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MAPPING THE 'PATCHWORK ECONOMY'
IN RURAL AND REMOTE AUSTRALIA:
HOW EMPLOYMENT IN INDUSTRY
SECTORS PLAYS OUT ACROSS REGIONS
DISCUSSION PAPER

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A discussion paper prepared for HC Coombs Policy Forum
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Abstract

This paper examines the patterns of industry of employment across 'regional' Australia between 1996 and 2006. The purpose of the exercise is to demonstrate the diversity of employment patterns during this period and to speculate as to what recent changes in patterns might mean for future regional labour markets. The paper theorises how two critical events in the early and mid 2000s – the beginnings of the current resources boom and the prolonged drought suffered by much of Australia – might serve to reinforce or remodel regional employment patterns. The theorising is based on the economic geography implied by Von Thünen's notion of concentric rings of regional economic activity and Innis' staples thesis. Data were drawn from the 1996 and 2006 Census of Population and Housing and the results illustrate a 'patchwork economy' characterised by diversity between and within regions, different experiences at local and regional scale, spatial clustering of particular types of activity, and a series of transitions which may persist for the short or long term. The paper concludes that, while specific changes in regional labour economies are difficult to predict, diversity of experiences of change and consequent labour market structures will persist. 'One size fits all' approaches to regional development policy in Australia are ill suited to the complexity of conditions that apply here.

Keywords: labour economy, Von Thünen's concentric rings model, staples thesis, rural and remote Australia

Introduction

This paper examines patterns of industry of employment across 'regional' Australia between 1996 and 2006. The purpose of the exercise is to demonstrate the diversity of employment patterns during this period and to speculate as to what recent changes in patterns might mean for future regional labour markets. The period under investigation was an extremely important one for many parts of Australia, as it encapsulated both the beginning of the most recent resources boom (starting about 2002), and a record period of drought particularly in the eastern states (starting about 2000). Both of these events have contributed to a heightened political focus on 'regional Australia' which has had to address both the consequences of growth (population, income, industrial development) and decline in different parts of the country.

This recent activity has occurred in the context of a broader reaching and longer standing discussion about the changing nature of 'rural' regions in globalised and developed nations. There is some debate about the extent to which globalisation and technological change have challenged or reaffirmed historical economic structures and disparities between regions (see, for example, Dibden, Potter and Cocklin, 2009). The economic geography of Australia is complicated by the existence of large but sparsely populated regions which have remained poorly connected to mainstream economic activities (Huskey, 2005). These regions often contain valuable natural (mineral) resources which attract localised development but have mixed outcomes at regional levels.

This paper suggests that an examination of patterns of employment across regional Australia can help inform discussions about 'what is regional Australia?' and provide insights into how different regions might develop over time. Specifically, we are interested in how the sectors of employment differ between regions, and how sectors of employment have changed over time. We also argue that the patterns of migration of labour between regions are particularly informative when considering which regions and which sectors of employment are growing or declining in importance.

The paper proceeds as follows. A geographic context is established for this research which includes rural and remote Australia but excludes metropolitan and inner urban Australia. The paper then briefly reviews the literature on patterns of rural and regional employment in places like regional Australia. It then examines 2006 Census data to reveal which industries employ how many people in which regions of Australia, and how diverse employment is within and between regions. 2006 data are compared with 1996 Census data to examine gross characteristics of changes in employment patterns. Discussion of the data considers both what the observed patterns say about past events (the drought and the mining boom), structural constants (differences between rural and remote regions, for example), and the prospects for future regional development.

Geographic Scope

The new 'regional' paradigm in Australia considers all of the country as belonging to one or another region, however the intent of this paper is to examine what might be normally termed as 'rural' or 'peripheral' regions. This excludes the capital cities and their immediate hinterlands (see Figure 1 – the black regions are excluded from this analysis). There are very important questions around how employment patterns are changing in metropolitan hinterlands in the face of increasing 'urban sprawl' and commuting distances (Holmes, 2006), but these are beyond the scope of this paper.

Figure 1 (page 4) divides what we consider to be regional Australia into rural-regional and remote-regional areas. There is continuing debate about what constitutes 'remoteness' and how remote areas should be identified for operational purposes which include the granting of tax concessions, special funding for health services and so on (Wakeman, 2004). This paper adopts the classification proposed by Carson (2011a) following his examination of patterns of labour migration in Australia. That examination suggested that regions with strong labour migration links to their State or Territory capital cities could be considered rural/ peripheral, while those with weak links and subsequently inefficient labour markets could be considered remote.

and reports for specific industries (for example, mining activity is documented at the *Australian Mines Atlas* www.australianminesatlas.gov.au), but there has been very little done which looks across the range of activities that take place in rural and remote Australia.

In the international literature, discussions about the spatiality of rural economic activity continue to refer explicitly or implicitly to the work of Von Thünen who, in the early 19th Century proposed that the type of economic activity that a rural region could support was determined by its proximity to its urban 'core' (see Combes, Mayer and Thisse, 2008). Von Thünen's ideas had a resurgence in the 1960s, and despite the dramatic changes in transport, communication and production technologies since Von Thünen's time (and from the 1960s to the present day), the original model has proven remarkably empirically sound. Von Thünen proposed that economic activity extended from major urban cores in a series of concentric rings. The inner rings supported activity which required limited land area but relatively large labour forces (manufacturing, intensive cropping, dairy farming etc). Middle rings supported activity which required substantial land area but had products which were expensive to transport (forestry products, mining products). Outer rings supported activity that require substantial land area but a relatively small (or non-permanent) workforce – beginning with extensive field crops such as grains, and extending out to pastoral activity (for a summary, see Fellman, Getis and Getis, 1999). In contemporary interpretations, activities that Von Thünen confined to the middle rings have been shown to have become more widespread as resources have been depleted and the economics of supply and demand have made it feasible to transport even bulky goods over longer distances.

The inevitability of resource depletion is a foundation of another theory of spatial distribution of rural and remote economic activity that has been proposed for jurisdictions which are perhaps more like Australia (Canada, the United States, Argentina, Brazil etc) than the smaller and more densely populated countries of western Europe where Von Thünen's work emerged. Harold Innis' version of the *staples thesis* initially examined how economic development occurred in countries which were distant from both the markets for their goods and the headquarters of the companies which financed the extraction or production of those goods (Barnes, 2005; Schedvin, 1990). This was a situation commonly applying to these countries in colonial times, and the resurgence of 'absentee landlords' as a function of globalisation of economies has led to renewed interest in Innis' work. More recent Innisian analyses have been applied to economic systems that operate within countries (sub-national) as well as to national systems (Howlett and Brownsey, 2007; Taylor et al., 2011).

Innis' work is interesting from a labour economics perspective for a number of reasons. The *staples thesis* argues that settler economies that are driven by export of natural resources have very localised areas of economic activity. The resources exist only where they exist (mineral deposits are in specific locations, rainfall occurs in specific locations etc) and so extraction and production has to occur in those places (Howlett and Brownsey, 2007). This adds a local scale to Von Thünen's concentric rings at which economic activity does not spread out contiguously, but occurs in discrete sites. Economic structures therefore can be expected to be local rather than regional, which is recognised in debates around Australia's current 'two speed economy', for example (Goodman and Worth, 2008). The local scale means that single industry towns can emerge which are often dislocated from the regions around them and which are vulnerable to periods of boom (rapid population and economic growth) and bust (equally rapid population loss and economic decline) (Randall and Ironside, 1996; Barnes, 2005).

The *staples thesis* also argues that the most efficient use of 'distant lands' is the extraction of natural resources that are exported in a minimally processed form to be value added to in places where labour is more plentiful (and cheap) and markets are more accessible. The export orientation means that there are likely to be fewer jobs in secondary, tertiary and quaternary industries in the locations where resource extraction occurs (Altman, 2003). There are also likely to be fewer and fewer jobs in the extractive industries themselves (at the point of extraction) over time as labour efficiencies are achieved to maximise returns (Clapp, 1998). The empirical investigations of the staples thesis have suggested that the loss of primary industry jobs over time is coupled either with loss of population in the region where the extractive activity occurs or with a shift to non-productive jobs in the public sector as governments attempt to compensate local communities (Auty, 2001). An alternative compensatory mechanism is investment in 'showy projects' which become legacies for administrations and provide (temporary) construction and related employment (Gylfason, 2001; Carson, Schmallegger and Harwood, 2010). Showy projects and government sector jobs have the additional advantage of being spatially flexible.

There are very few examples of declining extractive industries being replaced by productive but non-extractive economic activity, perhaps because of the difficulties involved in overcoming the institutional legacies which value extraction over alternatives. Where extraction is substituted with industries of 'attraction' (most commonly tourism, amenity migration, or cottage craft industries), this occurs mostly in more densely populated regions with ready access to local markets (Luke, 2003). Even in these areas, conflicts over land, labour or infrastructure use are usually resolved in favour of the extractive industry which offers governments the allure of export income and 'big business' relationships.

The juxtaposition of the two models – Von Thünen's concentric rings, and Innis' staples thesis – is interesting in the context of Australia's rural economies in transition. On the one hand, the mining boom offers opportunities for jobs in a range of related industries (mining, construction, transport) including in locations that are more distant from major urban centres and consequently may have limited alternatives. On the other hand, such jobs are likely to be temporary, and are increasingly awarded to non-resident workforces who can be more easily redeployed to new projects in new locations (Haslam McKenzie, 2011). Mining activity is also likely to come into conflict with other activities (manufacturing, tourism, agriculture) which are themselves spatially constrained by either Innis' ideas of localism and/or Von Thünen's ideas of proximity.

