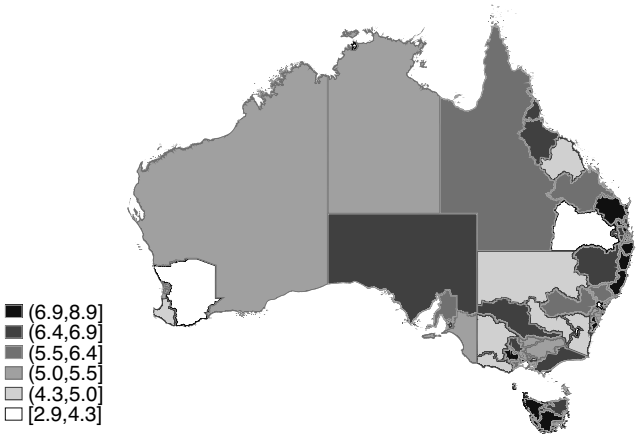
3. Data and methodology

Data

The primary dataset analysed in this paper is the December 2018 release of the ABS Labour Force Survey (ABS 2019a). This is a survey of around 26,000 dwellings conducted each month by the ABS. Data organised by statistical area level 4 (or SA4) region are used. Each region tends to have between 100,000 and 500,000 residents: between 100,000 and 200,000 in regional areas and between 300,000 and 500,000 in metropolitan areas. SA4 labour force data are based on where people live, not where they work. Regional boundaries have been designed by the ABS (2011) to ensure that a large proportion of people live and work within the same SA4 region, especially outside large cities. The sample period is 1999–2018, as the SA4 unemployment rates are available from October 1998.

Figure 2 provides a map of Australia's SA4 regions, showing average unemployment rates over January 1999–December 2018. SA4 regions in regional areas tend to be large in geographic area. The map suggests some degree of clustering of high-unemployment regions. There have been relatively high average unemployment rates in Tasmania and areas including coastal regions of northern New South Wales and southern Queensland. Most states have regions with low unemployment rates, such as Sydney – Baulkham Hills and the Hawkesbury region (New South Wales), Melbourne – Outer East (Victoria), Darling Downs – Maranoa (Queensland), and the Wheat Belt (Western Australia). At any point in time there is a wide divergence in unemployment rates within Australian states. For example, year-2018 annual average unemployment rates in NSW ranged from 2.6 per cent in Sydney – Sutherland to 9.1 per cent in Coffs Harbour – Grafton. Variation within states motivates analysis at the regional level.

Figure 2: Average unemployment rate for each SA4 region, January 1999–December 2018



Notes: Based on ABS (2019a) data. SA4 boundaries are based on 2011 definitions, which match the boundaries for the unemployment rate data.

Methods

The primary method is ordinary least squares (OLS) regression using an SA4 region's early-period unemployment rate to explain its current unemployment rate. In addition, a generalised spatial two-stage least squares approach is used to control for potential spatial correlations. The basic form of the estimation model is:

$$U_L = c + \alpha U_E + X' \beta' + \varepsilon$$

where U_L is an SA4's later-period unemployment rate, c is a constant, U_E is its early-period unemployment rate, X is a vector of controls, and ε is an error term.

The intuition behind this model is that the coefficient on U_E will measure the extent to which regions that had relatively high unemployment rates in year E (the early year) continue to have relatively high unemployment rates in year L (the later year). This measures the 'lock-in' effect. In a bivariate regression with no controls, $\alpha = 1$ would imply complete lock-in, meaning the unemployment rate in each region in year L is exactly equal to the year-E unemployment rate plus the average SA4-level change in the unemployment rate (given by c). $\alpha = 0$ would imply no lock-in, that is no observable relationship between a region's unemployment rate in years E and L.

If consecutive years were selected for analysis, one could expect a strong relationship between lagged and current unemployment rates, indicated by a relatively large coefficient on U_E. The consideration of longer periods allows more opportunity

for adjustments to any initial unemployment rate differential to occur. Blanchard and Katz's (1992) vector auto-regression findings for the US suggest one might not expect a statistically significant coefficient when years E and L are more than around five years apart.

The X control vector includes industry structure percentages from the ABS 'Data by region' portal (ABS 2019b). Industry structure variables are important in part because technological progress has made it more difficult to get a job in some low-skill industries in Australia over recent decades (Garnett 2018). Regions that have a large number of people employed in the same sector may experience different degrees of lock-in (for example because of different skillsets among workers). The industry structure variables include the percentages of the labour force employed in each of the five largest sectors: health care, retail trade, manufacturing, construction, and education. State binary variables are included in the X vector to control for state-level heterogeneity (for example due to legal or institutional arrangements).

The paper also explores the use of socio-economic controls. These include the log average income in the region, the share of the population with post-school education, and the region's early-year labour force participation rate (ABS 2019a).[2] Robustness tests also include other variables, including the log of the mean sale price of detached dwellings so as to control for wealth effects. These controls help to reduce the risk of omitted variable bias. Further, differences in effects for Greater Capital City Statistical Areas according to the 2011 Australian Statistical Geography Standard can be assessed. There are 46 capital city SA4s and 41 non-capital city SA4s in the dataset.

While SA4 regions were designed by the Australian Bureau of Statistics (ABS) to represent regional labour markets, in urban areas there is considerable commuting across SA4 boundaries for work. This paper also uses generalised spatial two-stage least squares estimation to consider unobserved correlated factors that vary across neighbouring SA4s. Specifically, a spatial-autoregressive approach is used for some estimates to control for unemployment rates in neighbouring SA4s. The spatial weighting matrix gives an equal positive weight on the neighbouring SA4 unemployment rate for all contiguous spatial regions.

The cross-sectional approach adopted in this paper is suitable for the primary aim of testing for long-term persistence in labour market outcomes. The method allows us to assess long-term impacts without the risk of short-term noise in the data being influential. It also avoids time-series problems of serial correlation in error terms that may arise when using annual data. Correlation of error terms over time is not possible in cross-sectional models, as error terms only exist for single time periods.

The labour force survey data are based on a multi-stage area sample of persons aged 15 or more from the Australian civilian population. Households are surveyed for eight months, with one-eighth of the sample being replaced each month. The use of flexible survey collection techniques helps the ABS to reduce the risk of spatial correlations in the measurement error as a result of non-participation in some areas,

2 Post-school education includes all educational attainments other than pre-primary, primary, or secondary education. Examples include Bachelor Degrees, Diplomas, and Certificate Level IV (ABS 2019b).

with information being obtained from participants by either self-completion online or by telephone. Any measurement issues related to specific individuals would thus have only a temporary effect, and would tend to be averaged out. The Australian Labour Force survey has a response rate of approximately 92 per cent, higher than in many other countries (ABS 2019c).

In line with ABS advice, the use of annual averages of unemployment rates in this paper helps to reduce the risk of unrepresentative surveys in particular months. Nevertheless, it is not possible to fully rule out the case that regional lock-in effects at least in part pick up persistence in region-level measurement error in the ABS Labour Force Survey (2019a). The results should be interpreted with this caveat.

4. Initial results

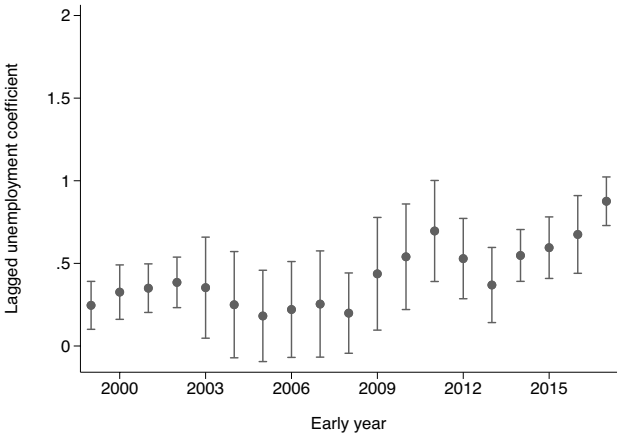
The initial specification is a simple regression that explains the unemployment rate in each SA4 region in 2018 (U_{2018}) using the region's unemployment rate in 1999 (U_{1999}) and no controls:

$$U_{2018} = c + \alpha U_{1999} + \varepsilon$$

This initial regression returns an estimated coefficient of α = 0.25 (standard error 0.075), which is statistically different from zero at the 1 per cent level. The regression R^2 is 0.14. This simple regression suggests a lock-in effect over a period of 19 years, longer than the time-frame in the state-level study of Blanchard and Katz (1992) for the US.

To test whether this effect exists more generally, the initial regression is repeated by varying the early year, holding the late year at 2018. The estimation coefficients and 95 per cent confidence intervals are plotted in Figure 3. The regression coefficient is similar for all years until 2008, and increases noticeably for the period 2009–2018. These results suggest that there is a lock-in effect lasting up to two decades or longer, with the effect being strongest for more recent years. It is possible that the global financial crisis (GFC), which was most acute in 2009, could have influenced this story, although the GFC was less pronounced in Australia compared to many other developed countries.

Figure 3: Regression coefficients and 95 per cent confidence intervals



Notes: The dependent variable is the unemployment rate in 2018. The independent variable is the unemployment rate in each early year.

5. More fully-specified estimates

Addition of controls

This section considers the addition of variables to the regression equation to control for unobserved factors that may affect regional unemployment rates. Model 2 includes state dummies, and the industry structure variables are included in model 3.[3] Model 4 also includes socio-economic variables such as the log of average income and the share of the regional population with post-school qualifications, as well as the year-1999 participation rate.

The socio-economic and industry structure variables are measured as at 2011, the earliest available date for the SA4 level. Ideally, all control variables would be measured at the initial time of 1999, but unfortunately data are not available for some variables in this early year. However, additional robustness tests (see online code) consider the effect of different timings of these variables. Using income and education variables measured as at the 2016 census does not have a major impact on the results, suggesting that the precise timing of these variables may not be crucial.

The unemployment rate results are again estimated using 1999 as the early year and 2018 as the later year when including the additional controls, such as the industry structure variables. Table 1 displays the results. Robustness tests in the online code control for other key sectors that vary substantially across SA4 regions, such as agriculture and mining.

3 State-specific dummy variables also cover territories. All states/territories except the ACT contain more than one SA4 region, with NSW having the most at 28.

Table 1: Regression results explaining 2018 unemployment rate

	Model 1	*Model 2*	*Model 3*	*Model 4*
1999 unemployment rate	0.246*** (0.075)	0.240*** (0.077)	0.205*** (0.059)	0.143* (0.072)
New South Wales		0.891*** (0.242)	0.160 (1.063)	0.370 (1.243)
Victoria		0.670** (0.254)	-0.160 (1.288)	0.055 (1.408)
Queensland		2.431*** (0.627)	1.860 (1.405)	1.811* (1.085)
South Australia		1.039** (0.437)	0.043 (1.354)	0.052 (1.240)
Western Australia		2.047*** (0.423)	1.546 (1.016)	1.613 (1.186)
Tasmania		1.229*** (0.308)	0.617 (1.150)	0.191 (1.095)
Northern Territory		1.239** (0.613)	1.236 (0.757)	0.078 (0.714)
Health			0.047 (0.147)	0.092 (0.173)
Retail			0.079 (0.309)	-0.365 (0.465)
Manufacturing			0.075 (0.099)	0.025 (0.140)
Construction			-0.117 (0.115)	0.015 (0.164)
Education			-0.153 (0.164)	-0.045 (0.151)
Log income				-1.590 (2.402)
Post-school education				-0.067 (0.087)
Participation rate, 1999				-0.043 (0.050)
R^2	0.143	0.315	0.340	0.419

Notes: ***, **, * show statistical significance at 1, 5 and 10 per cent level respectively. Robust standard errors are in brackets below the coefficients. Coefficients are not shown for constants. The state/territory variables are binary. The industry structure variables are the percentages employed in each industry in 2011, the earliest year available at the SA4 level. Model 1 and 2 have 87 observations. Model 3 and 4 have 86 observations based on availability of census data.

In model 2, each of the state binary variables are significantly different from the omitted variable for the Australian Capital Territory at the 5 per cent level. In model 3, none of the industry share coefficients are statistically significant. The 1999 unemployment rate coefficient is still positive and significant at the 1 per cent level for

models 2–3 with additional controls, and with a similar magnitude to model 1. This suggests the results are not substantially influenced by state-specific factors or the industry structure in particular regions. The unemployment rate coefficient declines in magnitude and significance when controlling for socio-economic variables in model 4, but remains positive and significantly different from zero at the 10 per cent level.

Further robustness tests

Results are similar in a number of robustness tests, including approaches to address possible spatial correlations. For instance, similar results are obtained using generalised spatial two-stage least squares estimates instead of ordinary least squares, as shown in Table 2. Models 1–3 show positive coefficients for the spatial autoregressive terms (that is, higher unemployment rates for neighbours having a positive effect), although these are not statistically significant. An alternative approach of controlling for seven climate zone variables also does not have a substantial effect on the lock-in relationship (results available in the online code). Results are also similar when controlling for outward migration divided by population in 2017, the log of average house price (excluding attached dwellings), and when using 2016 data for income and education rather than 2011 data. Further robustness tests in the online code account for population size. The unemployment-rate lock-in coefficients from Table 1 are similar when controlling for the log of the working-age population size.

