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Regional impacts of the accelerated decline of the manufacturing sector in Australia

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Abstract

The Australian economy continues to undergo significant structural change. Since the Global Financial Crisis (GFC), one of the features of this adjustment has been the accelerated decline of the manufacturing sector. In the 5 years to December 2013, manufacturing employment in Australia declined by 9.6 per cent, or 99,000 jobs. We investigate how Australia adapted to the considerable decline in manufacturing employment in recent years. The paper builds on previous research that has attempted to quantify the relationship between structural change and unemployment. Specifically, we examine the role that changes in manufacturing employment have played in employment-to-working-age-population ratios and unemployment rates at the Statistical Area Level 4 (SA4) between 2006 and 2011 using data from the Australian Census of Population and Housing. We find that the recent accelerated decline of the manufacturing sector did have a statistically significant impact on employment and unemployment rates at the SA4 level, but that Australia has shown resilience in the face of structural change and has demonstrated considerable capacity to adjust. Changes in skill levels more than offset the negative impacts of the decline in manufacturing on employment and unemployment rates.

JEL Codes: J61, J62, J24
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Key points

- **This paper builds on previous research into the relationship between structural change and employment outcomes by examining the effect of the contraction in manufacturing employment on employment and unemployment rates by geographic region.**
- **It demonstrates that the recent accelerated decline in employment in the manufacturing sector has impacted negatively on local labour markets, but that regions have demonstrated considerable resilience through structural change.**
- **By demonstrating that regions where skill-levels have increased are affected less by declines in manufacturing employment, we highlight the important role that skills play in facilitating efficient structural adjustment.**
- **Labour mobility is also demonstrated to play a moderating role in the relationship between contracting manufacturing employment and change in employment levels. Evidence is provided to corroborate previous research that has indicated lower levels of geographic labour mobility among manufacturing workers.**
- **Finally, it is shown that the rate of decline of manufacturing employment was an important factor with respect to the effect on employment levels, which suggests that as contraction slows in a post-GFC world, the impact of the structural decline of manufacturing will be less evident.**

1. Introduction[1]

Structural change is a broad concept that refers to shifts in the distribution of inputs or outputs between industries or regions. The sources of structural change are many and varied, but all have their origin in changes to endowments, preferences, technology and institutions, and the impact on the relative prices of goods, services, labour, capital and land.[2] Unless all industries and regions expand or contract at the same rate, it is inevitable that at least one will be increasing in relative size and therefore at least one decreasing in relative size. When relative prices change, patterns of production and consumption follow suit, so some industries and regions expand or contract in relative terms.

Structural change is of fundamental importance to the efficient allocation of economic resources, as it reflects the collective response of individuals and firms to changing relative prices and wages. The fluidity with which structural change occurs underpins an economy's ability to respond to changes in relative prices to allow optimal allocation of resources. Timely and unencumbered adjustment can, therefore, be important for continued economic growth, prosperity and development.

Efficient and responsive structural adjustment can be impeded by a number of factors, such as skill shortages and mismatches, transaction costs associated with workers changing jobs, or a reluctance or inability of workers to change industry or move geographically. These factors can hamper the process of structural adjustment, resulting in an inefficient allocation of resources. The adjustment process may also present greater challenges to some individuals or groups, particularly those who are not able to readily transition between industries, due to inadequate skills or geographical constraints, for example.

The Australian economy continues to undergo significant structural change. Since the Global Financial Crisis, one of the features of this adjustment has been the accelerated decline of the manufacturing sector. Manufacturing Industry Value Added, in price-adjusted chain volume measures, declined by $16.4 billion or 14.2 per cent to $99.6 billion, in the 5 years to June 2014. In the 5 years to December 2013, manufacturing employment in Australia declined by 9.6 per cent, or 99,000 jobs. Areas that are highly dependent on manufacturing as a source of employment may be particularly susceptible to the challenges that such rapid change presents. Regions and workers do adjust, however, and over time local economies demonstrate resilience to such shocks, either absorbing displaced workers or seeing them move to alternative labour markets.

This paper builds on previous research that has attempted to quantify the relationship between structural change and unemployment. Specifically, we examine the role that changes in manufacturing employment has played in employment-to-working-age-population ratios and unemployment rates

[1] An earlier version of this paper was presented at the Australian Conference of Economists, July 2014

[2] See Productivity Commission (2013) http://www.pc.gov.au/__data/assets/pdf_file/0007/128428/annual-report-2011-12-supplement.pdf Accessed [13 February 2014].

between 2006 and 2011 at the SA4 level of the Australian Statistical Geography Standard (ASGS), using data from the Australian Census of Population and Housing. Disaggregating the data by geographic location allows us to examine the extent to which regions have been affected by the decline of the manufacturing sector, and also helps to identify other factors that make regions resilient to employment shocks, which may not appear at the aggregate level. Through identifying factors which facilitate smooth structural adjustment, we may gain a better understanding of how to minimise the social and economic costs of this process.

2. Structural change and unemployment

The relationship between structural change and unemployment is both dynamic and complex. To better understand the relationship, Lilien[3] decomposed unemployment into two components: that which is attributable to unanticipated monetary shocks; and that which is attributable to volatility in industry-level employment growth rates. As suggested by Groenewold & Hagger,[4] these two components capture, firstly, the influence on the unemployment rate of changes in the level of aggregate demand and, secondly, the influence of changes in the composition of aggregate demand. The overall finding of the research conducted by Lilien, that up to half of the variance in unemployment between 1948 and 1980 was the result of fluctuations in the natural rate of unemployment caused by slow adjustment of labour to shifts in employment between industries, has been vigorously contested since.

Heaton & Oslington[5] identify considerable scepticism regarding this high estimate of the contribution of structural change to unemployment, citing conflicting results from Australian studies conducted by Trivedi & Baker,[6] the Productivity Commission[7] and Hoque & Inder,[8] among others. Results from their own analysis suggest that common shocks, rather than those specific to particular sectors, were predominantly responsible for changes in unemployment in Australia between 1978 and 1994. Despite this, Heaton & Oslington recognise that sectoral shocks, while not the dominant force influencing trends in unemployment rates, play a more important role than suggested by Trivedi & Baker or the Productivity Commission.

Despite contentious results regarding the relationship between structural adjustment and the unemployment rate in aggregate, structural change may present employment challenges at a regional level. This is particularly so for regions where the local economy relies more heavily on contracting industries as a source of employment.[9] As such, this paper intends to explore

[3] Lilien, D. (1982), Sectoral Shifts and Cyclical Unemployment, Journal of Political Economy 90, 77-93.
[4] Groenewold, N. and Hagger, A. (1998), The Natural Rate of Unemployment in Australia since the Seventies, Economic Record 74, 24-35.
[5] Heaton, C. and Oslington, P. (2002), The Contribution of Structural Shocks to Australian Unemployment, The Economic Record, 78(243), 433-442.
[6] Trivedi, P. and Baker, G. (1985), Equilibrium Unemployment in Australia: Concepts and Measurement, Economic Record, 61, 629-43.
[7] Productivity Commission (1998), Aspects of Structural Change in Australia. AGPS, Canberra.
[8] Hoque, A. and Inder, B. (1991), Structural Unemployment in Australia, Applied Economics, 23, 723-30.
[9] Productivity Commission (2003), Trends in Australian Manufacturing,

the relationship between structural change and employment dynamics at the SA4 level.

As unemployment and, subsequently, the competition between job seekers rises, real wages will fall. This has been supported empirically in such studies as Blanchflower & Oswald (2005),[10] which demonstrated a negative relationship between wage levels and unemployment in a number of countries, including Australia. Despite some evidence suggesting that these results reflect unemployment acting as a proxy to state fixed effects, such as the housing prices in different Australian states and territories,[11] the theoretical underpinnings are sound and the relationship intuitive, at least in the short-term.

Additionally, in response to region-specific increases in unemployment, workers may be seen to move to areas with more favourable labour market conditions.[12] Debelle & Vickery[13] show that interstate migration decisions are affected by relative labour market conditions in Australia, with individuals inclined to move from areas of relatively high unemployment to areas with relatively low unemployment. Further, the analyses provided by Debelle & Vickery suggests that relative unemployment levels play a more important role in such decisions than relative wages, and that persistent differences in unemployment levels reflect the balance found between lifestyle choices and labour market conditions. In all, Debelle & Vickery highlight four key mechanisms for structural adjustment following unemployment shocks: wage adjustment, firm mobility, labour mobility and workers exiting the labour force. They demonstrate, however, that migration is a slow process, with most migration occurring in the four years following an employment shock.