The timing of the first part of Australia's current mining boom (circa 2002 – 2008) coinciding with a period of drought across much of rural Australia (circa 2000 – 2010) might be hypothesised as serving to exaggerate the rural and remote labour market transitions that flow from Von Thünen's and Innis' conceptual work. Drought enhances the incentive for agri-businesses to achieve labour efficiencies. It likely leads to a contraction of agricultural activity nearer to the major urban centres both for reduced costs of labour and transport and because in Australia those urban centres tend to be in the more climatically favourable locations. The mining boom offers alternative employment opportunities for decommissioned agricultural labour as well as attracting new labour, but it does so in very specific locations (where the resources are, but more specifically where new activity is, given that more established activity is seeking labour efficiencies). It also provides a source of government income which we would expect to be invested in replacing lost agricultural jobs and compensating communities which do not directly access the mining driven employment opportunities. Government resourced jobs are likely to be in service industries (government administration, health and community services, education), but may also be in construction of showy projects. It is less clear how employment in tourism/ hospitality, manufacturing, and retail activity might be affected by the drought/ mining boom combination. Those activities may be expected to be concentrated in more densely populated regions and closer to major urban centres, but they may also be attracted to mining boom sites as support sectors.

The net result of these factors is likely to be a complex 'patchwork' of industries of employment with some underlying patterns based on distance from major urban centres. More distant regions may also have less internal diversity because of the limited economic opportunities available there, although this may be compensated somewhat by investment in public service jobs and activity in industries that support mining.

Methods

Data were drawn from the 2006 and 1996 Census of Population and Housing. The core data items used in the analysis were

- > Place of usual residence on Census night (coded to Statistical Division (SD) as per Figure 1, drawn from 2006 and 1996 Census data)
- > Place of usual residence on Census night (2006 Census, coded to Urban Centre and Locality (UCL) – which are population 'clusters' of more than 200 people)
- > Place of usual residence five years ago (2006 Census data only, coded to Statistical Division)
- > Industry of employment (coded to level 1 of the 1993 Australia and New Zealand Industry Classification (ANZIC) to allow time series comparison). Seventeen 'industries of employment' are included in the analysis:
 - Agriculture, Forestry and Fishing
 - Mining

- Manufacturing
- Electricity, Gas and Water Supply
- Construction
- Wholesale Trade
- Retail Trade
- Accommodation, Cafes and Restaurants
- Transport and Storage
- Communication Services
- Finance and Insurance
- Property and Business Services
- Government Administration and Defence
- Education
- Health and Community Services
- Cultural and Recreational Services
- Personal and Other Services

➤ Estimated Resident Population 1996-2006 for each SD.

2006 Census data were drawn from the 'Tablebuilder' online Census database. 1996 data were drawn from Basic Community Profiles available at www.abs.gov.au. Estimated Resident Population data were drawn from the electronic publication 3101.0 available at www.abs.gov.au

There are some minor geographic concordance issues at the Statistical Division level, but these apply mainly to metropolitan and inner urban SDs which were not included in this analysis. Nonetheless, some caution should be exercised in interpreting the 1996-2006 comparisons because of potential distortions related to changes in SD boundaries.

The data analysis process was as follows –

1. Identify the number of people employed in each industry who resided in each SD at 2006 Census and at 1996 Census;
 - a. Calculate percentage change in the number of people employed in each industry in each SD.
 - b. Summarise percentage change in the number of people employed in each industry for remote SDs, rural SDs, and rural and remote SDs combined.
2. This data were analysed to identify both the largest industry of employment for each SD, and whether that industry was a 'dominant' employer. An industry was considered 'dominant' if it employed more than 1.5 times the number of people as the next largest industry of employment.
3. A Herfindahl Index was calculated to assess the level of diversity of employment within each SD based on both 2006 and 1996 Census data. Herfindahl Index is a measure of industry concentration. A higher score (Index was scaled here from 0 – 1) indicates higher concentration of employment, while a low score suggests greater diversity of employment. Typically, a score of 0.30 or more would indicate a high concentration of employment in a small number of industries (Carson, 2011b). The percentage change in the Herfindahl Index between 1996 and 2006 was calculated for each SD.
4. A Principal Components Analysis (varimax rotation) was conducted on the distribution of employment across industries for the total group of rural and remote SDs separately for 2006 and 1996. The intention was to identify typical patterns of industries of employment across the set. Initially it was assumed that all components with an eigenvalue of greater than 1 would be derived and labelled, however, in both cases, the first four components accounted for greater than 95 per cent of variance and so it was decided to work with the smaller set of components (there were 7 components with eigenvalues greater than 1). Note that the SD 'Australian Capital Territory Balance' (a rural SD) was excluded from the analysis because of the small numbers of employed people usually resident there. Component 'scores' were calculated by multiplying the regression weights for each industry of employment by the percentage of people employed in that industry for each SD.

5. A labour migration analysis was conducted to further investigate changes in patterns of employment. Turnover and net migration rates were calculated for each industry for each SD. Turnover rates were calculated as the total number of people employed in the industry in 2006 who had moved into or out of the SD between 2001 and 2006 (based on place of usual residence five years ago data) divided by the total number of people employed in that industry in that SD in 2006. Net migration rates were calculated as the number of people employed in the industry in 2006 who had moved into the SD between 2001 and 2006 minus the number of people employed in the industry in 2006 who had moved out of the SD between 2001 and 2006 divided by the total number of people employed in the industry in the SD in 2006. Note that this data does not identify what industry people were employed in in 2001 and so changes in industry of employment over that time cannot be modelled (for example, someone working in the retail trade sector in SD A in 2006 may have been working in the Mining sector in SD B in 2001, but in this analysis would be included in calculations of turnover and net migration for the retail trade sector only). Note that turnover and net migration rates were calculated only for people who moved within Australia. The Census does not track people who move from Australia to another country. However, a separate analysis was conducted on the industry of employment and place of usual residence for people who had moved to Australia from another country between 2001 and 2006, examining both the percentage of employed overseas in-migrants employed in each industry in each SD, and the percentage of people employed in each industry in each SD who were overseas in-migrants.
6. A correlation matrix was constructed to examine linear relationships between change in total population (derived from the Estimated Resident Population data) and change in the number of people employed in each industry and component scores derived from the Principal Components Analysis. Correlations exceeding an absolute score of 0.4 were flagged as potentially important.
7. A correlation matrix was constructed to examine linear relationships between employment in mining and employment in other industries. Mining employment variables were the number of people employed in mining at the 2006 Census, percentage change in the number of people employed in mining 1996-2006, and the net migration rate of mining workers 2001-2006. Correlations exceeding an absolute score of 0.4 were flagged as potentially important.
8. Analysis 2 above was also applied to 2006 UCL data.

Results

Employment By Industry

According to the 2006 Census, there were nearly 222 000 people employed in the agriculture, forestry and fishing industry in rural and remote SDs. This represented 10.3 per cent of the total workforce, less than the proportion employed in retail trade (15.0 per cent), and health and community services (10.9 per cent), but more than in manufacturing (9.8 per cent) or mining (2.6 per cent). In 1996, 13.4 per cent of the employed population of rural and remote SDs were employed in agriculture, forestry and fishing. This was similar to the proportion employed in retail trade (13.9 per cent), and substantially more than the proportion employed in manufacturing (10.3 per cent), health and community services (9.6 per cent) and mining (2.8 per cent). Despite the recorded employed population of rural and remote SDs growing by more than 250 000 people between 1996 and 2006, there were 30 000 fewer people employed in agriculture, forestry and fishing in 2006 than in 1996. The only other sector with more than 3 per cent of employment to record a decline in absolute number of employed people was wholesale trade, which had 4.8 per cent of employment in 1996 but lost over 8 000 jobs to be 3.8 per cent of employment in 2006. The biggest growth sectors (in terms of number of people employed) were retail trade (gained 60 000 jobs), health and community services (53 000 jobs) and construction (52 000).

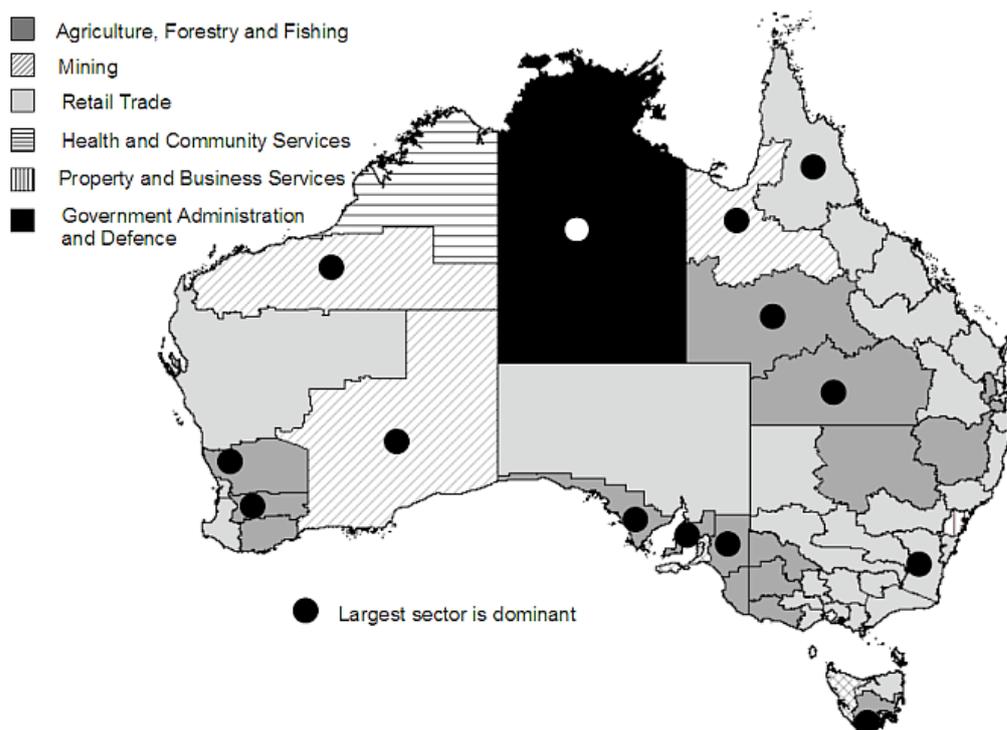
Both rural SDs (23 000 and 5 000 jobs) and remote SDs (7 000 jobs and 3 000 jobs) lost employment in agriculture, forestry and fishing and wholesale trade. In contrast, rural SDs collectively gained nearly 9 000 jobs in mining, while remote SDs collectively lost 5 000 jobs in that industry. Rural SDs collectively gained nearly 14 000 jobs in accommodation, cafes and restaurants, while remote SDs collectively lost nearly 1 500 jobs in that industry.