Table 2: Spatial-autoregressive regression results using the 2018 unemployment rate

	Model 1	*Model 2*	*Model 3*	*Model 4*
1999 unemployment rate	0.249***	0.242***	0.197***	0.155*
	(0.064)	(0.062)	(0.076)	(0.083)
Spatial autoregressive term	0.097	0.122	0.092	-0.101
	(0.093)	(0.086)	(0.088)	(0.104)
State dummies	No	Yes	Yes	Yes
Industry structure	No	No	Yes	Yes
Socio-economic variables	No	No	No	Yes

Notes: ***, **, * show statistical significance at 1, 5 and 10 per cent level respectively. Standard errors are in brackets below the coefficients. Coefficients are not shown for constants. There are 86 observations in each case. The spatial autoregressive term shows the effect of the unemployment rate in neighbouring SA4s in 2018 on the dependent variable based on a weighting matrix that assigns the same positive weight to each contiguous SA4 and zero otherwise.

To test whether lock-in effect exists for different sub-groups, separate regressions were conducted for the male unemployment rate, female unemployment rate, and the youth (under 25) unemployment rate. The results are presented in Table 3, and suggest that effects are particularly sizeable for the male unemployment rate.

The larger lock-in effect for males might be because other groups (female or youth) are more likely to move in and out of the labour force. The youth cohort may also be more mobile. The standard errors are largest for the youth unemployment rate, indicating estimates that are less precise.

Table 3: 1999 unemployment rate coefficient for male, female, and youth groups

Group	*Model 1*	*Model 2*	*Model 3*	*Model 4*
All	0.246***	0.240***	0.205***	0.143*
	(0.075)	(0.077)	(0.059)	(0.072)
Males	0.252***	0.270***	0.279***	0.215***
	(0.070)	(0.077)	(0.068)	(0.080)
Females	0.224***	0.200**	0.088	0.046
	(0.080)	(0.079)	(0.067)	(0.081)
Youth	0.126	0.073	-0.092	-0.140
	(0.100)	(0.103)	(0.102)	(0.098)
State dummies	No	Yes	Yes	Yes
Industry structure	No	No	Yes	Yes
Socio-economic variables	No	No	No	Yes

Notes: ***, **, * show statistical significance at 1, 5 and 10 per cent level respectively. Robust standard errors are in brackets below the coefficients. Coefficients are not shown for constants. These are separate regressions for each group. The dependent variable is the respective unemployment rate in 2018.

Lock-in effects may differ between major cities and the rest of the country. If people in urban areas find it easier to travel across SA4 boundaries and/or relocate to a different region in order to find work, lock-in effects for these areas may be smaller. However, if there are entrenched inequalities within urban areas, lock-in effects may instead be larger. Restricting the sample to only the 46 capital-city regions results in a finding of positive and significant lock-in effects for models 1–3 in Table 4, although not model 4. The equivalent non-capital city coefficients are positive but not significant. The online code also shows that an interaction term between the capital city binary variable and the lagged unemployment rate is positive and significant for models 1–3 in a full sample estimate. Lock-in effects thus seem to be larger across SA4 regions in major urban centres.

Table 4: 1999 unemployment rate coefficient for capital city and non-capital city sub-samples

Sub-sample	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Capital cities	0.530***	0.456***	0.215**	0.104
	(0.064)	(0.079)	(0.105)	(0.121)
Non-capital cities	0.031	0.053	0.153	0.162
	(0.125)	(0.139)	(0.152)	(0.224)
State dummies	No	Yes	Yes	Yes
Industry structure	No	No	Yes	Yes
Socio-economic variables	No	No	No	Yes

Notes: ***, **, * show statistical significance at 1, 5 and 10 per cent level respectively. Robust standard errors are in brackets below the coefficients. Coefficients are not shown for constants. These are separate regressions for both the 46 capital-city regions and the 41 non-capital-city regions.

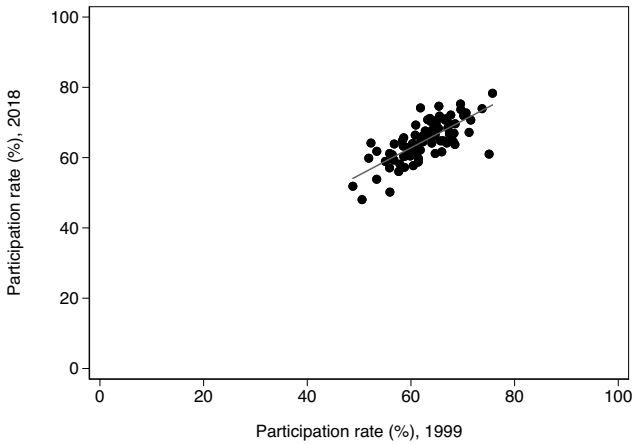
6. Alternative dependent variables

There are strong reasons to expect a regional lock-in effect for the labour force participation rate. A key one is that it is possible that those who are less committed to labour force participation choose locations based more on amenity and cost of living rather than expected wages. Sources of amenity are likely to include nice weather and coastal frontages. Coastal locations have indeed been associated with strong population growth (Garnett and Lewis 2007). There might also be demographic differences that themselves persist and that cause persistent differences in participation rates.
Using the same functional form, the results for the labour force participation rate are:

$$P_{2018} = 16.24 + 0.78P_{1999}$$

The coefficient on P_{1999} has a standard error of 0.10 and the regression has an $R^2 = 0.55$. The data points and the fitted regression function from the initial regression are plotted in Figure 4.

Figure 4: SA4 annual average participation rates in 1999 and 2018



Source: Based on ABS (2019a) data.

Consistent with expectations, there is a much stronger regional lock-in effect for participation rates than unemployment rates. Table 5 gives the results for participation rate lock-in effects, using 1999 as the early year. The magnitude of the lagged participation rate variables declines when the extra controls are added, but remains at 0.6 or above. Results are similar when controlling for climate zone. Lagged participation rates remain positive and significant at the 1 per cent level for each early year from 1999–2017 when controlling for state and industry structure variables, along with log income and the post-school education share.

Table 5: 1999 participation rate coefficients explaining 2018 participation rate

	Model 1	*Model 2*	*Model 3*	*Model 4*
1999 participation rate	0.776***	0.758***	0.698***	0.623***
	(0.100)	(0.118)	(0.120)	(0.130)
State dummies	No	Yes	Yes	Yes
Industry structure	No	No	Yes	Yes
Socio-economic variables	No	No	No	Yes

Notes: ***, **, * show statistical significance at 1, 5 and 10 per cent level respectively. Robust standard errors are in brackets below the coefficients. Coefficients are not shown for constants. The state/territory control variables are binary. The industry structure variables are the percentages employed in each industry. Model 1 and 2 have 87 observations. Model 3 and 4 have 86 observations based on availability of census data.

Repeated regressions with the participation rate for each early year from 2000–2017, again holding 2018 as the later year, show results for all years being consistent with those for 1999 (lagged participation-rate coefficients at or above 0.5), and the coefficients approaching one as the early year approaches 2018. The proportion of variation explained by the lagged participation rate is high and relatively consistent for each early year, and becomes even higher over the five most recent years (see the online code). The high proportions of explained variation suggest that unobserved differences may not be a major concern.

There are also similar results to those in Table 1 using a dependent variable measured as the number of unemployed persons divided by the population (using data for the civilian population aged 15 and over). This is in contrast to the primary approach of using the size of the labour force as the denominator.

7. Subset and case-study analysis

This section focuses on comparing regions with a persistently high unemployment rate with regions with a persistently low unemployment rate. The section also considers a case study of the Wide Bay statistical area in Queensland. The motivation for these analyses is to go deeper than what the full-sample analysis allows.

Subset analysis

Regions can be classified as:

- Those with a persistently high unemployment rate: regions that had an unemployment rate that was above the median for SA4 regions in every year from 1999–2018.
- Those with a persistently low unemployment rate: regions that had an unemployment rate that was below the median for SA4 regions in every year from 1999–2018.
- Others.

Using these definitions, six of the 87 SA4 regions have had a persistently high unemployment rate (Table 6). These six regions were distributed across five states. Four were in greater capital city areas, while two were elsewhere. Eight other regions have had unemployment rates above the median in at least 18 out of the 20 years. This includes four in greater capital city areas and four outside of greater capital city areas.

Table 6: SA4 regions with unemployment rates above or below the median in each of the 20 years to 2018

Above-median unemployment rates in every year from 1999–2018	*Below-median unemployment rates in every year from 1999–2018*
Sydney – South West	Sydney – Baulkham Hills and Hawkesbury
Melbourne –West	Sydney – Eastern Suburbs
Logan – Beaudesert	Sydney – North Sydney and Hornsby
Wide Bay	Sydney – Northern Beaches
Adelaide – North	Sydney – Sutherland
Tasmania –West and North West	Melbourne – Inner South
	Melbourne – Outer East
	Brisbane – Inner City
	Darwin
	Australian Capital Territory

Notes: There are also 8 regions that had unemployment rates above the median in at least 18 of 20 years. These regions were: Central Coast, Mid North Coast, Richmond – Tweed, Melbourne – North West, Moreton Bay – North, Sunshine Coast, Mandurah, and Launceston and North East.

There were 10 regions with a persistently low unemployment rate. These were predominantly in the large cities of Sydney and Melbourne. The list includes regions in the inner-city (Melbourne – Inner South, for example) as well as city-fringe areas (Sydney – Baulkham Hills and Hawkesbury, for example). There were also regional and remote areas that had unemployment rates below the median in at least 18 of 20 years (Darling Downs – Maranoa and Western Australia – Wheat Belt).

Table 7 compares characteristics of the two types of regions. The regions with a persistently high unemployment rate over 1999–2018 had a faster average rate of population growth, consistent with the idea that good employment prospects are not the only reason for driving regional population growth differentials. The level of income was substantially higher in the regions with persistently low unemployment rates on average. Public-sector and education-sector employment levels are lower in the regions with persistently high unemployment rates compared to regions with persistently low unemployment rates. Income growth and net migration levels are quite similar between the two types of regions.

Table 7: Characteristics of locked-in regions

Characteristic	*Persistently high unemployment rate*	*Persistently low unemployment rate*
Unemployment rate 1999	10.2	4.1
Unemployment rate 2018	7.0	3.4
Population growth	43.4	30.7
Income level 2016 ($'000)	51.2	80.1
Income growth	17.3	19.0
Inward migration	6.2	8.6
Outward migration	5.1	7.6
Public-sector employment 2011	6.1	9.6
Public-sector employment 2016	5.7	9.1
Education employment 2011	6.8	8.5
Education employment 2016	7.6	9.1

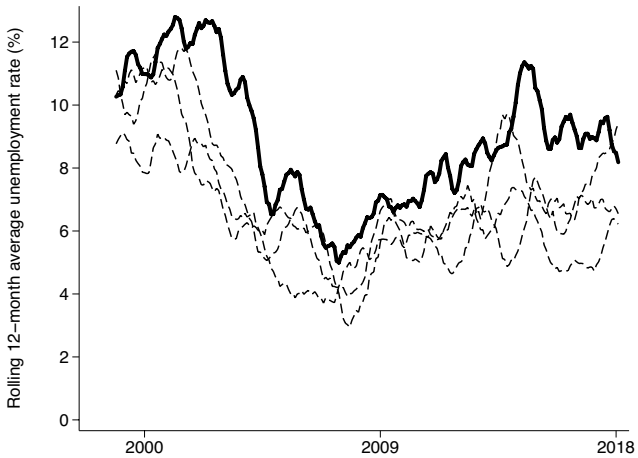
Notes: Values are percentages except for income level, which is in thousand dollars. Income growth is from 2011–2016. Population growth is from 1999–2018. Migration is a share of the total population in 2017. There were six regions with a persistently high unemployment rate and 10 with a persistently low unemployment rate, as listed in Table 6. Data are from the ABS (2019a; 2019b).

Case study: Wide Bay statistical area

Wide Bay is the statistical area to the north of the Sunshine Coast in Queensland. It includes the regional centres of Bundaberg, Maryborough, and Hervey Bay. Major industries of employment are health, retail, and agriculture. The region has a lower share of people in the 20–44 age group compared to the state and national averages, but an above-average proportion in the age group of 45 and above (Neville 2013).

There has been consistently high unemployment in Wide Bay over the last few decades. Wide Bay was the single worst performing labour market region in 5 of the 20 years since 1999 and has been in the quintile of worst-performing regions in every year except one. Figure 5 shows that the rolling 12-month unemployment rate has usually been above the corresponding rates in the nearby regions of Fitzroy (Gladstone and Rockhampton), the Sunshine Coast, and Moreton Bay – North.

