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THE AUSTRALIAN NATURAL DISASTER RESILIENCE INDEX

VOLUME II – INDEX DESIGN AND COMPUTATION

Chapter 5 – Statistical outputs: disaster resilience themes

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CHAPTER 5 – STATISTICAL OUTPUTS: DISASTER RESILIENCE THEMES

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Each section presents the statistical outputs and results of one disaster resilience theme.

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5.1.1 Transformation

The social character index is calculated by aggregating the social character indicators. Of the 15 indicators, 10 required rescaling and transformation before aggregation. Transformation details are shown in Table 5.1 and the results of transformation in Table 5.2. Raw and transformed indicator values are outlined in Appendix 5A.

Table 5.1: Transformation details for indicators used to form the social character sub-index.

Indicator	Transformation details		
	Skewness transform	**Exponent**	**Coefficient for kurtosis transform**
% population arrived in Australia 2001 onwards	Power transform	0.26	0.01
% of households with all or some residents not present a year ago	Power transform	-0.75	0.00
% speaks English not well or not at all	Power transform	0.18	0.23
% population with a core activity need for assistance	No transform	-	-
% one parent families	No transform	-	-
% households with children	No transform	-	-
% lone person households	No transform	-	-
% group households	Power transform	0.18	0.34
Sex ratio	Power transform	-4.71	0.20
% population aged over 75	Power transform	0.68	0.00
% population aged under 15	Power transform	1.16	0.27
Ratio of certificate and/or postgrad to year 8-12	No transform	-	-
% of labour force unemployed	Power transform	0.31	0.25
% not in labour force	Power transform	0.59	0.08
% managers and professionals	Power transform	0.12	0.00

Table 5.2: Transformation results for indicators used to form the social character sub-index.

Indicator	Raw data pre-transform			Post-transform		
	Skewness	Kurtosis	Outliers	Skewness	Kurtosis	Outliers
% population arrived in Australia 2001 onwards	1.79	4.72	25	-0.00	-0.00	8
% of households with all or some residents not present a year ago	2.33	12.29	22	0.00	-0.13	4
% speaks English not well or not at all	3.41	16.74	44	-0.08	0.00	0
% population with a core activity need for assistance	0.57	0.22	4	-0.57	0.22	4
% one parent families	0.69	0.53	9	-0.69	0.53	9
% households with children	0.30	0.01	0	-0.30	0.01	0
% lone person households	0.11	-0.12	2	-0.11	-0.12	2
% group households	2.46	7.32	49	-0.17	-0.00	3
Sex ratio	7.62	103.66	26	-0.01	0.00	2
% population aged over 75	0.47	0.24	6	-0.00	-0.21	1
% population aged under 15	-0.21	1.86	19	-0.01	0.00	2
Ratio of certificate and/or postgrad to year 8-12	0.18	-0.17	1	0.18	-0.17	1
% of labour force unemployed	5.48	96.49	10	-0.08	-0.00	3
% not in labour force	0.37	0.58	7	-0.00	-0.00	1
% managers and professionals	0.67	-0.07	1	0.00	-0.35	1

5.1.2 Correlation

The correlation plot has the indicators in the order given by the sorted loadings table from principal components analysis (PCA). It shows a number of groups of reasonably well correlated indicators, consistent with a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.72 (Figure 5.1). The scree plot was inconclusive as to the number of components, however a four component solution was suggested by the number of eigenvalues greater than one (Table 5.3).

Since these social character indicators were chosen for their known influence on resilience, causation flows from the indicators to the measure of resilience, and a formative measurement model is appropriate. There is strong multi-factor structure as evidenced by the high proportion of variance explained by the components and the relatively high KMO measure.

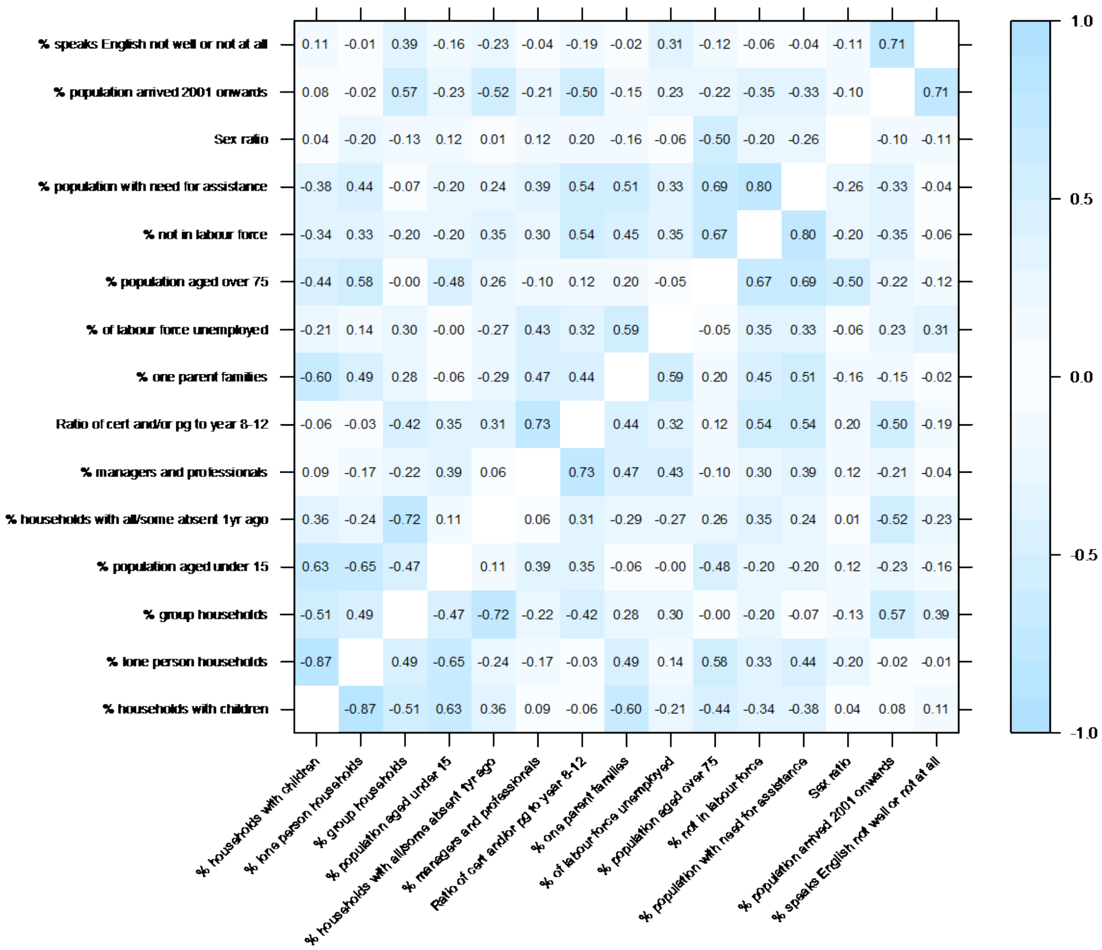


Figure 5.1: Correlation between indicators in the social character sub-index.

Regressions between each indicator as dependent variable and the remaining indicators as independent variables show that many of the indicators are well predicted by the remaining indicators (Table 5.4). However, the correlation plot shows that there are a number of negative correlations and for this reason, no indicators were discarded.

Table 5.3: Component loadings for the four component PCA solution for indicators in the social character sub-index.

Indicator	C1	C2	C3	C4
% households with children	-0.95			
% lone person households	0.87		0.33	
% group households	0.68			0.60
% population aged under 15	-0.67	0.33	-0.36	
% of households with all or some residents not present a year ago	-0.52		0.49	-0.50
% managers and professionals		0.85		
Ratio of certificate and/or postgrad to year 8-12		0.80		-0.40
% one parent families	0.52	0.73		
% of labour force unemployed		0.72		0.45
% population aged over 75	0.34		0.86	
% not in labour force		0.49	0.72	
% population with a core activity need for assistance		0.53	0.70	
Sex ratio			-0.62	-0.31
% population arrived in Australia 2001 onwards				0.89
% speaks English not well or not at all				0.85
Cumulative % of variance	22.78	43.74	62.01	80.14

Table 5.4: Regression analysis of each social character indicator as dependent variable against the remaining indicator values as independent variables.

Indicator denoted the dependent variable in the regression	R^2
% households with children	0.92
% population aged over 75	0.85
% lone person households	0.85
Ratio of certificate and/or postgrad to year 8-12	0.81
% not in labour force	0.81
% one parent families	0.81
% population with a core activity need for assistance	0.79
% population arrived in Australia 2001 onwards	0.78
% population aged under 15	0.77
% group households	0.77
% of households with all or some residents not present a year ago	0.74
% managers and professionals	0.72
% of labour force unemployed	0.65
% speaks English not well or not at all	0.64
Sex ratio	0.57

5.1.3 Measurement model

Since the 15 social character indicators had a strong multi-factor structure, but were not suited to a reflective measurement model, a two-level formative model for aggregation was chosen.

5.1.4 Aggregation

The two-level formative model, guided by the PCA results, comprised four sub-indices:

> *Household factors* – % households with children, % lone person households, group households, % population aged under 15 and % of households with all or some residents not present a year ago;
>
> *Socio-economic advantage* – % managers and professionals, ratio of certificate and/or postgrad to year 8-12, % one parent families and % of labour force unemployed;
>
> *Need for assistance* – % population aged over 75, % not in labour force, % population with a core activity need for assistance and sex ratio; and,
>
> *Familiarity with locality* – % population arrived in Australia 2001 onwards, % speaks English not well or not at all.

Because household factors include indicators that are strongly negatively correlated, some consideration needs to be given to compensability issues, since with such indicators, very high values of some indicators will be aggregated with very low values of other indicators. For example, will low numbers of lone person households compensate for high numbers of households with children in determining the resilience of a community and vice versa? Since there is little information in the natural disaster resilience literature to answer these questions precisely, the choice was made to use ordered weighted averaging (OWA) rather than the arithmetic mean. With an orness of 0.375, OWA provides moderate restraint on compensatory effects which would otherwise be unrestrained with the arithmetic mean.

An OWA of 0.375 was also used to aggregate each of the other three sub-indices. The four sub-indices were aggregated using OWA with an orness of o.375. This orness value was chosen in the absence of any evidence that household factors, socio-economic advantage, familiarity with locality and need for assistance could not substitute for each other to a moderate extent.

The comparison of aggregation methods (Figure 5.2), shows the results for the two level formative model and single level models with aggregation by OWA, geometric mean, Mazziotta-Pareto Index and arithmetic mean. As expected, the use of OWA with its constraints upon compensatory effects results in the social character sub-index taking values lower than that obtained with the arithmetic mean. There is not a lot of difference between the two level and single level models with aggregation by OWA (in the diagram the single level

OWA is obscured behind the two level OWA), although two level OWA retains the capacity for a more nuanced accounting for compensatory effects if required. The geometric mean gives approximately similar values of the sub-index as the arithmetic mean but falls to zero as soon as the coefficient of variation of the constituent indicators for an SA2 is high enough to be the result of one or more zero indicators. The Mazziotta-Pareto Index, with its fixed unbalance penalisation, severely reduces the value of the sub-index when the coefficient of variation for the indicators is high.

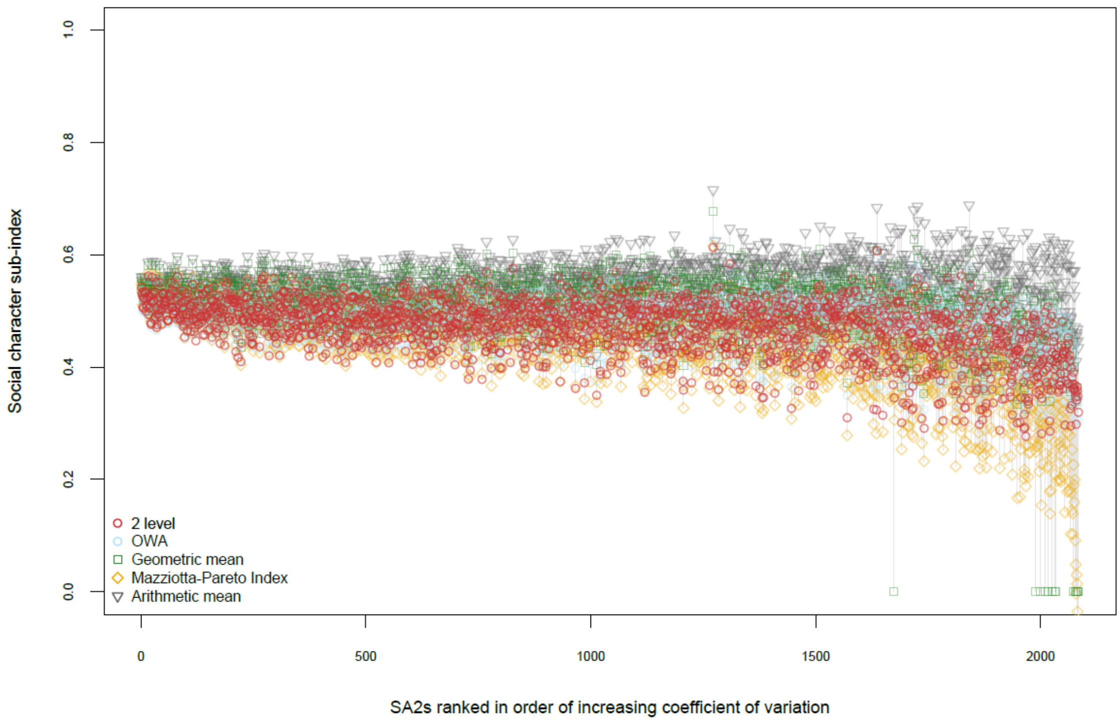


Figure 5.2: Comparison of aggregation methods for the social character sub-index.

The example SA2s in Table 5.5 show that a high coefficient of variation across the 15 indicators results in a larger difference between the two-level model using OWA and the simple arithmetic mean of the indicators. This is a consequence of OWA restraining the extent to which high values on some indicators can compensate for low values on other indicators.

Table 5.5: Example SA2s showing social character sub-index values obtained using different aggregation functions.

Indicator	Rescaled transformed indicator values High c.v. (Thamarrurr)	Low c.v. (Warragul)
% population arrived in Australia 2001 onwards	1.00	0.58
% of households with all or some residents not present a year ago	0.43	0.53
% speaks English not well or not at all	0.00	0.60
% population with a core activity need for assistance	0.84	0.68
% one parent families	0.39	0.63
% households with children	0.20	0.56
% lone person households	0.91	0.62
% group households	0.35	0.46
Sex ratio	0.42	0.60
% population aged over 75	0.89	0.52
% population aged under 15	0.00	0.48
Ratio of certificate and/or postgrad to year 8-12	0.03	0.51
% of labour force unemployed	0.26	0.52
% not in labour force	0.17	0.51
% managers and professionals	0.64	0.62
Social Character sub-index (2 level OWA)	0.32	0.54
Social Character sub-index (Arithmetic mean)	0.43	0.56
Coefficient of variation	0.79	0.11

5.1.5 Mapped social character sub-index

The mapped output of the social character sub-index is shown in Figure 5.3. Maps showing State/Territory and major metropolitan area resolution are provided in Appendix 5B.

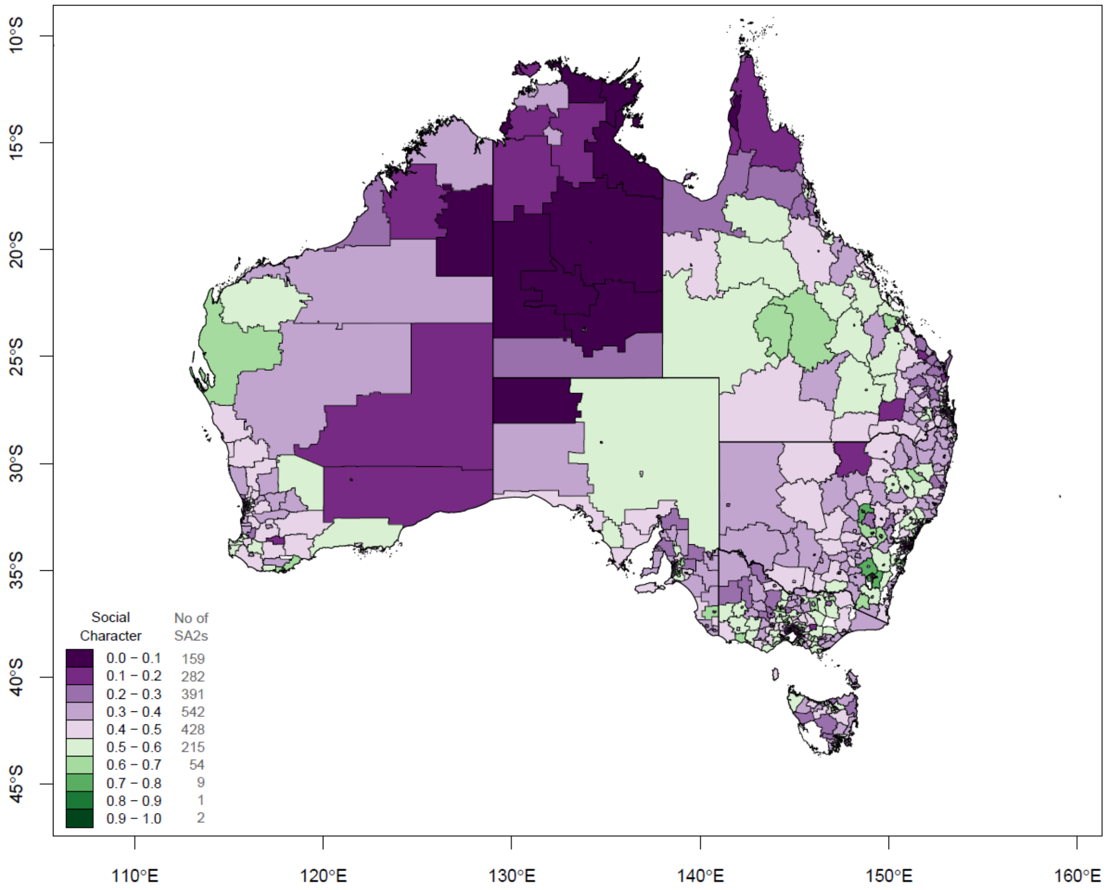


Figure 5.3: Mapped output of the social character sub-index at a national level.

5.1.6 Indicator relationships with composite index

5.1.6.1 National level

The correlations at national level between individual indicators and the social character sub-index are shown in Table 5.6. The magnitude of the correlation gives guidance as to which indicators have the most influence on the value of the social character sub-index. The corresponding scatter plots and histograms are given in Figure 5.4.

Nationally, per cent unemployment and per cent not speaking English well or at all, have the most influence on the value of the social character sub-index. So where the social character sub-index has a low value, it is likely that this could be caused by high unemployment or high proportions of people not speaking English. High proportions of people who have arrived in Australia since 2001 might also be involved. The opposite is likely to be the case when the social character sub-index has a high value. However, there will be exceptions to this pattern when smaller regions are considered.

Table 5.6: Correlations between indicators and the social character sub-index values, at a national level.

Indicator	Correlation with social character sub-index
% managers and professionals	0.33
Ratio of certificate and/or postgrad to year 8-12	0.32
% households with children	0.05
% population aged under 15	0.03
% population aged over 75	-0.01
Sex ratio	-0.02
% lone person households	-0.10
% of households with all or some residents not present a year ago	-0.12
% group households	-0.21
% population with a core activity need for assistance	-0.37
% one parent families	-0.38
% not in labour force	-0.39
% population arrived in Australia 2001 onwards	-0.53
% of labour force unemployed	-0.61
% speaks English not well or not at all	-0.75

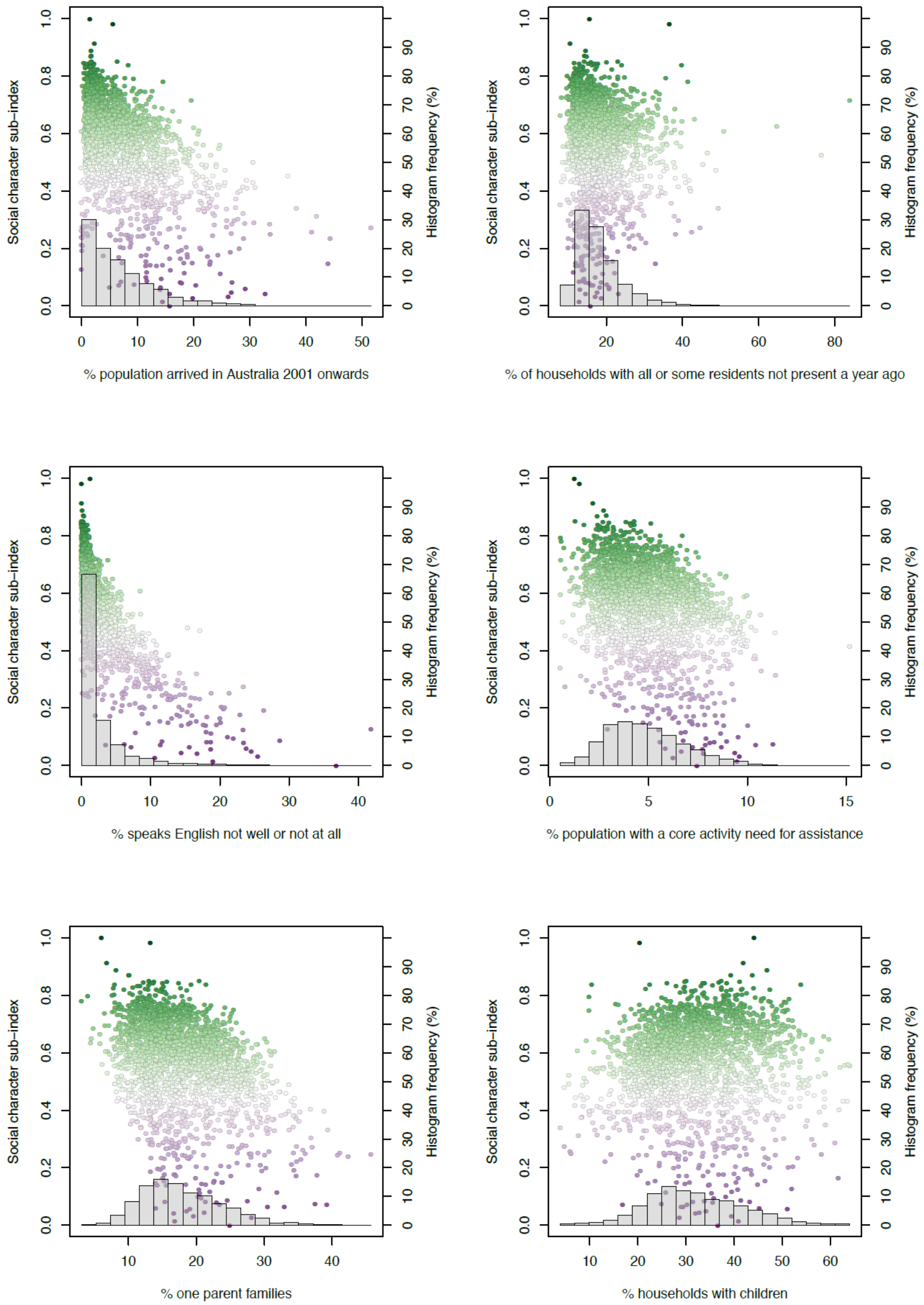


Figure 5.4: Scatterplots showing the relationships between social character sub-index values and component indicators at a national level. Raw indicator values, without reversal or transformation are used.