In terms of overall distribution of employment across industries, there were notable differences between rural SDs and remote SDs. Rural SDs had a greater proportion of employment in manufacturing (10.7 per cent compared with 6.3 per cent), retail trade (15.4 per cent compared with 13.3 per cent), and agriculture, forestry and fishing (10.7 per cent compared with 8.7 per cent). Remote SDs had a greater proportion of employment in government administration and defence (9.9 per cent compared with 5.4 per cent) and mining (5.8 per cent compared with 1.9 per cent). Employment in remote SDs was more diverse (Herfindahl index score of 28.2) than in rural SDs (Herfindahl index score of 29.5) although remote employment had become less diverse since 1996 (when its Herfindahl index score was 27.6) while rural employment was about as diverse in 2006 as it had been in 1996 (when its Herfindahl index score was 29.6). As a point of comparison, the Herfindahl index score for the major urban regions for 2006 was 29.1, which indicated slightly greater diversity of employment than in 1996 when the score was 29.7.

Retail trade was the largest employer in 23 of the 46 rural and remote SDs in 2006. Agriculture, forestry and fishing was the largest employer in 15 rural and remote SDs. Mining was the largest employer in three remote SDs (Pilbara and South Eastern in Western Australia, and North West Queensland), but not in any rural SDs. There were more remote SDs (8 of 14) where the largest employer was dominant (ie employed more than 1.5 times the number of people in the next largest industry) than there were rural SDs (6 of 32) where this was the case. Agriculture was the dominant employer in 8 rural and remote SDs in total (see Figure 2). Mining was dominant in three SDs, and government administration and defence was dominant in Northern Territory – balance and Canberra. Retail trade was dominant in Far North Queensland.

Figure 2
Largest Sector of Employment for Each SD in Australia, 2006

Source
Australian Bureau of Statistics, Census of Population and Housing 2006



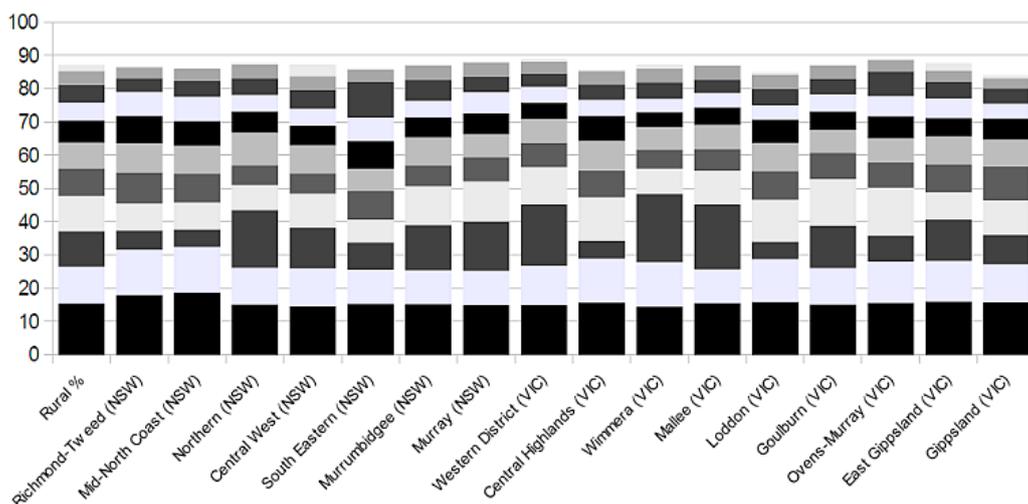
Diversity of Employment

Not surprisingly, SDs where there was a dominant industry of employment had less diverse employment than those where there was not a dominant industry. For example, Upper Great Southern Western Australia (agriculture, forestry and fishing was the dominant industry) had a Herfindahl index score of 44.83, Canberra (government administration and defence) had a Herfindahl index score of 37.6, and Central Western Queensland (agriculture, forestry and fishing) had a Herfindahl index score of 36.9. The largest Herfindahl index scores in SDs where there was not a dominant industry of employment were in SDs where agriculture, forestry and fishing was the largest sector of employment. On average, these SDs had a Herfindahl index score of 33. In contrast, SDs where retail trade was the largest employer had a Herfindahl index score of 29.9.

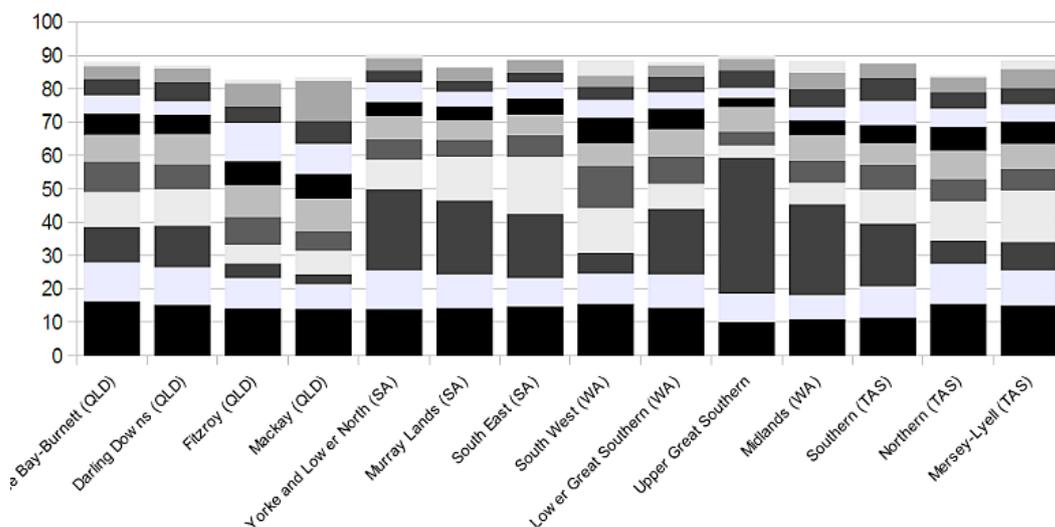
Figures 3a-c show the distribution of employment in 2006 among each of the main industries of employment for rural SDs in rural New South Wales and Victoria (3a), the remainder of rural Australia (3b) and remote SDs (3c). Each bar is labelled with the Herfindahl index score for that region for 2006. The legend is read left to right and top to bottom (eg Agriculture, forestry and fishing is the third bar in each graph). Figure 3a shows that rural SDs in New South Wales and Victoria had similar proportions of employment in retail trade and health and community services, but very different levels of employment in agriculture, forestry and fishing. Remote SDs had diverse levels of employment in agriculture, forestry and fishing, but also in government administration and defence, and mining.

Figure 3
Percentage of employment by Industry for Each Rural and Remote SD

Source Australian Bureau of Statistics, Census of Population and Housing 2006

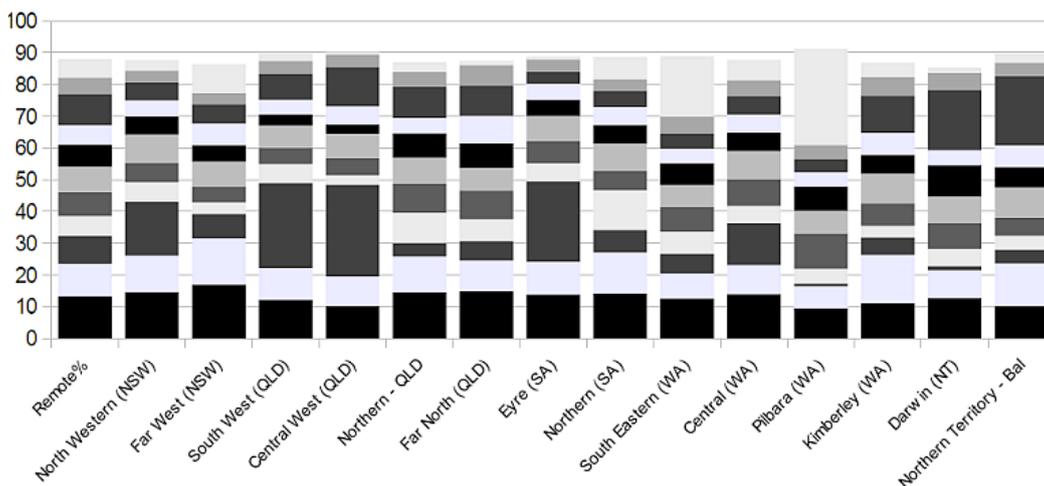


3a Rural SDs in New South Wales and Victoria



3b Remaining Rural SDs

- Legend**
- Retail Trade
 - Manufacturing
 - Property and Business Services
 - Transport and Storage
 - Health and Community Services
 - Construction
 - Accommodation, Cafes and Restaurants
 - Mining
 - Agriculture, Forestry and Fishing
 - Education
 - Government Administration and Defence