Figure 5: Rolling 12-month average unemployment rate for Wide Bay and nearby regions



Notes: Rolling 12-month average unemployment rate for Wide Bay (bold and solid line) and regions near Wide Bay: Fitzroy (Gladstone and Rockhampton), the Sunshine Coast, and Moreton Bay – North (dashed lines). Based on ABS (2019a) data.

There are a number of possible explanations for persistently high unemployment rates in Wide Bay. There have been pockets of high population growth in the region, despite the high unemployment rate. Population growth has been fast among the 45 years and above age group (Neville 2013). Wide Bay is one of a number of coastal areas that has above-average durations of job search along with high population growth, suggesting that people often choose the area for reasons other than job prospects (Garnett 2018). Another possible contributing factor is its large Indigenous population, which at 4.7 per cent of the population in 2016 was substantially above the national average of 2.8 per cent. The tendency to migrate to other regions can be lower for Indigenous Australians (Taylor and Stanley 2005).

The Wide Bay region is known as a hotspot of youth unemployment (Brotherhood of St Laurence 2018). Key areas in Wide Bay have high rates of disengagement – defined as people not working or studying – among young adults (Neville 2013). Fewer local tertiary education options are one possible explanation. Young people are also more likely to be unemployed if they live in a household where no one else is employed (Biddle 2007), which is more likely in Wide Bay due to its high overall unemployment rate.

8. Conclusion and policy implications

This paper examined whether lock-in effects exist among Australian regional labour market outcomes, with a focus on unemployment rates. The analysis found evidence of an unemployment-rate lock-in effect lasting at least 19 years. Strong lock-in effects

also exist for participation rates. These findings are based on concise econometric approaches that directly address the question of labour lock-in across regions. The results show a higher degree of persistence in regional differentials in unemployment rates than implied by the findings of most previous studies, for example the study of Blanchard and Katz (1992) for the US.

The results are robust to a number of model variants. This includes addition of state binary variables, industry structure percentages, socio-economic controls, and a spatial autoregressive term. Robustness tests in the online code using climate zone variables also help to control for unobserved heterogeneity at the regional level.

The existence of an unemployment-rate lock-in effect could be explained by a number of factors. These include constraints to worker relocation – potentially due to a lack of ability to move, and/or an unwillingness to leave because of personal connections. High amenity and low living costs could also compensate some people sufficiently for their unemployment status in some regions. However, robustness tests in the online code still reveal an unemployment-rate lock-in effect when accounting for migration, low house prices, and climate zone. Part of the unemployment-rate lock-in effect thus likely represents some form of persistent regional disadvantage.

The paper's results support the notion that place-based policies are relevant to consider in addressing persistent regional disadvantage (Partridge *et al*. 2015). For example, targeting of retraining initiatives and employment generation schemes in regions such as Wide Bay could be considered. This could include public sector employment. Diagnosis of a problem is different to identifying the best available cure, however. Both Glaeser and Gottlieb (2008) and the Productivity Commission (2017) warn that regionally-focused initiatives risk being inefficient, and Freebairn (2003) concluded that region-specific policies are often inferior to economy-wide policies for reducing unemployment. Another possibility is efforts to reduce barriers to mobility, such as reductions in stamp duty on home purchases.

Program design that facilitates ongoing monitoring and evaluation of policy effectiveness would allow evidence-based assessments of the value of specific place-based policies (Productivity Commission 2017). This could include further evaluation of past programs to address unemployment, such as recent funding for the Latrobe Valley, the Regional Growth Fund in Victoria, or the Royalties for Regions program in Western Australia. Identifying optimal approaches for overcoming region-based unemployment rate lock-in is an important area for future research.

References

ABS, Australian Bureau of Statistics. (2011), Australian Statistical Geography Standard, http://www.abs.gov.au/websitedbs/D3310114.nsf/home/Australian+Statistical+Geography+Standard+(ASGS), accessed 25.10.2018.

ABS, Australian Bureau of Statistics. (2019a), 6291.0.55.001 – Labour Force, Australia, Detailed, http://www.abs.gov.au/ausstats/abs@.nsf/mf/6291.0.55.001, accessed 31.1.2019.

ABS, Australian Bureau of Statistics. (2019b), 1410.0 Data by Region, http://www.abs.gov.au/ausstats/abs@.nsf/mf/1410.0, accessed 14.1.2019.

ABS, Australian Bureau of Statistics. (2019c), 6202.0 Labour Force, Australia, https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/6202.0Explanatory%20Notes1May%202019?OpenDocument, accessed 8.7.2019.

Altman J. and Daly, A. (1995), 'Indigenous Australians in the labour market: historical trends and future prospects', *Economic Papers*, 14(4), 64–73.

Amior, M. and Manning, A. (2018), 'The Persistence of Local Joblessness', *American Economic Review*, 108(7), 1942–1970.

Beaudry, C. and Schiffauerova, A. (2009), 'Who's right, Marshall or Jacobs? The localization versus urbanization debate', *Research Policy*, 38 ,318–337.

Best, R. and Burke, P. J. (2019), 'Macroeconomic impacts of the 2010 earthquake in Haiti', *Empirical Economics*, 56(5), 1647–1681.

Biddle, N. (2007), 'The labour market status of Australian students: Who is unemployed, who is working and for how many hours?', *Journal of Education and Work*, 20(3), 179–209.

Biddle, N. and Hunter, B. (2006), 'An Analysis of the Internal Migration of Indigenous and Non-Indigenous Australians', *Australian Journal of Labour Economics*, 9(4), 321–341.

Biewen, M. *et al*. (2012), 'The Effectiveness of Public Sponsored Training Revisited: The Importance of Data and Methodological Choices', *Journal of Labor Economics*, 32(4), 837–897.

Blanchard, O. J. and Katz, F. (1992), 'Regional evolutions', *Brookings Papers on Economic Activity*, 1:1992.

Blanchard, O. and Katz, L. F. (1997), 'What We Know and Do Not Know About the Natural Rate of Unemployment', *Journal of Economic Perspectives*, 11(1), 51–72.

Blanchard, O. and Summers, L. (1986), 'Hysteresis and the European Unemployment Problem', *NBER Working Paper Series*, Working Paper Number 1950.

Blanchflower, D. G. and Oswald, A. J. (2013), 'Does High Home-Ownership Impair the Labor Market?', *NBER Working Paper Series*, Working Paper Number 19079.

Bradley, R. and Gans, J. S. (1998), 'Growth in Australian cities', *Economic Record*, 74(226), 266–278.

Brotherhood of St Laurence (2018), 'An unfair Australia? Mapping youth unemployment hotspots', (March), Fitzroy, Victoria, Australia.

Burke, P. J., Best, R. and Jotzo, F. (2019), 'Closures of coal-fired power stations in Australia: local unemployment effects', *Australian Journal of Agricultural and Resource Economics*, 63(1), 142–165.

Cavallo, E., Galiani, S., Noy, I. and Pantano, J. (2013), 'Catastrophic Natural Disasters and Economic Growth', *Review of Economics and Statistics*, 95(5), 1549–1561.

Chapman, B. (1993a), 'Long-term unemployment: the dimensions of the problem', *Australian Economic Review*, 26, 22–25.

Chapman, B. (1993b), 'Long term unemployment: the case for policy reform', *The Economic and Labour Relations Review*, (December), 19–39.

Dao, M., Furceri, D. and Loungani, P. (2017), 'Regional labor market adjustment in the United States: Trend and cycle', *The Review of Economics and Statistics*, 99(2), 243–257.

Debelle, G. and Vickery, J. (1999), 'Labour market adjustment: Evidence on interstate labour mobility', *Australian Economic Review*, 32(3), 249–263.

Decressin, J. and Fatás, A. (1995), 'Regional labor market dynamics in Europe', *European Economic Review*, 39(9), 627–1655.

Dixon, R. and Shepherd, D. (2011), 'State and Territory Employment and Unemployment Patterns in Australia', *Australian Economic Review*, 44(2), 196–206.

Dixon, R., Shepherd, D. and Thomson, J. (2001), 'Regional unemployment disparities in Australia', *Regional Studies*, 35(2), 93–102.

Doerr, A., Fitzenberger, B., Kruppe, T., Paul, M. and Strittmatter, A. (2017), 'Employment and earnings effects of awarding training vouchers in Germany', Industrial and Labor Relations Review, 70(3), 767–812.

Elhorst, J. P. (2003), 'The mistery of regional unemployment differentials: theoretical and empirical explanations', Journal of Economic Surveys, 17(5), 709–748.

Fitzenberger, B. and Speckesser, S. (2007), 'Employment effects of the provision of specific professional skills and techniques in Germany', *Empirical Economics*, 32, 529–573.

Flatau, P., Lewis, P. E. T. and Rushton, A. (1991), 'The Macroeconomic Consequences of Long-Term Unemployment', *Australian Economic Review*, 24(4), 48–56.

Fleming, D. A., Measham, T. G. and Paredes, D. (2015), 'Understanding the resource curse (or blessing) across national and regional scales: Theory, empirical challenges and an application', *Australian Journal of Agricultural and Resource Economics*, 59(4), 624–639.

Freebairn, J. (2003), 'Economic policy for rural and regional Australia', *Australian Journal of Agricultural and Resource Economics*, 47(3), 389–414.

Garnett, A. M. (2012), 'The Effect of the Resources Boom on the Population and Labour Market of Western Australia', *Economic Papers*, 31(1), 63–75.

Garnett, A.M. (2018), 'The Changes and Challenges Facing Regional Labour Markets', *Australian Journal of Labour Economics*, 21(2), 99–124.

Garnett, A.M. and Lewis, P. (2007), 'Population and employment changes in regional Australia', *Economic Papers*, 26(1), 29–43.

Glaeser, E. (2007), 'The economics approach to cities', *NBER Working Paper Series*, Working Paper Number 13696.

Glaeser, E. and Gottlieb, J. (2008), 'The Economics of Place-making policies', *NBER Working Paper Series*, Working Paper Number 14373.

Groenewold, N. (1997), 'Does migration equalise regional unemployment rates? Evidence from Australia', *Papers in Regional Science*, 76, 1–20.

Groenewold, N. and Hagger, A. J. (2008), 'Regional unemployment disparities: An evaluation of policy measures', *Australian Economic Papers*, 47(4), 355–375.

Halleck Vega, S. and Elhorst, J. P. (2016), 'A regional unemployment model simultaneously accounting for serial dynamics, spatial dependence and common factors', *Regional Science and Urban Economics*, 60, 85–95.

Karunaratne, N. D. (1995), 'Paradox of Hysteresis and Real-Wage Flexibility in Australia', *Journal of Post Keynesian Economics*, 17(4), 503–514.

Kishi, T. (2014), 'Female Labour Supply in Australia and Japan: The Effects of Education and Qualifications', *Australian Journal of Labour Economics*, 17(3), 233–255.

Kishi, T. (2017), 'Labour market transitions in Australia and Japan: A Panel Data Analysis', *Australian Journal of Labour Economics*, 20(3), 175–197.

Kruppe, T. and Lang, J. (2018), 'Labour market effects of retraining for the unemployed: the role of occupations', *Applied Economics*, 50(14), 1578–1600.

Lewis, P. E. T. (1994), 'Long-term unemployment: the role of wage adjustments', *The Economic and Labour Relations Review*, 5(1), 11–20.

Martin, R. (2012), 'Regional economic resilience, hysteresis and recessionary shocks', *Journal of Economic Geography*, 12(1), 1–32.

McGuire, P. (2001), 'Regional unemployment in Queensland: Dimensions and policy issues', *Australian Bulletin of Labor*, 27(4), 296.

Neville, I. (2013), 'Bundaberg-Hervey Bay Priority Employment Area', *Australian Government, Department of Education, Employment and Workplace Relations*, (March), Canberra, Australia.

Partridge, M. D., Rickman, D. S., Olfert, M. R. and Tan, Y. (2015), 'When Spatial Equilibrium Fails: Is Place-Based Policy Second Best?', *Regional Studies*, 49(8),1303–1325.

Plummer, P. and Tonts, M. (2013), 'Do history and geography matter? Regional unemployment dynamics in a resource-dependent economy: Evidence from Western Australia, 1984-2011', *Environment and Planning A*, 45(12), 2919–2938.

Productivity Commission (2017), *Transitioning Regional Economies, Study Report*, Canberra, Australia Available at: https://www.pc.gov.au/inquiries/completed/transitioning-regions/report.

Shepherd, D. and Dixon, R. (2002), 'The relationship between regional and national unemployment', *Regional Studies*, 36(5), 469–480.

Smyth, R. (2003), 'Unemployment hysteresis in Australian states and territories: Evidence from panel data unit root tests', *Australian Economic Review*, 36(2), 181–192.

Taylor, J. and Stanley, O. (2005), 'The opportunity costs of the status quo in the Thamarrurr Region', *Working paper / Centre for Aboriginal Economic Policy Research, Australian National University*, (no 28/2005).