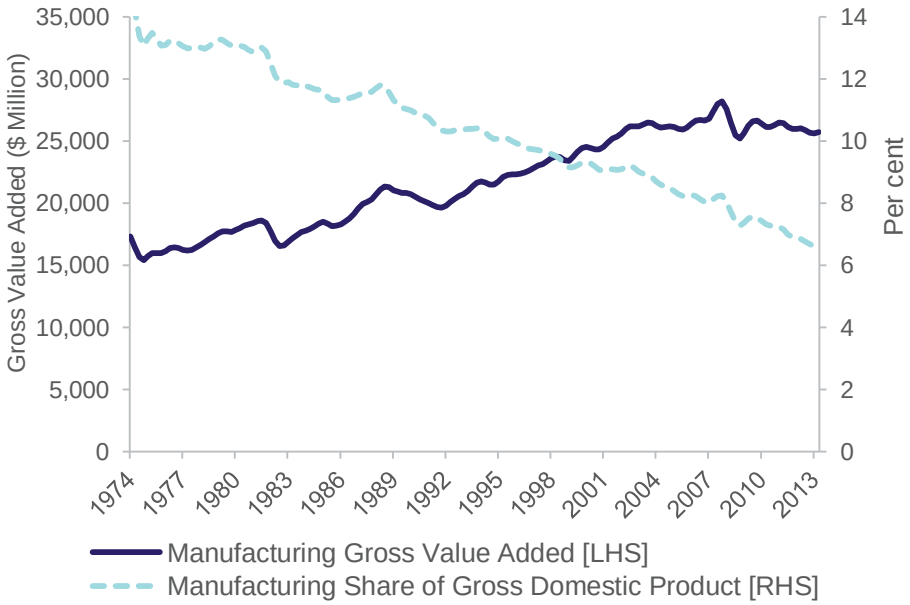
3. Manufacturing and structural change

Manufacturing remains an important part of the Australian economy. It produces around $100 billion of output each year, which ranks it sixth among ANZSIC industries,[14] and accounts for over 930,000 jobs, making it the fourth largest employing industry.[15]

Manufacturing has, however, been at the centre of significant structural change in Australia over recent decades, as it has been in most developed economies. As recently as 2008, Manufacturing was Australia's largest employing industry and the biggest producer of output. While the industry has enjoyed continued growth in output (at least up until the GFC), the industry's share of output has declined at a gradual but sustained pace, indicating that output has grown less quickly than in the rest of the economy (see Figure 3.1).

[10] Blanchflower, D. and A. Oswald (2005), The Wage Curve Reloaded, IZA Discussion Paper No. 1665, Institute for the Study of Labor, Bonn, Germany
[11] Kennedy, S. and J. Borland (2000), A Wage Curve for Australia?, Oxford Economic Papers, 52, pp.774-803, Oxford University Press
[12] Blanchard, O. and L. Katz (1992), Regional Evolutions', Brookings Papers on Economic Activity, 1, pp. 1–61.
[13] Debelle, G. and Vickery, J. (1998), Labour Market Adjustment: Evidence on Interstate Labour Mobility, Research Discussion Paper 9801, Reserve Bank of Australia.
[14] ABS cat. no. 5204.0.
[15] ABS cat. no. 6291.0.55.003.

Figure 3.1: Australian manufacturing Output, 1974 to present



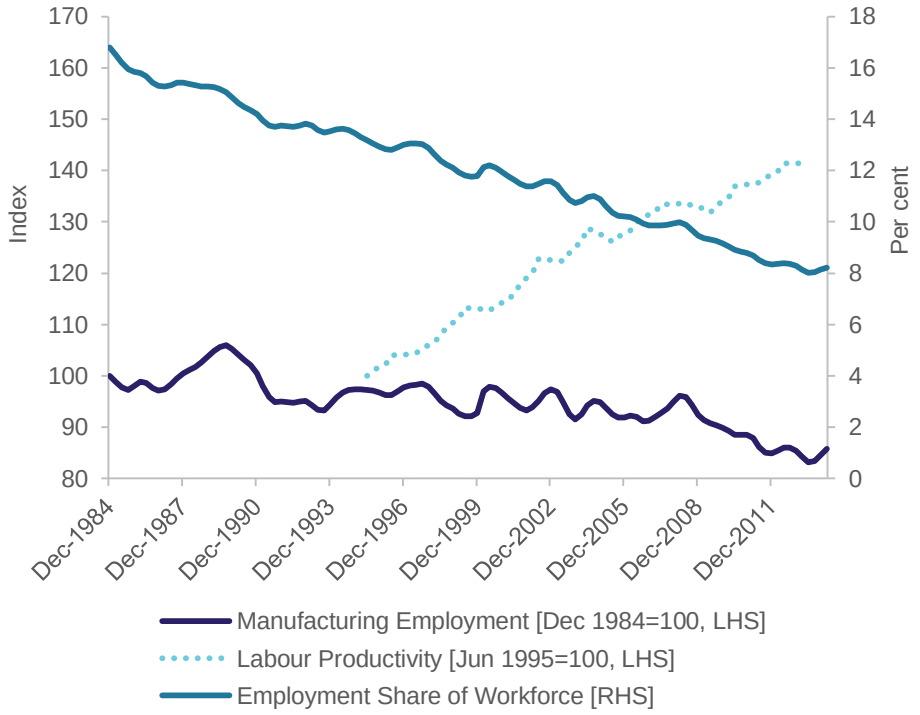
Source: ABS cat. No. 5206. 0.

Manufacturing employment, however, has declined in both relative and absolute terms. Absolute employment remained relatively steady until the end of 2008 then declined markedly, while the employment share of manufacturing has declined at a relatively constant rate over the past 30 years. In 1984, the manufacturing sector employed 1.1 million workers, representing 16.8 per cent of the Australian workforce.[16] By November 2013, the sector was employing 930,000 workers and represented 8.0 per cent of the workforce; less than half the proportion 30 years prior. That employment declined while output grew indicates that labour productivity increased (see Figure 3.2).

The beginning of a sharp contraction in manufacturing employment coincided with the onset of the Global Financial Crisis (GFC) and, in the 5 years to November 2013, manufacturing employment in Australia fell by 9.6 per cent or 99,000 jobs.[17] This contraction in employment may be attributed to a variety of factors, including the persistently high Australian dollar, increased competition from low cost countries such as China and India, and a switch to more capital intensive production processes.

[16] ABS cat. no. 6291.0.
[17] Ibid.

Figure 3.2: Australian manufacturing employment, 1984 to present



Source: ABS cat. no. 6291.0 & 5204.0.

The Australian manufacturing sector is expected to contract further over coming decades, with one study suggesting that manufacturing employment in Victoria, for example, will contract a further 8.5 per cent over the next 20 years.[18]

The contraction in aggregate manufacturing employment represents only part of the significant structural adjustment taking place. The nature of Australian manufacturing is also changing.

The two fastest growing manufacturing subsectors between 2006 and 2011, in terms of relative share of the industry, were Food Product Manufacturing and Machinery & Equipment Manufacturing. Employment in Food Product Manufacturing increased by 3454 workers between 2006 and 2011 to represent 18.2 per cent of employment in manufacturing in 2011.[19] Employment in Machinery & Equipment Manufacturing increased by 2031 workers, to represent 11.8 per cent of manufacturing employment in 2011.

Textile, Leather, Clothing & Footwear Manufacturing, along with Transport Equipment Manufacturing, were the fastest contracting manufacturing subsectors. The employment share of Textile, Leather, Clothing & Footwear Manufacturing decreased by 0.8 percentage points or approximately 9,000 employees, to represent 3.8 per cent of manufacturing employment in 2011. The employment share of Transport Equipment Manufacturing decreased by 1.0 percentage points, or approximately 14,000 employees, to represent 8.8 per cent of manufacturing employment in 2011.

[18] KPMG (2011), as cited in Victoria Competition and Efficiency Commission (2011)
[19] 2006 and 2011 ABS Census of Population and Housing

Skills that are applicable in one form of manufacturing may not necessarily be relevant to another. The changing nature of manufacturing, and relative growth and contraction in different subsectors, therefore presents its own challenges.

4. Conceptual framework

The decline of manufacturing employment in Australia is likely to have affected labour markets. While not observed in aggregate, it is likely that effects may be observed in local labour markets, particularly in areas where the downscale of manufacturing employment has been most prominent. We wish to test, therefore, the extent to which this decline has been directly responsible for changes in the employment to population ratios and unemployment rates of labour markets (defined at the Statistical Area level 4). However, there are considerable differences between labour markets. Such differences moderate the adjustment of local labour markets to downscaled manufacturing operations, allowing some regions to adjust more rapidly than others. The following equation sets out the conceptual framework for this research:

$$\Delta Employment_i = \Delta ManEmployment_i + \Delta Demand_i + \Delta RealWages_i + \Delta Skills_i + \Delta LM_i$$

The model stipulates that change (over time) in a region *i*'s employment metric (unemployment rate or employment to population ratio) will depend on the change in the region's manufacturing employment, the change in demand or economic activity in that region, the change in real wages in that region, the change in the skills of the workforce and the change in labour mobility (LM), i.e. how easily workers can change jobs.