3c Remote SDs

'Typical Patterns' of employment

The principal components analysis conducted with 2006 Census data is summarised in Table 1. Component 1 had a strong positive weighting for mining employment, and a strong negative weighting for employment in agriculture, forestry and fishing. Component 2 had a strong negative weighting for mining and moderate positive weightings for manufacturing and retail trade. Component 3 had a strong negative weighting for agriculture, forestry and fishing, and moderate positive weightings for government administration and defence, and health and community services. Component 4 had a moderate positive weighting for agriculture, forestry and fishing and government administration and defence and moderate negative weightings for mining and retail trade. Summary labels for the components are –

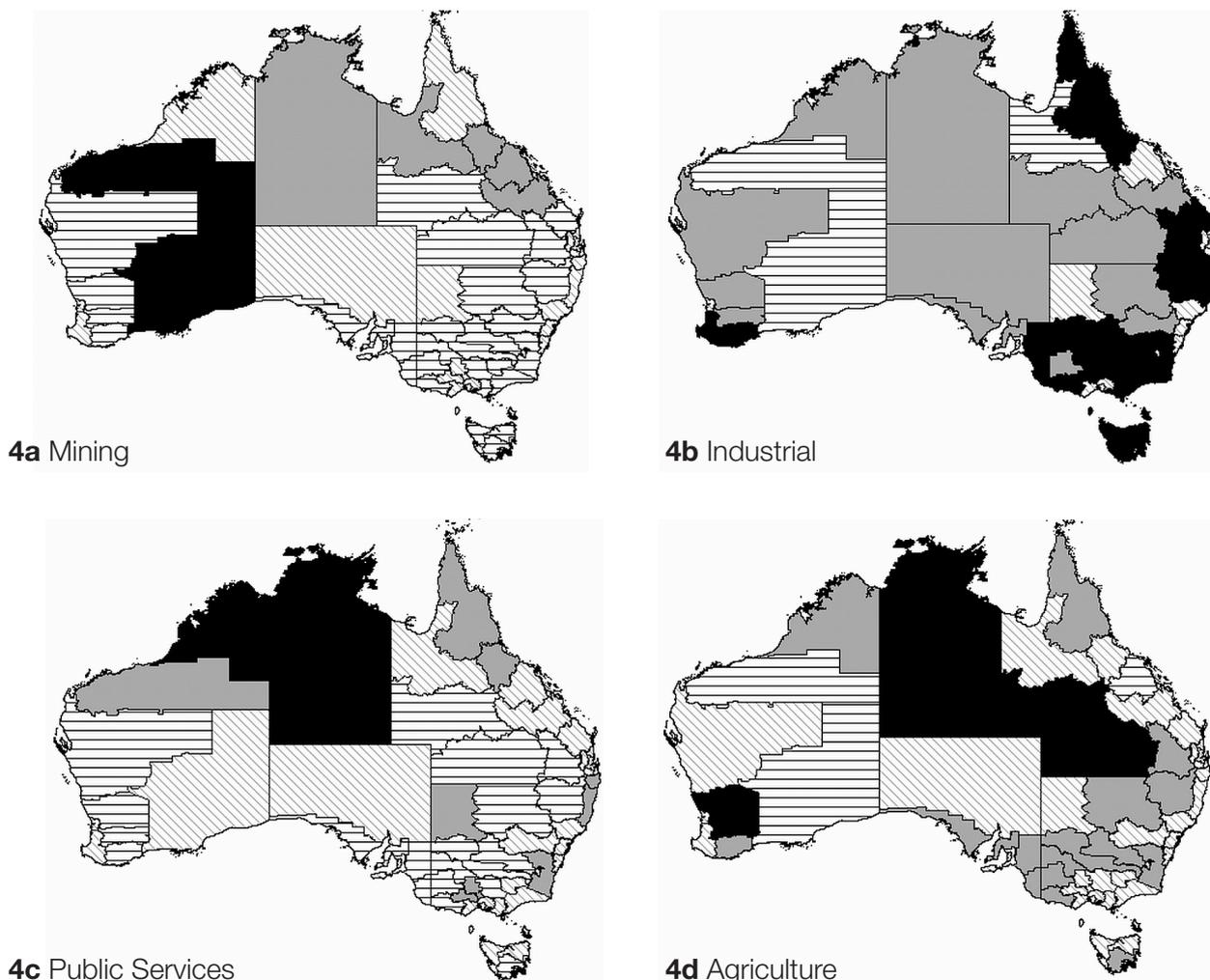
- > Component 1: Mining
- > Component 2: Industrial
- > Component 3: Public services
- > Component 4: Agricultural

Table 1 Rotated Component Matrix, 2006 Principal Components analysis

Industry	Comp. 1	Comp. 2	Comp. 3	Comp. 4
Agriculture, Forestry and Fishing	-5.11	-0.59	-4.40	1.58
Mining	3.05	-4.35	-0.21	-1.68
Manufacturing	-0.13	1.09	-0.77	-0.43
Electricity, Gas and Water Supply	-0.01	0.04	0.06	-0.20
Construction	0.15	0.09	0.01	-0.25
Wholesale Trade	0.08	0.38	-0.57	-0.12
Retail Trade	0.02	1.41	0.04	-1.12
Accommodation, Cafes and Restaurants	0.16	-0.06	0.30	0.03
Transport and Storage	0.50	-0.12	-0.08	0.19
Communication Services	-0.02	0.13	0.05	-0.01
Finance and Insurance	0.01	0.38	-0.04	-0.10
Property and Business Services	0.77	0.51	0.38	-0.02
Government Administration and Defence	0.86	-0.09	2.20	2.74
Education	0.03	0.35	0.61	-0.10
Health and Community Services	-0.50	0.56	1.50	-0.68
Cultural and Recreational Services	0.07	0.24	0.30	0.20
Personal and Other Services	0.07	0.02	0.60	-0.04

Figure 4a-d (page 12) shows the component score for each rural and remote SD for each component. Black regions have component scores greater than 25, grey regions have component scores between 1 and 25. Diagonal stripe regions have component score between -1 and -25, and horizontal stripe regions have component scores less than -25. 'Mining' regions were in the north and west. 'Industrial' regions tended to be more in the south east. 'Public services' regions were clustered in the north, with some additional high scoring regions along the south east coast. 'Agricultural' regions were widely distributed across rural and remote Australia.

Figure 4 Component Scores by SD for Patterns of Employment, 2006



Source Derived from Australian Bureau of Statistics, Census of Population and Housing 2006

Results of replicating the principal components analysis for 1996 Census data are presented in Table 2 (page 13). Component 1 had strong positive weighting for agriculture, forestry and fishing and strong negative weighting for mining. Component 2 had strong negative weighting for mining and moderate negative weighting for agriculture, but moderate positive weighting for retail trade and manufacturing. Component 3 had strong positive weighting for agriculture, forestry and fishing, moderate positive weighting for mining, and strong negative weighting for manufacturing. Component 4 had strong positive weighting for agriculture, forestry and fishing, and moderate negative weighting for health and community services. Summary labels for the components are –

- > Component 1: Agriculture dominant
- > Component 2: Industrial
- > Component 3: Diverse extractive
- > Component 4: Agriculture balanced