Trendle, B. (2002), 'Regional Variation in Queensland's Unemployment Rate', *Australasian Journal of Regional Studies*, 8(3), 327–347.

Unruh, G. (2000), 'Understanding carbon lock-in', *Energy Policy*, 28, 817–830.

Heigh-ho, heigh-ho, it's off to work we go – the Fourth Industrial Revolution and thoughts on the future of work in Australia

Lisa Denny University of Tasmania

Abstract

The Fourth Industrial Revolution (4IR) suggests large-scale transformation of the Australian economy with predictions of 'technological unemployment'. Combined with other significant economic, demographic and social shifts, it is inevitable that future of work will change. This paper applies industrial revolution scholarship to contribute new empirical insights into the transformation of Australia's economy between 2006 and 2016 and evaluate Australia's progress in the 4IR. The paper also introduces gender as a largely missing component in industrial revolution scholarship. Adapting the shift-share method of analysis to ABS Census data, the paper attributes the change in the share of employment and industry restructure over the decade to four factors: national economic growth, industry (re)structure, employment composition, and within industry employment composition. The paper finds that while job growth occurred in the decade to 2016, it was largely driven by a national growth effect associated with increasing consumption and the industry effect associated with the rise of the services sectors and the changing social organisation of care, rather than innovation and technological advancements. Job destruction, on the other hand, is evident in industry sectors associated with the 4IR; the replacement of jobs by automation and artificial intelligence to increase competitiveness and productivity. To transition to the phase of job creation in an industrial revolution, Australia needs socio-political intervention to address four key issues.

JEL Codes: E24, O1, O2, O3, O4, J1, J2
Keywords: future of work, Fourth Industrial Revolution, job destruction, job creation, educational attainment structure (EAS), Australia

Address for correspondence: Dr Lisa Denny, Institute for Social Change, University of Tasmania, TAS 7001, Australia. Email: lisa.denny@utas.edu.au

Introduction

Current public discourse regarding the future of work and the Fourth Industrial Revolution (4IR) invites anxiety (Morgan 2019), implies determinism (Nübler 2016) and fails to acknowledge the socio-political role required in shaping the future of work (Perez 2012b). Instead, the collective framing of a future of 'technological unemployment' is at risk of becoming a self-fulfilling prophecy.

The 4IR suggests significant transformation of the Australian economy. Within that structural change some industries will decline, others will grow, and all will undergo some form of change. Combined with other significant economic, demographic and social shifts, it is inevitable that future of work will also change.

This paper reviews industrial revolution scholarship and applies Perez' three phases of shifting techno-economic paradigm (Perez 2004, 2010); the International Labour Organisation's (ILO) theories of capabilities for productive transformation (Nübler 2014b), and Nübler's framework for achieving a golden age of job creation (2016), to contribute new empirical insights into the transformation of Australia's economy between 2006 and 2016 and evaluate Australia's progress in the 4IR. The paper also introduces gender as a largely missing component in industrial revolution scholarship.

Adapting the shift-share method of analysis (Arcelus 1984) to ABS Census data, the paper attributes the change in the share of employment and industry restructure over the decade to four factors:

1. National economic growth
2. Industry (re)structure
3. Employment composition
4. Within industry employment composition

The paper finds that while the Australian economy grew and jobs were created over the decade, job destruction occurred in the industries associated with the 4IR, particularly for men, and particularly for those employed full-time in the manufacturing sector, consistent with the 'disappearing working man' phenomenon (Rozner 2017). Both the share of Gross Domestic Product (GDP) and employment increased in sectors not directly associated with the 4IR; over a quarter of the total growth in employment was in the health care and social assistance sector (27.6 per cent), followed by education and training (16.0 per cent), mostly women employed full-time or part-time. This growth is more likely to be explained by the rise of the services sector (Autor and Dorn 2013; Gallie 1991, 2017) and, more specifically, the care economy resulting from changes to the social organisation of care (Dwyer 2013).

In addition, the shift to part-time work for both men and women indicates further risk of job destruction and widening inequality. The findings also show that some industry sectors remain highly gendered, however, a positive within sector effect is evident for women in the construction, mining and utilities sectors, traditionally considered male-dominated industries.

The structure of this paper is as follows. An overview of the transformational process of an industrial revolution is followed by an explanation of the empirical

approach used to analyse Australia's progress in the 4IR before presenting the findings. The paper then discusses the findings in relation to the literature and public policy in Australia, before concluding with thoughts on the future of work in Australia should current trends continue.

The process of industrial revolution

In Australia, recent literature pertaining to the current 4IR, defined as an extension of the third (digital) revolution to the convergence of digital, biological, and physical spheres (Schwab 2016), is largely dominated by a plethora of grey literature from business consultancy groups[1] focused on the implications of digital disruption and the FIR at the micro level – jobs and skills[2] –, or the meso-level – business model innovation to increase productivity[3] –, rather than the wider, macro-level strategic process of potential socio-economic transformation that the 4IR could enable (CEDA 2018; Dean and Spoehr 2018). There is however, extensive scholarship pertaining to the process of industrial revolution.

Like history, the process of an industrial revolution repeats itself; a long wave transformation which plays out over half a century, give or take a decade (Atkinson 2018; Perez 2004, 2010, 2012b; Soete 2018). The historical cycle of an industrial revolution is a three-phase process involving job destruction (Phase 1) and job creation (Phase 3) with a turning point, or adjustment phase, sandwiched between the two (Perez 2010). Perez describes an industrial revolution as 'the vast diffusion of what was once an invention into a socio-economic phenomenon' requiring a new 'techno-economic paradigm' (Perez 2010). To warrant revolutionary status, Perez and others (see for example Atkinson (2018); Hofheinz (2018); Nübler (2016); Soete (2018)) argue that new technologies in the market must have the capacity and capabilities to profoundly transform the rest of the economy and, eventually, society. This long wave transformation and ultimate diffusion consists of three phases culminating in a 'great surge of development'. Commencing with the installation period associated with the adoption of new technologies into business systems, led by finance and free markets, in the quest for increased productivity and competitiveness, this phase is also associated with job destruction. The third phase is the deployment period which is associated with job creation whereby the full benefits of the technological revolution are spread across the economy and society. Between these two phases sits an adjustment period which is accompanied by resistance to change, inertia, social dishevel, rising inequality, regional disparities and economic stagnation, eventually becoming a critical issue which requires socio-political intervention. Perez and others (listed above) argue that the adjustment period is not a passive process and cannot be left to the markets to determine. The period of this interval lasts as long as it takes to establish the institutional framework required to fully capture the potential of

1 See for example Bankwest Curtin Economics Centre (2018); Deloitte (2019); Hajkowicz *et al*. (2016); Reeson *et al*. (2016); Seet *et al*. (2018).

2 See Morgan (2019) pages 12 to 15 for a critique of 'consultancies, think tanks and modellers' contribution to the literature and policy making relating to the Fourth Industrial Revolution.

3 See for example Australian Industry Group (2019); CEDA (2012); McKinsey and Company (2019); Prime Minister's Industry 4.0 Taskforce (2017)

the new techno-economic realm; it needs to be shaped by government regulation and policies. The level of political consensus, conflict or confusion strongly influences the speed and the ease or difficulty with which the surge of development and growth is established. Given that changes in an economy usually happen at a much faster pace than institutional reform, according to Perez these adjustment phases have historically been long and difficult – two to three decades – and accompanied by considerable social costs.

While Schwab (2016) suggests the world is currently progressing through the Fourth Industrial Revolution (4IR), claiming 'We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before', others disagree. Perez (2010) argues that advanced nations are currently experiencing the adjustment period of the fifth industrial revolution while Atkinson (2018) argues the world is on the cusp of the sixth industrial revolution, having not fully realised the potential of the fifth given the inability to achieve the socio-political transformation required. He suggests that the next industrial revolution will 'likely be grounded in AI, robotics and perhaps nanotechnology and biotechnology' similar to Schwab's (2016) definition of the 4IR; the convergence of digital, biological, and physical spheres. Both Perez and Atkinson agree that the first industrial revolution of mechanisation in the 1770s was followed by steam and railways in the 1830s, steel, electricity and heavy engineering from 1875, oil, the automobile and mass production from 1908 and then the fifth, the age of information and telecommunications, from 1971. Each of these transformations followed the same installation, adjustment and deployment process outlined above whereby a new socio-political paradigm was required to fully realise the growth potential associated with each new techno-economic opportunity.

While technological advancements have the potential to revolutionise the economy and society, the argument that this will result in persistent 'technological unemployment' is contested (Anderson 2009; Atkinson 2018; Barany and Siegal 2015; Montresor 2018). Predictions for the future of work suggest significant transformation of the type, and content, of jobs available in the labour market resulting from economic restructuring, as has occurred in previous revolutions, however the focus on technology as the determinant of the structural change in the wider employment market leads to a narrow explanation of change over time (Fernández-Macías 2012). Atkinson (2018) argues future job creation will be based on consumption patterns, largely related to greater expenditure associated with higher incomes resulting from increased productivity and wealth generation during the deployment phase of the industrial revolution process. Additional factors include, but are not limited to, higher levels of educational attainment and labour force participation, the age structure of the respective populations, the level and type of immigration and the type of welfare state (Baum 1997; Goos and Manning 2007; Hamnett 1996; Murphy and Oesch 2018; Oesch and Rodríguez Menés 2010). Another perspective is that of the rise of the services sector (Autor and Dorn 2013; Gallie 1991, 2017) and, more specifically, the care economy resulting from changes to the social organisation of care (Dwyer 2013), closely linked to changing household consumption. Howcroft and Rubery

(2018) further argue that the changing nature of work has gender-specific impacts and that emerging forms of work reinforce gender inequalities, however, they do note that these issues are not related to technological advancement per se but to institutional frameworks and associated regulatory environments and policies. They suggest that the 4IR presents a timely opportunity to propose a rethink of both the structures of employment and the forms of work as well as the division in both paid and unpaid work between men and women.

Perez suggests that most advanced nations are on the cusp of the deployment period, the turning point of the revolutionary process which will eventually lead to job creation and wider wealth generation. However, to progress to the job creation phase, the increasing mismatch between the economy and the regulatory systems created during the installation phase needs to be resolved. The installation phase is a market driven process which involves the often rapid and intense adoption of new technologies into business models and practices with the aim of increasing productivity and remaining competitive in a global market, usually with a short term focus (Dean and Spoehr 2018; Nübler 2016; Perez 2010). This often includes new production techniques, diversification, changes in the organisation of work, cost savings and labour-saving processes and, as such, is associated with job destruction. This period is characterised by unintended consequences such as increasing job and skill mismatches, obsoletion of qualifications and training, unemployment, income and wealth polarisation, jobless economic growth and within nation economic and social divergence (Perez 2010). This period is also referred to as incremental or process innovation, or the imitation or adoption of new innovations rather than new product innovation itself which is considered to be the primary mechanism driving initial structural change and an ensuing industrial revolution (Nübler 2016). While some argue that the current revolution is data driven and that the global economic base has shifted from one dominated by the production of physical capital, to one of servicisation and intangible products (Hofheinz 2018; Soete 2018), Nübler (2016) suggests that it is product innovation which is primary mechanism for structural change and eventual job creation and further argues that product innovation is dependent on a strong manufacturing base. She provides evidence that those nations with diverse and sophisticated manufacturing bases are more dynamic and better positioned than services-based economies to revolutionise their economy and society and that this potential is underpinned by a nation's Educational Attainment Structure (EAS) (Nübler 2014a, 2016).

Despite widespread process innovation globally, productivity has not yet increased at the level expected to shift the transformation into the deployment phase whereby productivity gains are distributed more widely in society and job creation ensues (Gordon 2016; OECD 2015; Productivity Commission 2016). This is somewhat explained by the increasingly networked and expanded global market, and the speed at which new technology, largely digital rather than traditional manufacturing innovation, is applied and exploited, keeping downward pressures on costs to maintain competitiveness (Soete 2018), thus preventing product innovation.

Nübler (2016) expands on Perez' (2004, 2010) techno-economic paradigm for achieving economic and societal prosperity associated with industrial revolutions to

develop a framework for achieving a 'golden age of job creation'. This framework is underpinned by the International Labour Organisation's Theory of Capabilities for Productive Transformation (Nübler 2014b) arguing that the theory contributes to a better understanding of the link between education, training and technological learning on the one hand and economic growth on the other; facilitating the revolutionary opportunities attached to technological advancements.