Figure 5.4 (cont.)

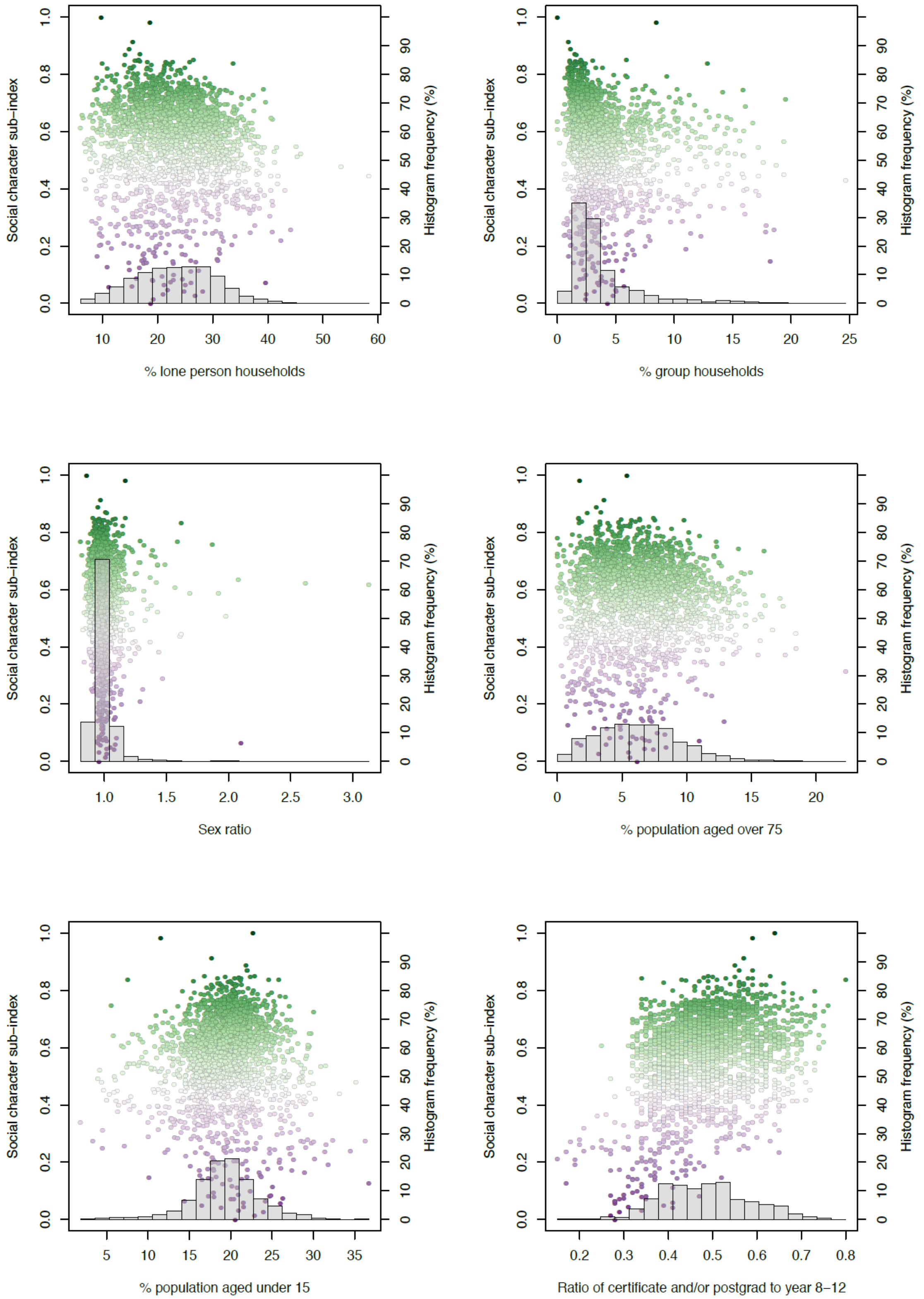
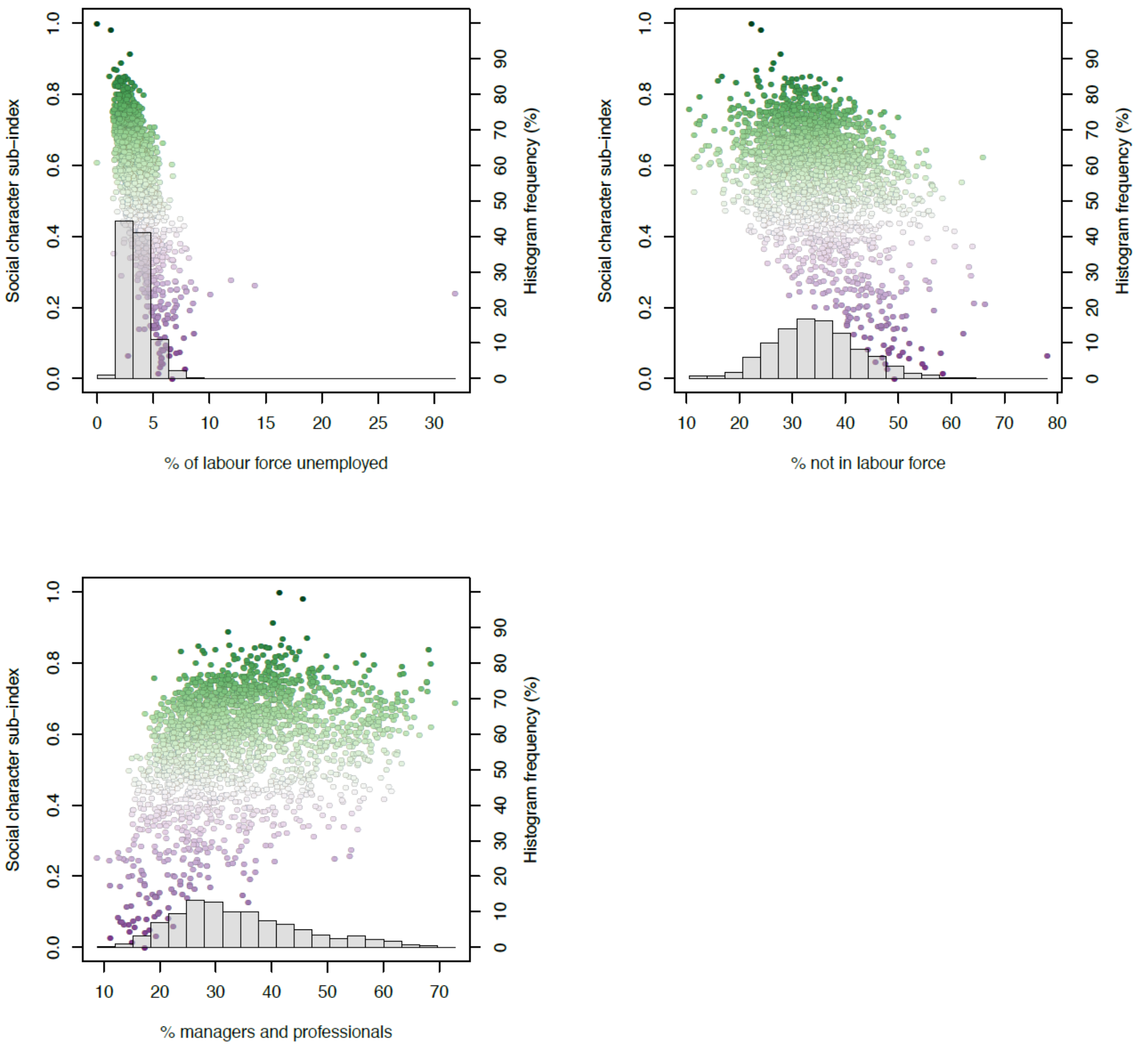


Figure 5.4 (cont.)



5.1.6.2 Regional level

Disaggregation of the correlations between indicators and sub-index to SA4 level (larger geographic areas containing around 20 SA2s) shows whether the regional differences in the patterns of correlations between indicators result in corresponding differences in the relationships between indicators and the social character sub-index (Figure 5.5).

For explanatory purposes, consider the scatter plots for percentage unemployment and percentage over 75 (Figure 5.5). In both plots, the group of points with a remoteness score of 1 or close to 1 are the metropolitan SA4s, including inner city and suburban areas. The points with remoteness scores of 2 through to 5 represent the SA4s ranging from inner regional Australia to very remote Australia. It can be seen that the correlation between percentage unemployment and the social character sub-index (the vertical axis in the scatter plot) remains negative and fairly large for all regions. This is the reason for the strong negative correlation between percentage unemployment and the social character sub-index at the national level.

However, there can be substantial differences in the correlation between percentage over 75 and the sub-index across different regions. In the metropolitan region, these correlations can be anywhere between large and positive, and large and negative. So in some metropolitan regions, percentage over 75 will be a strong positive influence on the social character sub-index, and in other metropolitan regions it will be a strong negative influence. In yet other metropolitan regions, percentage over 75 will be largely unrelated to the social character sub-index. The scatter plot also shows that percentage over 75 will be a moderate negative influence on the sub-index in inner and outer regional Australia, while in remote and very remote Australia, it will be a moderate positive influence.

Taking all the indicator correlations depicted in Figure 5.5, the following conclusions can be drawn about spatial variation in the influence of the indicators on the sub-index.

- The demographic heterogeneity of metropolitan regions means that, for most indicators, and in many regions, a high or low sub-index value could be the result of high or low values for any of the indicators.
- The indicators that are an exception to this are % speaks English not well or not at all, and % of labour force unemployed. For most metropolitan regions a high value of the sub-index is likely to be associated with low values of these two indicators, and vice versa.
- Recalling that the relative influences of indicators on the sub-index are controlled by the correlation patterns among the indicators, it appears that there are some systematic geographic gradients in these correlation patterns, from inner regional areas to very remote areas. These are manifested in changes in the correlation between some indicators and the sub-index that are associated with the degree of remoteness. For example, % households with children has a moderate positive correlation with the sub-index in inner regional areas, but this reduces to little to no correlation in outer regional areas, and then to a moderate negative correlation in remote areas. This means that, in inner regional Australia, high values of the sub-index could be associated with high percentages of households with children and vice versa. However, in remote areas high values of the sub-index would be more likely to be associated with lower percentages of households with children.
- Figure 5.5 suggests that geographic variation of the correlation between indicators and the sub-index also occurs with % households with some or all residents absent 1 year ago, % lone person households, % group households, % of population over 75, and % of population under 15.

These results highlight the importance of the pattern of correlations among indicators, and the geographical variation in these patterns, in the interpretation of sub-index values.

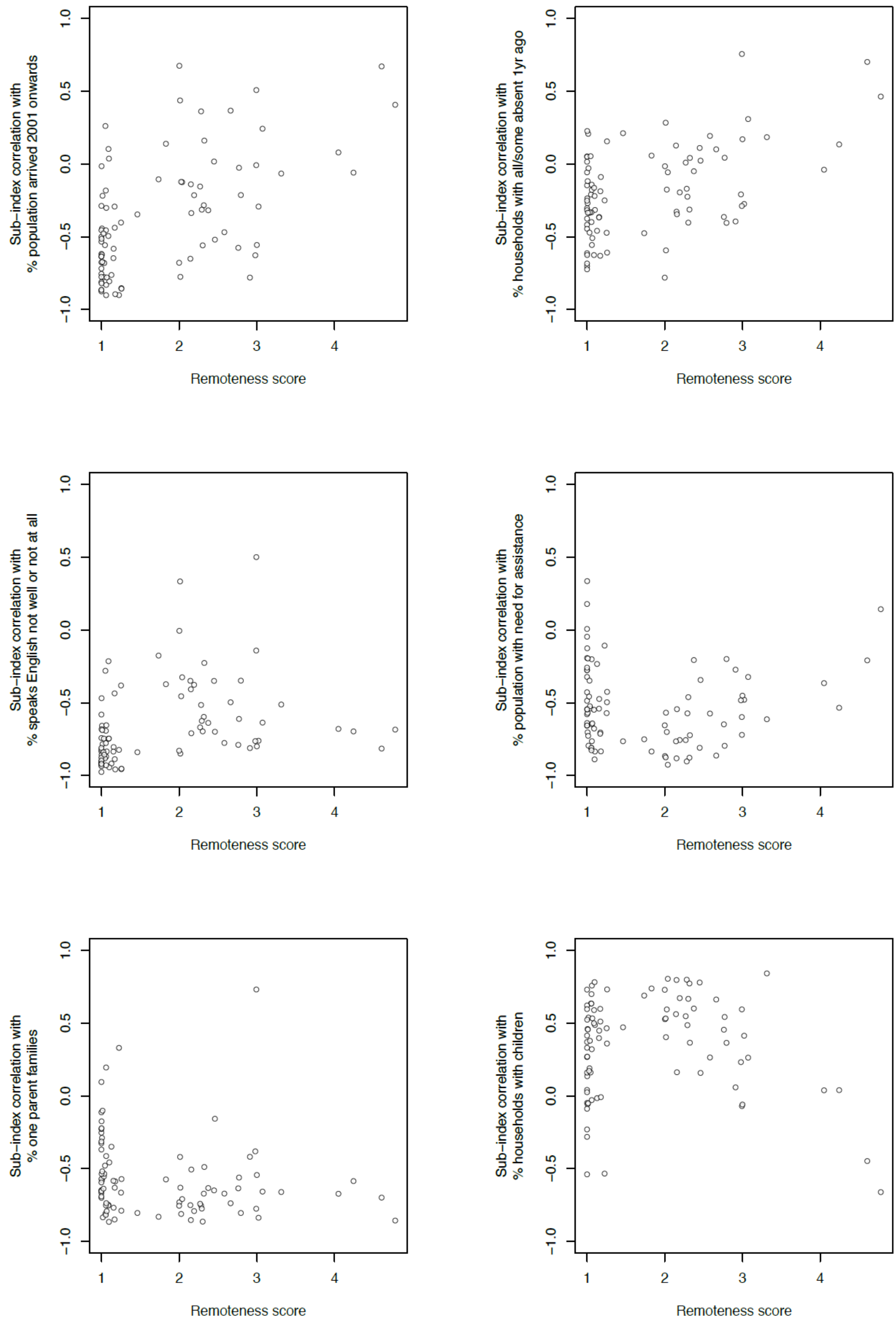


Figure 5.5: Correlation between indicators and social character sub-index values, at a regional level. Remoteness of 1 is metropolitan areas through to 5, very remote areas.

Figure 5.5 (cont.)

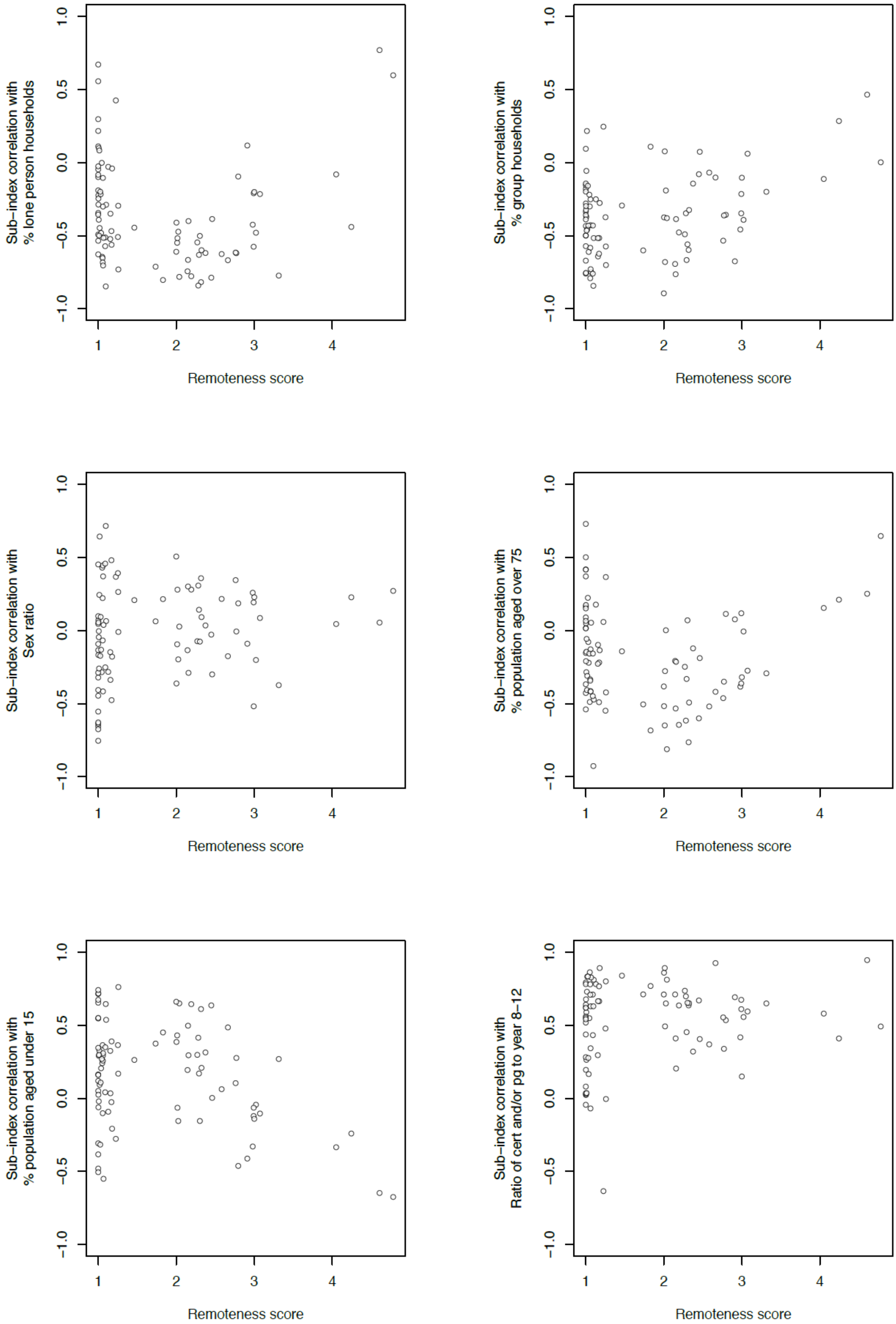
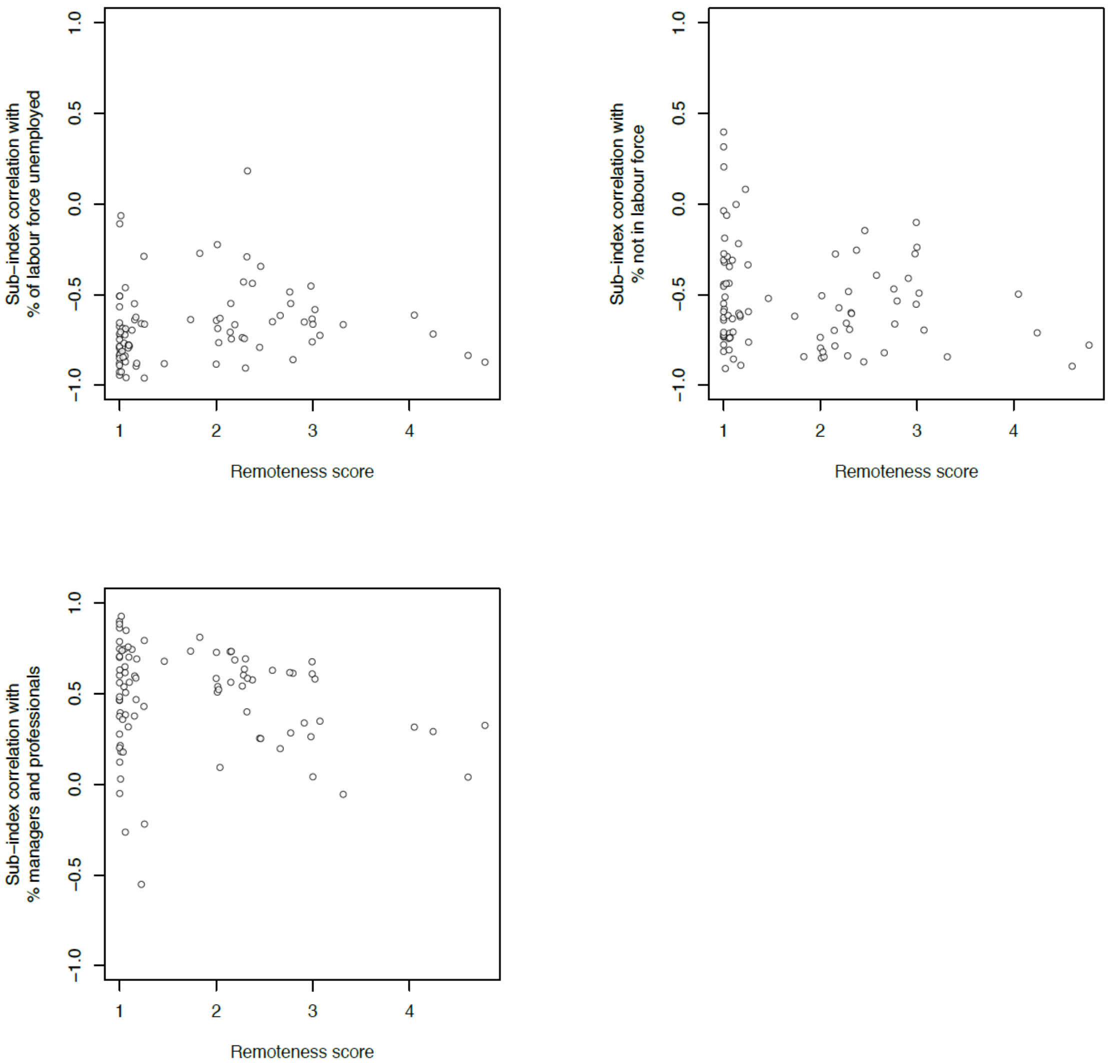


Figure 5.5 (cont.)



5.2 ECONOMIC CAPITAL

5.2.1 Transformation

The economic capital index is calculated by aggregating the economic capital indicators. All but one indicator required rescaling and transformation before aggregation. Transformation details are shown in Table 5.7and the results of transformation in Table 5.8. Raw and transformed indicator values are outlined in Appendix 5C.