Table 2 Rotated Component Matrix, 1996 Principal Components analysis

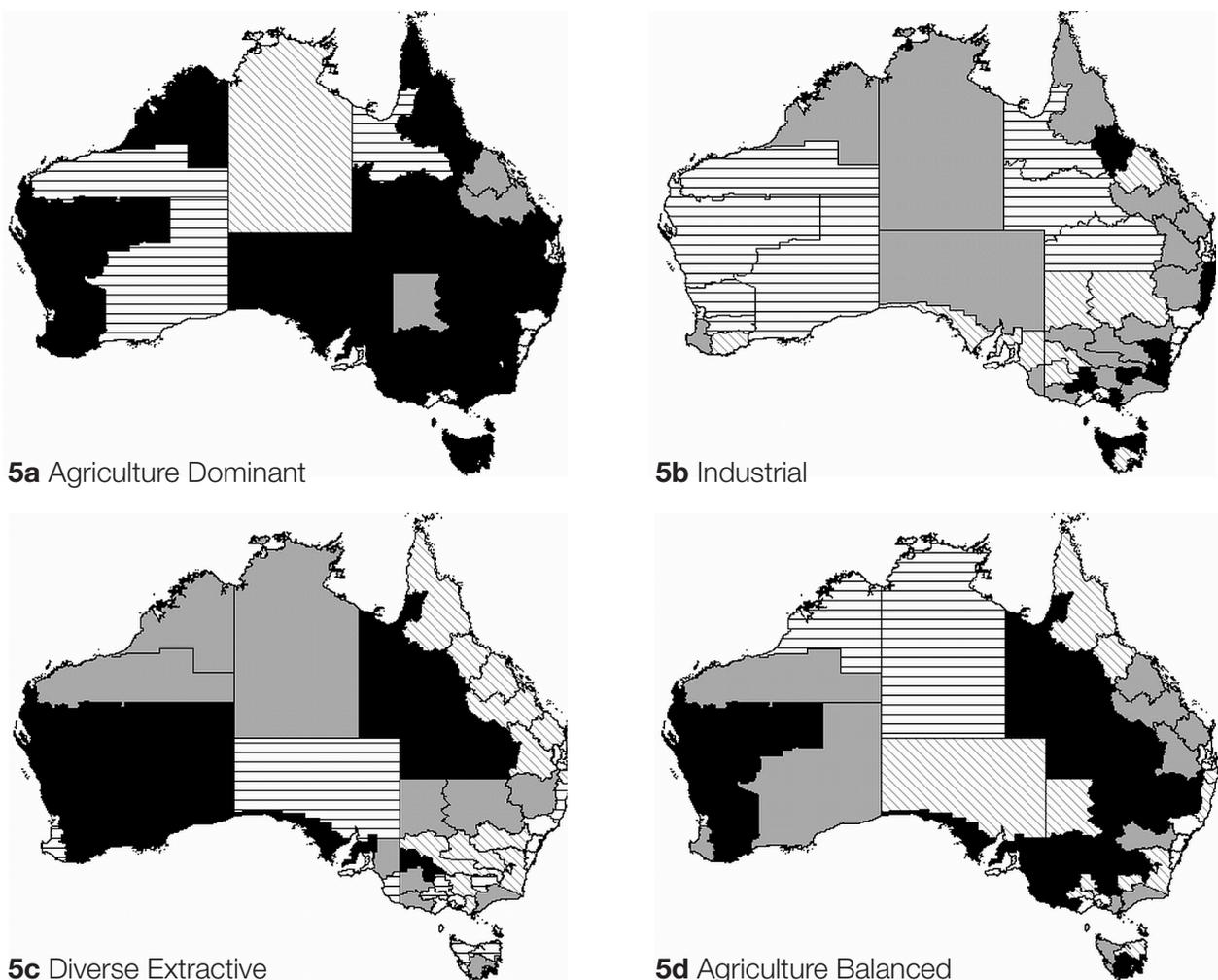
Industry	Comp. 1	Comp. 2	Comp. 3	Comp. 4
Agriculture, Forestry and Fishing	7.96	-1.85	2.45	3.23
Mining	-4.30	-3.40	1.56	0.90
Manufacturing	-0.10	1.24	-3.88	0.20
Electricity, Gas and Water Supply	-0.08	0.12	0.00	-0.02

Table 2 continued Rotated Component Matrix, 1996 Principal Components analysis

Industry	Comp. 1	Comp. 2	Comp. 3	Comp. 4
Construction	-1.24	-0.21	0.14	0.10
Wholesale Trade	0.21	0.41	-0.14	0.42
Retail Trade	-0.23	2.00	-0.54	-0.11
Accommodation, Cafes and Restaurants	-0.35	0.10	0.11	-0.31
Transport and Storage	-0.39	-0.25	0.10	0.00
Communication Services	0.02	0.16	0.02	-0.03
Finance and Insurance	-0.01	0.35	-0.11	-0.01
Property and Business Services	-1.08	0.43	-0.16	-0.25
Government Administration and Defence	-0.30	-0.11	0.56	-0.19
Education	0.06	0.38	0.09	-0.41
Health and Community Services	0.12	0.27	-0.03	-2.82
Cultural and Recreational Services	-0.17	0.27	-0.13	-0.18
Personal and Other Services	-0.14	0.08	0.00	-0.50

Figure 5a-d shows the component score for each rural and remote SD for each component. 'Agriculture dominant' regions were all across the south and east and along the west coast. 'Industrial' regions were along the east coast and in the centre. 'Diverse extractive' regions were prominent away from the east coast.

Figure 5 Component Scores by SD for Patterns of Employment, 1996



Source Derived from Australian Bureau of Statistics, Census of Population and Housing 2006

Labour Migration

Mining had the highest population turnover rate of the major industries of employment in rural and remote Australia. A volume of people equal to 55.3 per cent of the total number of mining employees in 2006 (29 000 of 52 000) either moved in to or out of rural and remote SDs between 2001 and 2006. The lowest turnover rate was in agriculture, forestry and fishing, where 39 000 people moved in to or out of rural and remote SDs (a rate of 18.3 per cent). The biggest volume of movers was in retail trade (104 000 people), which represented a turnover rate of 33.4 per cent. Remote SDs had substantially higher rates of population turnover across all industries except government administration and defence which had a turnover rate of about 47 per cent in both rural and remote SDs.

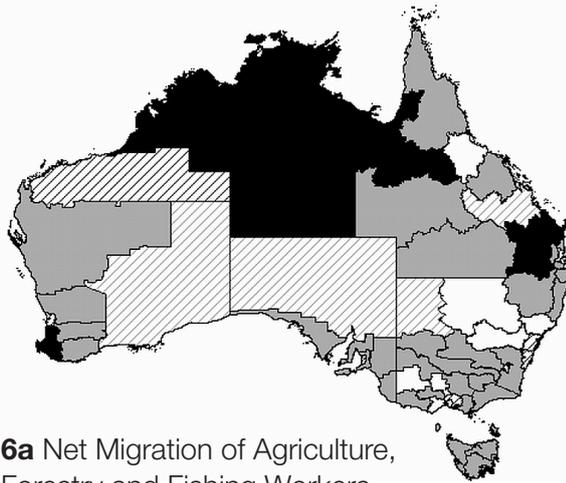
All but two rural and remote SDs (the exceptions being North Western and Far West New South Wales) had more accommodation, cafes and restaurants workers move in from other parts of Australia than move out between 2001 and 2006. In contrast, just 5 SDs experienced net positive in-migration of property and business services workers and just 7 experienced net positive in-migration of retail trade workers. The largest workforce gains from migration were also in accommodation, cafes and restaurants (average 11.5 per cent net positive migration), while the largest losses were in mining (average 22.1 per cent net negative migration). Migration generally contributed to population loss in all of the key industries except accommodation, cafes and restaurants, agriculture, forestry and fishing, and education. 36 of the 45 rural and remote SDs had net in-migration into the agriculture, forestry and fishing industry, with an average net in-migration across all SDs of 1.5 per cent. 27 rural and remote SDs had net in-migration into the education industry, with an average net in-migration of 0.9 per cent.

There was great diversity in the pattern of migration of mining workers. While just 12 of 45 rural and remote SDs experienced net in-migration of mining workers, on average these regions received 390 more mining workers than they sent away. In SDs where there was a net out-migration of mining workers, the average loss was 73 people. Similarly, SDs that gained government administration and defence workers (there were 13 such SDs) gained an average of 259 people, while those who lost workers lost on average 95 people. In the agriculture, forestry and fishing industry, the 36 SDs who gained workers gained an average of 171 people, and the 9 SDs who lost workers lost an average of 53 workers.

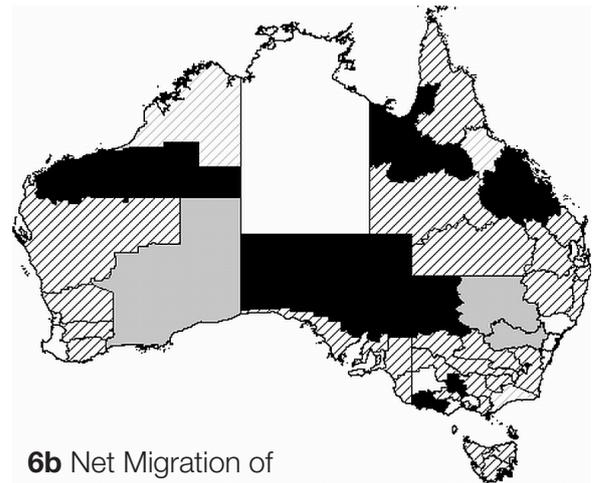
Remote SDs collectively lost 985 construction workers while rural SDs collectively gained 2108 construction workers. Remote SDs also lost health and community services workers (1000) while rural SDs gained workers in that industry (352). Remote SDs lost 2648 manufacturing workers, while rural SDs gained 840. In contrast, rural SDs lost 615 transport workers, while remote SDs gained 177, and rural SDs lost 267 government administration and defence workers while remote SDs gained 591.

While there is insufficient space in this paper to analyse migration patterns for each industry in each SD, Figure 6a-c (page 15) shows SDs where there was net in-migration and net out-migration of agriculture, forestry and fishing, mining, government administration and defence, and manufacturing workers. Net in-migration of agriculture, forestry and fishing labour occurred everywhere except in the southern inland region. In contrast, SDs in this region experienced net in-migration of mining workers. Net in-migration of government administration and defence workers was clustered in the north-east, in the south-west and in the south-east. Manufacturing labour migrated towards a few regions in coastal Queensland, northern Victoria and south western Western Australia.