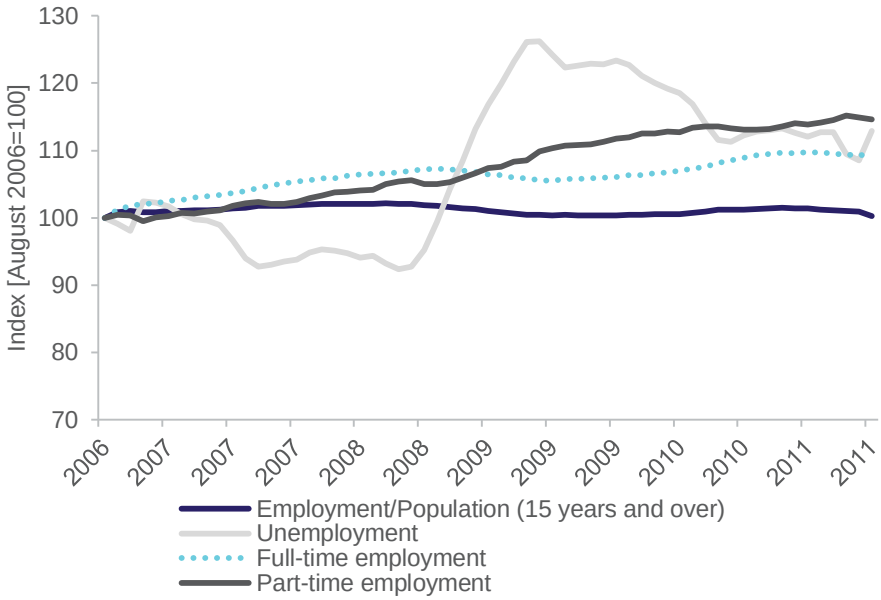
The signs of the independent variables will of course depend on the metric used for the dependent variable. In this study we use both unemployment rates and employment to (working age) population ratios as our dependent variables, as both have advantages and disadvantages and examination of both is required in order to tell the full story. For example, the advantage of a model which uses the employment to population ratio rather than the unemployment rate lies in its ability to account for changes in the participation rate. This is important because, when demand is strong, individuals who had been discouraged from looking for work may choose to re-enter the labour force as they believe their prospects have improved. This can lead to simultaneous increases in both the unemployment rate and the participation rate in the short-term. As such, a rising unemployment rate may sometimes mask the early stages of an economic recovery.

On the other hand, employment to population ratios do not account for those that have dropped out of the labour force willingly, to have children, for example.

Further, looking at employment to population ratios without separating full and part-time employment may be misleading. To illustrate, Figure 4.1 presents the unemployment rate, the employment to working age population

ratio, as well as the part-time and full time employment to working age population ratios for Australia between 2006 and 2011. The unemployment rate increased dramatically in early 2009, following the onset of the GFC. In contrast, total employment kept pace with the population growth rate, even during the GFC, resulting in a relatively stable employment to population ratio over the period.

Figure 4.1: Australian employment and unemployment, 2006 to 2011



Source: ABS cat. no. 6291.0.

The steady growth of employment during the GFC masked the true story, however. Figure 4.1 shows that full-time employment contracted during 2009. This contraction in full-time employment was offset by a rapid increase in part-time employment. The increase in part-time employment was likely the result of reduced hours for staff formerly working in full-time positions, those displaced from full-time positions obtaining part-time employment, and the greater propensity for workers to re-enter the labour force in a part-time capacity to supplement family income. The dichotomy of outcomes between full-time and part-time employment during the period led us to split the employment to population ratio dependent variable into part-time and full-time, leaving us with three models: an unemployment rate model, a full-time employment to working age population ratio model and a part-time employment to working age population ratio model.

We expect that a decrease in manufacturing employment will cause employment to population rations to fall (a positive relationship) and unemployment rates to rise (a negative relationship).

Regions with strong demand or economic activity are expected to adjust to manufacturing employment losses more quickly so this variable is expected to have a positive relationship with region's employment to population ratios and a negative relationship with unemployment rates (higher demand will cause unemployment to fall and vice-versa).

Similarly, the theory of human capital suggests that increasing skill levels in a region, either through training and formal education, or through skilled migration, would be expected to reduce unemployment rates and increase employment to population ratios.

Increased labour mobility is also expected to help the adjustment process, as workers can easily move between regions to the areas where there are more employment opportunities.

The relationship between real wages and labour markets is more complex. While higher wages will attract workers to a region, they will also increase costs for businesses, making it difficult to take on more staff. In addition, regions adversely affected by an employment shock may be better able to adjust if wages are flexible and can adjust downwards to accommodate lower labour demand.

Other 'region specific' effects, which do not change much over time, such as proximity to other labour markets, are discussed in the next section.

5. Methodology

This paper uses data from the Australian Census of Population and Housing (2006 and 2011) to explore the relationship between manufacturing employment change and the employment outcomes in regions across the period. Specifically, regions are examined at the Statistical Area Level 4 (SA4) of the Australian Statistical Geography Standard.[20] This level of geographic disaggregation is designed for the output of Labour Force Survey data and intended to reflect labour markets within each state and territory. The proposed models were designed to explain the impact that the contraction in manufacturing employment has had on employment-to-working-age-population ratios and the unemployment rate in 87 SA4 regions over the 2006 to 2011 period.[21]

Examining the relationship between the contraction in manufacturing employment and the resulting change in employment and unemployment rates is complicated by the fact that geographic areas are likely to exhibit region specific effects that may impact on these relationships. These effects may result from such factors as cultural differences, geographic features, differences in the innate ability of the population, socio-economic characteristics and access to labour markets. It is impractical to attempt to control for all of these effects, due to both the sheer number and their largely unobservable nature. Without accounting for this, however, the model will suffer from omitted variable bias and the coefficients of the independent variables are likely to be biased. One way to address this issue is to include a dummy variable for each of the regions (minus one for the base case) to account for these region specific factors. However, this would result in a long and cumbersome regression equation and exhaust our degrees of freedom.

[20] The Australian Statistical Geography Standard (ASGS) is the Australian Bureau of Statistics' geographical framework used for the 2011 Census of Population and Housing. SA4s are the largest sub-State regions. There are 88 SA4s with populations ranging from 100,000 to 500,000.

[21] Due to atypical demographic and economic characteristics 'Other Territories' was excluded from the analysis.

A simpler alternative is the Fixed Effects model. Fixed Effects models assume that all region specific effects do not vary across time.[22] We consider this a reasonable assumption as key factors such as remoteness, geographic features, access to labour markets and the socioeconomic status of the region are unlikely to have changed substantially over the five-year period used in this study.

Using the within transformation, or by taking first differences (the two methods are equivalent in a two period model), time-invariant regional effects may be removed from the model, leaving only variables that have changed over time. This resolves the issue of accounting for unobservable region specific effects without expending our degrees of freedom.

To illustrate, consider the following model:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + a_i + u_{it} \quad (1)$$

Where:

Y_{it} = the dependent variable of interest

X_{it} = the independent variable(s) of interest

β_0 and β_1 are the intercept term and the coefficient(s) of X_{it} respectively

u_{it} = an *iid* error term

a_i = the region specific effects associated with region i

By taking first differences in (1), we are able to eliminate the time invariant components, β_1 and a_i, as follows:

$$(Y_{it} - Y_{it-1}) = (\beta_0 - \beta_0) + \beta_1 (X_{it} - X_{it-1}) + (a_i - a_i) + (u_{it} - u_{it-1})$$

This can be re-written as:

$$\Delta Y_i = \beta_1 \Delta X_i + \Delta u_i \quad (2)$$

This is known as a first difference transformation. First difference models estimate the change in Y for a given change in X. The models we have used are in the form of equation 2 above, but with multiple (k) exogenous variables, as below:

$$\Delta Y_{it} = \sum_{j=1}^{k} \beta_j \Delta X_{ijt} + \Delta u_{it}$$

Only variables that change over time can be included in such models, so time invariant factors such as remoteness and socio-economic status are omitted. At first glance it may seem that these should be included, however, while there is no doubt that such factors have an influence over the *level* of the employment to population ratio or unemployment rate in an area, they are unlikely to have an effect on the *change*, at least in the short to medium term.

[22] Another assumption of Fixed Effects models is that they allow region specific effects to be correlated with the independent variables.

6. Descriptive statistics

Table 6.1 presents the variables used in our models as well as descriptive statistics of change in these variables between 2006 and 2011.

During the 2006 to 2011 period the unemployment rate increased in 54 of the 87 regions, for a mean of 0.31 percentage points. The unemployment rate and the employment to population ratio were simultaneously increasing in almost half of the regions (35 out of 87) This may at first appear counter-intuitive, but was predominantly due to increases in the participation rate (60 of 87 regions), leading to increases in both employment and unemployment.