Table 5.7: Transformation details for indicators used to form the economic capital sub-index.

Indicator	Transformation details		
	Skewness transform	Exponent	Coefficient for kurtosis transform
% residents owning own home outright	No transform	-	-
% residents owning own home with a mortgage	Power transform	0.86	0.23
% residents renting their home	Power transform	0.32	0.13
Median weekly rent	Power transform	0.82	0.12
Median monthly mortgage repayments	Power transform	1.04	0.16
Median weekly personal income	Power transform	0.28	0.18
Median weekly family income	Power transform	0.35	0.02
% families with less than $600 p.w. income	Power transform	0.40	0.05
% families with more than $3,000 p.w. income	Power transform	0.23	0.02
% employment in largest single sector	Power transform	0.12	0.26
Economic diversity index	Power transform	6.44	0.00
% businesses employing 20 or more people	Power transform	0.43	0.29
Retail and/or commercial establishments per 1,000 people	Power transform	0.23	0.34
% population change 2001 to 2011	Power transform	0.05	0.44
Gini coefficient	Power transform	0.73	0.44
Local government grant per capita	Power transform	0.07	0.29

Table 5.8: Transformation results for indicators used to form the economic capital sub-index.

Indicator	Raw data pre-transform			Post-transform		
	Skewness	Kurtosis	Outliers	Skewness	Kurtosis	Outliers
% residents owning own home outright	-0.43	-0.09	0	-0.43	-0.09	0
% residents owning own home with a mortgage	0.27	0.83	4	0.05	0.00	0
% residents renting their home	1.43	3.27	27	-0.01	-0.00	2
Median weekly rent	0.29	1.32	5	0.03	0.00	2
Median monthly mortgage repayments	-0.07	1.15	17	0.01	0.00	2
Median weekly personal income	1.47	4.33	16	0.06	-0.00	2
Median weekly family income	0.71	-0.11	1	0.01	0.00	3
% families with less than $600 p.w. income	1.10	3.53	13	0.00	-0.00	6
% families with more than $3,000 p.w. income	1.15	0.79	8	0.01	0.00	2
% employment in largest single sector	2.27	5.80	34	-0.16	-0.00	2
Economic diversity index	-1.46	1.07	0	0.00	-1.29	0
% businesses employing 20 or more people	7.94	126.83	13	-0.07	-0.00	5
Retail and/or commercial establishments per 1,000 people	9.85	155.17	14	0.02	-0.00	8
% population change 2001 to 2011	30.68	1073.36	6	-0.15	-0.00	7
Gini coefficient	1.08	9.71	32	-0.04	0.00	10
Local government grant per capita	10.77	164.01	23	-0.30	-0.00	1

5.2.2 Correlation

The correlation plot (Figure 5.6) has the indicators in the order given by the sorted loadings table from principal components analysis (PCA). The correlation plot is for transformed indicators with reversals carried out where appropriate. For some correlations the negative value is a consequence of one indicator having been reversed and the other not reversed. For example, median monthly mortgage repayments is negatively correlated with % families with more than $3,000 p.w. income. Without reversals these would be positively correlated, but median monthly mortgage repayments is reversed since it is believed to have a negative effect on resilience. On the other hand, median monthly mortgage repayments is negatively correlated with % families with less than $600 p.w. income, and both the indicators have been reversed to reflect the belief that they both have a negative influence on disaster resilience. It is this second type of negative correlation between indicators that has implications for aggregation.

The correlation plot shows a number of groups of reasonably well correlated indicators, consistent with a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.77 (Figure 5.6). The scree plot was inconclusive as to the number of components, and a solution based on the number of eigenvalues greater than one gave a number of uninterpretable components. After examining a number of possible solutions, a three component solution provided some guidance for the aggregation strategy (Table 5.9).

Since these indicators were chosen for their known influence on disaster resilience, causation flows from the indicators to the measure of resilience, and a formative measurement model is appropriate. There is moderately strong multi-factor structure as evidenced by the proportion of variance explained by the components and the relatively high KMO measure.

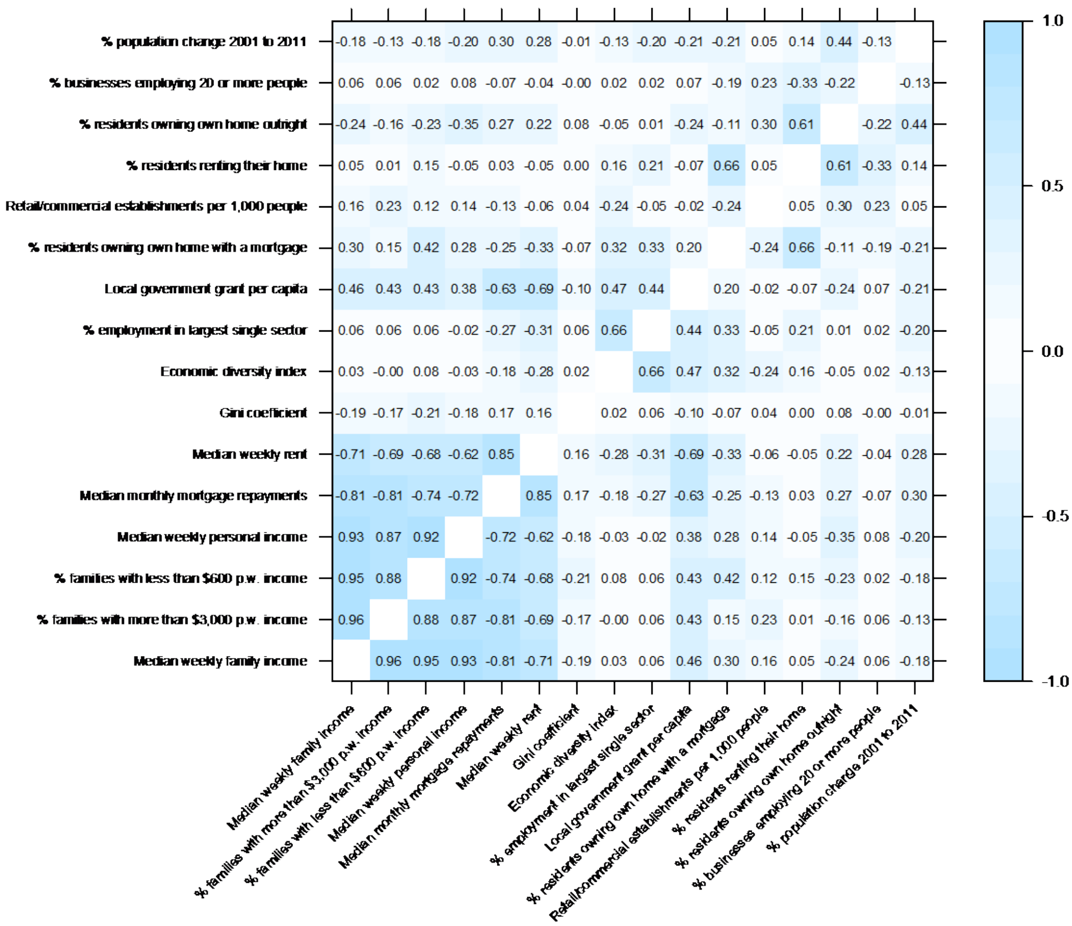


Figure 5.6: Correlation between indicators in the economic capital sub-index.

Table 5.9: Component loadings for the three component PCA solution for the indicators in the economic capital sub-index.

Indicator	C1	C2	C3
Median weekly family income	0.98		
% families with more than $3,000 p.w. income	0.95		
% families with less than $600 p.w. income	0.95		
Median weekly personal income	0.93		
Median monthly mortgage repayments	-0.86		
Median weekly rent	-0.77	-0.39	
Gini coefficient			
Economic diversity index		0.83	
% employment in largest single sector		0.79	
Local government grant per capita	0.49	0.57	
% residents owning own home with a mortgage	0.31	0.54	0.46
Retail and/or commercial establishments per 1,000 people		-0.42	
% residents renting their home			0.92
% residents owning own home outright			0.77
% businesses employing 20 or more people			-0.51
% population change 2001 to 2011		-0.39	0.41
Cumulative % of variance	34.29	50.50	64.13

Regressions between each indicator as dependent variable and the remaining indicators as independent variables show that many of the indicators are well predicted by the remaining indicators. However, the correlation plot shows that there are a number of negative correlations and for this reason, no indicators were discarded.

Table 5.10: Regression analysis of each economic capital indicator as dependent variable against the remaining indicator values as independent variables.

Indicator denoted the dependent variable in the regression	R^2
Median weekly family income	0.98
% families with more than $3,000 p.w. income	0.95
% families with less than $600 p.w. income	0.94
% residents renting their home	0.92
Median weekly personal income	0.92
% residents owning own home with a mortgage	0.89
% residents owning own home outright	0.86
Median monthly mortgage repayments	0.85
Median weekly rent	0.78
Local government grant per capita	0.60
Economic diversity index	0.57
% employment in largest single sector	0.55
Retail and/or commercial establishments per 1,000 people	0.35
% population change 2001 to 2011	0.30
% businesses employing 20 or more people	0.20
Gini coefficient	0.06

5.2.3 Measurement model

Since the 16 economic capital indicators had a strong multi-factor structure, but were not suited to a reflective measurement model, a two-level formative model for aggregation was chosen.

5.2.4 Aggregation

The two-level formative model, guided by the PCA results, comprised three sub-indices:

> *Disposable income* – median weekly family income, % families with more than $3,000 p.w. income, % families with less than $600 p.w. income, median weekly personal income, median monthly mortgage repayments, median weekly rent;
>
> *Ownership* – % residents renting their home, % residents owning own home with a mortgage, % residents owning own home outright; and,
>
> *Economy* – economic diversity index, % employment in largest single sector, local government grant per capita, % population change 2001 to 2011, retail and/or commercial establishments per 1,000 people and % businesses employing 20 or more people.

Since the correlation plot showed the Gini coefficient to have very low correlations with any of the remaining indicators (Figure 5.6), the effect on the economic capital theme sub-index of omitting the Gini coefficient was tested. The correlation between the theme sub-indices with and without the Gini coefficient was 0.99, which was considered grounds for omitting this indicator.

Because disposable Income includes indicators that are strongly negatively correlated, some consideration needs to be given to compensability issues, since with such indicators, very high values of some indicators will be aggregated with very low values of other indicators. For example, will low numbers of families with less than $600 p.w. income (higher resilience) compensate for high median monthly mortgage repayments (lower resilience) in determining the resilience of a community and vice versa? Since there is little information in the natural disaster resilience literature to answer these questions precisely, the choice was made to use ordered weighted averaging (OWA) rather than the arithmetic mean. With an orness of 0.375, OWA provides moderate restraint on compensatory effects which would otherwise be unrestrained with the arithmetic mean.

OWA with an orness of 0.375 was also used to aggregate each of the two other sub-indices. This orness value was chosen in the absence of any evidence that disposable Income, ownership and economy could not substitute for each other to a moderate extent.

The comparison of aggregation methods (Figure 5.7) shows the results for the two level formative model and single-level models with aggregation by OWA, geometric mean, Mazziotta-Pareto Index and arithmetic mean. As expected, the use of OWA with its constraints upon compensatory effects results in the economic capital theme sub-index taking values lower than are obtained with the arithmetic mean. There is not a lot difference between the two level and single level models with aggregation by OWA (in the diagram the single level OWA is obscured behind the two-level aggregation), although the two level aggregation retains the capacity for a more nuanced accounting for compensatory effects if required. The geometric mean gives approximately similar values of the sub-index as the arithmetic mean but falls to zero as soon as the coefficient of variation of the constituent indicators for an SA2 is high enough to be the result of one or more zero indicators. The Mazziotta-Pareto Index, with its fixed unbalance penalisation, severely reduces the value of the sub-index when the coefficient of variation for the indicators is high.

The three sub-indices, disposable income, ownership and economy were aggregated using OWA with an orness of 0.375.

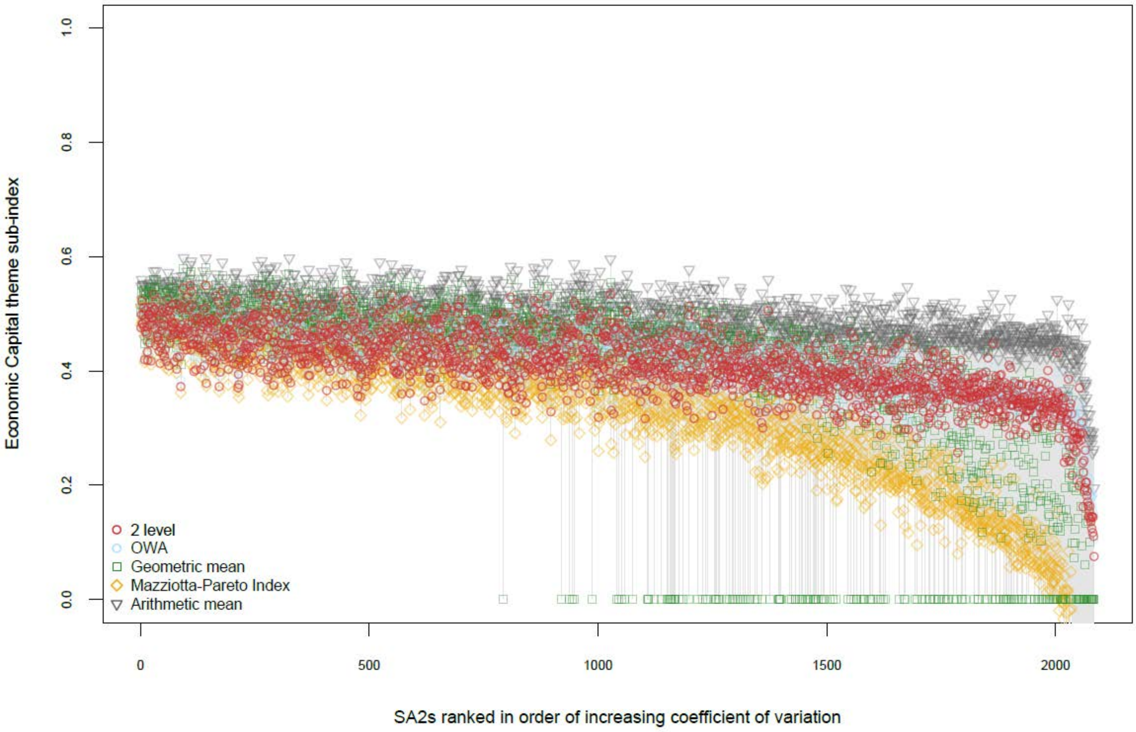


Figure 5.7: Comparison of aggregation methods for the economic capital sub-index.

The example SA2s in Table 5.11 show that a high coefficient of variation across the 15 indicators results in a larger difference between the two-level model and the simple arithmetic mean of the indicators. This is a consequence of OWA restraining the extent to which high values on some indicators can compensate for low values on other indicators.

Table 5.11: Example SA2s showing economic capital sub-index values obtained using different aggregation functions.

Indicator	Rescaled transformed indicator values	
	High c.v. (Thamarrurr)	Low c.v. (Currumbin Waters)
% residents owning own home outright	0.00	0.59
% residents owning own home with a mortgage	0.00	0.57
% residents renting their home	0.01	0.42
Median weekly rent	0.93	0.55
Median monthly mortgage repayments	1.00	0.54
Median weekly personal income	0.00	0.58
Median weekly family income	0.00	0.62
% families with less than $600 p.w. income	0.00	0.44
% families with more than $3,000 p.w. income	0.37	0.59
% employment in largest single sector	0.15	0.33
Economic diversity index	0.00	0.56
% businesses employing 20 or more people	0.00	0.39
Retail and/or commercial establishments per 1,000 people	0.00	0.58
% population change 2001 to 2011	0.27	0.49
Local government grant per capita	0.19	0.42
Economic Capital theme sub-index (2 level model)	0.08	0.48
Economic Capital theme sub-index (Arithmetic mean)	0.19	0.51
Coefficient of variation	1.58	0.17

5.2.5 Mapped economic capital sub-index

The mapped output of the economic capital sub-index is shown in Figure 5.8. Maps showing State/Territory and major metropolitan area resolution are provided in Appendix 5D.

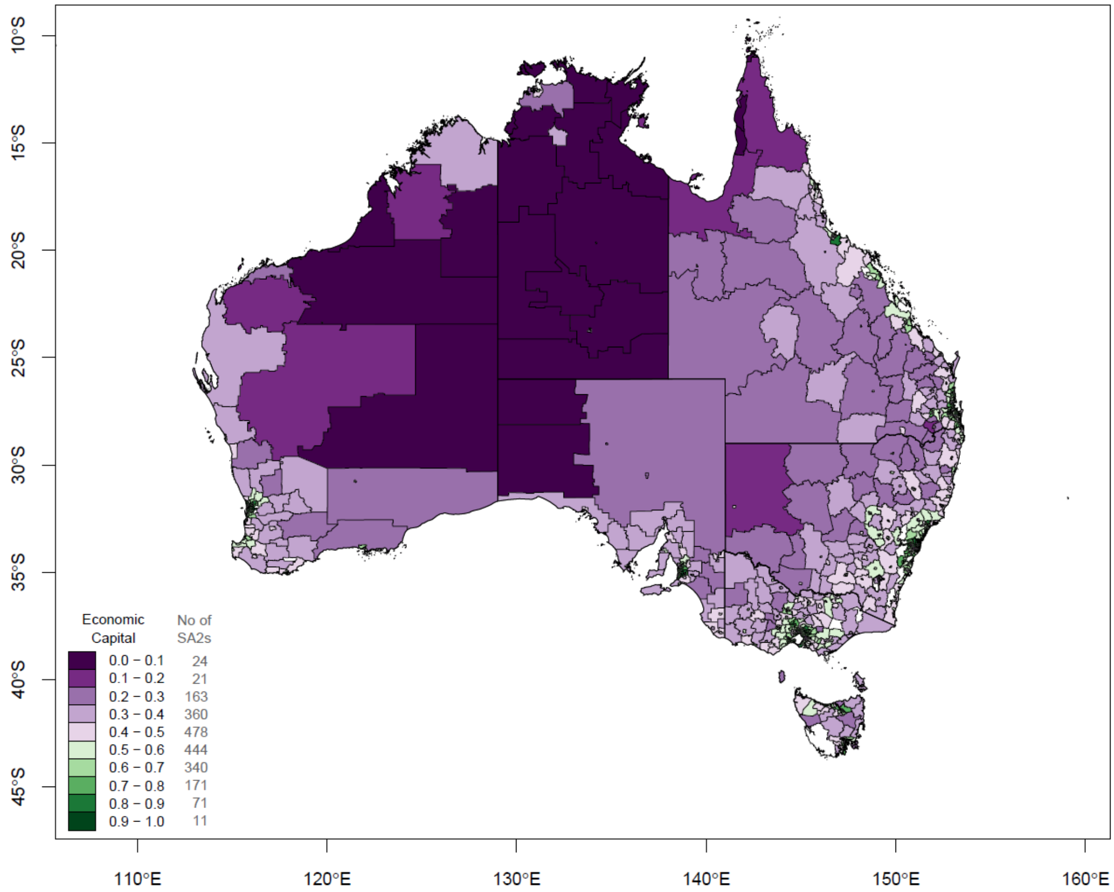


Figure 5.8: Mapped output of the economic capital theme sub-index values at a national level.

5.2.6 Indicator relationships with composite index

5.2.6.1 National level

The correlations at national level between individual indicators and the economic capital sub-index are shown in Table 5.12. The magnitude of the correlation gives guidance as to which indicators have the most influence on the value of the economic capital sub-index. The corresponding scatter plots, as well as histograms are given in Figure 5.9.

The correlations and scatter plots show that, nationally, the economic diversity index and % residents renting their home have the most influence on the value of the economic capital sub-index. The first indicator has a positive influence, while the second has a negative influence on the economic capital sub-index. So where, for example, the sub-index has a low value, it is likely that this could be caused by low diversity in the local economy and a high proportion of residents renting their home. The opposite is likely to be the case when the Economic Capital theme sub-index has a high value. However, there will be exceptions to this pattern when smaller regions are considered.

Table 5.12: Correlations between indicators and the economic capital sub-index values, at a national level.

Indicator	Correlation with economic capital theme sub-index
Economic diversity index	0.62
% residents owning own home with a mortgage	0.59
% residents owning own home outright	0.43
Median weekly rent	0.32
Median monthly mortgage repayments	0.28
Median weekly family income	0.19
% families with more than $3,000 p.w. income	0.09
Median weekly personal income	0.00
Retail and/or commercial establishments per 1,000 people	-0.04
% population change 2001 to 2011	-0.08
% businesses employing 20 or more people	-0.15
Local government grant per capita	-0.33
% families with less than $600 p.w. income	-0.45
% employment in largest single sector	-0.57
% residents renting their home	-0.75

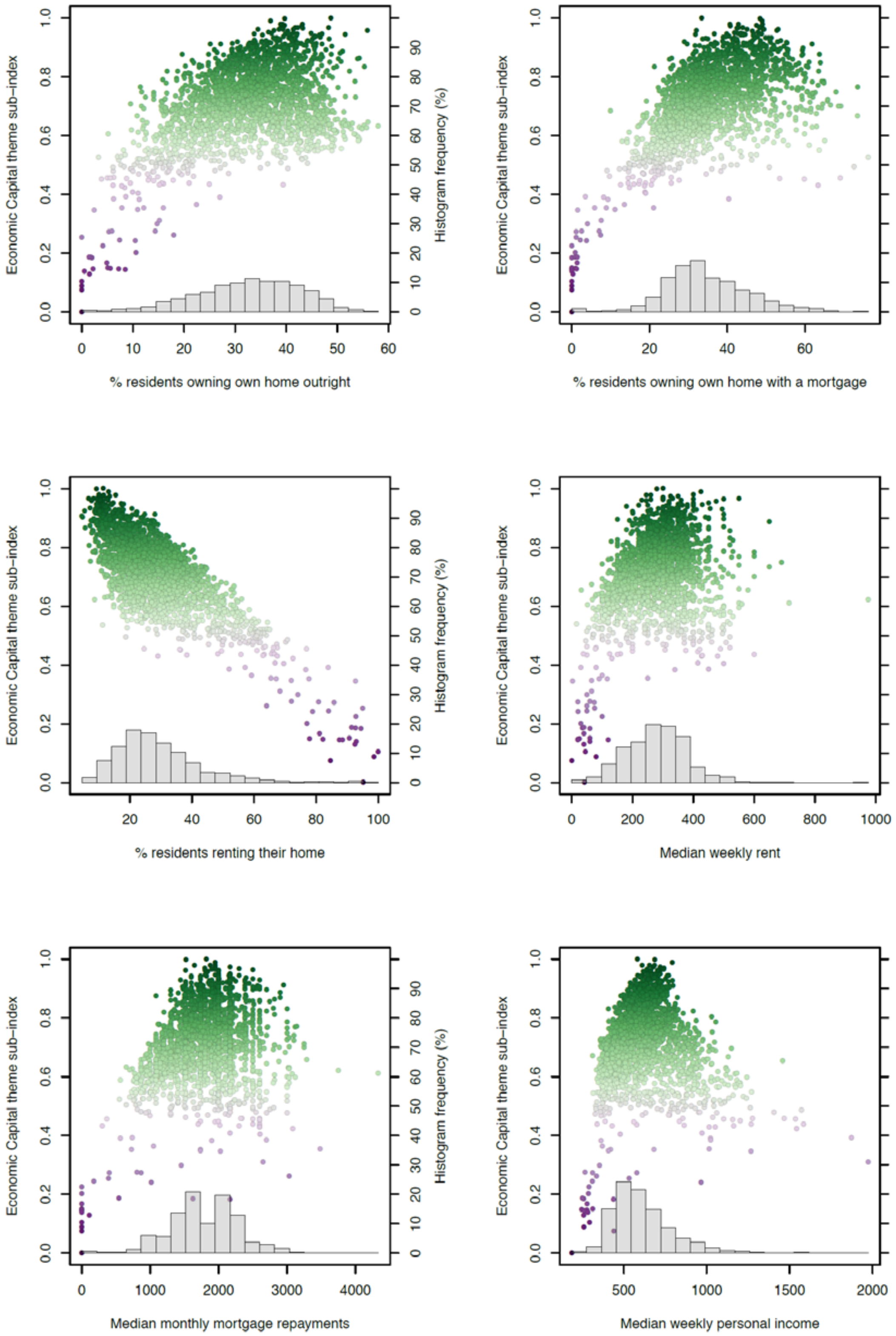


Figure 5.9: Scatterplots showing the relationships between economic capital index values and component indicators at a national level. Raw indicator values, without reversal or transformation are used.