Essentially, Nübler argues that revolutionary opportunities are endowed within a nation's productive capabilities. These include the physical capacities; production factors and infrastructure, and the social capabilities; the collective knowledge base and the institutional framework, which enable transformation. While some nations may share similar physical capacities, it is the intangible capabilities, which differ among nations, that facilitate the level of innovation and economic diversification possible. It is these capabilities which also shape future structural change. Nübler (2014b, 2016) argues that it is the combination of productive capabilities which are the major determinants of the job creation adjustment process. In particular, she argues that it is the competence of the labour force; the nature and knowledge base, combined with the institutional framework of the society; the rules, regulations and policies, which determine the performance and progress of an economy and society during an industrial revolution. ILO research into the difference in competence of labour forces identified that different knowledge bases, measured by the educational attainment structure (EAS), explains differences in industry structures and therefore economic performance, and that it holds for both developing and developed countries. Nübler (2014a) argues that the EAS, rather than educational levels, is the most significant determinant of the pattern of industrial development and growth. As such, the EAS represents an important carrier of capabilities to diversify, develop and achieve growth. Defined as the share of the labour force based on educational attainment, EAS, can be further defined according to its shape along a bell curve. Capabilities to innovate and develop new products are therefore influenced by the particular mix of educational, vocational and technical competencies, which increase with the diversity and complexity of the knowledge sets embodied in the labour force.

'Strong middle' EAS are those with relatively higher shares of vocational and technical education and training. This EAS provides the widest range of options for developing and diversifying industry structures associated with a technological revolution.

'Missing-middle' EAS are polarised and present with relatively lower shares of vocational and technical education but higher shares of schooling and tertiary education. According to Nübler, missing middle EASs provide limited options for advancing technological revolutions as the labour force lacks the broad supply of complementary occupations required in addition to tertiary qualified managers and professionals. Rather, the relatively higher tertiary education share provides options to develop advanced services such as research and development, finance, tourism, ICT enabled services, and administrative services.

The ILO's comparison of the strong and missing middle EAS shows that these two EAS' result in different patterns of industrial development. According to the ILO, the missing middle countries are limited in expanding their manufacturing base, and

industrialise by expanding sophistication in services, however, the ILO suggests that even the highest performing missing middle countries cannot achieve the levels of sophistication within manufacturing that can be achieved by the strong middle nations. Further, EAS tends to reflect income and wealth distribution in society, and missing middle EAS are often found in countries with high inequalities (Nübler 2014a). These findings are also consistent with the literature on over-qualification associated with the expansion of higher education (see for example Figueiredo *et al*. 2015; Holmes and Mayhew 2015, 2016; Lloyd and Payne 2016), skill utilisation (see for example Felstead, Gallie and Green 2017; Keep 2017; Livingstone 2017; McGuinness, Pouliakas and Redmond 2017; Quintini 2011; Smith 2017) and job polarisation (see for example, Barany and Siegal 2015; Cirillo 2018; Coelli and Borland 2016; Denny 2019; Goos and Manning 2007; Montresor 2018; Salvatori 2015) .

The other element for achieving a 'golden age of job creation' is the process of collective learning, including trust in the institutional framework (Morgan 2019; Nübler 2016; Perez 2004, 2012b). The premise of collective learning is that it incorporates not just education from schooling and higher education, but is accumulative, including tacit learning of concepts, rules, procedures and expectations in organisational, social, cultural and economic contexts, not just at an individual level but also at the collective level such as within enterprises, organisation and societal groups. This process of collective learning develops a knowledge structure within society which, according to Nübler (2014b), determines the feasible patterns of productive transformation. In the context of industrial revolution, Perez argues that this process of collective learning also requires unlearning, learning and relearning processes, new rules and regulations and undertaking new training and skill development. Morgan (2019) extends the understanding of the revolutionary process, stating that the diffusion of new technology is subject to the values, principles and mechanisms of society so much so that the extent of diffusion is subject to the response by institutions, rules, laws, behavioural responses, rights and obligations associated with new technology and how society uses it, or rejects it.

The institutional framework which governs the rules and regulations of both the economy and society, forms a critical component of the process to job creation during an industrial revolution. Nübler (2016) argues that institutions are integral in the pace of change, driving the adjustment phase and mobilising support for change whereby the institutional framework generates a sense of justice in society, that the distribution of gains and losses; the unintended consequences of technological advancements associated with the revolution, are considered fair. This has already been recognised in Australia by CEDA (2018), pointing out that 'while businesses adapt to the disruption that new technologies create, governments need to be identifying new regulations to be institutionalised to keep economies transparent and effective'. This includes maintaining trust in the institutional framework. Trust that institutions will respond accordingly in times of systemic failings provides people and society with the confidence and security they need to continue on with their lives, highlighting the importance of institutions being adaptable and flexible to achieve long-term advances in prosperity. Perez (2004) sums up the challenges of the adjustment phase as a process whereby the existing institutional framework becomes obsolete as it was designed

around a previous techno-economic paradigm, arguing that the persistent application of obsolete practices can actually aggravate society and the economy contributing to a collapse, often in the form of a recession or financial market failure.

Given the long wave creative destruction process (Schumpeter 1942) to widespread prosperity of an industrial revolution, Hofheinz (2018) suggests that the pressing issue now is how do nations prepare for and legislate for an economy where society faces a different set of challenges, problems that will need to be mitigated with a different set of policies, proclaiming "We stand on the cusp of an important decision: will we find and develop the social innovation needed to make the digital revolution a win-win for all?"

The following section outlines the empirical approach to analysing Australia's progress in industry restructuring and socio-economic transformation within the revolutionary process of the 4IR.

Method

In order to better understand the restructuring of the Australian industry base over the decade between 2006 and 2016 and how it may align with the phases of an industrial revolution, this paper adapts the shift-share analysis method first used in regional economics to study the components of regional growth and development (Dunn 1960). Shift-share analysis is an effective method used to isolate structural and compositional characteristics within aggregate change over a period of time (Danko III and Hanink 2018). It has been used extensively to identify sector-level employment change in regions which could be attributable to national, regional or industry factors while controlling for national, aggregate, effects.

This paper uses shift-share analysis to attribute changes in employment in the Australian economy to economic performance, industry structural change, employment composition (labour force participation by men and women), and, adapting Arcelus' (1984) extended shift-share analysis method to disaggregate the industry effect; compositional labour force change within an industry sector. Using ABS Census data for 2006 and 2016, changes in employment in Australia over the decade are attributable to four different effects:

1. National economic growth
2. Industry structure
3. Employment composition
4. Within industry employment composition

The change in employment between two periods is simply the difference in employment levels between period 1 E_1 and period 2; E_2 so that:

$$\Delta E = E_{2-} E_1$$

In its simplest form, the shift-share analysis method enables the statistical separation of the main national and industrial forces affecting the change in

employment; ΔE_s^e– the number of men and women employed full-time or part-time (e) for industry (s).

This change in employment can be decomposed to national, industrial and employment composition effects and expressed as follows:

$$\Delta E = NG_s^e + LM_s^e + IS_s^e$$

Whereby, NG_s^e represents the national growth component which is the expected change in employment composition (e) for industry (s) if it grew at the same rate as the total national employment rate. LM_s^e represents the employment composition component – the mix of men and women employed full-time or part-time – which is the portion of the employment change attributed to the difference in employment composition (e) of industry (s) and that of the nation. IS_s^e represents the industry share component. That is, the share of the change in employment attributed to differences in the change in employment composition at industry and national level due to the particular circumstances of the industry. In regional studies, this component is referred to as the 'competitive effect' (Danko III and Hanink 2018) as it illustrates whether a region possesses a competitive advantage in that industry over other regions on a national scale.

In this adaptation, the competitive effect can be equally applied to an industry's competitive advantage in terms of employment opportunities in times of economic restructuring, as in the case of the 4IR. That is, the competitive advantage that an industry sector may offer men or women full-time or part-time employment opportunities.

$$NG_s^e = E_s^e * e^n$$

$$LM_s^e = E_s^e * (e_e^n - e^n)$$

$$IS_s^e = E_s^e * (e_s^e - e_s^n)$$

Where E_s^e is the number employed by employment composition (e) for industry (s) and where e^n is the percentage change in the national employment level, e_s^n, is the percentage change in employment in industry (s) at the national level, e_e^n, is the percentage change in employment composition (e) at the national level and e_s^e is the percentage change in employment composition (e) for industry (s).

Arcelus argues that the competitive effect in its simplest form does not account for regional effects as it is restricted to employment change analysis based on national performance. As such he extends the simple form to disaggregate the competitive advantage effect to include *a regional growth effect* – the part of ΔE attributable to growth of the region – and *the regional industry mix effect* – the part of ΔE attributable to combined regional and industry factors, that is, a within region competitive advantage.

For this study, these regional effects are translated as industry structure effects (I_s^e) and within industry employment composition effects (IM_s^e). The industry structure

effect identifies the industry share of employment change due to the overall change in employment in the industry and the within industry employment composition effect identifies the share of employment change that is particularly due to the change in employment composition for the industry. Based on this, the industry share component can be redefined as follows:

$$IS_s^e = I_s^e + IM_s^e$$

Arcelus also argues this can be equally applied to the national growth component and the employment composition component; providing a competitive advantage sub-component and a degree of differentiation component.

Arcelus further argued that this simple form of shift-share analysis does not account for the degree of differentiation within sectors and with respect to both the national and employment composition components either. Using Arcelus' extended method each shift-share analysis component is disaggregated into an 'expected' or 'differential' effect (1984, p. 6). The expected effect is the share of employment change that would have been expected that is due to overall change in employment for industry (s) if the industry had the same employment composition as the nation. The differentiation effect is the share of employment change that is attributed to the extent of deviation from the nation for industry (s) and employment composition (e). These effects are calculated based on the concept of 'homothetic employment' (HE_s^e), that is, the employment composition (e) for industry (s) if the structure of the employment in the industry was equal to the national employment structure.

Homothetic employment is expressed as follows:

$$HE_s^e = E_s * \frac{E_e^n}{E^s}$$

Where, E^s is the total employment in the industry sector, E_e^n is the national employment composition and E^n is the total national employment, all for the first period.

Given these extensions, the three shift-share components in equation 2 are calculated as follows:

$$NG_s^e = HE_s^e * E^n + (E_s^e - HE_s^e) * e^n$$

$$LM_s^e = HE_s^e (e_e^n - e^n) + (E_s^e - HE_s^e) * (e_e^n - e^n)$$

$$IS_s^e = HE_s^e (e_s^e - e_s^n) + (E_s^e - HE_s^e) * (e_s^e - e_s^n)$$

IS_s^e is also calculated to account for the disaggregation of the industry effect and the within industry employment composition effect, so that

$$I_s^e = HE_s^e (e^s - e^n) + (E_e^s - HE_s^e) * (e^s - e^n)$$

$$LM_s^e = HE_s^e * [(e_s^e - e^s) - (e_e^n - e^n)] + (E_e^s - HE_s^e) * [(e_s^e - e^s) - (e_e^n - e^n)]$$

Thus, NG_s^e can identify the extent to which employment composition (e) in industry (s) is impacted by national economic performance and the degree of differentiation, or lack thereof, in employment composition (e). LM_s^e can identify whether an industry experienced a shift (positive or negative) ('competitive advantage' in regional studies) compared with other industries in terms of employment composition opportunities as well as the extent to which an industry may be gendered or the workforce standardised (whereby 'standardised' is full-time employment).

Data used for this analysis is drawn from the 2006 and 2016 ABS Census' of Population and Housing (Census). These collections were selected as they represent similar, relatively stronger periods of economic performance compared with 2011. The dataset includes all those Australian men and women employed full-time or part-time by the industry in which they worked[4], as defined by the Australia New Zealand Standard Industry Classification (ANZSIC), at the Division level.

Findings

Over the decade to 2016, an additional 1,385,142 Australians were employed, either full-time or part-time, a growth rate of 16.6 per cent. Part-time employment grew 28.1 per cent, while full-time employment increased by 11.3 per cent, so that the share in full-time employment reduced to 65.4 per cent of the workforce from 68.5 per cent in 2006. Over half of the increase (56.9 per cent) was experienced by women, where employed women increased by 20.4 per cent, compared to a 13.2 per cent increase for men. Part-time employment increased substantially for both men and women, 35.8 per cent and 24.6 per cent respectively. See Table 1.

Table 1. Change in employment composition, Australia, 2006 to 2016

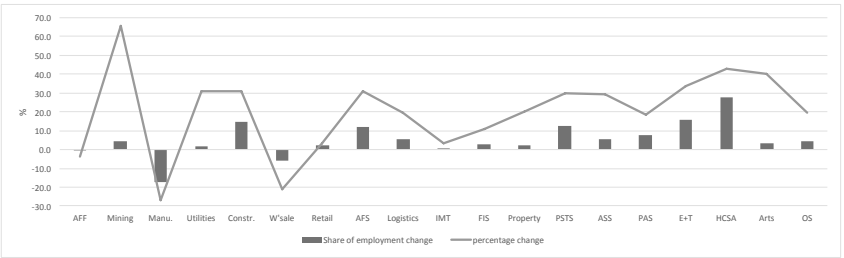
	Percentage change (%)	*Share of total employment change (%)*
Women	20.4	56.9
Men	13.2	43.1
Part-time	28.1	53.3
Full-time	11.3	46.7
Men, full-time	8.3	22.0
Women, full-time	16.7	24.6
Men, part-time	35.8	21.1
Women, part-time	24.6	32.2

Source: ABS Census of Population and Housing, 2006 and 2016, author calculations.