The increase in employment was driven by accelerated growth in part-time employment. Part-time employment as a proportion of the population aged 15 and over increased in 77 of the 87 regions by an average of 0.69 percentage points. At the same time, full-time employment as a proportion of the population aged 15 and over increased in only 37 out of the 87 regions, averaging a decrease of 0.06 percentage points.

The manufacturing share of employment decreased in every region, by an average of 1.37 percentage points.

Changes in average annual wages were anchored to changes in the national wage to give a 'real wage' approximation. This means that on average, the change should be close to zero as approximately half of all regions' wages increase more than the national average and approximately half increase by less.

The proportion of the population that had lived at a different address in the previous 12 months (LD) was used as a proxy of labour mobility. This variable is used as a proxy for labour mobility, although it only takes into account one dimension—geographic labour mobility. It does not account for those that change occupation, but do not move. On average LD was negative, suggesting that overall, people moved less in the year to August 2011 than they did in the year to August 2006.

CertOv and Cert are the skills variables. All regions experienced an increase in the proportion of their workforce with Certificate III qualifications, averaging 5.7 percentage points, while all but five regions experienced an increase in the percentage of their workforce with Certificate III or certificate IV qualifications, increasing by an average of 1.75 percentage points.

Build is a proxy for demand as it is expected that an increase in building approvals[23] will follow strong demand conditions in a region and vice-versa. On average, building approvals were up slightly in 2011 compared with 2006.

[23] Building approvals reflect all residential building approvals valued at $10,000 or more and all non-residential building approvals valued at $50,000 or more. This may include new structures, alterations and additions, and conversions. This does not include construction of non-building structures, such as roads, bridges and railways.

Table 6.1: Model variables and change observed between 2006 and 2011

Variable	*Type*[24]	*Description*	*Mean*	*Std. Dev*	*Min*	*Max*
FTE[a]	D	The ratio of full-time employment in a region to the population aged 15+ in that region	-0.0006	0.0119	-0.027	0.037
Unemp[a]	D	The number of total unemployed persons in a region divided by the labour force (number of employed plus unemployed in a region).	0.0031	0.0090	-0.018	0.025
PTE[a]	D	The ratio of part-time employment in a region to the population aged 15+ in that region	0.0069	0.0077	-0.027	0.020
Man[a]	I	The ratio of manufacturing employment in a region to total employment in that region (i.e. the manufacturing share of employment)	-0.0137	0.0074	-0.031	-0.001
RelWage[b]	I	Average annual personal wage and salary income less national wage	42.839	1547	-1974	6000
LD[a]	I	The proportion of the population aged 15+ that lived at a different address one year ago.	-0.0124	0.0113	-0.043	0.013
CertOv[a]	I	The proportion of the working age population (15-64) with Certificate III qualifications or higher	0.0570	0.0083	0.042	0.091
Cert[a]	I	The proportion of the working age population (15-64) with certificate III or IV qualifications.	0.0175	0.0106	-0.003	0.044
Build[b]	I	Building approvals in a region over year t divided by the population aged 15+ in that region.	0.0042	0.0023	0.001	0.018

Source: Department of Industry and Science, 2015.

7. Results

Model 1: Full-time employment to population ratio

Model 1 was designed to measure the impact that the decline in manufacturing employment has had on the change in the full-time employment to population ratio at the SA4 level over the 2006 to 2011 period. Other variables included are those that may also have impacted on the full-

[24] Dependent variables (D) and Independent variables (I)
[a] ABS Australian Census of Population and Housing, 2006 and 2011
[b] ABS Cat. No. 1379.0.55.001 *National Regional Profiles*. Due to data limitations, variables from this source use change between 2007 and 2011 to proxy change between 2006 and 2011.

time employment to population ratio and, as such, may have moderated the effect of the decline in manufacturing.

We can interpret results from this model, provided in Table 2, as follows:

- A one percentage point decrease in the ratio of manufacturing employment to total employment will result in, on average, a 0.359 percentage point decrease in the full-time employment to population ratio in a given region, holding all else constant.
- A $1,000 increase (decrease) in the average wage in a region in excess of the increase in the Australian average wage over the period will result in a 0.400 percentage point increase (decrease) in the full-time employment to population ratio in that region, holding all else constant.
- A one percentage point increase (decrease) in the proportion of the population aged 15 years and older that lived at a different address 12 months ago will result in, on average, a 0.444 percentage point increase (decrease) in the full-time employment to population ratio in a given region, holding all else constant.
- A one percentage point increase in the proportion of the working age population with a Certificate III qualification (or higher) will result in, on average, a 0.174 percentage point increase in the full-time employment to population ratio in a given region, holding all else constant.

The results indicate that the decline in manufacturing employment has had a significant adverse effect on full-time employment at the regional level.

The demand variable, Build, was omitted from the model as it was not statistically significant, indicating no relationship between full-time employment to population ratios and demand at the regional level.

We were interested to compare this result to the effect on part-time employment. In 2006, 80 per cent of those employed in the manufacturing industry in 2006 were working full-time, compared to 63 per cent of those employed in the economy as a whole. As a result, and together with the overall increase in part-time employment over the period, our prior expectation was that the impact of the decline in manufacturing on part-time employment would be significantly less evident. A similar model with the part-time employment to population ratio as the dependent variable is discussed below.

Table 7.1: Results of estimation

Variable	*Model 1: ΔFTE*	*Model 2: ΔPTE*	*Model 3: ΔUnemp*
ΔMan	0.359** (0.150)		-0.358*** (0.065)
ΔRelWage	0.004*** (0.001)	-0.001** (0.000)	0.001*** (0.000)
ΔLD	0.444*** (0.089)	0.192*** (0.065)	-0.500*** (0.083)
ΔCertOv	0.174*** (0.046)	0.171*** (0.018)	
ΔBuild		-0.943** (0.458)	-0.967** (0.444)
ΔCert			-0.471*** (0.074)
Adjusted R^2	0.3885	0.5921	0.5264

Notes: ** Significant at the 5 per cent level

*** Significant at the 1 per cent level

Source: Department of Industry and Science, 2015.

Model 2: Part-time employment to population ratio

Model 2 was designed to measure the impact that the decline in manufacturing employment has had on the change in the part-time employment to population ratio at the SA4 level over the 2006 to 2011 period.

We can interpret results from this model, provided in Table 7.1, as follows:

- A $1,000 increase (decrease) in the average wage in a region in excess of the increase in the Australian average wage over the period will result in a 0.100 percentage point decrease (increase) in the part-time employment to population ratio in that region, holding all else constant.
- A one percentage point increase (decrease) in the proportion of the population aged 15 years and older that lived at a different address 12 months ago will result in, on average, a 0.192 percentage point increase (decrease) in the part-time employment to population ratio in a given region, holding all else constant.
- A one percentage point increase in the proportion of the working age population with a Certificate III qualification (or higher) will result in, on

average, a 0.171 percentage point increase in the part-time employment to population ratio in a given region, holding all else constant.

- A one percentage point increase (decrease) in the number of building approvals as a ratio of the working age population over 2011 compared with over 2006 in a region will result in, on average, a 0.943 percentage point decrease in the part-time employment to population ration in a given region, holding all else constant.

The part-time model initially had the same specification as the full-time model, using the part-time employment to population ratio as the dependent variable.

However, the coefficient of Man was negative but not significant in this model (at the 10 per cent level) and was omitted as a result. That the decline in Manufacturing employment did not have a significant effect on part-time employment to population ratios was consistent with our prior expectations. The lack of a significant effect may indicate an opposing influence. While manufacturing firm closures result in displacement of fulltime and part-time employees, a lack of decline in the number of part-time positions may indicate replacement of fulltime jobs with part-time positions. That is, a proportion of former full-time manufacturing workers that were displaced may have been re-employed in part-time positions.

Interestingly, in contrast to the full-time model, the demand variable 'Build', which reflects the change in the number of building approvals in each region over the period, was statistically significant at the 5 per cent level in this model and was therefore included. This supports data presented in Figure 4.1, indicating that demand shocks have a positive impact on part-time job growth, though this likely indicates issues with underemployment during such times.[25]

Model 3: Unemployment rate

Model 3 was designed to measure the impact that the decline in manufacturing employment has had on the change in unemployment levels.

We can interpret results from this model, provided in Table 2 (above), as follows:

- A one percentage point decrease in the ratio of manufacturing employment to the total employment will result in, on average, a 0.358 percentage point increase in the unemployment rate in a given region, holding all else constant.
- A $1,000 increase (decrease) in the average wage in a region in excess of the increase in the Australian average wage over the period will result in a 0.100 percentage point increase (decrease) in the unemployment rate in that region, holding all else constant.

[25] We also attempted to fit a model with the total employment to population ratio as the dependent variable. However, this model was discarded because the independent variable of interest Man was found to be not significant (marginally), with a p-value of 0.108. As might be expected the coefficient of Man was in-between that of the part-time and full-time models at 0.272.