Figure 5.9 (cont.)

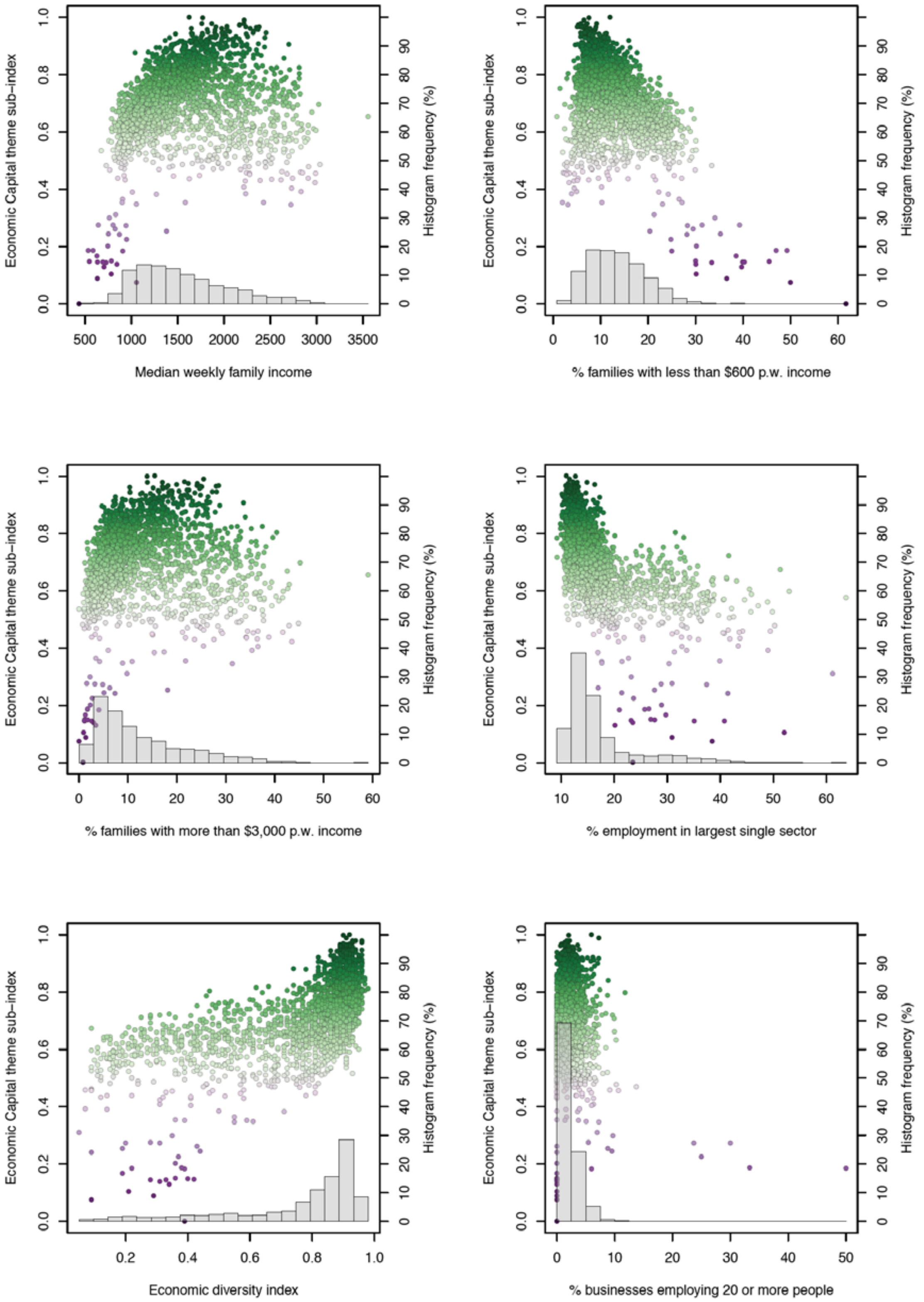
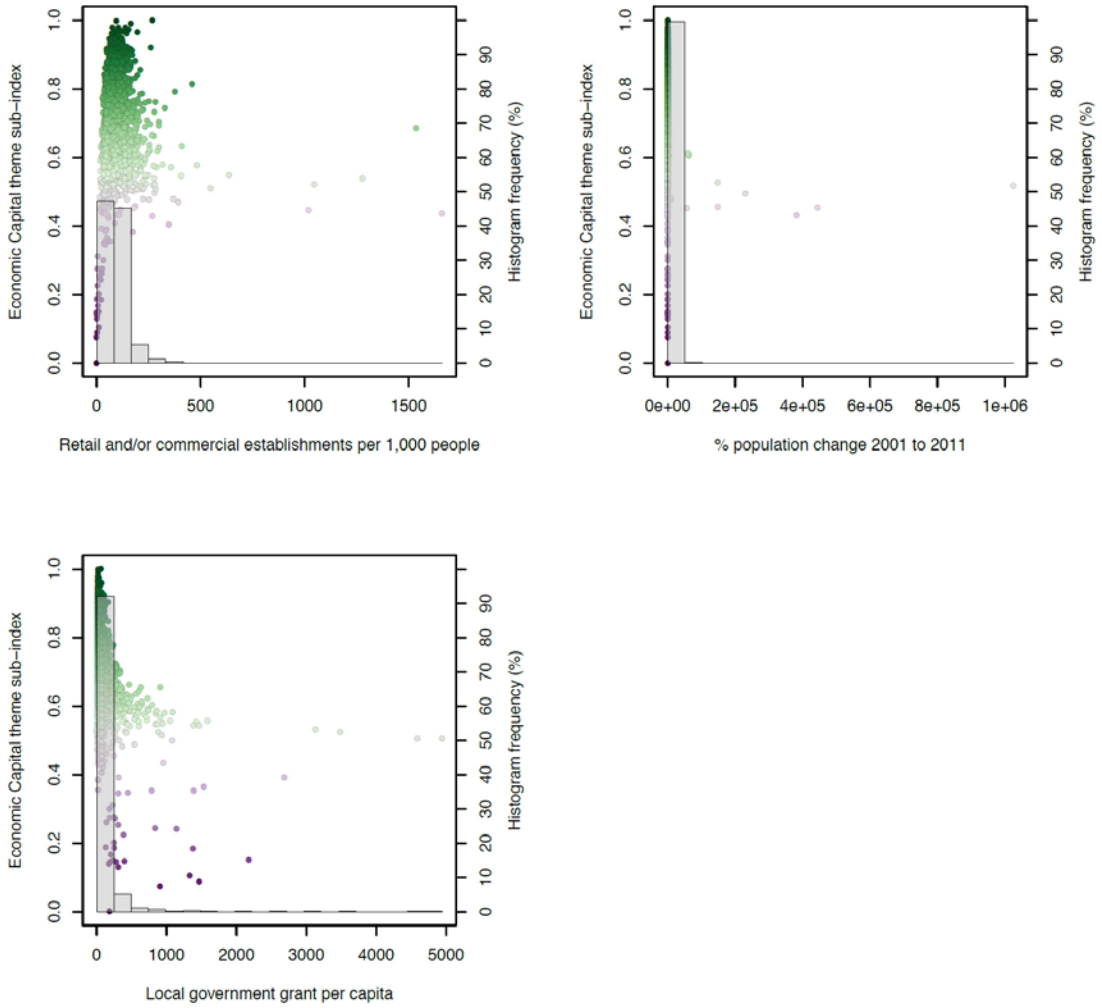


Figure 5.9 (cont.)



5.2.6.2 Regional level

Disaggregation of the correlations between indicators and sub-index to SA4 level (larger geographic areas containing around 20 SA2s) reveals that the regional differences in the patterns of correlations between indicators result in corresponding differences in the relationships between indicators and the economic capital theme sub-index (Figure 5.10).

The group of points with a remoteness score of 1 or close to 1 are the metropolitan SA4s, including inner city and suburban areas. The points with remoteness scores of 2 through to 5 represent the SA4s ranging from inner regional Australia to very remote Australia. Taking all the indicator correlations depicted in Figure 5.10, the following conclusions can be drawn about spatial variation in the influence of the indicators on the economic capital theme sub-index:

- % residents renting their own home is a strong negative influence on the sub-index in metropolitan areas and remote areas, but less so in regional areas.
- % residents owning their home outright is a moderate positive influence on the sub-index in metropolitan and remote areas, but in regional areas this indicator is more likely to be a negative influence on the sub-index.
- The indicators that have a strong influence on the sub-index in many of the regional SA4s are % residents owning own home with a mortgage (positive), median weekly rent (positive), % employment in largest single sector (negative), economic diversity index (positive) and local government grant per capita (negative). This strong influence extends to metropolitan and remote areas for % employment in largest single sector and economic diversity index which is consistent with the national results tabulated above.
- % businesses employing 20 or more people generally has little influence on the sub-index, regardless of the region.

These results highlight the importance of the patterns of correlations among indicators, and the geographical variation in these patterns, in the interpretation of sub-index values.

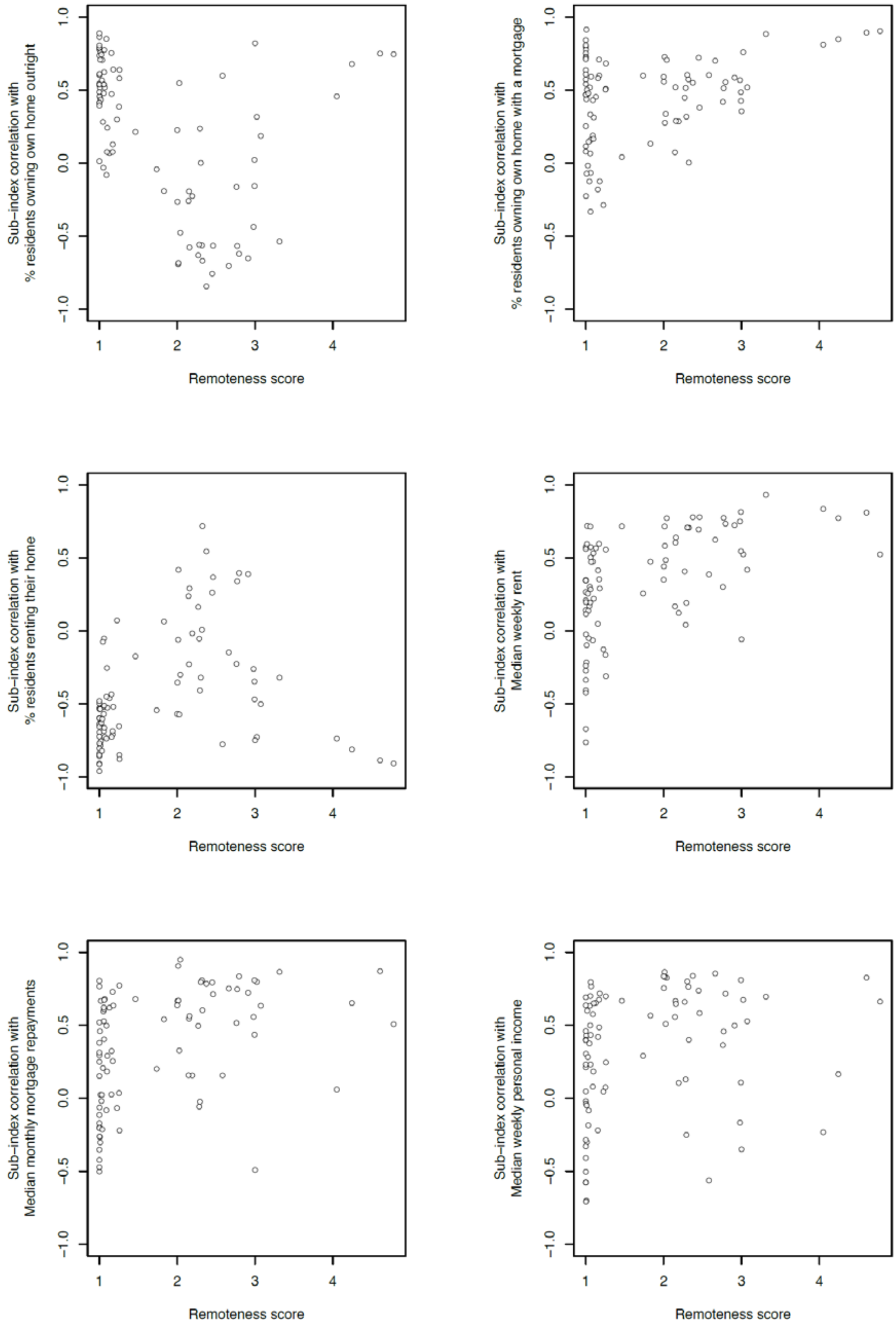


Figure 5.10: Scatterplots showing the relationships between economic capital sub-index values and component indicators at a regional level. Remoteness of 1 is metropolitan areas through to 5, very remote areas.

Figure 5.10 (cont.)

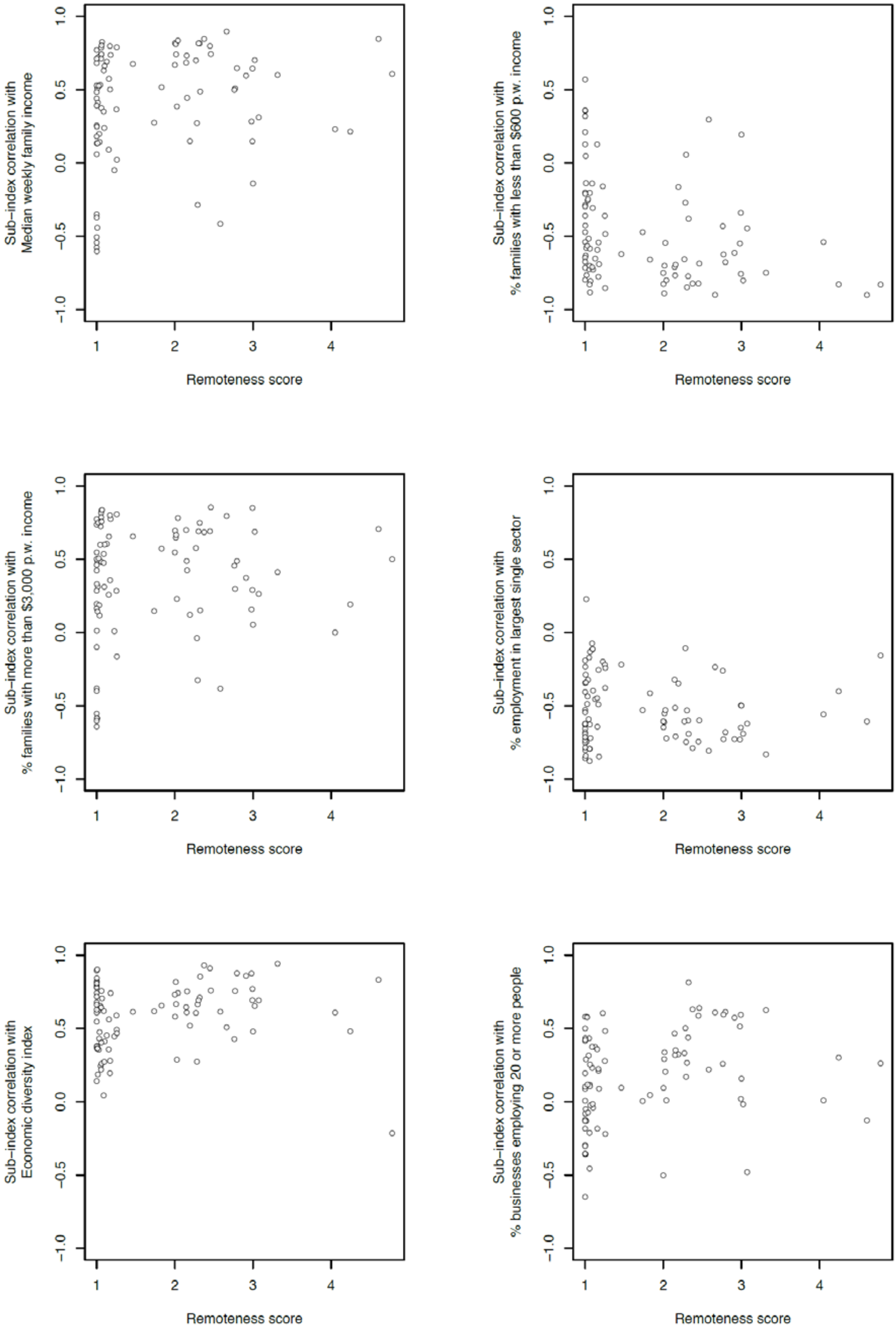
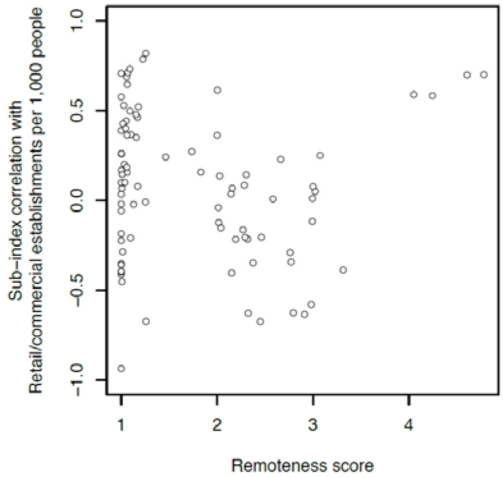
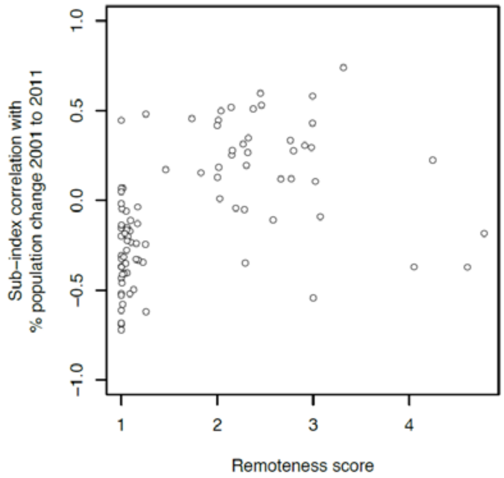
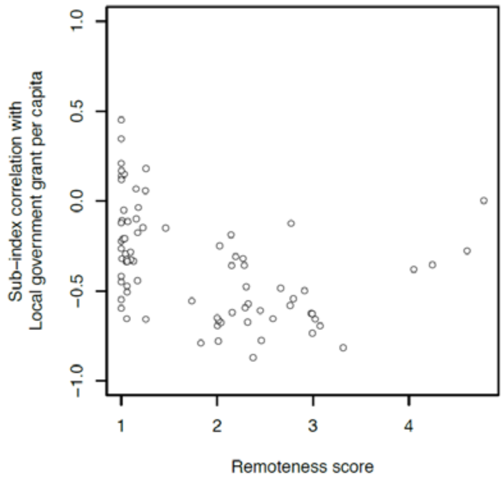


Figure 5.10 (cont.)







5.3 EMERGENCY SERVICES

5.3.1 Transformation

The emergency services index is calculated by aggregating the emergency services indicators. Eleven of the 13 indicators required rescaling and transformation before aggregation. Transformation details are shown in Table 5.13 and the results of transformation in Table 5.14. Raw and transformed indicator values are outlined in Appendix 5E.

Table 5.13: Transformation details for indicators used to form the emergency services sub-index.

Indicator	Transformation details		
	Skewness transform	Exponent	Coefficient for kurtosis transform
Medical practitioners per 1,000 people, 2011	Power transform	0.17	0.43
Registered nurses per 1,000 people, 2011	Power transform	0.22	0.33
Psychologists per 1,000 people, 2011	Power transform	0.17	0.35
Available hospital beds per 1,000 population	Power transform	0.56	0.64
Welfare support workers per 1,000 population	Power transform	0.35	0.41
Ambulance officers and paramedics per 1,000 population	No transform	-	-
Fire and emergency workers per 1,000 population	Power transform	0.65	0.01
Police per 1,000 population	Power transform	0.43	0.08
Fire, Emergency, SES organisations, cost per 1,000 population	Power transform	0.38	0.00
Ambulance organisations, cost per 1,000 population	Power transform	1.41	0.20
Fire service volunteers per 1,000 people	Power transform	1.86	0.00
SES volunteers per 1,000 people	No transform	-	-
Distance to a medical facility (km)	Power transform	0.07	0.35

Table 5.14: Transformation results for indicators used to form the emergency services sub-index.