4 Those employed, but away from work, are excluded from the dataset as their level of attachment to the labour force (full or part-time) cannot be determined.

When employment change is considered by industry, substantial restructuring of the economy is evident. While the number of people employed increased for all but three industries (Agriculture, Forestry and Fishing, Manufacturing and Wholesale Trade) the share of employment growth by industry shifted considerably from the traditional industrial sectors to the services sectors. Over a quarter of the total growth in employment was in the Health Care and Social Assistance sector (27.6 per cent), followed by Education and Training (16.0 per cent). Construction (14.9 per cent), Professional, Scientific, Technical Services (12.5 per cent) and Accommodation and Food Services (12.0 per cent) shared the majority of the remaining employment growth, supressed by Manufacturing (-17.5 per cent) and Wholesale Trade (-5.8 per cent).

Figure 1. Percentage change in employment and in employment share', ANZSIC Division 1, Australia, 2006 to 2016



Source: ABS Census of Population and Housing, 2006 and 2016, author calculations

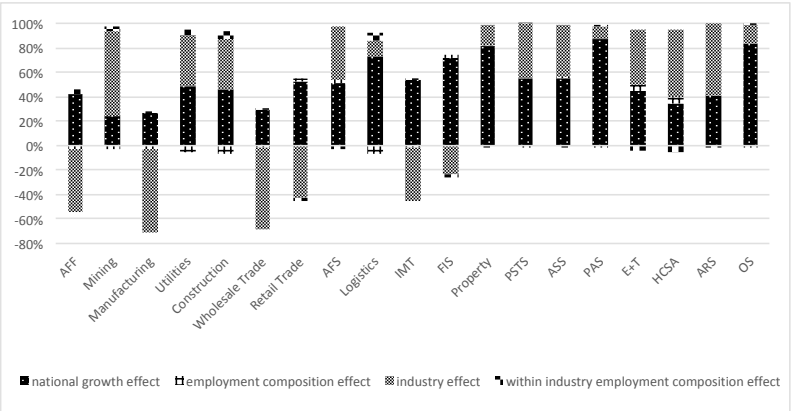
Applying the extended shift-share analysis outlined in the method section, a greater understanding of the factors associated with the changes in employment is possible.

At an industry only level, the change in the share of employment is attributable to either the national growth effect or the industry effect, with the employment composition effects offsetting the other. As expected, given a larger population, growing economy and associated increasing consumption, the national growth effect contributed positively to each industry's change in employment over the decade, however, at varying degrees. See Figure 2. The national growth effect was the greatest contributor to change in employment for Public Administration and Safety, as well as the consumption services sectors such as Other Services, Property[5], Financial and Insurance Services and Logistics[6] supporting the thesis of the rise of services associated with changing consumption patterns of the population (Atkinson 2018; Dwyer 2013; Gallie 2017). Whereas the industry effect was the greatest contributor to change in employment for those sectors with exposure to opportunities based on

5 Rental, Hiring and Real Estate Services
6 Transport, Postal and Warehousing Services

changing demographics (Health Care and Social Assistance), policy priorities (the NDIS, education and training, arts and recreation) and the resource boom (Mining). Industries such as Utilities[7], Construction, Accommodation and Food Services and Administration and Support Services shared their growth between national and industry effects. The industry effect placed downward pressure on industries exposed to automation and globalisation (Manufacturing and Agriculture, Forestry and Fishing), technological advancements (Wholesale Trade and Retail Trade) and artificial intelligence (Information, Media and Telecommunications and Financial and Insurance Services).

Figure 2. Drivers of employment change by ANZSIC Division 1, Australia, 2006 to 2016



Source: ABS Census of Population and Housing, 2006 and 2016, author calculations

Figure 3 illustrates the four shift-share analysis effects on employment change for men and women employed full-time or part-time for each industry sector. For all employment composition combinations, the national growth effect is positive, and the industry effect is consistent within the industry sector, that is either positive or negative, however, the extent of the effect differs. Where the employment composition effect is positive, the industry sector experienced a positive shift compared with other industries for that combination of sex and labour force attachment. The converse is true when the employment composition effect is negative. That is, the employment composition, and its extent, indicates whether an industry's workforce is gendered or standardised, compared with other industries. Where the within industry employment composition effect is positive, the industry sector experienced a positive shift for that employment composition combination within the sector. The converse is true if the within industry employment composition effect is negative. Also see Table 2.

7 Electricity, Gas, Water and Waste Services

For the Agriculture, Forestry and Fishing, Manufacturing and Wholesale Trade sectors, all associated with the implications of technology advancements, job destruction is evident. Employment decline was driven by a strong, negative industry effect, slightly offset by a weaker national growth effect. For each there is also a strong shift away from full-time employment for men, with the shift for employment composition negative for full-time work, and strong and positive for part-time work for men. Within wholesale trade, men and women also experienced a strong negative effect for part-time work (-16.1 and -17.4 per cent respectively).

National growth strongly effected the utilities, Construction, Professional, Scientific and Technical Services, Administration and Support Services and Accommodation and Food Services sectors. All were also accompanied by a strong industry effect, particularly so for women in the utilities, construction and professional services sectors, traditionally considered male-dominated sectors. All sectors show a negative shift for full-time employment for men, and a shift to part-time employment, particularly for the professional services (33.1 per cent), Administrative and Support Services (39.2 per cent) and Construction (36.0 per cent) sectors. Within industry competitive advantage differs for each sector, however, part-time work within the industry has a negative effect for women in all sectors except for Administration and Support Services (17.5 per cent), and particularly for those in Construction (-39.9 per cent). Full-time work for women shows a strong negative effect for Accommodation and Food Services (-39.3 per cent) and Administration and Support Services (-33.0 per cent), yet a strong positive effect for Construction (15.8 per cent) and utilities (29.6 per cent), while slightly negative for professional services (-13.0 per cent).

While Retail Trade, Information, Media and Telecommunications (IMT) and Financial and Insurance Services experienced a positive national growth effect within its overall employment growth, each was also offset by a negative industry effect, more so for the Retail sector (associated with digital disruption and the 4IR). Each sector also shows a positive effect for part-time employment, particularly for men, while within industry employment composition effects favour men working full-time, particularly for the Financial and Insurance Services (36.7 per cent) and IMT (26.3 per cent) sectors, with a corresponding negative effect within industry effect for women working full-time in Financial and Insurance Services (-16.9 per cent), providing evidence of gendered industries and the impact of the internet of things and artificial intelligence.

Employment growth for the Logistics, Property, Public Administration and Safety and Other Services sectors was driven by strong, positive national growth effects, particularly for women. Each sector also experienced a positive, yet weak, industry effect. Like all other sectors, the shift for men was strongly positive for part-time employment, and to a lesser degree for women employed part-time. Within sector employment composition effects differed considerably. Property favoured full-time work for men and women (19.5 per cent and 24.2 per cent respectively) while the converse was true for other services (-8.9 per cent and -28.8 per cent respectively). Administration and Support Services provided a stronger negative shift for full-time employment for women (-33.0 per cent) while Logistics showed a strong negative shift for part-time employment for women (-26.7 per cent).

The industry effect was stronger than the national growth effect for the Mining, Education and Training, Health Care and Social Assistance, and Arts and Recreation Services sectors, particularly the Mining sector, reflecting the resource boom over the period of analysis. The industry effect was also relatively stronger for women than men, excepting the Arts and Recreation sector. All sectors showed a strong shift to part-time work for men. Mining showed a positive within sector employment composition shift for women employed full-time (12.2 per cent), while the Arts and Recreation Services sector showed a strong, negative within industry employment composition effect for women employed full-time (-20.2 per cent). Men employed full-time in the Education and Training sector shows both a negative employment composition shift (-17.4 per cent) as well as a negative within sector shift (-12.3 per cent), as did men employed part-time (-10.1 per cent). Women employed in the Health Care and Social Assistance sector show a negative within sector shift, despite a positive shift for the overall employment composition effect. Conversely, men employed in the Health Care and Social Assistance sector enjoyed a positive employment composition shift within the sector.

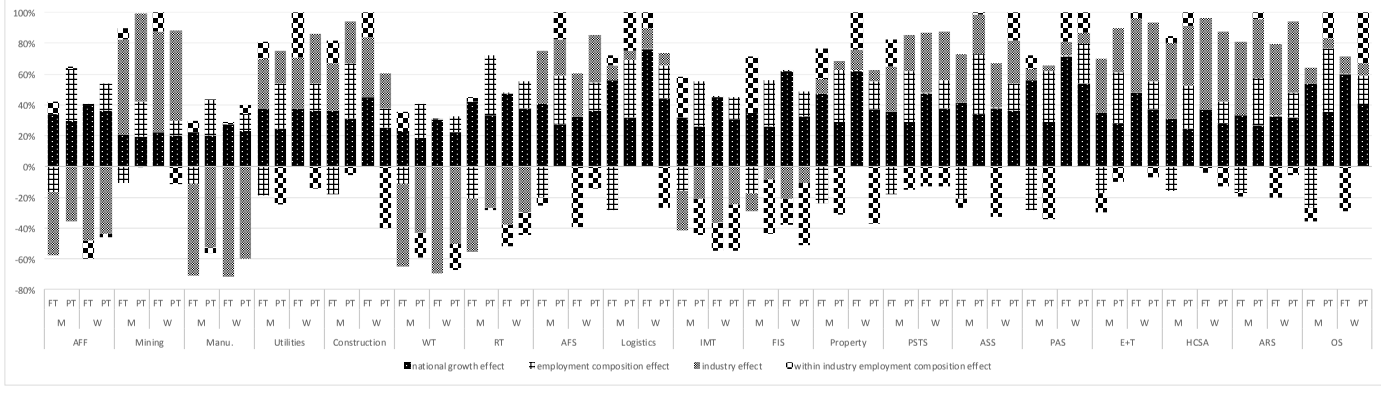
These findings largely reflect the gendered reality of the labour market. Most of the job change for men and for women depends on what is happening in male-dominated and female-dominated occupations; men are particularly vulnerable to changes in manufacturing and construction and women particularly vulnerable to changes in the public sector and private services (Howcroft and Rubery 2018; Rozner 2017). Further, women are disproportionately represented in non-standard forms of work (i.e. part-time), however this situation is also increasing for men. The findings also show that while some industry sectors remain highly gendered, a positive within sector comparative effect is evident for women in the Construction, Mining and Utilities sectors, traditionally considered male-dominated industries.

Table 2. Employment composition effect and within industry employment composition effect, men and women, full time and part time, by industry

	Employment composition				*Within industry employment composition*			
	Men		*Women*		*Men*		*Women*	
	Full time	*Part time*	*Full time*	*Part time*	*Full time*	*Part time*	*Full time*	*Part time*
Agriculture, Forestry and Fishing	-	+		+			-	
Mining	-	+					+	-
Manufacturing	-	+		+				
Utilities	-	+		+	+	-	+	+
Construction	-	+		+	+		+	-
Wholesale Trade	-	+		+	+	-		-
Retail Trade	-	+		+			-	-
Accommodation and Foods Services	-	+		+		+	-	-
Logistics	-	+		+		+		-
Information, Media and Telecommunications	-	+		+	+	-	-	-
Finance and Insurance Services	-	+		+	+	-	-	-
Property	-	+		+	+	-	+	-
Professional, Scientific and Technical Services	-	+		+	+	-	-	-
Administration and Support Services	-	+		+			-	+
Public Administration and Safety		+		+		-	+	+
Education and Training	-	+		+	-	-		
Healthcare and Social Assistance	-	+		+				-
Arts and Recreation Services	-	+		+			-	
Other Services	-	+		+	-	+	-	+

Source: ABS Census of Population and Housing, 2006 and 2016, author calculations

Figure 3. Drivers of employment change by ANZSIC Division 1, by employment composition, Australia, 2006 to 2016



Source: ABS Census of Population and Housing, 2006 and 2016, author calculations
Notes: FT = full-time employment, PF = Part-time employment, M = men, W = Women, AFF = Agriculture, Forestry and Fishing, Manu. = Manufacturing, WT = Wholesale Trade, RT = Retail Trade, AFS = Accommodation and Food Services, FIS = Financial and Insurance Services, PSTS = Professional, Scientific and Technical Services, ASS = Administrative and Support Services, PAS = Public Administration and Safety, E+T = Education and Training, HCSA = Healthcare and Social Assistance, ARS = Arts and Recreation Services, OS = Other Services

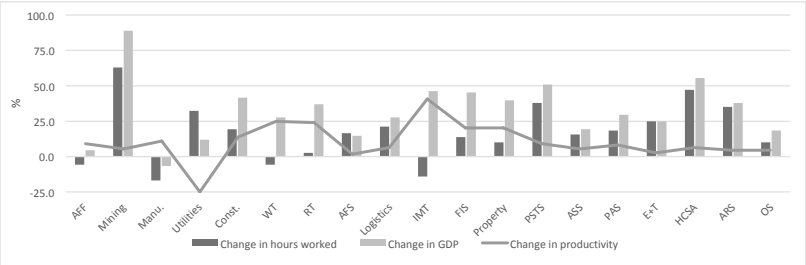
Discussion

At an aggregated data level, over the decade to 2016, the Australian economy grew, both in terms of Gross Domestic Product (GDP) and employment. However, aggregated data can mask the transformation of economies and societies impacting on the ability to identify the need to undertake regulatory reform. As this paper shows, a portion of employment growth is attributable to overall national economic growth, but within economy structural change is also evident in Australia over the decade. These changes warrant more detailed attention.