- A one percentage point increase (decrease) in the proportion of the population aged 15+ that lived at a different address 12 months ago will result in, on average, a 0.500 percentage point decrease (increase) in the unemployment rate in a given region, holding all else constant.
- A one percentage point increase in the proportion of the working age population with a certificate III or IV qualification will result in, on average, a 0.471 percentage point decrease in the unemployment rate in a given region, holding all else constant.
- A one percentage point increase (decrease) in building approvals divided by the population aged 15 and over in that year will result in, on average, a 0.967 percentage point decrease (increase) in the unemployment rate in a given region, holding all else constant.

Due to the opposing influence of higher education and vocational-level education, discussed in detail below, Cert (the proportion of each region's workforce with Certificate III or IV qualifications) is used as the skills measure in this model rather than CertOv (the proportion of the region's workforce with a Certificate III qualification or above).[26]

This model indicates that the accelerated decline in manufacturing employment is having a significant impact on unemployment rates at the SA4 level. To provide an anchor point for the figures above, the average decline in the ratio of manufacturing employment to population aged 15 years and over, at the SA4 level, was 1.4 percentage points. Feeding this into the models, the decline in manufacturing in the average region would have coincided with an increase in the unemployment rate in that region of just over half a percentage point.

8. The moderating role of education

The relationship between higher educational attainment and the unemployment rate has been, in recent years, a source of controversy. While some commentators argue that the relationship is always negative, with one describing this as a "nearly ubiquitous observation"[27], others have identified shifts over time, citing strong criticism of the expansion of higher education (bachelor level and above) during the 1970s, based on concerns of over-education and mismatches leading to graduate unemployment or underemployment.[28] Overwhelming evidence suggests, however, that graduates are, on average, less likely to be unemployed at any point in time due to both a lower risk of displacement and shorter periods of subsequent unemployment.[29] For this reason, it is important to carefully consider the moderating impact of educational attainment on unemployment stemming from the decline in manufacturing employment.

The results from the models presented suggest that increases in the proportion of the population with post-secondary school education significantly moderated the impacts of the decline in the manufacturing

[26] Indeed, CertOv, in model specifications containing this variable was not found to be significant.
[27] Mincer (1991) Education and Unemployment. National Bureau of Economic Research (p.2)
[28] Teighler & Kehm (1995) Towards a New Understanding of the Relationships between Higher Education and Employment. European Journal of Education, Vol. 30, 2.
[29] Ibid

sector. To illustrate, the average regional increase in the proportion of people aged 15-64 with Certificate III qualifications or higher was 5.7 percentage points between 2006 and 2011. The results from Model 1 suggest that this would coincide with an increase in the employment to population ratio of just under 1 percentage point, on average. That is, the average change in the proportion of 15-64 year olds holding Certificate III qualifications or higher resulted in an increase in the employment to population ratio of 0.99 percentage points in any given region. This more than offsets the average decline in the full-time employment to population rate that the model predicts will occur due to the average decline in manufacturing employment (half a percentage point).

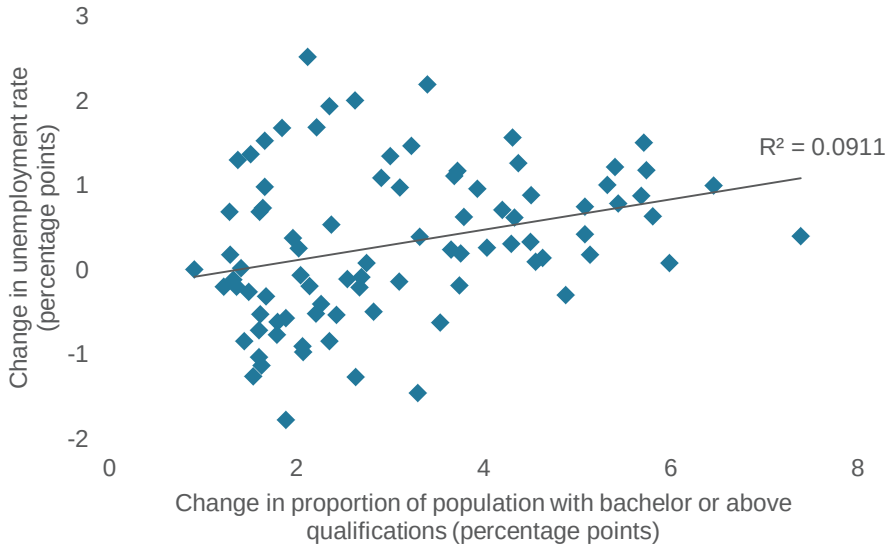
Similarly, the average increase in the proportion of the population aged 15 and over with Certificate III and IV qualifications was 1.8 percentage points. When applied to our model, this results in a substantial 0.9 percentage point reduction in the unemployment rate, which more than offsets the half-a-percentage-point decline in the unemployment rate that is attributable to the reduction in manufacturing employment.

CertOv, however, did not appear to have an effect on the unemployment rate at the SA4 level, as it was not found to be statistically significant in this model. As a result, we attempted to fit the model using separate variables for Certificate qualifications and University level qualifications (denoted Uni) to determine whether an increase in specific qualification types affects unemployment rates. The coefficient of Uni was positive (coefficient of 0.096) and significant.

This positive sign was unexpected, and goes against prevailing views on the relationship between educational attainment and employment. As the adjusted R^2 figure of the model containing Uni was considerably lower than that of the model using the Cert variable (0.33 compared to 0.53), the Uni variable was not included in the final specification. This unexpected finding, however, prompted further investigation into the relationship between university qualifications and unemployment rates.

Figure 8.1 displays the positive relationship between changes in university level qualifications and changes in the unemployment rate at the SA4 level. This surprising relationship indicates that areas with larger increases in university graduates were more likely to experience rising unemployment rates during the period. This positive relationship explains why the CertOv variable was not found to be significant in the unemployment model, as the higher education and vocational education appear to have affected unemployment rates in opposing ways.

Figure 8.1: Unemployment rates and university qualifications



Source: ABS Census of Population and Housing, 2006 & 2011

While an increase in university qualifications did not seem to reduce unemployment in that region, it remains likely that gaining a university education will reduce the likelihood of unemployment at an individual level. One explanation of the unexpected positive relationship between unemployment and university level qualifications could be that regions struggle to absorb large numbers of graduates into the labour force in the short-term.

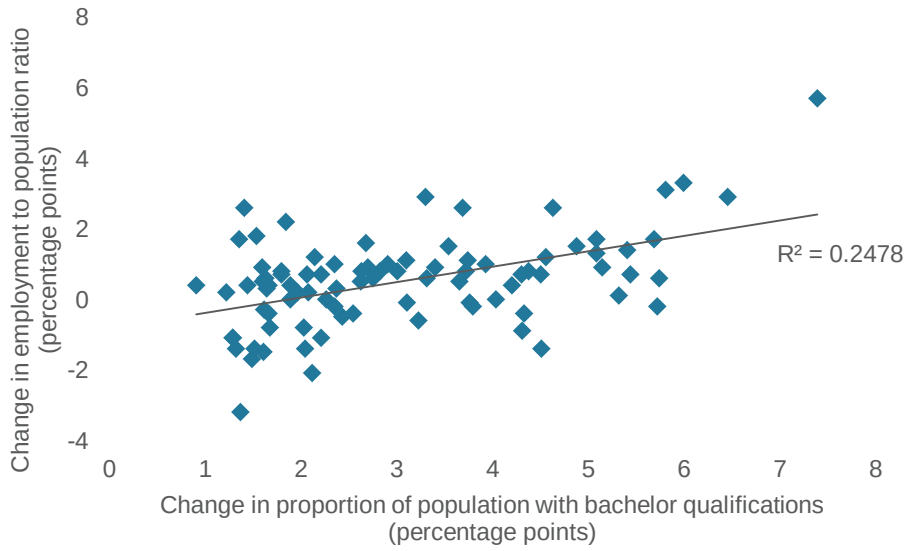
Another explanation could be that local economies require a balance of workers with certificate level qualifications and university qualified workers. For example, economies require trades people, construction workers and transport workers, as well as professionals such as lawyers and accountants. Regions where there is an oversupply of university educated graduates may suffer from skills shortages in occupations which require workers with certificate level qualifications, while those with university level qualifications may find it difficult to find work that makes use of their skills.

It is possible that the phenomenon displayed in Figure 8.1 could be due to changing demographics of regions. Graduates are more likely to be a younger cohort and young people may be more likely to be unemployed than older age groups. Thus the reason for the positive relationship between increases in unemployment rates and increases in the proportion of populations with university qualifications could be attributed to age factors rather than skill factors. To test this we included a variable to control for increases in the proportion of the SA4's population aged 15-24 in the unemployment model. The 'Young' variable was negative (coefficient of -0.241) and marginally not significant at the 10 per cent level (p-value of 0.105), and was omitted as a result. Furthermore, when the BA and Young variables are both included in the unemployment model to control for increases in the proportion of young people, the BA variable remains positive,

but slightly lower (0.92 compared to 0.96 when the Young variable is not included), and the p-value falls from 0.045 to 0.098. This indicates that demographic factors may have played some role in the relationship, however, its effect is not strong enough to disregard the positive relationship between university qualifications and unemployment at the regional level.