Indicator	Raw data pre-transform			Post-transform		
	Skewness	Kurtosis	Outliers	Skewness	Kurtosis	Outliers
Medical practitioners per 1,000 people, 2011	6.70	76.91	50	0.12	-0.00	12
Registered nurses per 1,000 people, 2011	7.95	118.69	37	0.02	-0.00	14
Psychologists per 1,000 people, 2011	4.43	28.07	46	0.06	-0.00	4
Available hospital beds per 1,000 population	1.84	6.81	43	0.08	-0.00	0
Welfare support workers per 1,000 population	3.86	23.64	24	-0.05	-0.00	0
Ambulance officers and paramedics per 1,000 population	-0.00	-0.89	0	-0.00	-0.89	0
Fire and emergency workers per 1,000 population	0.64	0.53	11	-0.00	-0.00	0
Police per 1,000 population	1.27	2.07	48	0.00	-0.00	0
Fire, Emergency, SES organisations, cost per 1,000 population	0.89	-1.03	0	-0.00	-1.14	0
Ambulance organisations, cost per 1,000 population	-0.82	0.91	0	-0.01	-0.00	0
Fire service volunteers per 1,000 people	-1.09	1.28	0	0.00	-0.94	0
SES volunteers per 1,000 people	-0.39	-1.64	0	-0.39	-1.64	0
Distance to a medical facility (km)	10.36	128.16	28	-0.16	0.00	1

5.3.2 Correlation

The correlation plot (Figure 5.11) has the indicators in the order given by the sorted loadings table from principal components analysis (PCA). The correlation plot is for transformed indicators with reversals carried out where appropriate. There are several groups of with moderate positive correlations, and one group with negative correlations – between fire, emergency, SES organisations, cost/1,000 people and SES volunteers/1,000 people (Figure 5.11). The latter is a little unexpected, given that more SES volunteers might require more expenditure. However, the correlation is based on just eight State and Territory values and is likely to be confounded by various State and Territory factors.

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.58 suggests limited factor structure. Table 5.15, with each indicator as dependent variable and the remaining indicators as independent variables shows that only a small number of indicators are reasonably well predicted by other indicators.

For these reasons, principal components analysis is unlikely to provide a guide for the aggregation strategy. This was guided instead by substantive considerations. The correlation plot shows one moderately high negative correlation and for this reason, no indicators were discarded. Since these indicators were chosen for their hypothesised influence on disaster resilience, causation flows from the indicators to the measure of disaster resilience, and a formative measurement model is appropriate.

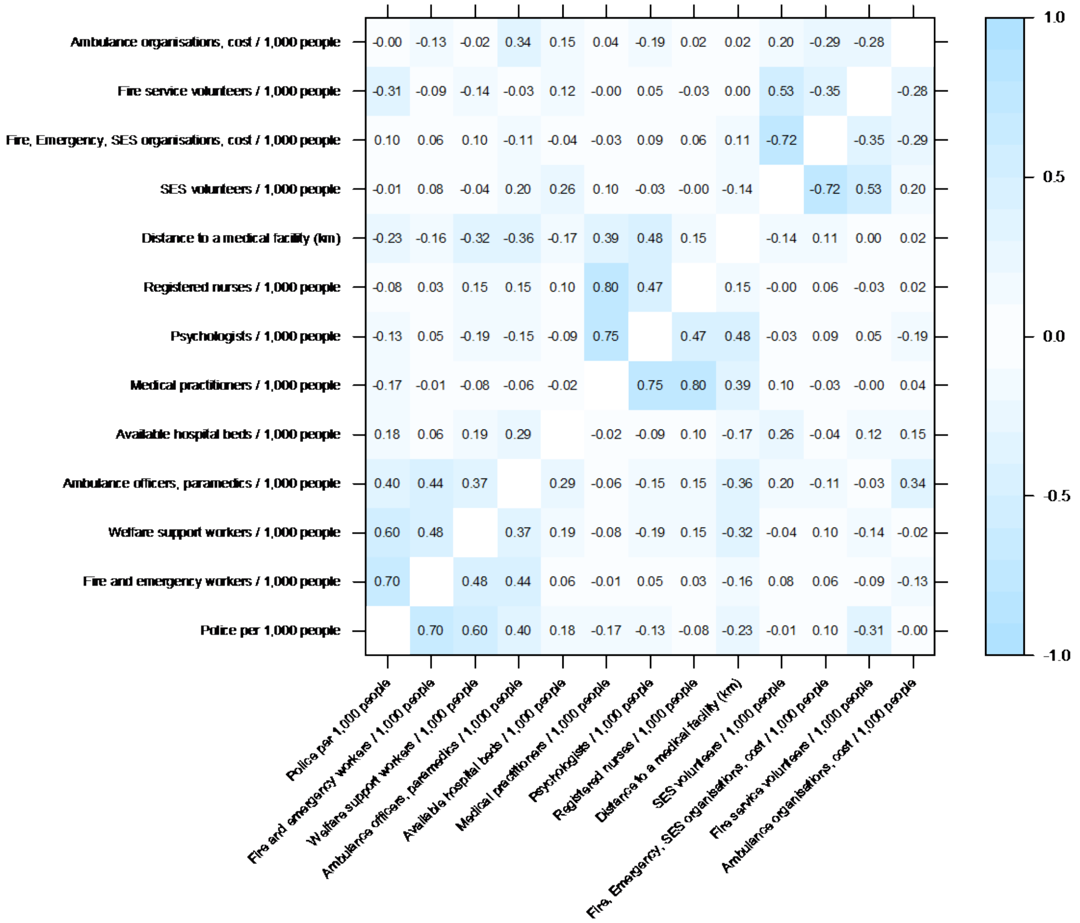


Figure 5.11: Correlation between indicators in the emergency services sub-index.

Table 5.15: Regression analysis of each emergency services indicator as dependent variable against the remaining indicator values as independent variables.

Indicator denoted the dependent variable in the regression	R^2
Medical practitioners per 1,000 people, 2011	0.86
Registered nurses per 1,000 people, 2011	0.77
SES volunteers per 1,000 people	0.70
Psychologists per 1,000 people, 2011	0.70
Police per 1,000 population	0.68
Fire and emergency workers per 1,000 population	0.61
Fire service volunteers per 1,000 people	0.58
Fire, Emergency, SES organisations, cost per 1,000 population	0.58
Ambulance officers and paramedics per 1,000 population	0.53
Ambulance organisations, cost per 1,000 population	0.53
Welfare support workers per 1,000 population	0.49
Distance to a medical facility (km)	0.42
Available hospital beds per 1,000 population	0.23

5.3.3 Measurement model

Since the 13 emergency services indicators had weak multi-factor structure and were amenable to a grouping on substantive grounds, a two-level formative model for aggregation was chosen.

5.3.4 Aggregation

While the correlation plot shows that most of the higher correlations among indicators are positive, there are also many indicator pairs that are uncorrelated or have moderate negative correlations (Figure 5.11). This means that compensability issues will have to be considered in aggregation. A feature of the emergency services theme indicators is that the potential for substitution between indicators is low. For example, low levels of police provision cannot be compensated for with high levels of ambulance or fire service provision. Likewise, a shortage of doctors cannot be compensated for by a surplus of psychologists or welfare workers. This means that the aggregation method has to place substantial restraint on compensation effects.

The first 12 indicators all relate to resources that underpin emergency response. These 12 indicators could be grouped according to various dimensions in emergency response resources; however these dimensions were not identified in advance from the literature and appropriate indicators sought. Rather the dimensions in the 12 indicators reflect the availability of secondary data at a national level and, as such, are an arbitrary selection rather than comprehensive coverage of the factors known to affect emergency response. For this reason, the twelve response resources indicators were aggregated to give the emergency response resources sub-index, with the distance to a medical facility being the sole constituent indicator of a proximity sub-index. For the emergency response resources sub-index, an orness value of 0.125 was chosen for aggregation by Ordered Weighted Averaging (OWA).

With just two sub-indices, emergency response resources and proximity, and since a reasonable judgment can be made about the relative importance of these two sub-indices, aggregation by discrete Choquet integral is feasible. Firstly, it is reasonable to assume that substitution between response resources and proximity is relatively limited, corresponding to an orness value of 0.125 for the fuzzy measure required by the discrete Choquet integral. Secondly, it can be argued that, from a resilience perspective, a situation where it was a long distance from very good emergency response resources is probably better than close proximity to very poor response resources. The fuzzy measure vector {} = 0, {resources} = 0.167, {proximity} = 0.083, {resources, proximity} = 1.000 meets these conditions.

The comparison of aggregation methods (Figure 5.12) shows the results for the two level formative model (2 level) and single level models with aggregation by OWA, geometric mean, Mazziotta-Pareto Index and arithmetic mean. As expected, the use of OWA with a low value of orness results in considerable separation between the various aggregation methods, with the two level formative model using OWA and the discrete Choquet integral producing the lowest values of the sub-index, apart from the geometric mean. The latter takes the value zero whenever one or more of the constituent indicators has the value zero. The arithmetic mean, because it allows unrestrained compensation when indicators are a mixture of high and low values, has the highest values of the sub-index. The Mazziotta-Pareto Index, with its fixed unbalance penalisation, severely reduces the value of the sub-index when the coefficient of variation for the indicators is high.

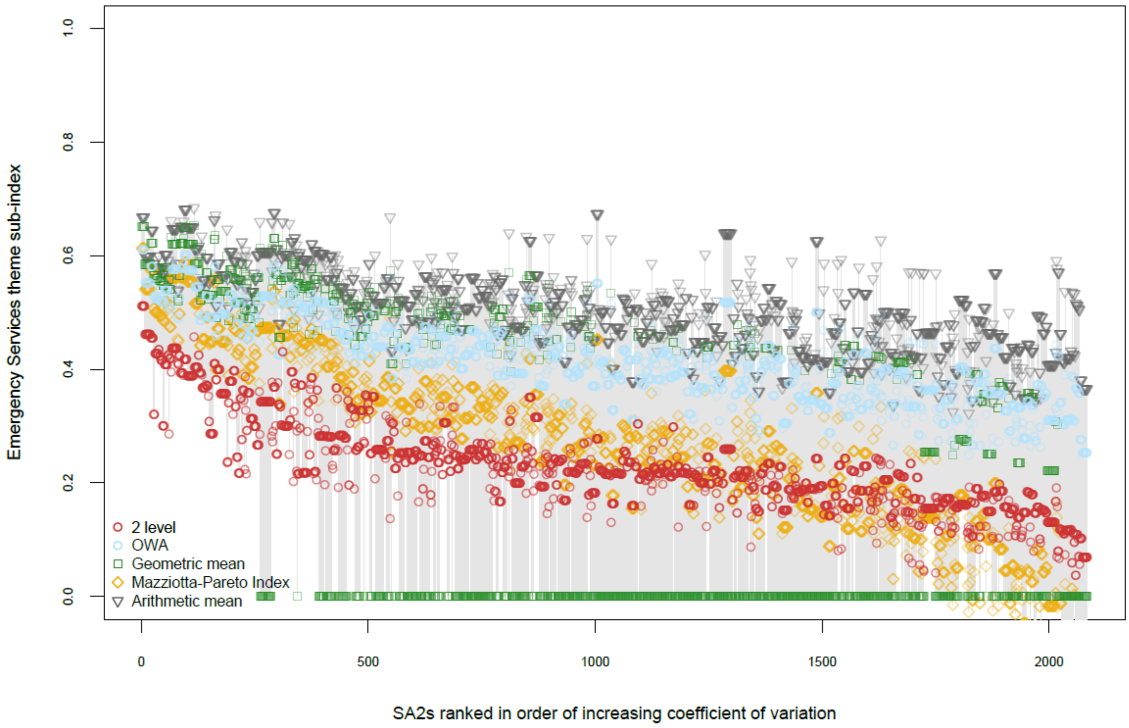


Figure 5.12: Comparison of aggregation methods for the emergency services sub-index.

The example SA2s in Table 5.16 show that a high coefficient of variation across the 13 indicators results in a larger difference between the two-level model using OWA - Choquet integral and the simple arithmetic mean of the indicators. This is a consequence of OWA and the discrete Choquet integral restraining the extent to which high values on some indicators can compensate for low values on other indicators.

Table 5.16: Example SA2s showing emergency services sub-index values obtained using different aggregation functions.

Indicator	Rescaled transformed Indicator values	
	High c.v. (Amaroo + 11 others, ACT)	Low c.v. (Hobart + 6 others)
Medical practitioners per 1,000 people, 2011	0.00	0.81
Registered nurses per 1,000 people, 2011	0.00	0.77
Psychologists per 1,000 people, 2011	0.41	0.86
Available hospital beds per 1,000 population	0.64	0.51
Welfare support workers per 1,000 population	0.44	0.61
Ambulance officers and paramedics per 1,000 population	0.27	0.44
Fire and emergency workers per 1,000 population	0.60	0.67
Police per 1,000 population	0.76	0.70
Fire, Emergency, SES organisations, cost per 1,000 population	0.93	0.66
Ambulance organisations, cost per 1,000 population	0.31	0.61
Fire service volunteers per 1,000 people	0.00	0.99
SES volunteers per 1,000 people	0.08	0.55
Distance to a medical facility (km)	0.32	0.51
Emergency Services theme sub-index (2 level OWA)	0.06	0.51
Emergency Services theme sub-index (Arithmetic mean)	0.37	0.67
Coefficient of variation	0.83	0.23

5.3.5 Mapped emergency services sub-index

The mapped output of the emergency services sub-index is shown in Figure 5.13. Maps showing State/Territory and major metropolitan area resolution are provided in Appendix 5F.

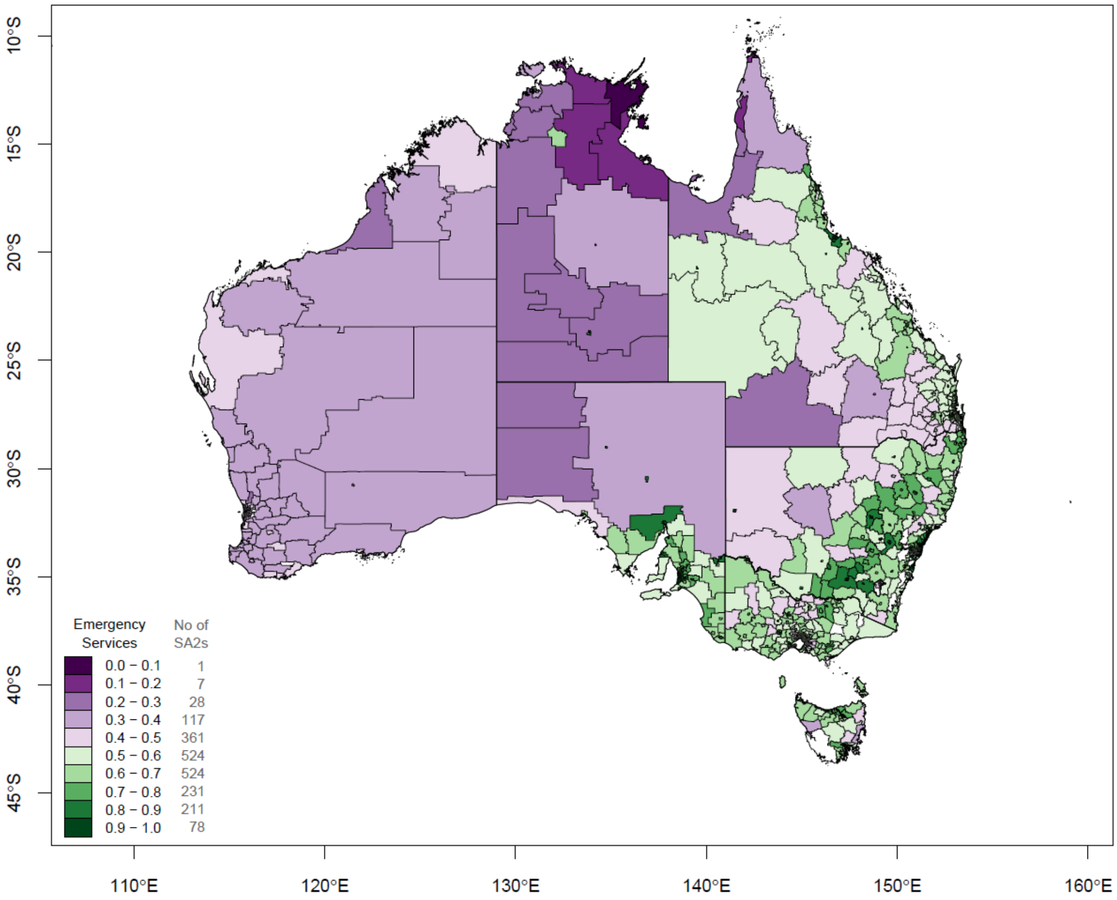


Figure 5.13: Mapped output of the emergency services sub-index at a national level.

5.3.6 Indicator relationships with composite index

5.3.6.1 National level

The correlations at national level between individual indicators and the Emergency Services theme sub-index are shown in Table 5.17. The magnitude of the correlation gives guidance as to which indicators have the most influence on the value of the emergency services sub-index. The corresponding scatter plots and histograms are given in Figure 5.14.

The correlations and scatter plots show that, nationally, none of the individual indicators has a strong influence on the value of the sub-index. The two ambulance-related indicators have the greatest influence. While the linear correlations between indicators and the sub-index are not particularly high, the scatter plot for distance to a medical facility shows a fairly strong non-linear relationship, with the value of the sub-index increasing rapidly when the distance falls below about 10km (Figure 5.14).

Table 5.17: Correlations between indicators and the emergency services sub-index values, at a national level.

Indicator	Correlation with emergency services theme sub-index
Ambulance organisations, cost per 1,000 population	0.43
Ambulance officers and paramedics per 1,000 population	0.40
Fire and emergency workers per 1,000 population	0.36
SES volunteers per 1,000 people	0.30
Fire service volunteers per 1,000 people	0.28
Registered nurses per 1,000 people, 2011	0.15
Available hospital beds per 1,000 population	0.14
Police per 1,000 population	0.12
Medical practitioners per 1,000 people, 2011	0.11
Psychologists per 1,000 people, 2011	0.08
Welfare support workers per 1,000 population	0.07
Fire, Emergency, SES organisations, cost per 1,000 population	-0.23
Distance to a medical facility (km)	-0.28

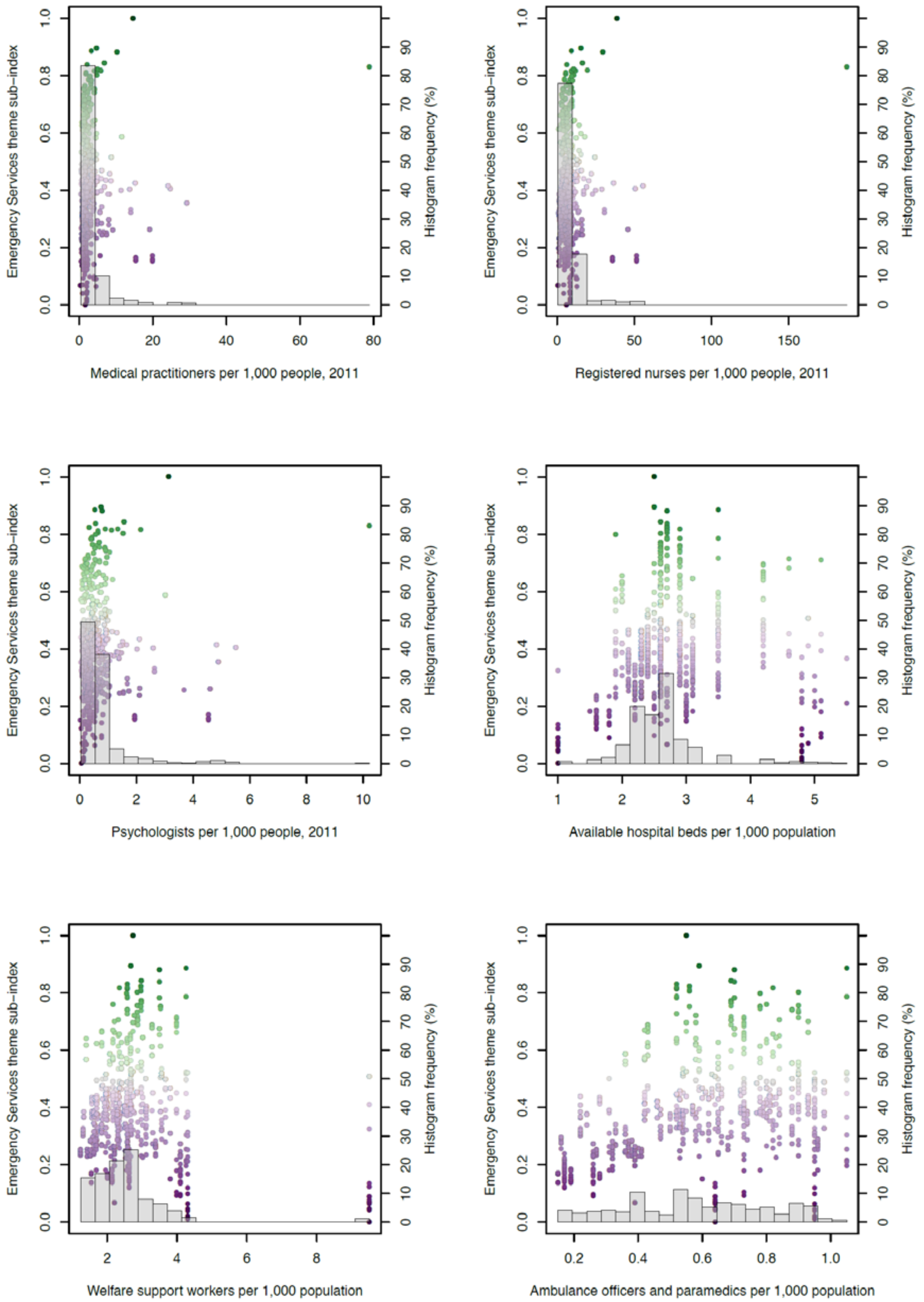


Figure 5.14: Scatterplots showing the relationship between emergency services sub-index values and component indicators at a national level. Raw indicator values, without reversal or transformation are used.

Figure 5.14 (cont.)