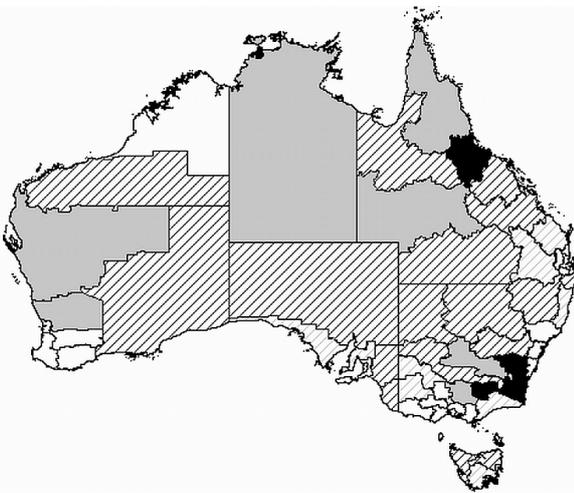
Figure 6 Net Migration of Workers in Key Industries, 2001-2006



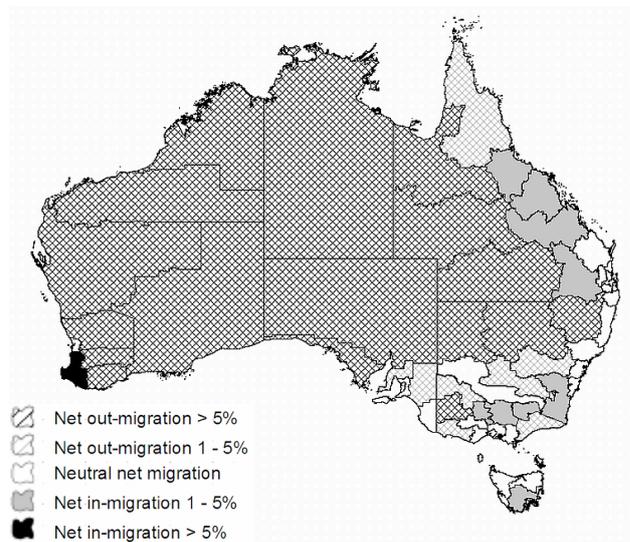
6a Net Migration of Agriculture, Forestry and Fishing Workers



6b Net Migration of Mining Workers



6c Net Migration of Government Administration and Defence Workers



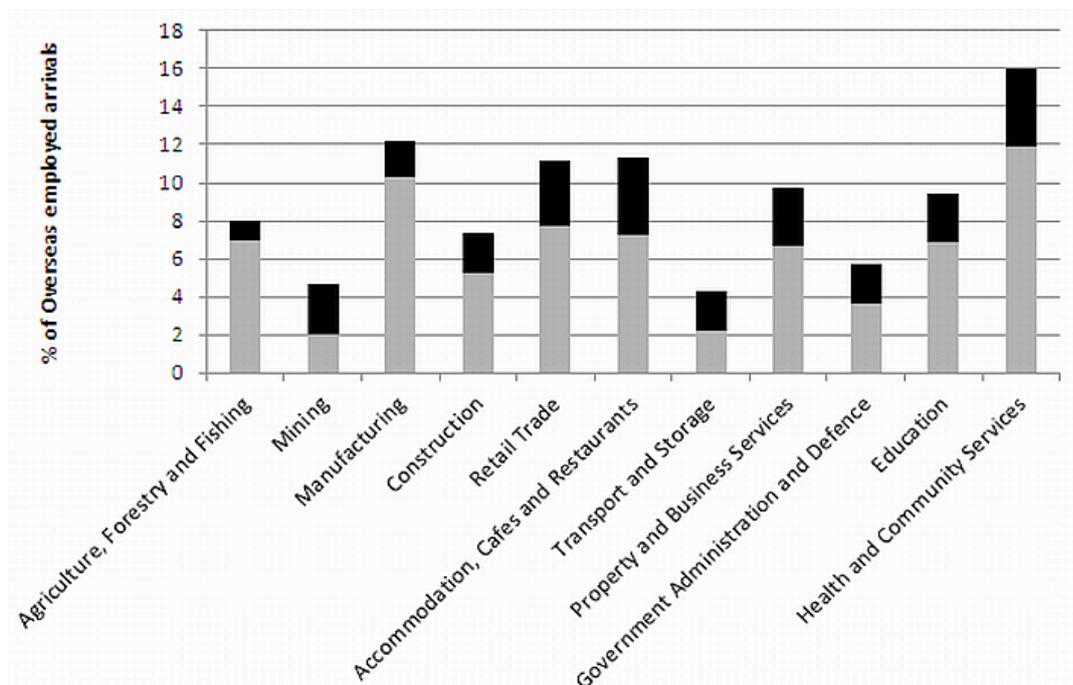
6d Net Migration of Manufacturing Workers (and Legend)

Source Australian Bureau of Statistics, Census of Population and Housing 2006

The largest numbers of overseas in-migrants between 2001 and 2006 worked in the health and community services industry (6 100 workers), followed by manufacturing (4 600) and accommodation, cafes and restaurants (4 300). There were 3 100 overseas in-migrants working in agriculture, forestry and fishing in 2006. Figure 7 (page 16) shows the 2006 industry of employment of overseas in-migrants to rural and remote Australia between 2001 and 2006.

Figure 7
2006 Industry
of Employment
of Arrivals
from Overseas
2001-2006

Source
Australian
Bureau of
Statistics,
Census of
Population and
Housing 2006



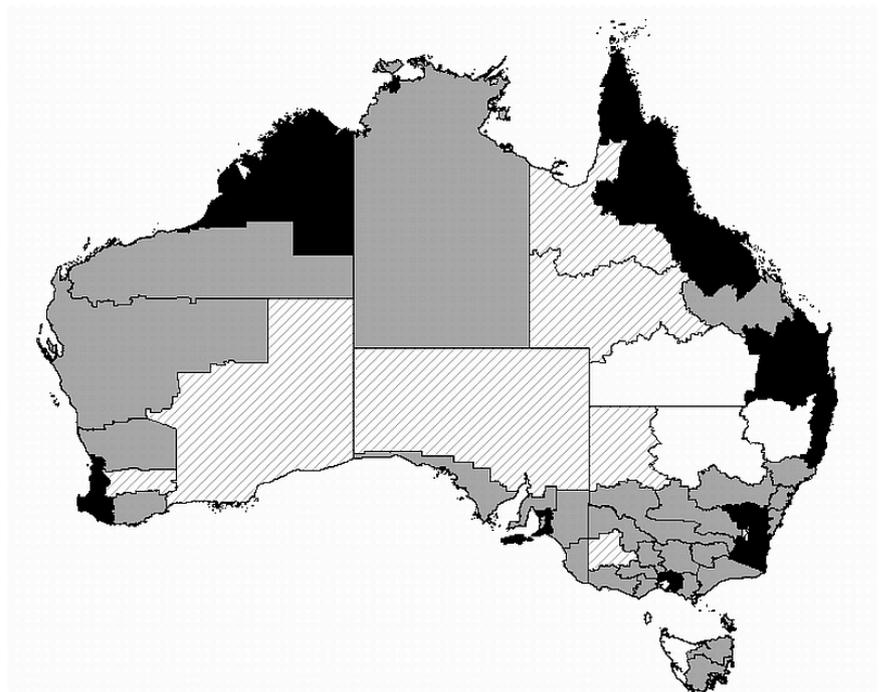
■ remote
■ rural

Correlates of Population Growth and Mining Employment

Between 1996 and 2006, Australia as a whole was estimated to have experienced population growth of around 13.0 per cent. The average population growth in all rural and remote SDs was 6.9 per cent, with rural SDs averaging 8.0 per cent and remote SDs averaging 4.4 per cent. In total, 35 of the 45 rural and remote SDs experienced some population growth, but there were three rural SDs (Wimmera in Victoria, Upper Great Southern in Western Australia, and Mersey-Lyle in Tasmania) and seven remote SDs (North Western and Far West New South Wales; South West, Central West and North West Queensland; Northern South Australia; and South Eastern Western Australia) which experienced population decline. Figure 8 shows the levels of population growth/ decline experienced in each SD in Australia between 1996 and 2006. The map is benchmarked against the national population growth rate for the period (13.0 per cent), with solid black regions experiencing higher population growth than the national average, solid grey regions experiencing population growth but below the national average, solid white regions experiencing very little change in population, and striped regions experiencing population decline. High population growth was restricted to the capital cities and immediate surrounding regions, with the exceptions of northern Queensland and northern Western Australia.

Figure 8
Population
Change by SD,
1996-2006

Source
Australian
Bureau of
Statistics
Estimated
Resident
Population,
Catalogue
Number 3218.0



Across all rural and remote SDs, population growth was positively correlated with the percentage of the workforce employed in construction ($r = 0.8$), and with change in the number of construction workers ($r = 0.5$). Population growth was also positively correlated with change in the number of retail trade workers ($r = 0.5$) and government administration and defence workers ($r = 0.4$). Population growth was negatively correlated with the percentage of people employed in agriculture, forestry and fishing ($r = -.05$) but not correlated in either direction with change in the number of agriculture, forestry and fishing workers between 1996 and 2006. This pattern was replicated in rural SDs, but remote SDs were slightly different. Similar relationships existed between population growth and construction and agriculture, forestry and fishing, but not with retail. Instead, population growth was positively correlated with the percentage of people employed in government administration and defence ($r = 0.5$) and with change in the number of government administration and defence workers ($r = 0.5$). Population growth in remote SDs was negatively correlated with change in the number of health and community services workers ($r = -0.5$).