While increases in the proportion of the population in each region with university level qualifications were not found to reduce unemployment rates in those regions, change in university level qualifications did display a positive relationship with employment rates, as shown in Figure 8.2. This indicates that an increase in the proportion of populations with university level qualifications is likely to increase the participation rate in that region.

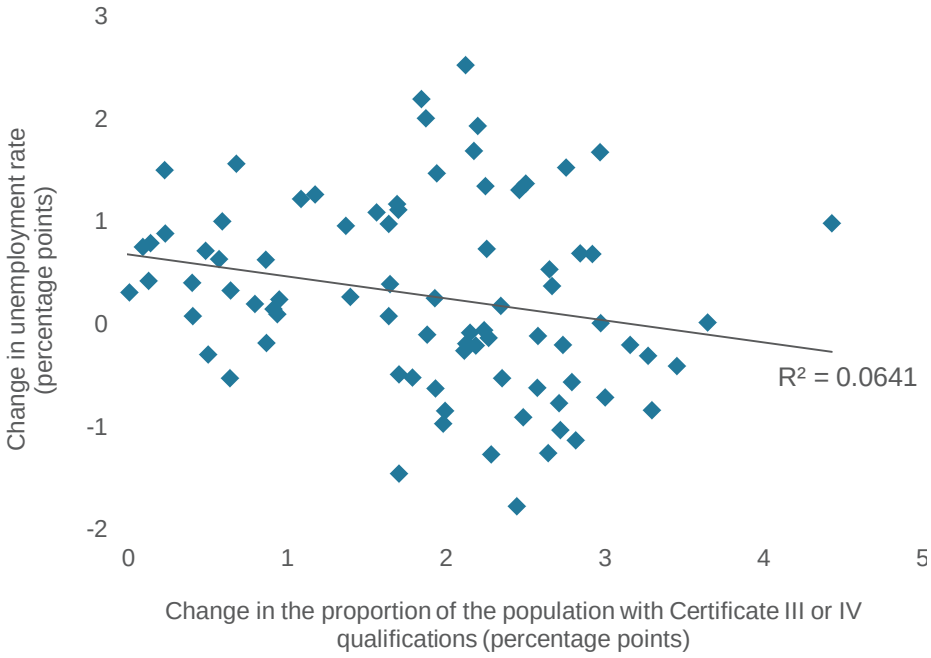
Figure 8.2: Employment to population ratios and university qualifications



Source: ABS Census of Population and Housing, 2006 & 2011

Figure 8.3 demonstrates that an increase in the proportion of a region's population with certificate level qualifications had a clear negative relationship with changes in unemployment in those regions. This indicates that increases in the proportion of a region's population with certificate level qualifications tended to lower the unemployment rate in that region. Certificate III and IV qualifications may be more commonly obtained by workers who maintain full-time employment while studying, through apprenticeship programs, for example. As such, graduates of vocational education may be less likely than their higher education counterparts to experience a period of unemployment (or underemployment) immediately following graduation.

Figure 8.3: Unemployment rates and Certificate III and IV qualifications



Source: ABS Census of Population and Housing, 2006 & 2011

9. Labour mobility of manufacturing workers

Labour mobility refers to the movement of workers between jobs, industries, occupations and locations. A highly mobile workforce better facilitates structural adjustment, as workers can move quickly into occupations, industries and geographic locations where the demand for labour is highest. This adjustment, in response to changes in relative wages and prices, will result in a more efficient allocation of resources. Impediments to labour mobility will therefore hinder the adjustment process and lead to inefficiencies.

Geographic labour mobility is one aspect of the mobility of labour. Workers that can readily move geographically can take advantage of opportunities in other regions and help to alleviate skills shortages.

Unfortunately, data limitations meant that we could not measure the *change* in labour mobility for each region between 2006 and 2011 and, as such, could not include it as a variable in the models. We were, however, able to compare the geographic mobility of manufacturing workers with non-manufacturing workers. Differences in labour mobility will have implications for understanding the effect of contracting employment in manufacturing because if manufacturing workers are less mobile, the recent accelerated decline in manufacturing employment may be having a greater impact on employment and unemployment rates than would otherwise be expected.

The Australian Census Longitudinal Dataset (ACLD) was used to determine the proportion of manufacturing workers in each SA4 region who remained in that region in 2011.[30] The proportion of non-manufacturing workers that remained in the region was also determined. The residuals of these provide the proportion of manufacturing workers and non-manufacturing workers that left the region between 2006 and 2011.

The proportion of non-manufacturing workers who had changed region between 2006 and 2011 was larger, on average, than the proportion of manufacturing workers who had changed region (25.9 per cent and 22.6 per cent respectively). This result was found to be highly significant, as indicated in the results from the t-test provided in Table 9.1, below.

Table 9.1: Geographic labour mobility paired t-test results

Variable	*Mean*	*Std. Err.*	*Std. Dev.*	*t-statistic*	*p-value*
Non-Manufacturing	0.2594	0.0079	0.0737	4.5028	0.0000
Manufacturing	0.2261	0.0081	0.0758		
Difference	0.0332	0.0074	0.6880		

Source: *Australian Census Longitudinal Data Set*. 2006-2011

It should be noted that the measure used is a relatively naive measure of geographic labour mobility, assuming that those who move out of a region will also change jobs, and that those who remained in a region will not change jobs.[31] However, despite the narrow measure of geographic labour mobility we employ here, it should provide some indication of the geographic mobility of manufacturing workers compared to those in the rest of the economy.

The finding that manufacturing workers are less geographically mobile than workers in the rest of the economy corroborates results from the Productivity Commission which suggested that workers in the manufacturing industry were the least likely to have moved labour markets in the year prior to the 2011 census.[32] As such, structural adjustment stemming from a decline in the manufacturing industry may be slower and more costly than structural adjustment stemming from declines in other industries, as manufacturing workers are less likely or less able to move geographically to pursue employment opportunities.

[30] The Australian Census Longitudinal Dataset (ACLD) is a 5% random sample drawn from the 2006 Census of Population and Housing that has been linked with corresponding records from the 2011 Census using data linkage techniques without name and address. The ACLD can be used to track groups of workers across the two census periods, e.g. manufacturing workers that were in a particular region in 2006, and were still in that region in 2011. However, as the dataset only takes into account the two time periods, it doesn't take into account what may have happened in-between. For example, a manufacturing worker in a particular region may have left that region somewhere between 2006 and 2011 and then returned prior to 2011. This study will designate that person as having stayed in the area over the period.

[31] The recent report by the Productivity Commission into geographic labour mobility, for example, takes a broader view of geographic labour mobility and includes those that remain in a residence but change jobs, travel long distances to work (such as fly-in fly-out) and telecommute. See Productivity Commission (2013) Geographic Labour Mobility (p.33)

[32] Productivity Commission (2013) Geographic Labour Mobility (p. 104)

Policy makers would be interested in the reasons that manufacturing workers are less geographically mobile than workers from other industries. The Productivity Commission found that older workers and those with lower skill levels were less likely to move than younger workers and those with higher skill levels, respectively. Manufacturing workers in 2011 were both older (median age 43 compared to median age 41 in the rest of the workforce) and had lower skill levels (13.5 per cent of manufacturing workers held bachelor level qualifications or higher compared to 27.4 per cent in the rest of the workforce) than workers across other industries.[33] In addition, the Productivity Commission noted that mobility increases in industries with seasonal work such as agriculture, hospitality and tourism. Given that manufacturing has more limited seasonal elements, this may also contribute to the low levels of geographic labour mobility.

The extent that tertiary education and on the job training are specific to an industry, occupation, region or a particular firm will also affect labour mobility. If manufacturing skills are extremely specific this may also contribute to the relatively low levels of labour mobility in the industry.

Finally, it is possible that labour mobility in the manufacturing industry is low due to the relatively rapid rate of contraction in manufacturing employment and subsequently large population of former manufacturing workers seeking new employment. Workers are most likely to transfer between jobs within the same industry, particularly if the skills required for that industry are specific. An industry in decline, however, will provide fewer job opportunities, meaning that it is difficult for those in manufacturing to change jobs but remain in the same industry. Furthermore, the fact that manufacturing workers are less mobile than workers from other industries suggests that the employment contraction in manufacturing may have a larger impact per redundancy than for other industries.

10. Wages as a signalling mechanism

It is a well-recognised and intuitive phenomenon that workers will move from regions with lower wages to areas with higher wages. While our models do not directly measure the impact of changes in relative wages on labour flows, we have included RelWage as a control measure to account for the impact of changes in relative wages on employment to population ratios and unemployment rates.