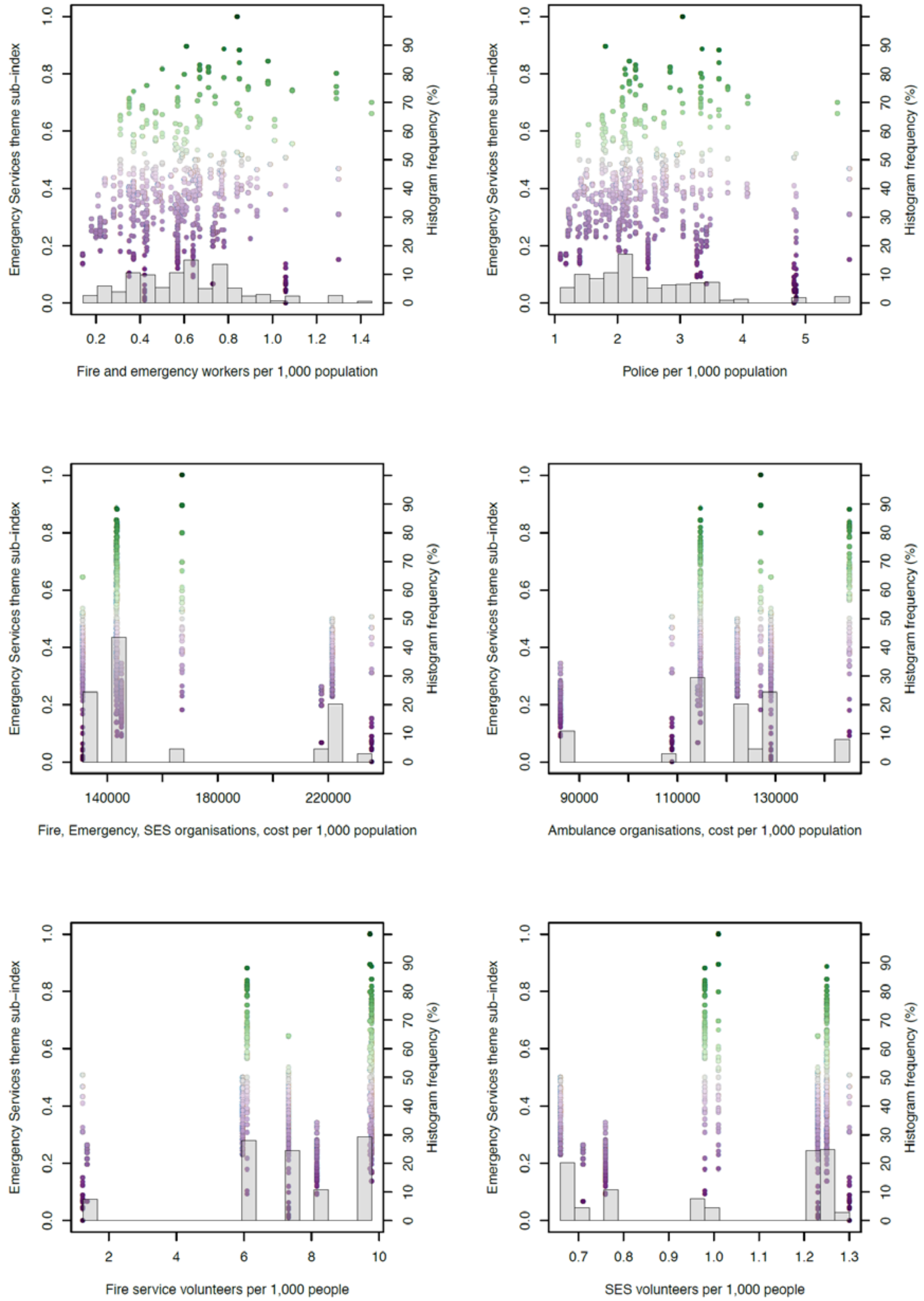
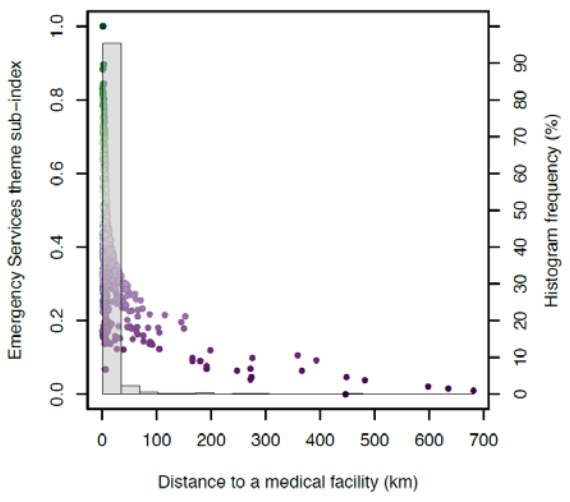


Figure 5.14 (cont.)



5.3.6.2 Regional level

Disaggregation of the correlations between indicators and sub-index to SA4 level is not possible for all the indicators in the emergency services theme because for some indicators, being based on disaggregation from State or SA4 level data, the groups of SA2s within a SA4 can have the same value for the indicators and/or the theme sub-index.

Among the indicators for which correlations can be disaggregated to SA4 level, it appears that there is generally little difference between metropolitan, regional and remote areas in the relationships between indicators and the theme sub-index (Figure 5.15).

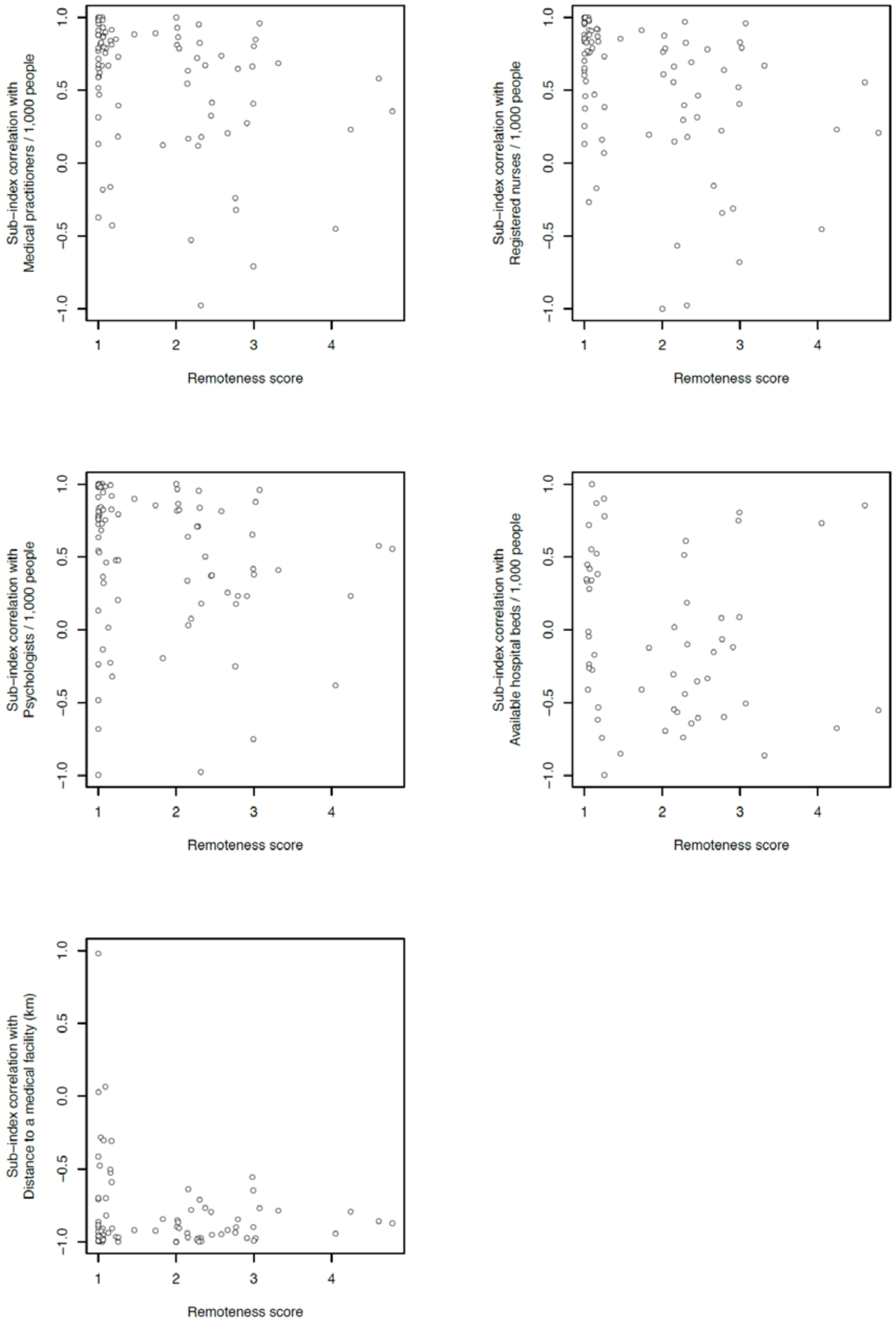


Figure 5.15: Correlation between indicators and selected emergency services sub-index values, at a regional level. Remoteness of 1 is metropolitan areas through to 5, very remote areas.

5.4 PLANNING AND THE BUILT ENVIRONMENT

5.4.1 Transformation

The planning and the built environment index is calculated by aggregating the planning and the built environment indicators. Of the 14 indicators, 10 required rescaling and transformation before aggregation. Transformation details are shown in Table 5.18 and the results of transformation in Table 5.19. Raw and transformed indicator values are outlined in Appendix 5G.

Table 5.18: Transformation details for indicators used to form the planning and the built environment sub-index.

Indicator	Transformation details		
	Skewness transform	Exponent	Coefficient for kurtosis transform
% Caravans and improvised dwellings	Power transform	0.16	0.00
% Residential pre-1980	No transform	-	-
% Residential post-1981	No transform	-	-
% Commercial and industrial pre-1980	No transform	-	-
% Commercial and industrial post-1981	No transform	-	-
Emergency plan assessment score	Power transform	6.43	0.00
FTE council staff 14-15	Power transform	0.09	0.21
Area km2/FTE	Power transform	0.07	0.24
Population/FTE	Power transform	0.05	0.50
Road km/FTE	Power transform	0.07	0.37
Dwellings/FTE	Power transform	0.05	0.53
New dwellings (2012-16) as proportion of 2011 dwellings (%)	Power transform	0.08	0.42
New dwellings per week (2015-16)	Power transform	0.13	0.13
Planning assessment score	Power transform	0.22	0.00

Table 5.19: Transformation results for indicators used to form the planning and the built environment sub-index.

Indicator	Raw data pre-transform			Post-transform		
	Skewness	Kurtosis	Outliers	Skewness	Kurtosis	Outliers
% Caravans and improved dwellings	6.53	79.96	35	0.00	-1.66	0
% Residential pre-1980	0.13	-1.38	0	-0.13	-1.38	0
% Residential post-1981	-0.12	-1.38	0	-0.12	-1.38	0
% Commercial and industrial pre-1980	0.34	-1.39	0	-0.34	-1.39	0
% Commercial and industrial post-1981	-0.18	-1.49	0	-0.18	-1.49	0
Emergency plan assessment score	-1.95	4.43	55	0.00	-1.23	0
FTE council staff 14-15	3.04	8.25	126	0.03	0.00	1
Area km2/FTE	15.14	281.63	18	-0.11	-0.00	10
Population/FTE	4.34	16.89	95	-0.16	-0.00	1
Road km/FTE	3.43	11.18	100	-0.26	-0.00	2
Dwellings/FTE	4.34	16.91	95	-0.17	-0.00	1
New dwellings (2012-16) as proportion of 2011 dwellings (%)	2.46	4.33	8	-0.19	-0.00	2
New dwellings per week (2015-16)	3.74	15.75	58	-0.01	0.00	10
Planning assessment score	-1.55	2.37	34	0.00	-1.84	0

5.4.2 Correlation

5.4.2.1 Data adjustments

There were high correlations and/or simple linear relationships between:

- % Residential pre-1980 and % Residential post-1981;
- % Commercial pre-1980 and % Commercial post-1981;
- Area km2/FTE and Road km/FTE, and,
- Dwellings/FTE and Population/FTE (Figure 5.16).

These are indicative of structural redundancies in the indicator set. Accordingly, the following indicators were deleted from the indicator set:

- residential pre-1980 (a simple linear function of residential post-1981 and highly correlated with it),
- commercial pre-1980 (a simple linear function of commercial post-1981 and highly correlated with it),
- population/FTE (highly correlated with dwellings/FTE and representing the same aspect, viz. demand on council staff due to provision of services relating to housing infrastructure), and

- road km/FTE (highly correlated with area km2/FTE and representing the same aspect, viz. demand on council staff due to maintenance of distributed infrastructure).

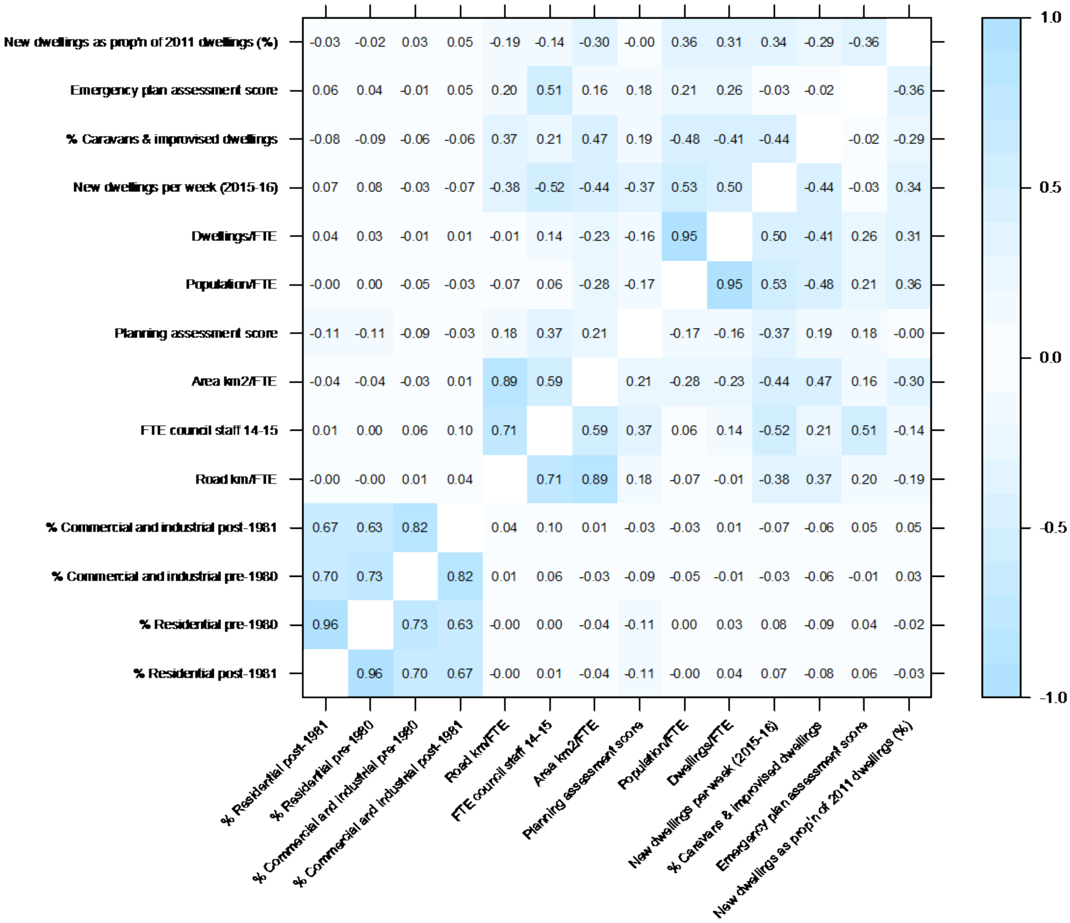


Figure 5.16: Correlation between all indicators in the planning and the built environment data set, prior to removal of correlated indicators.

Routine checks on indicators also revealed that NSW values for % residential post 1981 and % commercial post 1981 appear to be systematically different from the corresponding values in other States (Figure 5.17).

If the histograms of the original values for each State of these two indicators are examined (Figure 5.18), it can be seen that NSW is different from all the other States and Territories, and has very few SA2s with the percentage of post 1981 buildings less than 40 per cent. The map above shows that this is particularly the case in rural areas of NSW, such as south west NSW which is markedly different from western Victoria. This difference also occurs between northwest NSW and south west Queensland. The latter region appears to have much lower proportions of post-1981 residential buildings than comparable regions elsewhere in Australia.

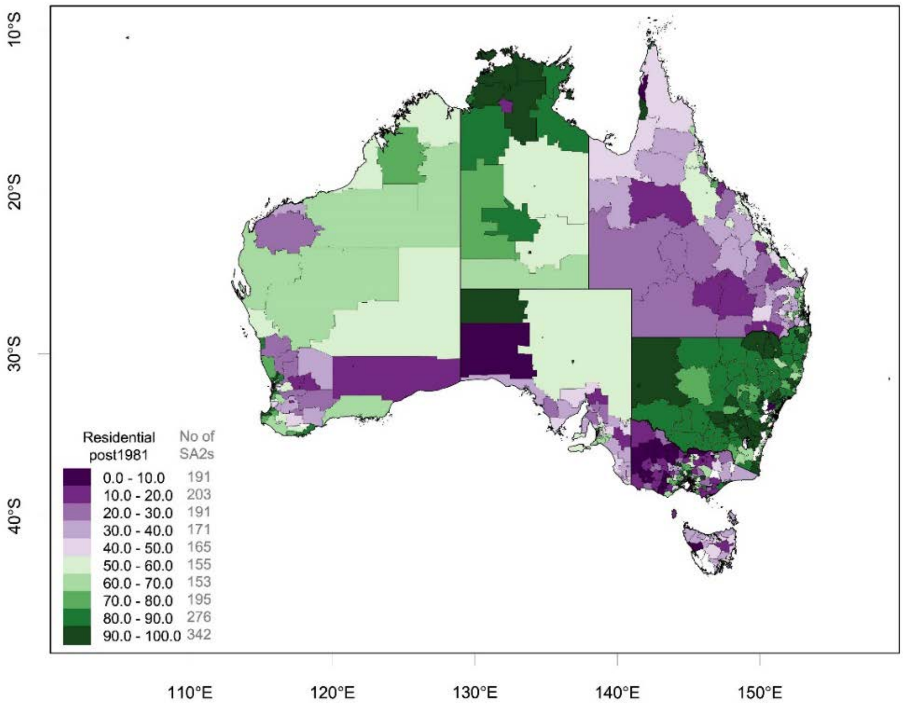


Figure 5.17: Proportion of residential buildings erected post-1981, derived from raw data.

These indicators were derived from the NEXIS building exposure database. Some differences across State borders are to be expected, since most border regions are in remote areas, the SA2s are large and may encompass regions that have some actual differences. However, the differences along the NSW border are very large, and occur in both remote and regional areas. The only conclusion that can be drawn is that the NEXIS building exposure data has some measurement or modelling artefact that produces this difference.

Three different methods of adjusting the NSW data were trialled. First, min-max rescaling within States was used, but this did not change the marked differences along the NSW border. Given the distributions of the two indicators within States, with that for NSW being different from the other States, the failure of min-max rescaling is to be expected.

The second method of adjustment was to adjust the implausibly skewed building age distribution in NSW by a power transform, to make the distribution approximately similar to that in other States. The residential distribution can be transformed to zero skewness by a power transform with exponent 4.07. The corresponding exponent for the commercial distribution is 4.41. Figure 5.19, for the indicator % residential post 81 with transformed NSW values shows that the contrast between NSW and the other States has been reduced. However, it was found that, on proceeding with the construction of the theme sub-index for infrastructure and planning, using the adjusted building aged data for NSW, the mapped sub-index values still showed implausibly large differences across the NSW border.

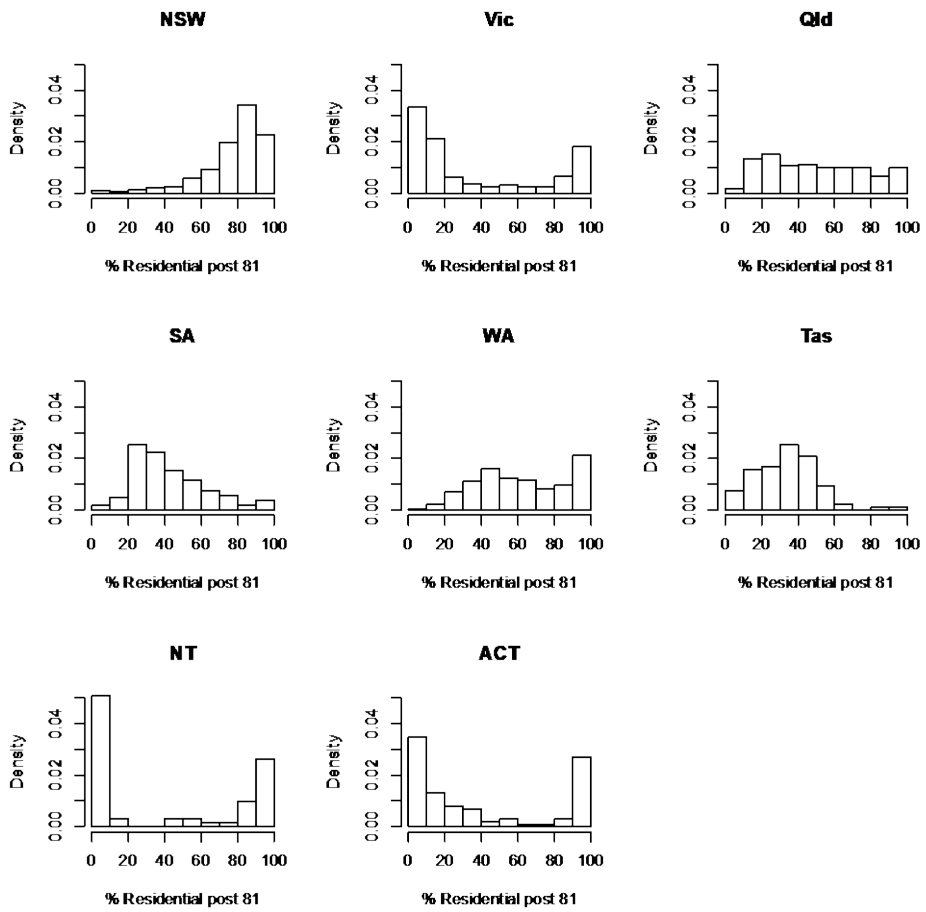


Figure 5.18: Histograms of building age data by States and Territories.

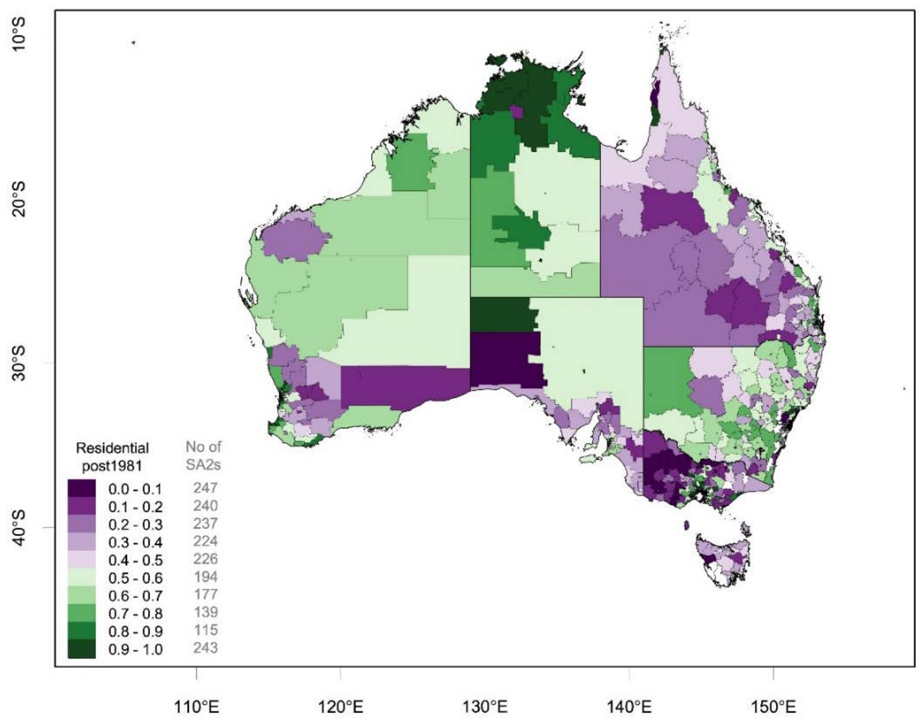


Figure 5.19: Adjusted % residential post 81 with NSW values transformed using a power transform.