Over the period, job destruction occurred. Consistent with Perez' Phase 1 of an industrial revolution and the Routine-Biased Technological Change (RBTC) thesis of Goos, Manning and Salomons (2014), this loss occurred predominantly in sectors associated with technological advancements; Manufacturing, Agriculture, Forestry and Fishing, Wholesale Trade and IMT, evident from the negative industry effect in the shift-share analysis. While the Manufacturing sector also realised a reduction in GDP, the latter three sectors increased their economic contribution, indicating improvements in productivity (measured as the relationship between inputs (hours worked) and economic output (GDP), which is also consistent with the process of an industrial revolution. Considerable improvements in productivity are also evident for most other sectors (except Accommodation and Food Services), with the increase in GDP greater than the increase in the number of hours worked, particularly for Retail Trade, Finance and Insurance Services and Property, again consistent with technological advancements, but less so for the Arts and Recreation Services, Education and Training and Health Care and Social Assistance sectors. See Figure 4.

Job creation also occurred. Aside from the Construction sector being driven by a national growth effect, sectors which experienced the greatest growth in jobs were in the services sectors; Health Care and Social Assistance and Education and Training, mostly women employed full-time or part-time. Driven by a positive industry effect, this growth is more likely to be explained by changing demographics, consumption patterns (Atkinson 2018; Autor and Dorn 2013; Gallie 1991, 2017) and the social organisation of care (Dwyer 2013), rather than the job creation phase of an industrial revolution. That said, relatively strong job creation in Professional, Scientific and Technical Services, is consistent with the imitation phase of an industrial revolution and Goos, Manning and Salomons (2014) Skill-Biased Technological Change (SBTC) hypothesis as well as the industrial profile of Nübler's missing middle EAS nations.

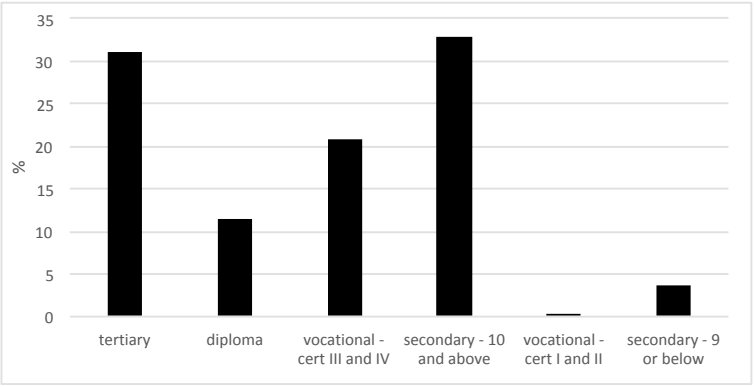
Figure 4. Economic restructuring, ANZSIC Division 1, change in hours worked, GDP and productivity, Australia, 2006 to 2016



Source: ABS, Australian National Accounts: National Income, Expenditure and Product, Jun 2019, Cat. No. 5206.0; Labour Force, Australia, Detailed, Quarterly, Aug 2019, Cat. No. 6291.0.55.003; Australian National Accounts, Jun 2016, Cat. No. 5204.0.

Australia's educational attainment structure can be defined as a 'missing middle' EAS according to Nübler's (2014a, 2016) classification. Around a third of Australia's labour force highest level of educational attainment is a tertiary qualification (30.1 per cent) or secondary school education – year 10 or higher (32.8 per cent), while only 20.1 per cent have a vocational or technical qualification at the certificate III or IV level. See Figure 5. This missing middle EAS constrains Australia's ability to innovate and diversify its industry base beyond a services-based economy. As Nübler explains the EAS represents an important carrier of capabilities to expand, innovate and develop the manufacturing of inventions and other technological advancements, rather than just adopting other nation's innovations within a business model, as appears to be the case in Australia.

Figure 5. Educational Attainment Structure (EAS), Australian labour force, 2016



Source: ABS Census of Population and Housing, 2016 NB. data not available for 2006

Nübler asserts that manufacturing is a "leading sector" in the process of productive transformation with strong linkages between industries and services sectors in progressing technological advancement. While the services sectors have replaced manufacturing in nations with a missing middle EAS, Kucera and Roncolato (2013) argue that advanced services can also be a lagging or leading complement to manufacturing and therefore shouldn't be considered in isolation of each other in industrial policy.

In Australia, Dean and Spoehr (2018) assert that Australia's manufacturing policy is situated in Phase 1 of the industrial revolution being limited to short term objectives using process innovation aimed at increasing productivity. Alternative approaches to manufacturing policy should incorporate longer-term objectives of industrial transformation and the development of new markets, jobs and economic sectors based in digitally connected supply and value chains. In the absence of a longer term view, Dean and Spoehr (2018) suggest the consequences will be dire for the labour market, resulting in widespread job destruction. This is fear is affirmed in a report to the Prime Minister's Industry 4.0 Taskforce (Prime Minister's Industry 4.0 Taskforce 2017) which states the aim of adopting and deploying new technologies associated with the 4IR is to digitise the entire manufacturing process to increase competitiveness so that 'the interconnection of products, machines, networks and systems independently communicating and cooperating with each other over the entire manufacturing process results in minimal or no human intervention'. Even so, according to Grodach and Gibson (2019) while broader government agendas position the manufacturing sector in 'inevitable decline', it also attempts to rebrand manufacturing within the narrative of a high-tech, innovation-driven advanced manufacturing economy. The confused rhetoric regarding manufacturing and its future role in the economy demonstrates a false dichotomy between manufacturing and the knowledge and creative spheres, suggesting that the latter needs to replace the former in the period of economic transformation (Gibson and Warren 2013). There has been a failure to shift the understanding of manufacturing from traditional to contemporary resulting in manufacturing policy being situated between entrenched visions of deindustrialisation and emerging notions of a renewed, advanced manufacturing sector.

The Harvard University Kennedy Business School's Atlas of Economic Complexity (Hausmann 2019) confirms that Australia lacks the economic diversity and productive capabilities to enable it to grow strongly relative to other countries into the future. Similar to Nübler and Perez, Hausmann states that the ability of a country to achieve relatively strong growth is dependent on the productive knowledge that goes into making products (know-how or productive capabilities) and diversity, the number and breadth of products a country is able to make. Hausmann (2019) argues that a country's total diversity can also be expressed by the collective know-how held within that country, what Nübler would refer to as the EAS and social capabilities. Of 133 countries in the Atlas, Australia ranks as the 93rd most complex. Compared to a decade prior, Australia's economy has become less complex, worsening 22 positions in the ECI ranking[8] due to its dependence on commodities. It concludes that Australia's

8 A measure of the knowledge in a society as expressed in the products it makes. The economic complexity of a country is calculated based on the diversity of exports a country produces and their ubiquity, or the number of the countries able to produce them (and those countries' complexity).

worsening complexity has been driven by a lack of diversification of exports and that in the future Australia is positioned to take advantage of only a moderate number of opportunities to diversify its production using its existing productive capabilities.

According to Hausmann (2019) economic growth is driven by a process of diversifying know-how (productive capabilities) to produce a broader, and increasingly more complex, set of goods and services. In Australia, export growth over the past five years has been driven by expanding its global market share of services, however, globally, long term economic growth is driven by diversification into new products that are incrementally more complex. Based on Australia's export profile, Hausmann (2019) concludes that Australia has diversified into too few products to substantially increase income growth into the future.

Conclusion

Based on Perez' (2010) three phases of techno-economic paradigm, the ILO's Theory of Productive Capabilities (Nübler 2014b) and Nübler's (2016) framework for achieving a 'golden age of job creation', this paper finds that Australia's industrial structure and knowledge sphere is well positioned to develop advanced and sophisticated professional services as well as the adoption of innovation into business models. However, the nation will be constrained in its ability to lead product innovation and transition to the job creation phase of an industrial revolution to achieve a 'great surge of development' due to its educational attainment structure (EAS) and proportionately smaller, and declining, manufacturing sector.

While job growth occurred in the decade to 2016, this was largely driven by a national growth effect associated with increasing consumption and the industry effect associated with the rise of the services sectors and the changing social organisation of care, rather than innovation and technological advancements. Job destruction, on the other hand, is evident in industry sectors associated with the 4IR; the replacement of jobs by automation and artificial intelligence to increase competitiveness and productivity.

Public discourse relating to the Fourth Industrial Revolution is currently stuck in the job destruction phase rather than job creation and widespread prosperity, the risk being a failure of public policy and institutional frameworks to prevent the former becoming a self-fulfilling prophecy.

The ability of a country to transition its economy from job destruction to job creation requires extension beyond relying on market forces to encompassing socio-political intervention. This potential socio-economic transformation is dependent upon a country's productive and social endowments whereby productive capacities are embodied in the physical sphere of production factors and infrastructure and the social capabilities are embodied in the intangible sphere; the educational attainment structure (EAS), the collective knowledge base of a society and its institutional framework (Nübler 2014a, 2014b, 2016).

In order to transition to the third phase of industrial revolution to achieve longer term growth and social prosperity, Australia needs socio-political intervention to address four issues:

1. The transformation of the institutional framework to facilitate both economic and social prosperity through increasing trust and safe-guarding;
2. The repositioning of education, skill and training policy to shift its educational attainment structure to one of 'strong middle' and enhancing collective learning and the knowledge structure;
3. The prioritisation of gender equality in rethinking both the structure of employment and the forms of work for both men and women; and
4. Redesigning economic development policy to embrace contemporary manufacturing as a growing, important industry.

Perez likens the current global economic and social challenges to the period prior to the Great Depression of the 1930s and resistance to then US President Franklin Roosevelt's New Deal for prolonged economic stagnation (Perez 2012a). However, despite declaring that he may not succeed but that he would try and try again; "The country needs and, unless I mistake its temper, the country demands, bold, persistent experimentation. It is common sense to take a method and try it. If it fails, admit it frankly and try another. But above all, try something.", through political leadership and government and industry collaboration, Roosevelt facilitated institutional reform that created the greatest 'surge of development' in history.

References

Anderson, P 2009, 'Intermediate occupations and the conceptual and empirical limitations of the hourglass economy thesis', *Work, Employment and Society*, vol. 23, no. 1, pp. 169.

Arcelus, FJ 1984, 'An extension of shift-share analysis', *Growth and change*, vol. 15, no. 1, pp. 3.

Atkinson, R 2018, 'Shaping structural change in an era of new technology', in M Neufeind, J O'Reilly & F Ranft (eds), *Work in the Digital Age: challenges of the Fourth Industrial Revolution*, Rowman & Littlefield International London, p. 103.

Australian Industry Group 2019, *The Fourth Industrial Revolution: Australian businesses in transition*, AiGroup, Sydney.

Autor, D & Dorn, D 2013, 'The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market', *American Economic Review*, vol. 103, no. 5, pp. 1553.

Bankwest Curtin Economics Centre 2018, *Future of Work in Australia: preparing for tomorrow's world*, Curtin University, WA.

Barany, Z & Siegal, C 2015, *Job Polarization and Structural Change*, SciencesPo Department of Economics, France.

Baum, S 1997, 'Sydney, Australia: A Global City? Testing the Social Polarisation Thesis', *Urban Studies*, vol. 34, no. 11, pp. 1881.

CEDA 2012, 'Australia adjusting: Productivity, innovation and the future of work', paper presented to Prime Minister's Economic Forum, Brisbane.

—— 2018, *Connecting people with progress: securing future economic development*, Committee for Economic Development of Australia,, Melbourne.

Cirillo, V 2018, 'Job polarization in European industries', *International Labour Review*, vol. 157, no. 1, pp. 39.

Coelli, M & Borland, J 2016, 'Job polarisation and earnings inequality in Australia', *Economic Record*, vol. 92, no. 296, pp. 1.

Danko III, JJ & Hanink, DM 2018, 'Beyond the obvious: A comparison of some demographic changes across selected shrinking and growing cities in the U nited S tates from 1990 to 2010', *Population, Space and Place*, vol. 24, no. 6, p. e2136.