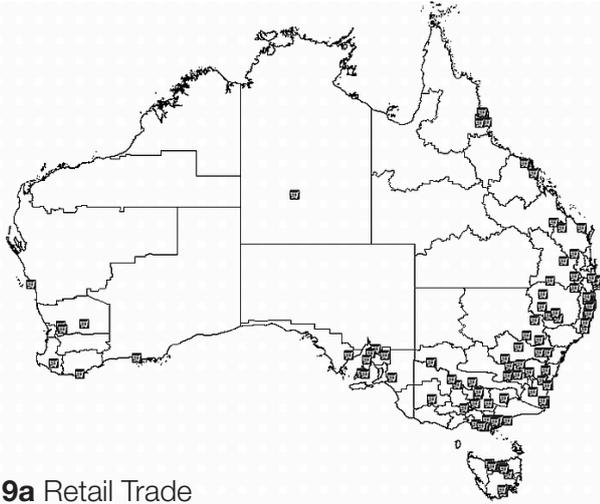
The percentage of people employed in mining was not positively correlated with employment in any other industry across the rural and remote SDs as a whole. Employment in mining was, however, negatively correlated with employment in health and community services ($r = -0.4$), and was negatively correlated with change in the number of people employed in agriculture, forestry and fishing ($r = -0.4$), construction ($r = -0.5$), retail trade ($r = -0.5$), accommodation, cafes and restaurants ($r = -0.6$), and health and community services ($r = -0.5$). Increases in the number of people employed in mining between 1996 and 2006 were positively correlated with increases in the number of people employed in construction ($r = 0.5$), accommodation, cafes and restaurants ($r = 0.4$), and health and community services ($r = 0.4$).

There were several differences in correlates with mining employment between rural SDs and remote SDs. There was a negative correlation between percentage of people employed in mining and percentage of people employed in agriculture, forestry and fishing ($r = -0.4$) in remote SDs but not in rural ones. The same occurred for employment in construction ($r = -0.5$), accommodation, cafes and restaurants ($r = -0.5$), and government administration and defence ($r = -0.4$). There were also negative correlations between the percentage of people employed in mining and changes in the number of people employed in manufacturing ($r = -0.5$), retail trade ($r = -0.5$) and accommodation, cafes and restaurants ($r = -0.7$) in remote SDs which were not observed in rural SDs. Change in the number of people employed in mining between 1996 and 2006 was positively correlated with change in the number of people employed in agriculture, forestry and fishing ($r = 0.4$), manufacturing ($r = 0.5$), construction ($r = 0.7$), retail trade ($r = 0.7$), and accommodation, cafes and restaurants ($r = 0.7$).

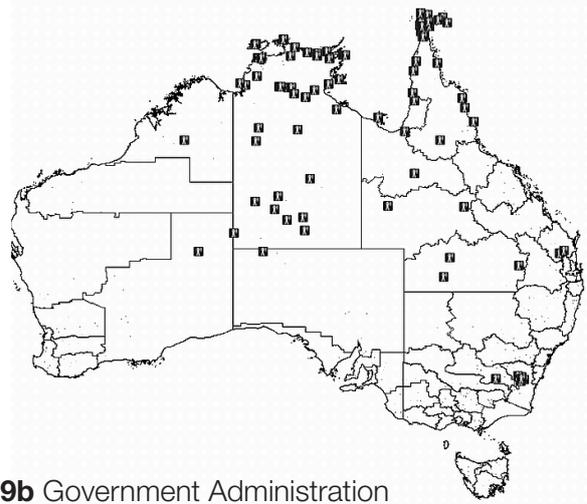
‘Dominant Industry Towns’

There were 1315 urban centres and localities across rural and remote SDs at the 2006 Census. 440 of these had an industry of employment which was at least 1.5 times the size of the next largest industry of employment. One quarter of these had retail trade as their dominant industry of employment, and nearly one fifth had government administration and defence as their dominant industry of employment. Agriculture, forestry and fishing was the dominant industry in 67 UCLs (15.2 per cent of dominant industry towns), manufacturing in 62, mining in 39, and accommodation, cafes and restaurants in 31. Figure 9a-f (page 18) shows the locations of UCLs which had these dominant industries. Retail trade towns were almost exclusively along the east coast of Queensland and New South Wales, throughout Victoria and Tasmania and in close proximity to Adelaide and Perth. Government administration and defence towns were more clustered in the north and around the Australian Capital Territory. Agriculture, forestry and fishing towns were widely distributed through New South Wales, Victoria and Tasmania, but otherwise located only in the south east of Queensland, South Australia, and the south west of Western Australia. Manufacturing towns were similarly distributed, but there were also manufacturing towns along the Queensland coast. There were clusters of mining towns in central and northern Queensland, and southern and central Western Australia. There was a cluster of accommodation, cafes and restaurants towns in north eastern Victoria and south eastern New South Wales, with the remaining distributed mainly in coastal areas of Queensland, Tasmania, and Western Australia.

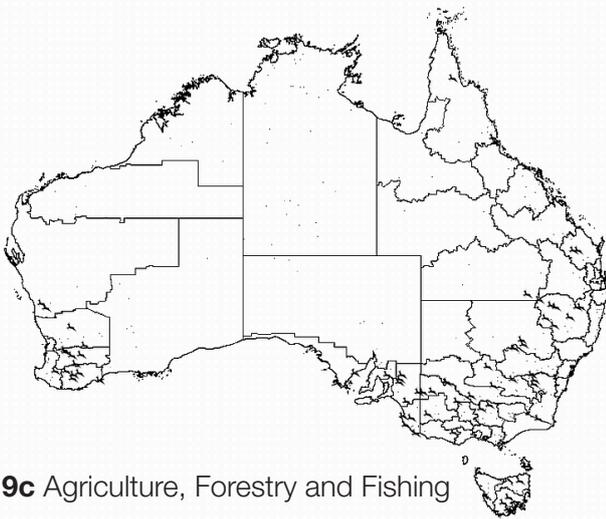
Figure 9 Location of Urban Centres and Localities with Dominant Industries, 2006



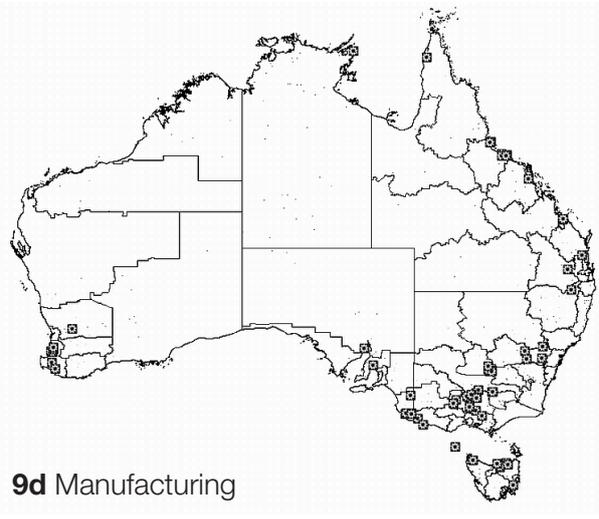
9a Retail Trade



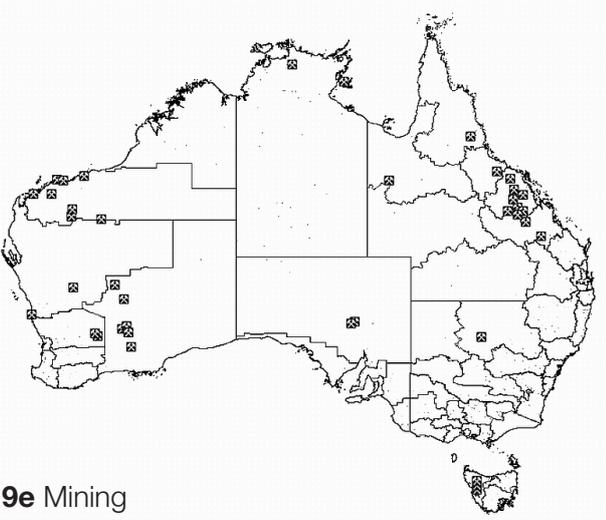
9b Government Administration and Defence



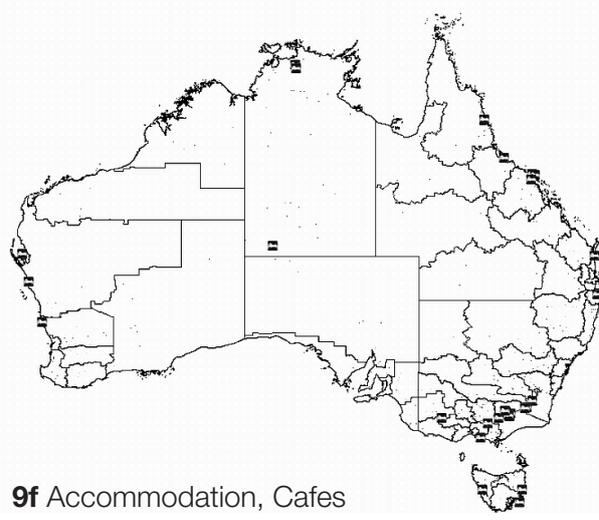
9c Agriculture, Forestry and Fishing



9d Manufacturing



9e Mining



9f Accommodation, Cafes and Restaurants

Source Australian Bureau of Statistics, Census of Population and Housing 2006

Discussion

The 'patchwork' nature of employment by industry across rural and remote Australia in 2006 (and in 1996) is apparent even at the high level at which 'industry' has been classified for this research and the high level at which 'regions' have been defined. The retail trade industry was the largest employer in the more densely populated 'rural' regions along the east coast and south east corner of mainland Australia, but it was the dominant industry of employment in only one region (Far North of Queensland), which is a sparsely populated remote region rather than a densely populated rural one. The agriculture, forestry and fishing industry was the dominant employer in half (8 of 16) of the regions where it was the largest employer. Those agriculture, forestry and fishing dominant regions, however, were in South Australia, Western Australia, Tasmania and Queensland rather than in New South Wales and Victoria. This reveals an issue of scale in the analysis, because New South Wales and Victoria collectively were home to twenty-eight urban centres and localities in which agriculture, forestry and fishing was the dominant industry (see Figure 9c).