A third method of adjustment was trialled, based on the observation that the NSW border differences are at their most extreme in remote and regional areas. The method used the 2011 Remoteness Area classifications and population-weighted concordance to SA2 published by the ABS (1270055006C029 Statistical Area Level 2 2011 to Remoteness Area 2011). The Remoteness Area categories are:

- Major Cities of Australia,
- Inner Regional Australia,
- Outer Regional Australia,
- Remote Australia, and
- Very Remote Australia

By scoring these categories from 1 to 5 (1 = Major Cities of Australia), and using the population-weighted concordance, it is possible to construct a remoteness score for each SA2. This score can be used to select subsets of SA2s, based on their remoteness.

The third method of adjusting the two building age indicators was to take all SA2s in NSW with a remoteness score of three or greater and proportionally reduce the indicator values, while increasing the indicator values for the corresponding region in Queensland, so that the disparities along the NSW and Queensland borders appeared to be a minimum when the indicators were mapped. For NSW a reduction factor of 1.8 (i.e. dividing indicator values by 1.8) was used, while for Qld the following inflation function was used (recognising that the indicator values had been scaled to a range of 0 to 1:

new value = old value / 1.53 + 0.35

For example, the inflation function applied to old values:

0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0

would produce new values of:

0.35, 0.42, 0.48, 0.55, 0.61, 0.68, 0.74, 0.81, 0.87, 0.94, 1.0.

The above reduction factor and inflation function resulted in an improved and more plausible NSW distribution of the indicator % residential post 1981(Figure 5.20). This adjustment will not alter the ranking by indicator value of NSW SA2s within the subset with remoteness scores of three or greater but will alter the position of these SA2s in the NSW ranking as a whole. The same applies to the corresponding region in QLD.

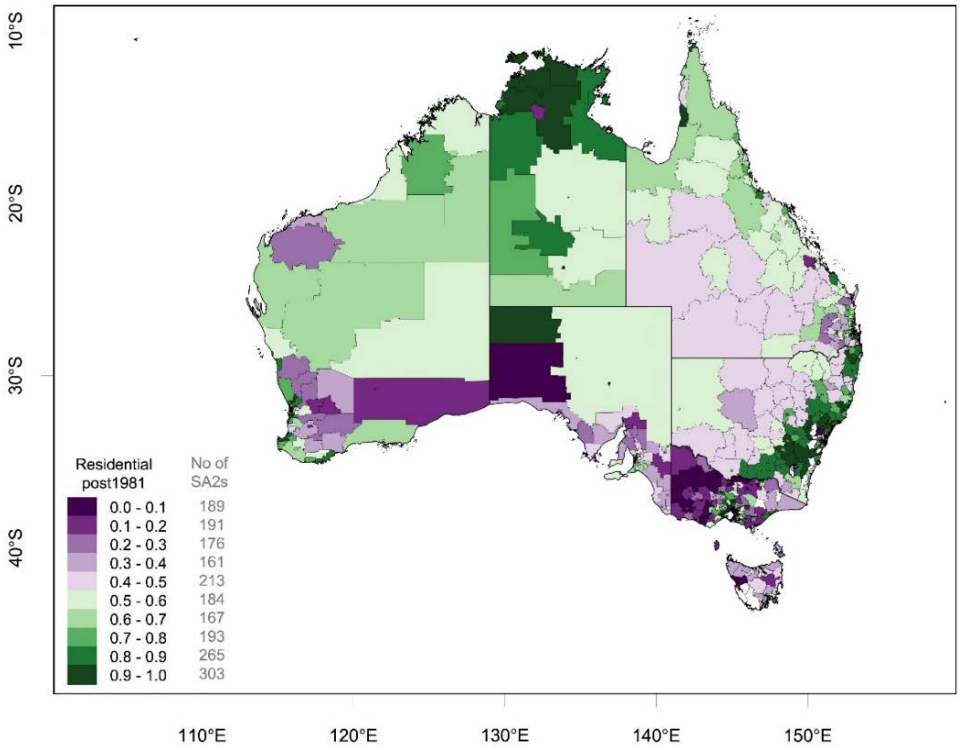


Figure 5.20: Final adjusted % residential post 81 with New South Wales and Queensland.

5.4.2.2 Final correlation

The correlation plot suggests only weak factor structure (Figure 5.21) and this is confirmed by a Kaiser-Meyer-Olkin measure of sampling adequacy of 0.52, which indicates that PCA is very unlikely to produce well differentiated components. For these reasons, PCA was not carried out on the ten planning and the built environment indicators.

Regressions between each indicator as dependent variable and the remaining indicators as independent variables show that several indicators are moderately well predicted by the remaining indicators (Table 5.20). However, these R squareds were not considered to be high enough to warrant further deletions of indicators.

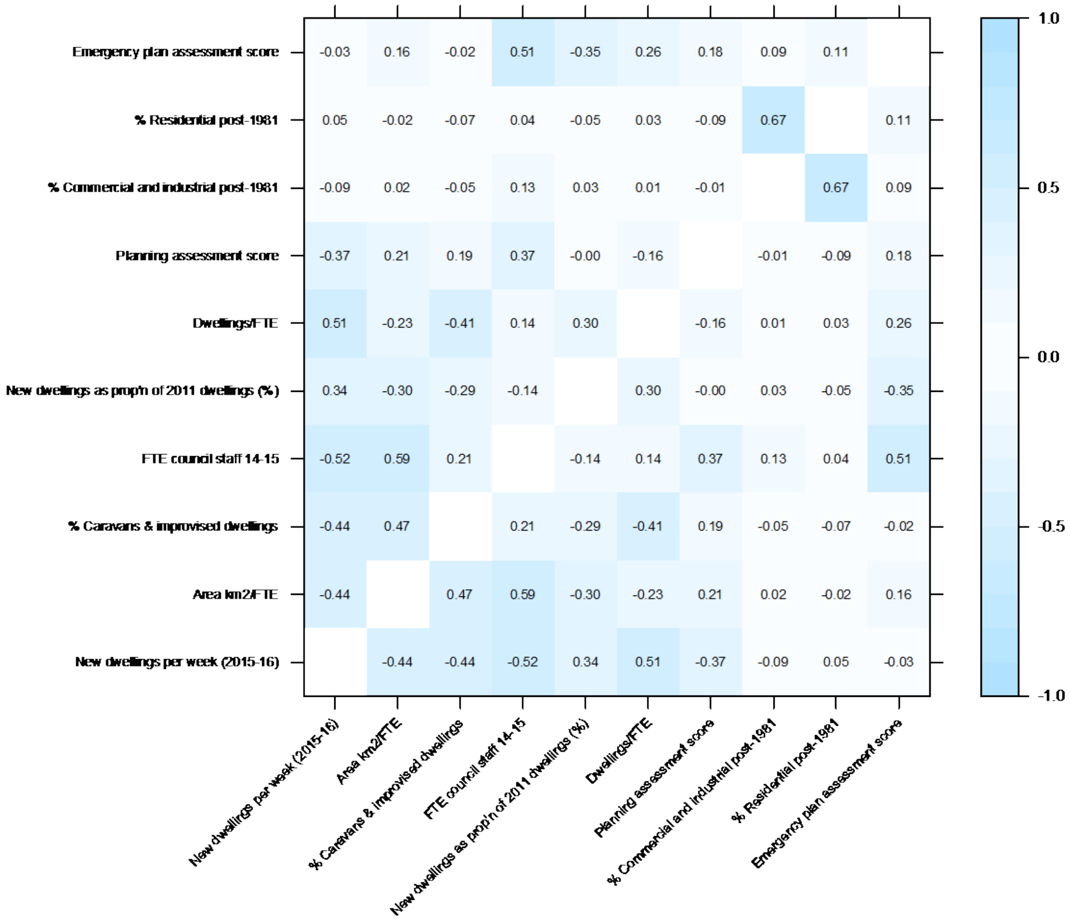


Figure 5.21: Correlation between indicators in the planning and the built environment sub-index.

Table 5.20: Regression analysis of each planning and the built environment indicator as dependent variable against the remaining indicator values as independent variables.

Indicator denoted the dependent variable in the regression	R^2
FTE council staff 14-15	0.78
New dwellings per week (2015-16)	0.69
Dwellings/FTE	0.57
Area km2/FTE	0.56
Emergency plan assessment score	0.54
% Commercial and industrial post-1981	0.48
% Residential post-1981	0.48
New dwellings (2012-16) as proportion of 2011 dwellings (%)	0.44
% Caravans and improvised dwellings	0.35
Planning assessment score	0.24

5.4.3 Measurement model

The ten infrastructure and planning indicators clearly fell into two groups. Seven of the indicators relate to local government capacity to provide services, maintain infrastructure and develop planning and response strategies for natural hazard management:

- FTE council staff 14-15;
- New dwellings per week (2015-16);
- Dwellings/FTE;
- Area km2/FTE;
- Emergency plan assessment score;
- New dwellings (2012-16) as proportion of 2011 dwellings (%); and,
- Planning assessment score.

The remaining three indicators relate to the integrity of built residential and commercial infrastructure in resisting natural disasters:

- % Commercial and industrial post-1981;
- % Residential post-1981; and,
- % Caravans and improvised dwellings.

Since the ten infrastructure and planning indicators did not have a strong multi-factor structure and did not have a strong single factor structure, but could be grouped on substantive grounds, a two level formative model for aggregation was chosen.

5.4.4 Aggregation

In the two level formative measurement model, the seven local government capacity indicators were aggregated to form one sub-index and the three built infrastructure integrity indicators were aggregated to form another.

It was assumed that some compensation effects could be allowed in the aggregation of the seven local government capacity indicators, since local government staff resources have some flexibility in responding to various patterns of demand. Accordingly, an orness value of 0.375 was chosen for aggregation by Ordered Weighted Averaging (OWA). This resulted in a weighting vector of {0.24, 0.20, 0.16, 0.13, 0.11, 0.09, 0.07} (see Chapter 3).

On the other hand, the three built infrastructure integrity indicators represent aspects where compensatory possibilities are more restricted. For example, having mostly post-1981 commercial premises is unlikely to diminish the impacts of natural disasters if most the residential premises are poorly built pre-1980 buildings, or are caravans and improvised dwellings. Accordingly, an orness value of 0.125 was chosen for aggregation by OWA. This resulted in a weighting vector of {0.79, 0.17, 0.04} (see Chapter 3).

With just two sub-indices, local government capacity and built infrastructure integrity, and since a reasonable judgment can be made about the relative importance of these two, aggregation by discrete Choquet integral is feasible. If it is assumed that some, but not completely unrestrained, compensation is possible between the two aspects of the planning and built environment theme, and that the two sub-indices are of equal importance, then a fuzzy measure vector of {} = 0, {capacity} = 0.375, {integrity} = 0.375, {capacity, integrity} = 1.000 meets these conditions (this is mathematically equivalent to OWA with an orness of 0.375).

For aggregation by OWA of all ten indicators for comparison purposes, it is necessary to choose a value for the orness of the weighting vector. Since the seven local government and three building infrastructure integrity sub-indices were calculated by OWA with orness values of 0.375 and 0.125, respectively, the orness value for OWA of all ten indicators was chosen, somewhat arbitrarily, to be 0.3.

Generally, all the aggregation methods that attempt to control for compensatory effects in some way produce values of the planning and built environment theme sub-index that are lower than that produced by the arithmetic mean (Figure 5.22). This is consistent with expectations.

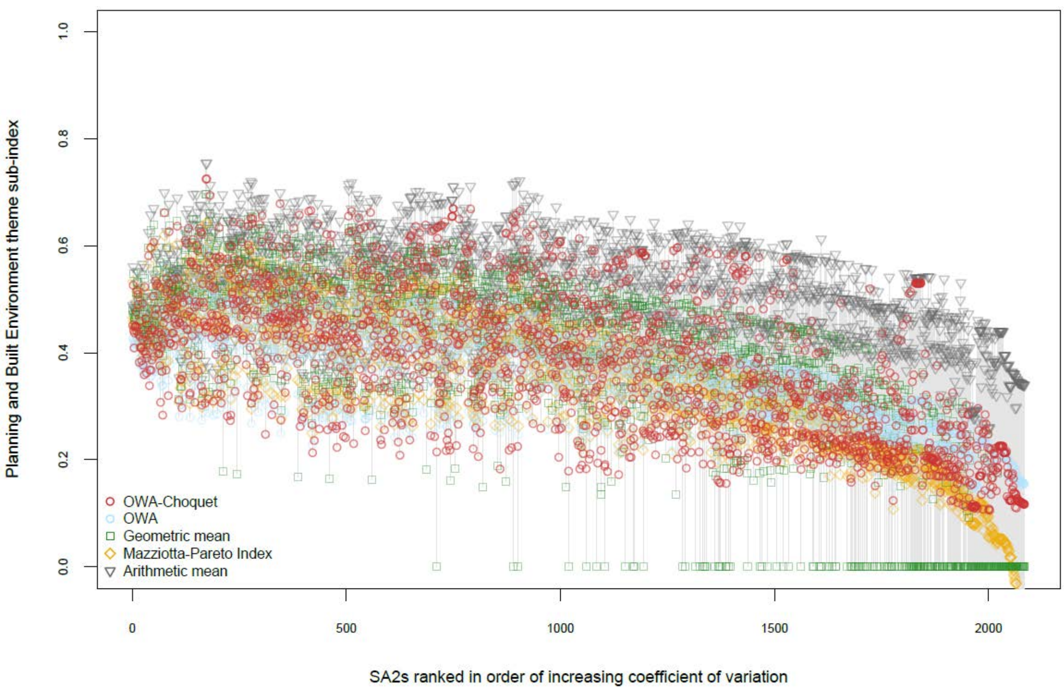


Figure 5.22: Comparison of aggregation methods for the planning and the built environment sub-index.

A small number of SA2s have values of the OWA-Choquet sub-index that are much higher than the majority of SA2s. Examination of the individual indicator values for these SA2s showed that they all have high values for the three building infrastructure integrity indicators. Because the Choquet aggregation of the building infrastructure integrity sub-index and the local government capacity sub-index accords them equal importance, the aggregation results in a higher value than would be the case for other aggregation methods that treat all ten indicators equally.

The two level formative model with aggregation by OWA and discrete Choquet integral provides a more nuanced aggregation than any of the other methods (Figure 5.22). It also can be noted from Figure 5.22, that the Mazziotta-Pareto Index with its fixed unbalance penalisation, severely reduces the value of the infrastructure and planning sub-index when the coefficient of variation for the indicators for a SA2 is high. More generally, the comparison plot shows the increase in the differences between aggregation methods as the coefficient of variation increases and the control (or lack of control) of compensatory effects between indicators comes into play.

The example SA2s in Table 5.21 show that a high coefficient of variation across the three indicators results in a larger difference between the sub-index calculated with OWA and the discrete Choquet integral and that calculated the simple arithmetic mean of the indicators. This is a consequence of the discrete Choquet integral restraining the extent to which high values on some indicators can compensate for low values on other indicators.

Table 5.21: Example SA2s showing planning and the built environment index values obtained using different aggregation functions.

Indicator	Rescaled transformed Indicator values	
	High c.v. (Weetangera)	Low c.v. (Dorrigo)
% Caravans and improvised dwellings	1.00	0.46
% Residential post-1981	0.00	0.47
% Commercial and industrial post-1981	0.00	0.56
Emergency plan assessment score	0.17	0.51
FTE council staff 14-15	0.52	0.60
Area km2/FTE	0.24	0.33
Dwellings/FTE	0.00	0.45
New dwellings (2012-16) as proportion of 2011 dwellings (%)	0.21	0.51
New dwellings per week (2015-16)	0.26	0.66
Planning assessment score	1.00	0.34
Planning and Built Environment theme sub-index (OWA-Choquet)	0.12	0.45
Planning and Built Environment theme sub-index (Arithmetic mean)	0.34	0.49
Coefficient of variation	1.13	0.21

5.4.5 Mapped planning and the built environment sub-index

The mapped output of the planning and the built environment sub-index is shown in Figure 5.23. Maps showing State/Territory and major metropolitan area resolution are provided in Appendix 5H.

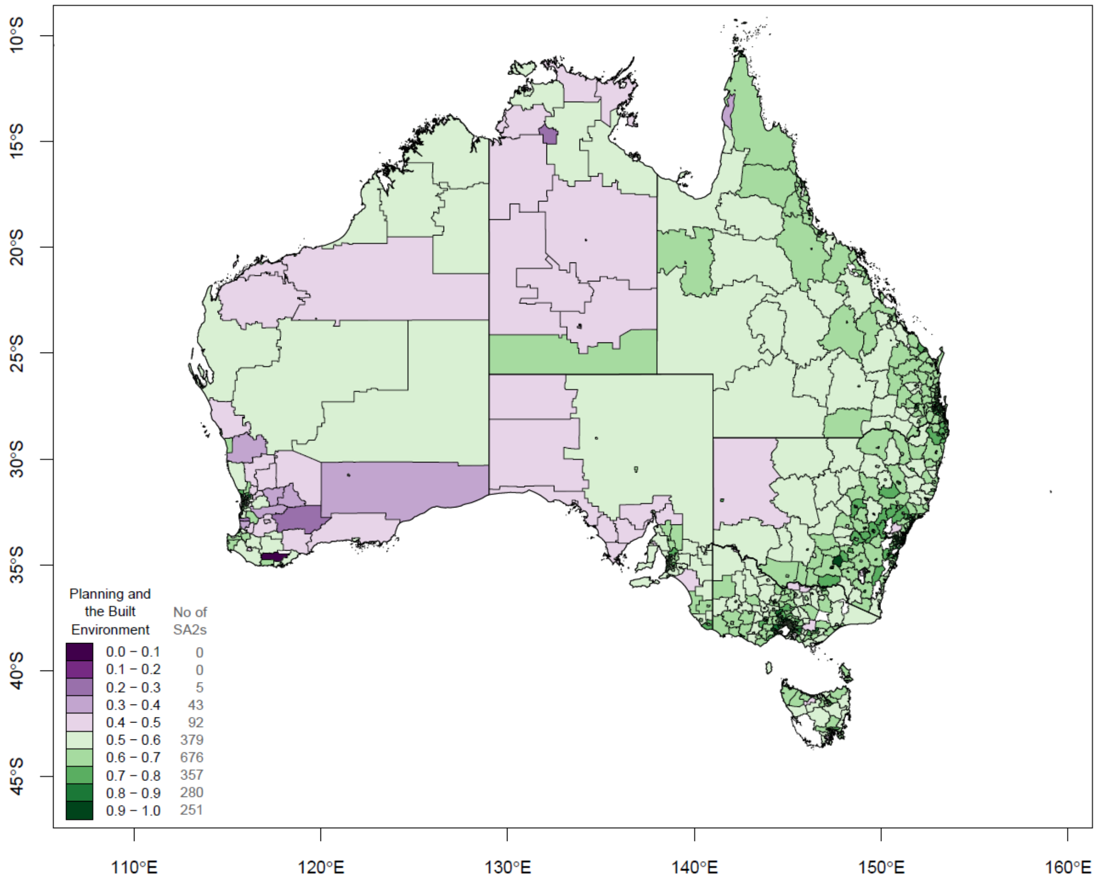


Figure 5.23: Mapped output of the planning and the built environment sub-index at a national level.

5.4.6 Indicator relationships with composite index

5.4.6.1 National level

The correlations at national level between individual indicators and the planning and the built environment theme sub-index are shown in Table 5.22. The magnitude of the correlation gives guidance as to which indicators have the most influence on the value of the planning and the built environment sub-index. The corresponding scatter plots, as well as histograms are given in Figure 5.24.

The correlations (Table 5.22) and the scatter plots (Figure 5.24) are a reflection of the method of aggregation and the nature of the constituent indicator data. % commercial and industrial post-1981 and % residential post-1981 have relatively high correlations with the theme sub-index for two reasons. First, these two indicators are reasonably well correlated (0.67; Figure 5.21) and, being part of a three indicator building integrity intermediate index that was aggregated with a seven indicator local government capacity intermediate index in a two-level formative model, they will naturally have more influence on the theme sub-index. Second, as the scatter plots show, the indicators in the local government capacity intermediate index have fairly disjointed distributions, which will reduce their correlations with the theme sub-index.

Table 5.22: Correlations between indicators and the planning and the built environment sub-index values, at a national level.