Dean, M & Spoehr, J 2018, 'The fourth industrial revolution and the future of manufacturing work in Australia: challenges and opportunities', *Labour & Industry: a journal of the social and economic relations of work*, vol. 28, no. 3, pp. 166.

Deloitte 2019, *The path to prosperity: why the future of work is human*, Deloitte Australia, Australia.

Denny, L 2019, 'Economic restructuring and the polarisation of the workforce: a regional perspective', *Australasian Journal of Regional Studies*, vol. 25, no. 1, pp. 4.

Dunn, ES 1960, 'A statistical and analytical technique for regional analysis', *Papers in Regional Science*, vol. 6, no. 1, pp. 97.

Dwyer, RE 2013, 'The Care Economy? Gender, Economic Restructuring, and Job Polarization in the U.S. Labor Market', *American Sociological Review*, vol. 78, no. 3, pp. 390.

Felstead, A, Gallie, D & Green, F 2017, 'Measuring Skills Stock, Job Skills, and Skills Mismatch', in C Warhurst, K Mayhew, D Finegold & J Buchanan (eds), *The Oxford Handbook of Skills and Training*, Oxford University Press, UK, p. 321.

Fernández-Macías, E 2012, 'Job Polarization in Europe? Changes in the Employment Structure and Job Quality, 1995-2007', *Work and Occupations*, vol. 39, no. 2, pp. 157.

Figueiredo, H, Biscaia, R, Rocha, V & Teixeira, P 2015, 'Should we start worrying? Mass Higher Education, skill demand and the increasingly complex landscape of young graduates' employment', *Studies in Higher Education*, pp. 1.

Gallie, D 1991, 'Patterns of skill change: upskilling, deskilling or the polarization of skills?', *Work, Employment and Society*, vol. 5, no. 3, p. 319.

—— 2017, 'The quality of work in a changing labour market', *Social Policy & Administration*, vol. 51, no. 2, pp. 226.

Gibson, C & Warren, A 2013, 'A city that makes things: reconstituting manufacturing', https://apo.org.au/node/59746.

Goos, M & Manning, A 2007, 'Lousy and lovely jobs: The rising polarization of work in Britain', *The review of economics and statistics*, vol. 89, no. 1, pp. 118.

Goos, M, Manning, A & Salomons, A 2014, 'Explaining Job Polarization: Routine-Biased Technological Change and Offshoring', *American Economic Review*, vol. 104, no. 8, pp. 2509.

Gordon, J 2016, 'Australia's Productivity: Some Insights from Productivity Analysis', *Asia & the Pacific Policy Studies*, vol. 3, no. 2, pp. 173.

Grodach, C & Gibson, C 2019, 'Advancing Manufacturing?: Blinkered Visions in U.S. and Australian Urban Policy', *Urban Policy and Research*, vol. 37, no. 3, pp. 279.

Hajkowicz, S, Reeson, A, Rudd, L, Bratanova, A, Hodgers, L, Mason, C & Boughen, N 2016, *Tomorrow's digitally enabled workforce: Megatrends and scenarios for jobs and employment in Australia over the coming twenty years*, CSIRO, Brisbane.

Hamnett, C 1996, 'Social Polarisation, Economic Restructuring and Welfare State Regimes', *Urban Studies*, vol. 33, no. 8, pp. 1407.

Hausmann, R 2019, *Atlas of Economic Complexity*, Harvard's Growth Lab, Harvard Kennedy School, Harvard University, US, 4 November 2019, data visualisation tool.

Hofheinz, P 2018, 'Value creation in the data-driven economy', in M Neufeind, J O'Reilly & F Ranft (eds), *Work in the Digital Age: challenges of the Fourth Industrial Revolution*, Rowan & Littlefield, London, p. 89.

Holmes, C & Mayhew, K 2015, *Over-qualification and skills mismatch in the graduate labour market*, Chartered Institute of Personnel and Development, London.

—— 2016, 'The economics of higher education', *Oxford Review of Economic Policy*, vol. 32, no. 4, pp. 475.

Howcroft, D & Rubery, J 2018, 'Gender equality prospects and the fourth industrial revolution', in M Neufeind, J O'Reilly & F Ranft (eds), *Work in the Digital Age: challenges for the fourth industrial revolution*, Rowman & Littlefield, London, p. 63.

Keep, E 2017, 'Current Challenges: policy lessons and implications', in C Warhurst, K Mayhew, D Finegold & J Buchanan (eds), *The Oxford Handbook of Skills and Training*, Oxford University Press, New York.

Kucera D., Roncolato L. (2013) Structure Matters: Sectoral Drivers of Growth and the Labour Productivity-Employment Relationship. In: Islam I., Kucera D. (eds) *Beyond Macroeconomic Stability. Advances in Labour Studies*. Palgrave Macmillan, London.

Livingstone, D 2017, 'Skill Under-Utilization', in C Warhurst, K Mayhew, D Finegold & J Buchanan (eds), *The Oxford Handbook of Skills and Training*, Oxford University Press, USA, p. 281.

Lloyd, C & Payne, J 2016, *Skills in the Age of Over-qualification: Comparing Service Sector Work in Europe*, Oxford University Press.

McGuinness, S, Pouliakas, K & Redmond, P 2017, *How Useful Is the Concept of Skills Mismatch?*, IZA Discussion Papers, No. 10786.

McKinsey & Company 2019, *Australia's automation opportunity: reigniting productivity and inclusive income growth*, McKinsey Australia, Australia.

Montresor, G 2018, 'Job polarization and labour supply changes in the UK', *Labour Economics*, vol. 58(C), pp. 187.

Morgan, J 2019, 'Will we work in twenty-first century capitalism? A critique of the fourth industrial revolution literature', *Economy and Society*, pp. 1.

Murphy, E & Oesch, D 2018, 'Is Employment Polarisation Inevitable? Occupational Change in Ireland and Switzerland, 1970–2010', *Work, Employment and Society*, vol. 32, no. 6, pp. 1099.

Nübler, I 2014a, 'Social policy and productive transformation: Linking education with industrial policy', in *UNRISD Conference, New Directions in Social Policy: Alternatives from and for the Global South*, Geneva, Switzerland.

—— 2014b, 'A theory of capabilities for productive transformation: Learning to catch up', in J Salazar-Xirinachs, I Nübler & R Kozul-Wright (eds), *Transforming Economies: Making industrial policy work for growth, jobs and development*, International Labour Office, Geneva, pp. 113-149.

—— 2016, *New technologies: A jobless future or golden age of job creation?*, International Labour Office Geneva.

OECD 2015, *The Future of Productivity*, OECD Publishing, Paris, /content/book/9789264248533-en http://dx.doi.org/10.1787/9789264248533-en.

Oesch, D & Rodríguez Menés, J 2010, 'Upgrading or polarization? Occupational change in Britain, Germany, Spain and Switzerland, 1990–2008', *Socio-Economic Review*, vol. 9, no. 3, pp. 503.

Perez, C 2004, 'Technological revolutions, paradigm shifts and socio-institutional change', in E Reinert (ed.), *Globalization, economic development and inequality: An alternative perspective*, Edward Elgar Publishing Limited, UK, pp. 217-242.

—— 2010, 'Technological revolutions and techno-economic paradigms', *Cambridge journal of economics*, vol. 34, no. 1, pp. 185.

—— 2012a, 'Technological revolutions and the role of government in unleashing golden ages', in *Kondratieff Waves: Dimensions and Prospects 2012*, vol. 1929, pp. 211-218.

—— 2012b, 'Technological Revolutions and the Role of Government in Unleashing Golden Ages', *Journal of Globalization Studies*, vol. 3, no. 2, pp. 19.

Prime Minister's Industry 4.0 Taskforce 2017, *Industry 4.0 Testlabs in Australia: preparing for the future*, Swinburn Unveristy of Technology,Australian Government, Victoria.

Productivity Commission 2016, *Increasing Australia's future prosperity*, Canberra.

Quintini, G 2011, *Over-qualified or under-skilled: a review of existing literature*, OECD.

Reeson, A, Mason, C, Sanderson, T, Bratanova, A & Hajkowicz, S 2016, *Report Report for TAFE Queensland, The VET era: Equipping Australia's workforce for the future digital economy*, CSIRO, Brisbane.

Rozner, G 2017, *The disappearing Australian working man*, Institute of Public Affairs, Melbourne.

Salvatori, A 2015, *The anatomy of job polarisation in the UK*, IZA.

Schumpeter, J 1942, 'Creative destruction. Capitalism', *Socialism and Democracy*, vol. 825, pp. 82.

Schwab, K 2016, 'The Fourth Industrial Revolution: what it means, how to respond', viewed 17 September 2019, https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/.

Seet, P-S, Jones, JT, Spoehr, J & Hordacre, A-L 2018, *The Fourth Industrial Revolution: the implications of technological disruption for Australian VET*, 1925717208, NCVER, Adelaide.

Smith, C 2017, 'Skill demands and developments in the advanced economies', in J Buchanan, D Finegold, K Mayhew & C Warhurst (eds), *The Oxford Handbook on Skills and Training*, Oxford University Press, New York.

Soete, L 2018, 'Destructive creation: explaining the productivity paradox in the digital age', in M Neufeind, J O'Reilly & F Ranft (eds), *Work in the digital age: challenges for the Fourth Industrial Revolution*, Rowman & Littlefield, London, pp. 29-46.

bankwest | Curtin University

Bankwest Curtin Economics Centre

2019 SUBSCRIPTION TO THE AUSTRALIAN JOURNAL OF LABOUR ECONOMICS

The Australian Journal of Labour Economics [ISSN 1328 1143] of the Centre for Labour Market Research is published twice a year.

I would like to subscribe/renew my subscription for:

WITHIN AUSTRALIA*

☐ 1 year $146 (including GST) (Students $95) (Institutions $196)

☐ 3 years $358 (including GST) (Students $179) (Institutions $513)

*Includes GST

INTERNATIONAL

☐ 1 year A$182 (Students A$130) (Institutions A$206)

☐ 3 years A$424 (Students A$284) (Institutions A$526)

METHOD OF PAYMENT

☐ For on-line credit card payment please visit our webpage for details:
https://payments.curtin.edu.au/OneStopWeb/AJLE

Name:..... Title:.....

Company/Organisation:.....

Address:.....

.....

Email:.....

For further details:

Subscription Manager
Bankwest Curtin Economics Centre
Curtin University
Curtin Business School
GPO Box U1987 Perth WA 6845 Australia

Telephone: +61 89266 1744
For further details email: ajle@curtin.edu.au

Notes to Authors

The Australian Journal of Labour Economics (AJLE) is a forum for the analysis of labour economics and labour relations. It is particularly focused on theoretical and policy developments in respect of Australian labour markets. Interdisciplinary approaches are particularly encouraged. The AJLE invites submissions of articles in the following areas:

- Time allocation, work behaviour, and employment determination
- Wages, compensation, and labour costs
- Labour-management relations, trade unions, and collective bargaining
- Work organisation and the sociology of work
- Productivity
- Income and wealth distribution
- Mobility, unemployment, labour force participation and vacancies
- Gender, ethnicity, labour market segmentation and discrimination
- Population and demography in respect of the labour market

While contributors to the AJLE are expected to demonstrate theoretical or empirical originality – and preferably both – they should make their work accessible to readers from a non-technical background. Survey articles are also encouraged. Further, as a means of strengthening the integration of theory and practice the AJLE welcomes reflective contributions from practitioners. The AJLE recognises that the areas of labour economics and labour relations are subject to controversy and aims to provide an arena for debate.

Submission of Papers

Contributors should submit manuscripts via the email in Microsoft Word to:

ajle@curtin.edu.au
Sandie Rawnsley
Australian Journal of Labour Economics
C/o Bankwest Curtin Economics Centre
Curtin Business School
Curtin University
GPO Box U1987 Perth WA 6845

Manuscripts should not normally exceed 8000 words and should contain an abstract of approximately 150 words. They should be double-spaced and should include a separate title sheet which contains the author's name and affiliation, contact details, followed by the abstract, along with at least three Econlit subject descriptors. The next page will start with the Introduction. Text should be in Times 12pt with first level headings numbered using Century Gothic lower case, secondary headings italics bold (no numbering). Notes should be numbered in sequence and placed at the bottom of each relevant page.

References in Harvard style. A detailed style guide for preparation of final drafts will be sent to authors should the manuscript be accepted for publication and is also accessible through the Centre's website at http://businesslaw.curtin.edu.au/our-research/publications/australian-journal-labour-economics/

Refereeing Procedure

It is the policy of the editors to send submitted papers to two referees. The names of authors are not disclosed to referees.

the **CENTRE** *for*
LABOUR MARKET RESEARCH

The Centre is a consortium of Curtin University, Murdoch University, the University of Canberra and The University of Western Australia.

The objectives of the Centre are to further the understanding of labour market and related issues through research, with special reference to Australian labour markets. The Centre promotes the exchange of knowledge and expertise on labour economics and labour relations between the academic community, governments, business and trade unions.