The scale effect also occurred with the mining industry, which was the largest and dominant employer in three regions (South Eastern Western Australia, Pilbara and North West Queensland) but which was dominant in 24 urban centres and localities outside of those regions (see Figure 9e). This implies 'patchworks within the patchwork' which highlights the need for an even more detailed understanding of how diverse employment patterns are across rural and remote Australia than is provided in this paper.

Along with issues of scale within the patchwork are issues of clustering. The various maps of employment (Figure 2 and Figure 9 in particular) reveal clustering effects with, for example, manufacturing, retail trade, and agriculture, forestry and fishing industries more prominent near the major urban population centres, and mining and government administration and defence more prominent in more remote regions.

The 2006 data therefore reveal a diversity of employment patterns (revealed in greatest detail in Figure 3) but with some clear groupings of regions based on their proximity to one another and to the urban/metropolitan parts of Australia. The principal components analysis of 2006 Census data emphasises this, with regions with high scores on the 'mining' component (Figure 4a) in the sparsely populated north and west, those with high scores on the 'industrial' component (Figure 4b) largely adjacent to the State capital cities, 'public services' again predominantly in the north and west (Figure 4c) and 'agriculture', while more dispersed, still prominent in a south to north inland band from Adelaide in South Australia around to Darwin in the Northern Territory.

The 'patchwork' that can be described for 2006 patterns of employment is quite different to that which likely applied in 1996. Likely differences are revealed here in the principal components analysis, which produced substantially different constructs of components for 1996 than for 2006 (compare Figures 4 and 5). In 1996, three of the four components that are focused on in this paper included a strong contribution from the agriculture, forestry and fishing industry (the remaining component (Figure 5b) was focused on manufacturing and other industrial activities). A particularly important difference is likely to be that agriculture co-existed with mining in the third component drawn from 1996 data, but the weightings for components one and four in 2006 had opposite effects of mining and agriculture.

It is difficult to draw inferences about the extent to which migration contributed to the apparent transitions between 1996 and 2006. The migration data are restricted to the period 2001 to 2006, and there is only one-way flow information for international migration. Nevertheless, Figure 6 does provide some insights. Of particular interest is Figure 6b which shows high in-migration of mining workers to a very small number of regions but out of virtually all other regions (with the Northern Territory have negligible flows either in or out). This effect is dramatically demonstrated for manufacturing labour in Figure 6d, and a similar effect can be seen for government administration and defence employment in Figure 3c, except there are more receiving regions and the flow out of many of the densely populated regions is less dramatic than for mining. The movement of agriculture, forestry and fishing workers seems to follow almost a reverse pattern, with many receiving regions spread right across rural and remote Australia and just a few giving regions, among which the capital cities (excluding Perth) were prominent.

Migration is a key component of population growth and decline in rural and remote Australia, and it was interesting to note that population growth was more strongly linked to the construction sector than to the core sectors of mining, agriculture, forestry and fishing, or manufacturing. No doubt at least a proportion of the construction workforce would be engaged in mining related projects, but they may also be engaged in public developments, particularly in remote areas where construction and government administration and defence were both correlates of population growth.

The growth in mining employment across all of rural and remote Australia (about 3 500 new mining jobs between 1996 and 2006) was relatively modest when compared with declines in employment in agriculture (30 000 fewer jobs) and wholesale trade (over 8 000 fewer jobs) and growth in retail trade (60 000 more jobs), construction (52 000 more jobs), and even manufacturing (16 000 more jobs). Recall also that there was actually a decline in the total number of mining jobs in remote regions (about 5 000 fewer jobs) despite the three mining dominant regions being remote ones. Irrespective of that, mining employment, and particularly the change in mining employment between 1996 and 2006 had substantial correlations with employment in a range of other sectors. The pattern that is revealed in the correlation matrix is, however, a complex one. It appears that change in the number of people employed in the mining industry was more strongly correlated with other changes in employment patterns than the total number of people employed in mining, and that there were strong positive relationships between mining employment and employment in construction and accommodation, cafes and restaurants. These relationships were more marked in remote areas than rural ones, but in remote areas growth in mining employment was more likely to be accompanied by growth in employment in agriculture, forestry and fishing and manufacturing than was the case in rural areas.

Despite a number of regions having dominant industries of employment, and the existence of nearly 300 urban centres and localities with a dominant industry of employment, rural economies were about as diverse as major urban ones in terms of employment and remote economies were more diverse. While it was beyond the scope of this paper to conduct a detailed comparison of rural and remote regions with major urban ones, it must be noted that there were substantial differences in the specific industries of employment in major urban regions compared with rural and remote ones. Major urban regions had much lower levels of employment in agriculture, forestry and fishing, and mining, and much higher levels of employment in manufacturing, wholesale trade, finance and insurance, and property and business services.

Conclusions

The core themes emerging from this analysis are: diversity; scale; clustering; and transition. Diversity is apparent not only between regions, but within regions, where specific localities may be dependent on a particular industry of employment that is not so critical at the regional level. This issue of scale adds complexity to assessment of the vulnerability of regions to shocks to specific industries. It may be the dominant industry towns which are central to the economic (and social) functioning of the region despite their surrounding regions having different employment bases. On the other hand, regions as a whole may be more resilient in the face of employment change than has been assumed because different localities are able to survive shocks and provide opportunities for diversification. An analysis of employment and population change at the urban centre and locality level compared to the statistical division level for the 1996 – 2006 period may reveal cases of each dynamic. What is important at a policy level is that the extent to which rural and remote regions are vulnerable or resilient to change cannot be assumed based on high level understandings of (spatial) employment patterns at a particular point in time. There needs to be attention paid to the complex interplay between local and regional labour economies.

The clustering of (sectoral) patterns of employment can make it difficult for policy makers to recognise diversity and scale. The view from a particular part of Australia can be clouded by what happens in that immediate region. This can lead to inappropriate policies for regions that are different. The effect is most starkly illustrated in the differences between employment structures in the densely populated south east and south west corners of Australia and the more sparsely populated north. In the densely populated areas, spatial and sectoral patterns of employment closely resemble Von Thünen's concentric rings model. Manufacturing and retail industries are close to the major urban centres, and

agriculture tends to extend further from those centres. In the sparsely populated north, however, activity becomes more localised. The connections between sites of productive activity and the urban centres (which are cores of consumption, contracting and transportation) are no longer contiguous, and there are vast regions where productive industries have very little presence and employment is focused on the public and social services industries. The policy implications of assuming contiguous development where it does not exist have been discussed by Carson (2011b) and Taylor and colleagues (2011) as contributing to the persistence of economic 'haves and have nots' in remote dwelling populations.

The temporal scale of the data available for this analysis makes it difficult to assess the causes of transition in Australia's rural and remote labour economies. On the surface, there is evidence for the effects of the twin 'shocks' of the drought and the first stage of the mining boom. However, the growth in mining employment was not as dramatic as might have been assumed, perhaps because substantial 'mining' employment during this period was in construction projects, and the evidence for a direct competition between mining and agricultural employment was mixed and appeared very much to rely on local circumstances. It is likely that the longer term trends in employment in these sectors – increasing labour efficiency and increasing distance between the sites of extractive activity and the recipients of the economic benefits of such activity through use of non-resident workforces (including overseas guest workers) – along with the highly localised nature of mining activity have been as important in determining the transitions described in this paper as have been the 'shocks'.

The second major transition has been towards increasing importance of services employment, and particularly public and social services. This sort of transition is not unexpected in an environment where the productive economies remain heavily based on staples activities. Rural and (particularly) remote Australia's transition to post staples or mature staples economies has been retarded by the renewed reliance on extractive (mining) activity, but it may also be retarded by the extent to which development of tertiary and quaternary activity has been driven by government investment in addressing 'disadvantage'. Rural and (particularly) remote regions which have not been able to profit directly from the mining boom (and this includes some parts of northern Queensland and Western Australia where mining activity is located) have been compensated by increased investment in government and health and community services jobs.

This paper was drafted as the 2011 Census was being conducted (August, 2011), and results from that Census will be available in mid to late 2012. The 2011 Census captures rural and remote Australia at a point when the mining boom has experienced a 'second wave' following the global financial crisis of 2008/9, the drought has broken in many parts of Australia but has been replaced in some locations by floods and destructive storms. The Australian dollar has been trading at record highs against the United States dollar (and other currencies), and this has threatened manufacturing, retail and tourism industries in particular. These conditions, along with the long term labour economy trends described above, are likely to be reflected in the 2011 data in a reinforcement of the core themes of diversity, scale, clustering and transition. An assessment of how specific regions and locations may change is beyond the scope of this paper, but in broad terms it could be expected that 'productive' industries not associated with mining will consolidate in closer proximity to major urban centres because those regions are more able to access domestic markets and labour to compensate for decreased export demand and to facilitate niche marketing and diversification. Mining will have significant local effects in selected locations beyond the urban periphery and these effects will not just be in mining employment, but in construction, transport and retail services to mining communities. How long those effects may persist is an important question being addressed by researchers such as Haslam McKenzie (2011) and others. The suspicion is that effects will be increasingly short term and localised, and the economic development of more sparsely populated areas of Australia will continue to rely on government investment in 'industries of disadvantage'.

This paper presents further evidence of how 'one size fits all' approaches to regional development policy in Australia are ill suited to the complexity of conditions that apply here. It is difficult to avoid making generalisations about how industries are performing and how regions are benefiting or suffering from both long term trends and shorter term shocks, but clearly there is a need for place based assessment of what works and does not work and what might be needed to prepare local and regional economies to adapt. The research described here can serve as a template for how to imagine the patchwork economy and anticipate and monitor its changing patterns and fabric.

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