Changes in relative wages are likely to have differing effects on employment and unemployment rates. Wages act as a signalling mechanism so that an increase in relative wages in a region is likely to attract workers to the region and increase the employment to population ratio in that region. Increases in relative wages may also increase unemployment in a region, as input costs for businesses will increase. Regions where wages are flexible may be able to adjust wages downward, which may help to absorb employment losses.

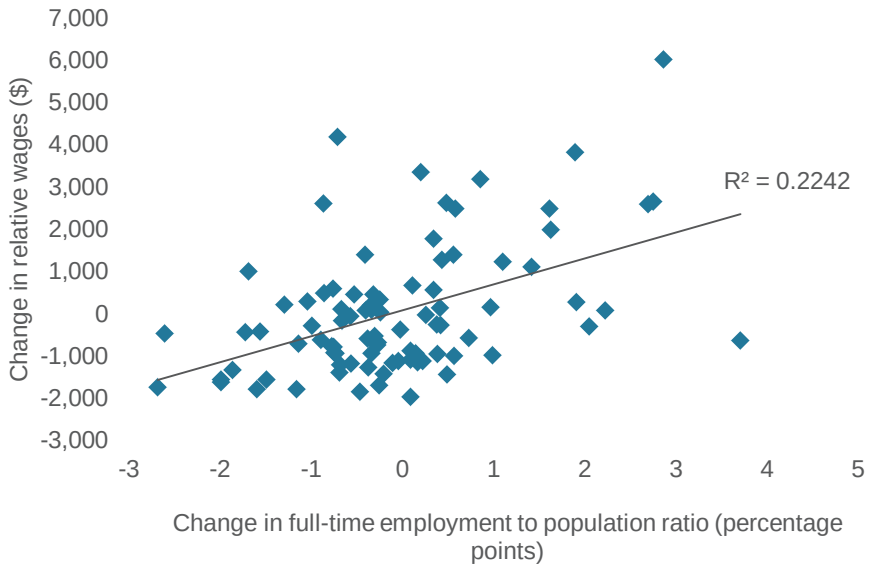
The coefficient of RelWage is positive in the full-time employment model and negative in the unemployment model. Interestingly, the coefficient of

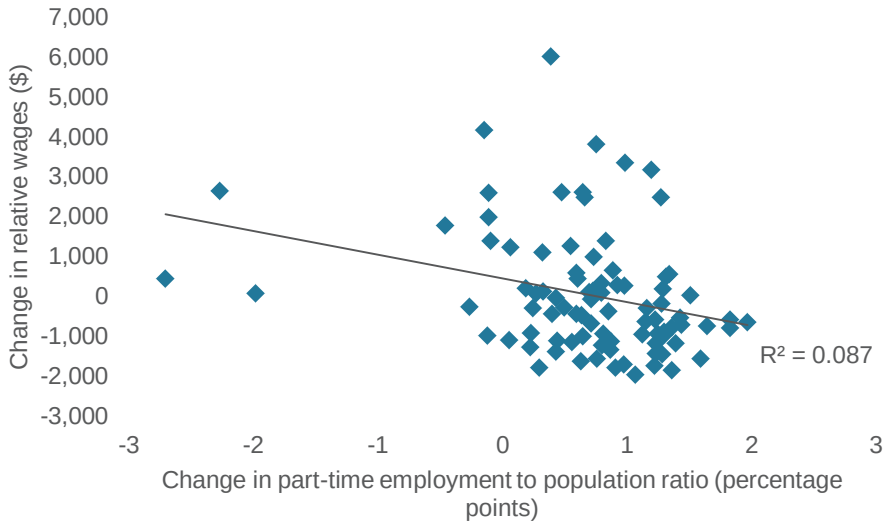
[33] Australian Census Longitudinal Dataset (ACLD)

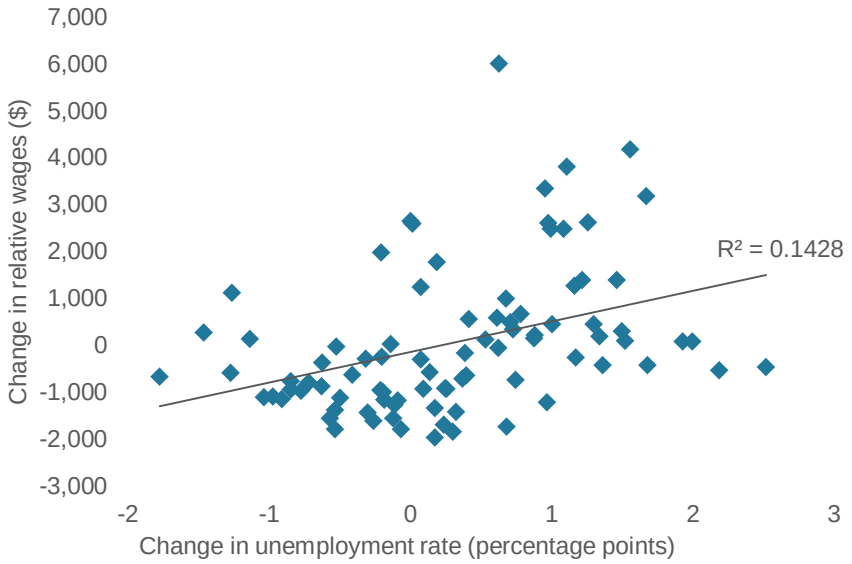
RelWage is negative in the part-time model. This may indicate that increases in wage levels encourage employers in these regions to take on part-time staff rather than full-time staff, to cut down total hours worked by their staff in order to save on labour costs. The scatterplots in Figure 10.1 illustrate these relationships.

As noted at the beginning of this paper, there are significant transaction and social costs associated with moving which may dissuade workers from doing so. It can take a long time to sell a house, for example, and there are search costs associated with looking for new employment and accommodation. A social element is also present, with parents reluctant to change their children's school. People are naturally resistant to moving away from family and friends, as well as lifestyle factors associated with specific areas. The combination of these motivations may mean that, while significant, the pulling power of regional wage differentials is not as strong as the theory may suggest, and the adjustment process to changes in relative wages may be slower, allowing wage differentials between regions to persist.

Figure 10.1: Changes in relative wages vs. changes full-time and part-time employment to population ratios and unemployment rates







Source: ABS Census of Population and Housing, 2006 & 2011

11. Labour market sensitivity to a contraction in manufacturing employment

In order to test the sensitivity of employment and unemployment to the decline in manufacturing employment, the models were applied to data for the 2001 to 2006 period. Over this period, the decline in manufacturing employment was not as pronounced, as either a share of employment or in absolute terms (as shown in Figure 3.1).

We were unable to obtain SA4 level wage and building approvals data for this period, so the models presented below are limited in their specification.

However, it is still informative to compare the results between the two periods.

Table 11.1 presents the results of the limited specification models for both the 2001 to 2006 period as well as the 2006 to 2011 period.

Table 11.1: Time period comparison, 2001 to 2006 and 2006 to 2011

	2001 to 2006			2006 to 2011		
	ΔFTE	ΔPTE	ΔUnemp	ΔFTE	ΔPTE	ΔUnemp
ΔMan	0.415***	-0.104*	0.217	0.549***	-0.129	-0.314***
	(0.129)	(0.053)	(0.136)	(0.175)	(0.109)	(0.068)
ΔLD	0.096	0.012	0.343***	0.317***	0.179***	-0.615***
	(0.091)	(0.037)	(0.078)	(0.103)	(0.0642)	(0.080)
ΔCertOv	0.305***	0.201***		0.198***	0.133***	
	0.074	(0.030)		(0.055)	(0.0344)	
ΔCert			-0.741***			-0.518***
			(0.132)			(0.0769)
Adjusted R^2	0.2668	0.8042	0.6991	0.1286	0.5524	0.4695

Source: Department of Industry and Science, 2015.

The coefficient of Man in the 2001 to 2006 full-time employment to population ratio model was statistically significant at the 1 per cent level and its value was 0.415. While the decline in manufacturing appeared to negatively impact full-time employment during this period, the coefficient is lower than in the 2006-2011 period (0.549). This indicates that the decline of the manufacturing share of employment had less impact on full-time employment over the 2001 to 2006 period.

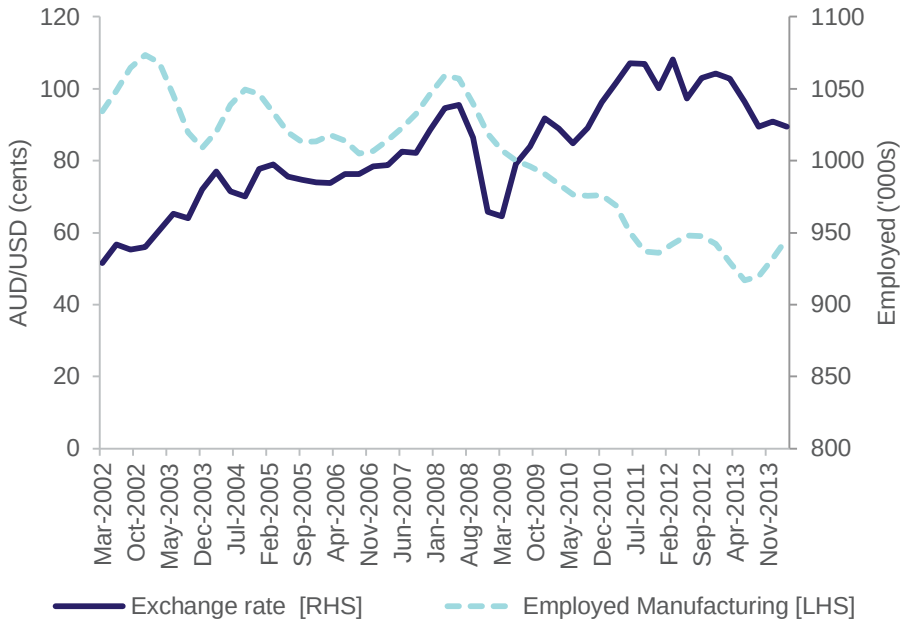
In the 2001 to 2006 unemployment model, the coefficient of Man returned an unexpected (positive) sign and was not statistically significant at the 10 per cent level, indicating no relationship between the decline in the manufacturing share of employment and unemployment during the 2001 to 2006 period (unlike in the 2006 to 2011 period).

This indicates that the speed of structural adjustment must be sufficiently rapid for a significant adverse effect to be observed in that region. That is, a slower contraction in manufacturing employment allows a greater number of displaced manufacturing workers to be absorbed by the labour market, while faster contraction may have more of an impact on employment and unemployment levels.

Alternatively, it may indicate that it was only once manufacturing employment began to decline in absolute terms that the effect on the labour market became apparent. Figure 11.1 shows that the absolute decline in manufacturing employment coincided with the onset of the GFC as well as a sustained appreciation of the Australian dollar. This may indicate that the absolute decline in manufacturing was predominately a cyclical phenomenon

and, if a lower Australian dollar can be sustained in conjunction with a continued recovery in global markets, the rapid decline in manufacturing employment may also be arrested, alleviating the pressure on labour markets.

Figure 11.1: Manufacturing Employment and AUD Exchange Rate, 2002 to present



Source: RBA and ABS cat. no. 6291.0.

12. Conclusion

This paper has built on earlier research into the relationship between structural change and employment outcomes by examining the impact of the contraction in manufacturing employment on regional employment and unemployment rates. While structural adjustment represents natural market reactions to changing prices, preferences and wages, certain factors make some labour markets more resilient to structural adjustment than others. We have explored the role played by education, delineating the effect of changes to the level of vocational education and training from the effects of higher education. The mobility of manufacturing workers has also been analysed, and support for evidence suggesting the relatively low geographic mobility of manufacturing workers uncovered.

Overall, while the contraction in manufacturing employment had a significant impact on regional full-time employment and unemployment rates, regions have demonstrated substantial resilience in the face of such structural change. The unemployment rate decreased in over a third of regions despite the global recession, while the employment to population ratio increased in more than two thirds of regions. Some of this resilience may be attributed to various government assistance and adjustment programmes that were rolled

out during the GFC period, however without the counterfactual it is difficult to assess the impact of any such intervention.

The impact of the contraction in manufacturing employment on full rather than part-time employment may be due to the manufacturing industry being predominantly comprised of full-time workers. It may, however, be the result of former full-time manufacturing workers settling for part-time work in the absence of an alternative.

Our analysis indicates that skills and education play an important role in reducing the economic and social costs of adjustment. A negative relationship was found between the proportion of local labour markets with Certificate III and IV qualifications and changes in unemployment rates, suggesting that vocational education may help facilitate the adjustment process for displaced workers. Surprisingly, the results suggest a converse result for university qualifications. Regions that experienced increases in university level qualifications were more likely to display increases in the unemployment rate. This may reflect a number of underlying causes, including skills mismatch, youth unemployment immediately following graduation, or labour markets flooded with recent university graduates. This finding potentially highlights an avenue for further research.

Both types of qualifications, however, were found to increase employment to population ratios. This suggests that while increases in university qualifications do not reduce unemployment rates in local labour markets, they may play a role in increasing participation rates in these areas.

Our analysis also corroborates existing evidence that manufacturing workers are among the least geographically mobile in the economy. Low levels of labour mobility may be a result of both the nature of work in the manufacturing industry and the demographic characteristics of the manufacturing workforce. Manufacturing workers are older on average than the rest of the workforce, and have lower skill levels, both of which are factors that contribute to lower labour mobility. The contraction of a sector with low levels of labour mobility may inhibit the structural adjustment process and may exacerbate the adverse impacts of structural adjustment. This reluctance or inability to move should be a central consideration in planning structural adjustment assistance programs that aim to target former manufacturing workers, taking into account the reasons for this lack of mobility.

The rate of structural change is an important factor in terms of the impact of an industry contraction on employment and unemployment rates. Gradual change allows greater absorption of displaced workers, while rapid contraction creates high levels of competition due to the similar skill sets of workers in the pool of job seekers. Our modelling indicates that unemployment rates at the SA4level were affected much more substantially during the 2006 to 2011 period, as contraction in employment accelerated during the GFC, than in the preceding 5 years.

In the near future, a lower Australian dollar and a more stable global economy should mean that the rate of contraction of manufacturing employment is slower than in the period we have analysed here. If so, our analysis indicates

that labour markets will be better placed to cope and the effects will be diminished.

References

Australian Bureau of Statistics. Cat. 5206 Australian National Accounts: National Income, Expenditure and Product, December 2013

Australian Bureau of Statistics. *Australian Census Longitudinal Data Set*. 2006-2011

Australian Bureau of Statistics. Census of Population and Housing 2006

Australian Bureau of Statistics. Census of Population and Housing 2011

Australian Bureau of Statistics. Cat. 1379.0.55.001 *National Regional Profile, 2007 to 2011*

Australian Bureau of Statistics. Cat. 6202 *Labour Force, Australia, January 2014*

Australian Bureau of Statistics. Cat. 6291.0.55.001 *Labour Force, Australia, Detailed, November 2013*

Australian Workforce and Productivity Agency (2014) *Manufacturing Workforce Study*

Blanchard, O. and L. Katz (1992), 'Regional Evolutions', Brookings Papers on Economic Activity, 1, pp. 1–61.

Blanchflower, D. and A. Oswald (2005), 'The Wage Curve Reloaded', IZA Discussion Paper No. 1665, Institute for the Study of Labor, Bonn, Germany

Borland, J. (2011), 'The Australian Labour Market in the 2000s: The Quiet Decade', *Conference Volume, Reserve Bank of Australia*

Debelle, G. and Vickery, J. (1998), 'Labour Market Adjustment: Evidence on Interstate Labour Mobility', Research Discussion Paper 9801, Reserve Bank of Australia

Kennedy, S. and J. Borland (2000), 'A Wage Curve for Australia?', Oxford Economic Papers, 52, pp.774-803, Oxford University Press

Lilien, D. (1982), 'Sectoral Shifts and Cyclical Unemployment', *Journal of Political Economy 90, 77-93.*

Groenewold, N. and Hagger, A. (1998), 'The Natural Rate of Unemployment in Australia since the Seventies', *Economic Record* 74, 24-35.

Heaton, C. and Oslington, P. (2002), 'The Contribution of Structural Shocks to Australian Unemployment', *The Economic Record,* 78(243), 433-442.

Hoque, A. and Inder, B. (1991), 'Structural Unemployment in Australia', *Applied Economics,* 23, 723-30.

Mincer, J. (1991) 'Education and Unemployment', *National Bureau of Economic Research*

Productivity Commission (1998), *Aspects of Structural Change in Australia*. AGPS, Canberra.

Productivity Commission (2003), '*Trends in Australian Manufacturing',* Commission Research Paper, AusInfo, Canberra.

Productivity Commission (2013), 'Geographic Labour Mobility: Draft Report', Canberra.

Productivity Commission (2013), 'Looking Back on Structural Change in Australia: 2002−2012', Supplement to *Annual Report* 2011-12, Canberra.

Teighler, U. & Kehm, B.M. (1995), 'Towards a New Understanding of the Relationships between Higher Education and Employment', *European Journal of Education*, Vol. 30, 2.

Trivedi, P. and Baker, G. (1985), 'Equilibrium Unemployment in Australia: Concepts and Measurement', *Economic Record*, 61, 629-43.

Victorian Competition and Efficiency Commission (2011), '*Victorian Manufacturing: Meeting the Challenges'*, State of Victoria.