Indicator	Correlation with planning and the built environment theme sub-index
% Commercial and industrial post-1981	0.81
% Residential post-1981	0.72
Emergency plan assessment score	0.23
Planning assessment score	0.22
FTE council staff 14-15	0.11
New dwellings per week (2015-16)	-0.08
Area km2/FTE	-0.11
New dwellings (2012-16) as proportion of 2011 dwellings (%)	-0.11
% Caravans and improvised dwellings	-0.15
Dwellings/FTE	-0.20

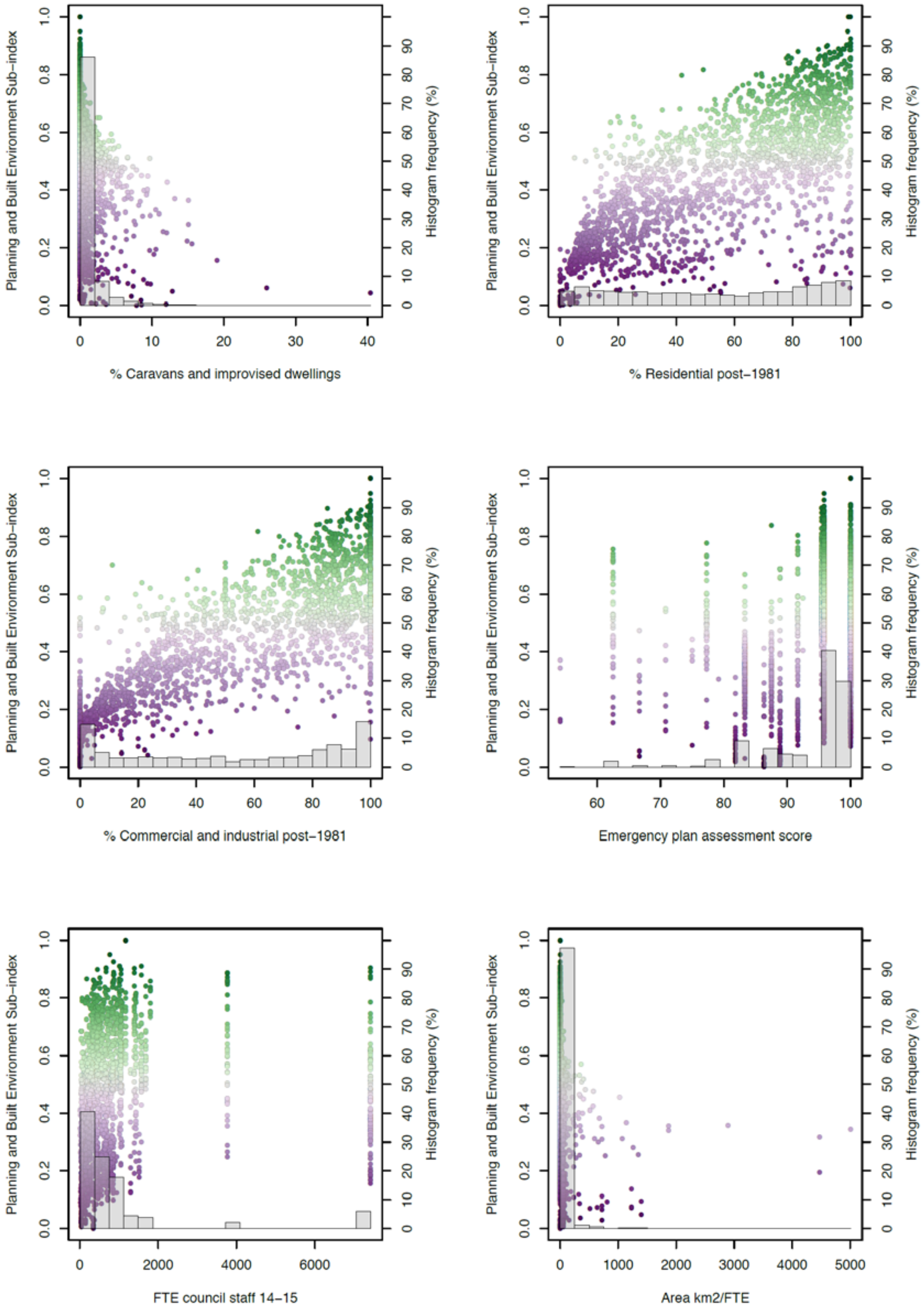
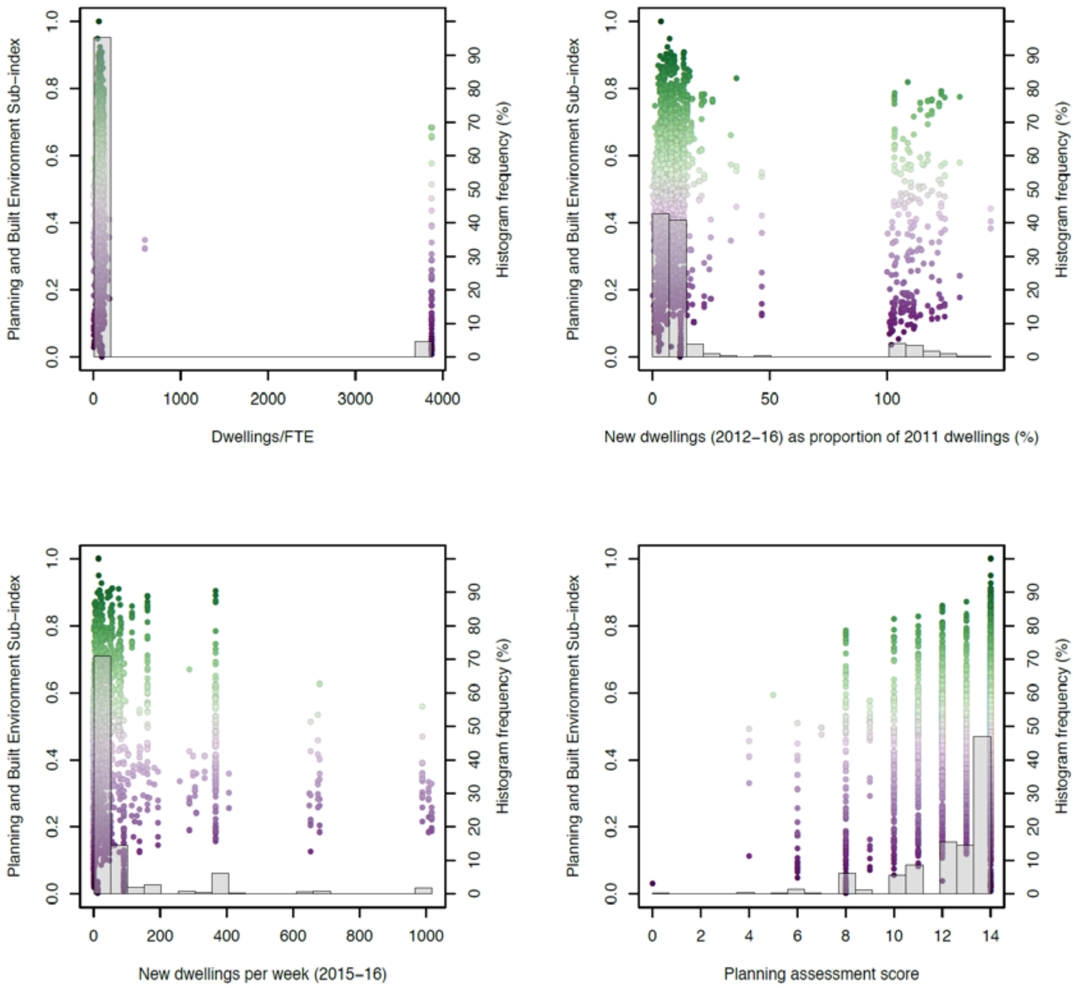


Figure 5.24: Scatterplots showing the relationships between planning and the built environment index sub-values and component indicators, at a national level. Raw indicator values, without reversal or transformation are used.

Figure 5.24 (cont.)



5.4.6.2 Regional level

Disaggregation of the correlations between indicators and sub-index to SA4 level (larger geographic areas containing around 20 SA2s) shows whether there are any regional differences in the patterns of correlations between indicators that result in corresponding differences in the relationships between indicators and the planning and the built environment sub-index (Figure 5.25). The scatter plots suggest that the influences of the indicators on the theme sub-index are much the same in metropolitan areas as they are in regional and remote Australia (Figure 5.25).

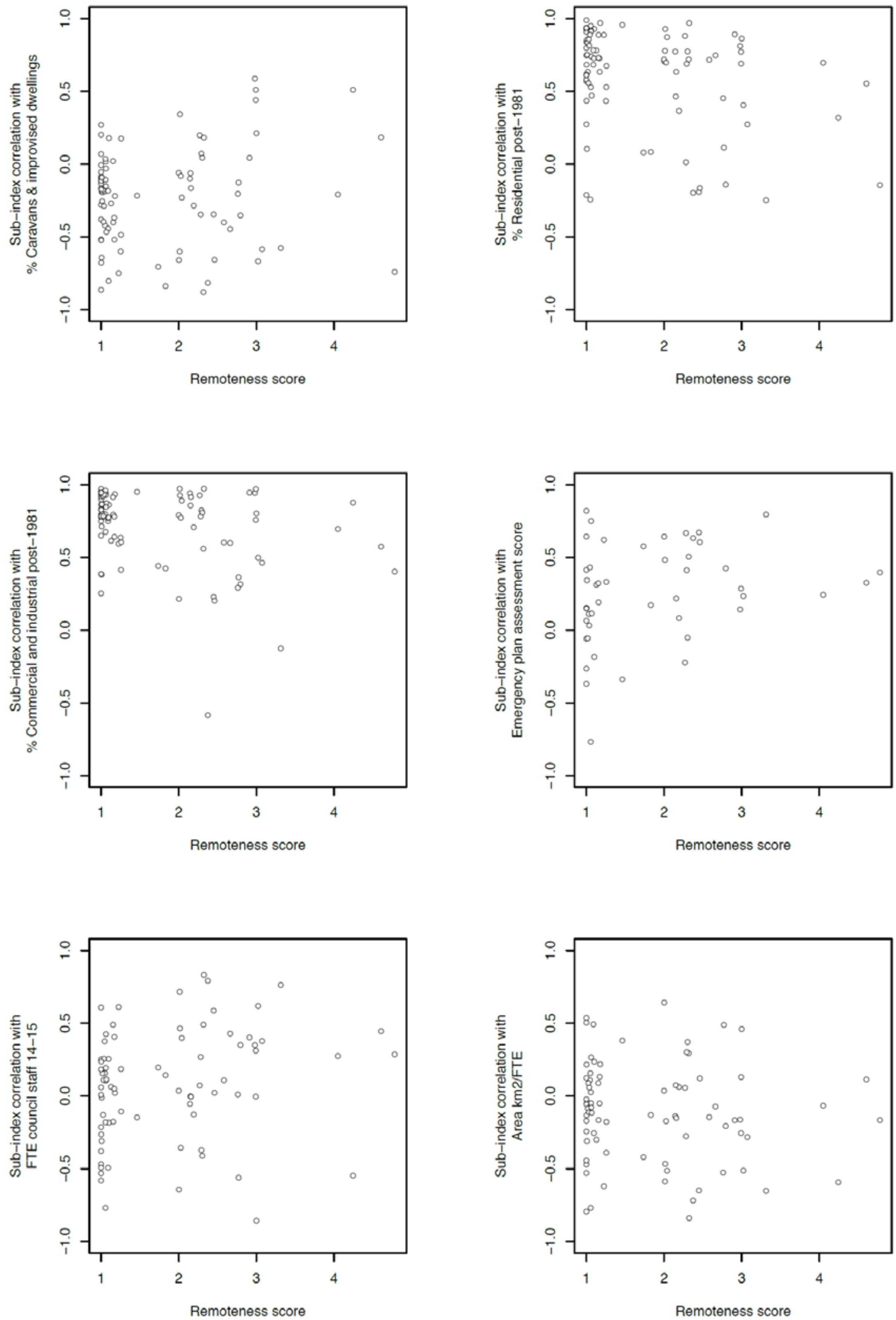
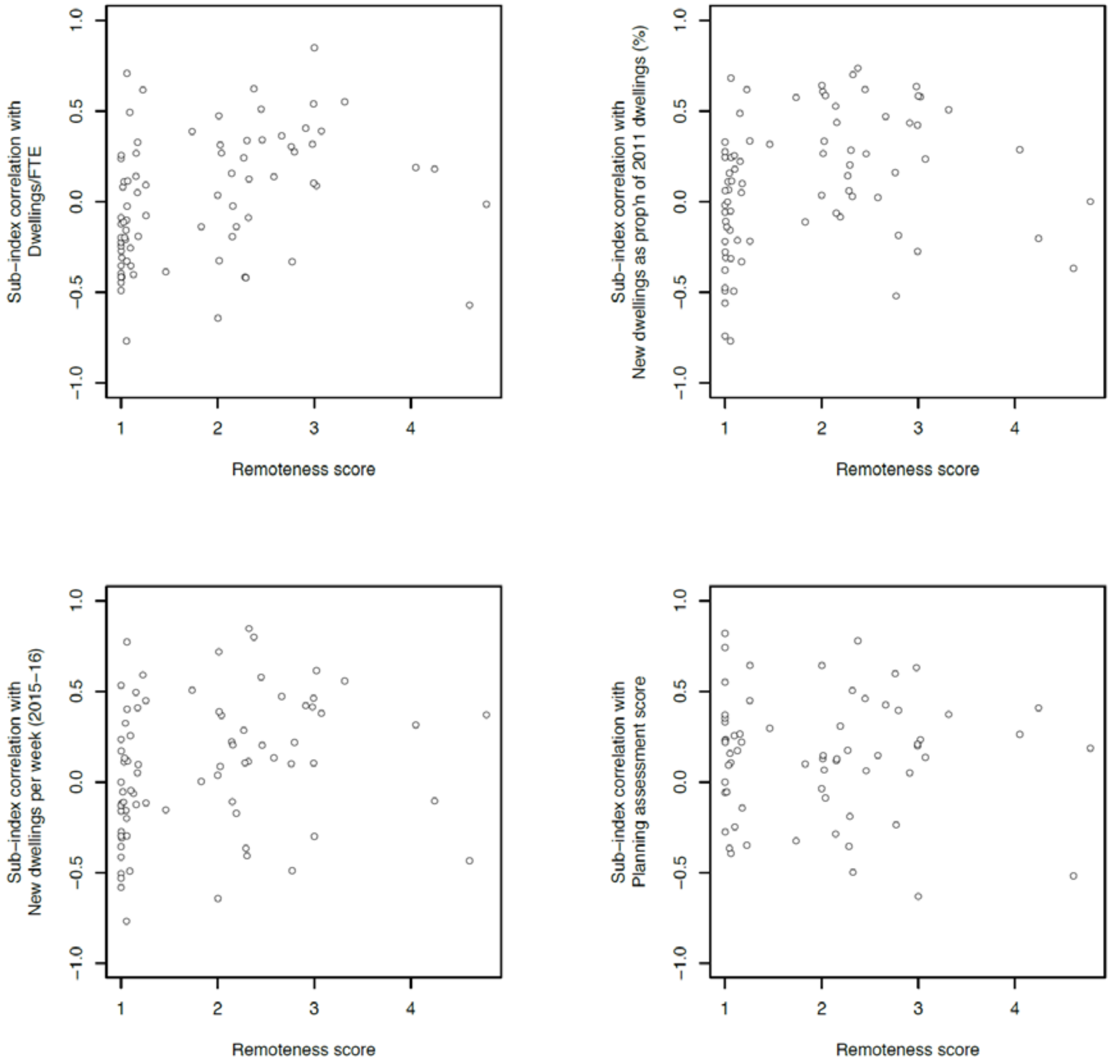


Figure 5.25: Correlation between indicators and planning and the built environment sub-index values, at a regional level. Remoteness of 1 is metropolitan areas through to 5, very remote areas.

Figure 5.25 (cont.)



5.5 COMMUNITY CAPITAL

5.5.1 Transformation

The community capital sub-index is calculated by aggregating the community capital indicators. All but one of the indicators required rescaling and transformation before aggregation. Transformation details are shown in Table 5.23 and the results of transformation in Table 5.24. Raw and transformed indicator values are outlined in Appendix 5I.

Table 5.23: Transformation details for indicators used to form the community capital sub-index.

Indicator	Transformation details		
	Skewness transform	Exponent	Coefficient for kurtosis transform
Offences against persons, 2011-12, per 100,000 population	Power transform	0.15	0.28
Offences against property, 2011-12, per 100,000 population	Power transform	0.39	0.38
Support in crisis ASR, 2010, per 100	Power transform	2.13	0.18
Safe walking in neighbourhood ASR, 2010, per 100	No transform	-	-
Difficulty accessing services ASR, 2010, per 100	Power transform	0.49	0.17
Poor self-assessed health ASR, 2010, per 100	Power transform	0.39	0.41
Raise $2,000 in week ASR, 2010, per 100	Power transform	2.71	0.20
% Residents in same residence > 5 years	Power transform	2.94	0.00
% Households with no motor vehicle	Power transform	0.20	0.21
% Population undertaking voluntary work	Power transform	0.60	0.06
% Jobless families	Power transform	0.33	0.22

Table 5.24: Transformation results for indicators used to form the community capital sub-index.

Indicator	Raw data pre-transform			Post-transform		
	Skewness	Kurtosis	Outliers	Skewness	Kurtosis	Outliers
Offences against persons, 2011-12, per 100,000 population	9.72	172.01	24	-0.07	-0.00	3
Offences against property, 2011-12, per 100,000 population	6.09	85.47	15	0.04	-0.00	3
Support in crisis ASR, 2010, per 100	-1.32	3.28	18	-0.05	0.00	5
Safe walking in neighbourhood ASR, 2010, per 100	-0.43	0.19	0	-0.43	0.19	0
Difficulty accessing services ASR, 2010, per 100	0.66	0.21	13	0.16	-0.00	1
Poor self-assessed health ASR, 2010, per 100	10.89	212.77	3	0.13	-0.00	3
Raise $2,000 in week ASR, 2010, per 100	-3.07	19.26	19	0.02	0.00	0
% Residents in same residence > 5 years	-1.31	2.72	21	0.00	-0.32	2
% Households with no motor vehicle	3.41	19.33	31	0.03	0.00	3
% Population undertaking voluntary work	0.58	0.73	12	-0.00	-0.00	1
% Jobless families	2.12	9.39	28	-0.05	0.00	11

5.5.2 Correlation

The correlation plot has the indicators in the order given by the sorted loadings table from principal components analysis (PCA). The correlation plot is for transformed indicators with reversals carried out where appropriate. It shows relatively few strong correlations between indicators, consistent with a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.60 (Figure 5.26). Principal components analysis confirmed that there were no obvious groups of highly inter-correlated indicators, with low correlations with indicators outside the group. Inspection of the three possible components suggests that the correlations between indicators making up a component are not necessarily indicative of similar aspects of the community capital theme, nor could it be plausibly hypothesised that they reflect the influence of some latent factor. For example, % jobless families, poor self-assessed health and raise $2,000 in a week are all correlated with each other and constitute the main indicators in one of the principal components. However, the first and third indicators relate to household economic capacity while the second relates to community health.

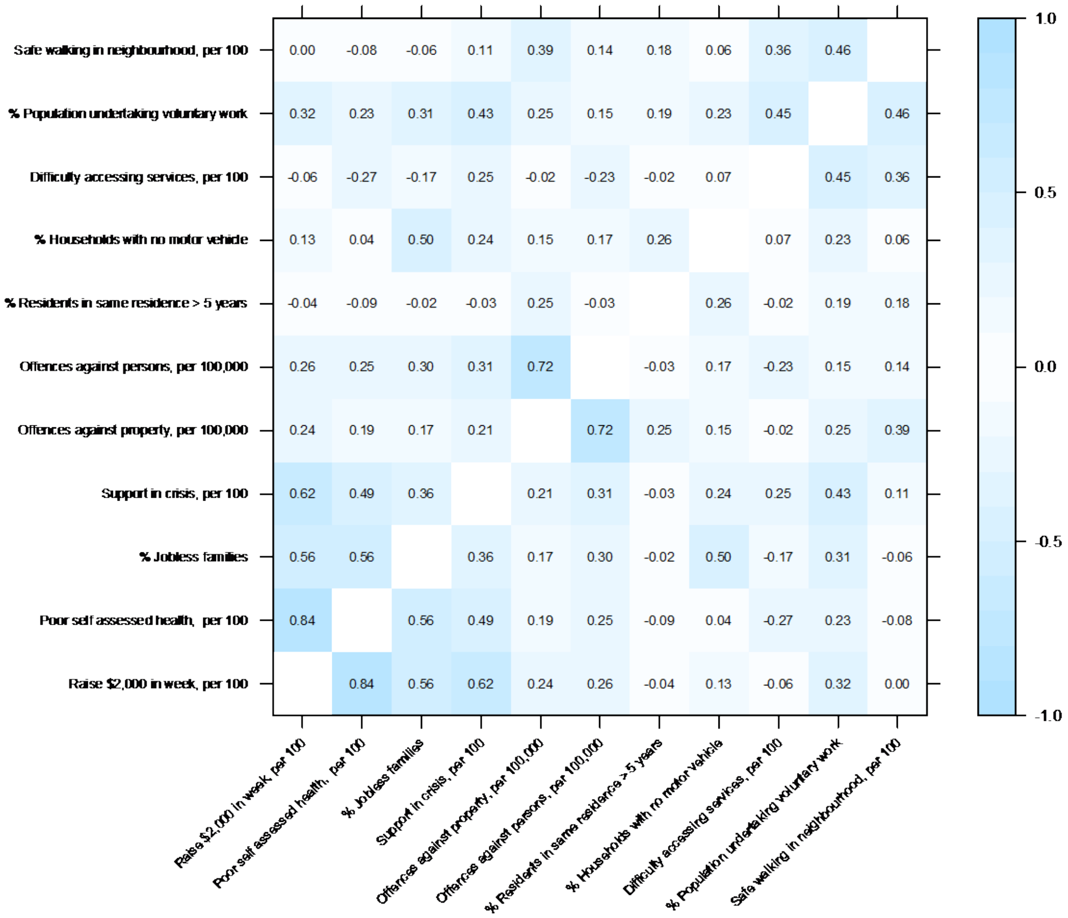


Figure 5.26: Correlation between indicators in the community capital sub-index**.**

Regressions with each of the indicators against the remaining indicators suggests that the redundancy in the indicator set is not excessively high (Table 5.25).

Table 5.25: Regression analysis of each community capital indicator as dependent variable against the remaining indicator values as independent variables.

Indicator denoted the dependent variable in the regression	R^2
Poor self-assessed health ASR, 2010, per 100	0.79
Raise $2,000 in week ASR, 2010, per 100	0.79
Offences against persons, 2011-12, per 100,000 population	0.67
Offences against property, 2011-12, per 100,000 population	0.67
% Jobless families	0.61
Difficulty accessing services ASR, 2010, per 100	0.57
Support in crisis ASR, 2010, per 100	0.55
% Population undertaking voluntary work	0.53
% Households with no motor vehicle	0.43
Safe walking in neighbourhood ASR, 2010, per 100	0.39
% Residents in same residence > 5 years	0.31

5.5.3 Measurement model

Focussing on the substantive nature of the indicators rather than their inter-correlations suggests there are at least six aspects of community capital covered by the indicators. These include household economic capacity, community health, crime levels, mobility, residential fixity and community participation. A two level formative model would require six sub-indices to be aggregated in the upper level to construct the community capital sub-index. This rule out aggregation by discrete Choquet integral. Given there are few very high correlations between indicators and given the range of aspects covered by the indicators, there is little risk of the sub-index being seriously impacted by aggregating redundant indicators. For these reasons a simple single level formative model with OWA of the full set of 11 indicators was chosen as the preferred aggregation option.

5.5.4 Aggregation

It appears that some substitution between the aspects represented by the indicators is possible, so an orness of 0.375 was chosen for the OWA. For example, a low household economic capacity might be offset in disaster situations by a strong volunteering culture.

The comparison of aggregation methods (Figure 5.27) shows the results for the simple single level models with aggregation by OWA, geometric mean, Mazziotta-Pareto Index and arithmetic mean. As expected, the use of OWA (with an orness value of 0.375 which allows a moderate amount of compensation among indicators) means there are not large differences between the aggregation methods. Aggregation by OWA gives a slightly lower value of the sub-index than does the arithmetic mean. The geometric mean gives approximately similar values of the sub-index as the arithmetic mean but falls to zero as soon as the coefficient of variation of the constituent indicators for an SA2 is high enough to be the result of one or more zero indicators. The Mazziotta-Pareto Index, with its fixed unbalance penalisation, severely reduces the value of the sub-index when the coefficient of variation for the indicators is high.

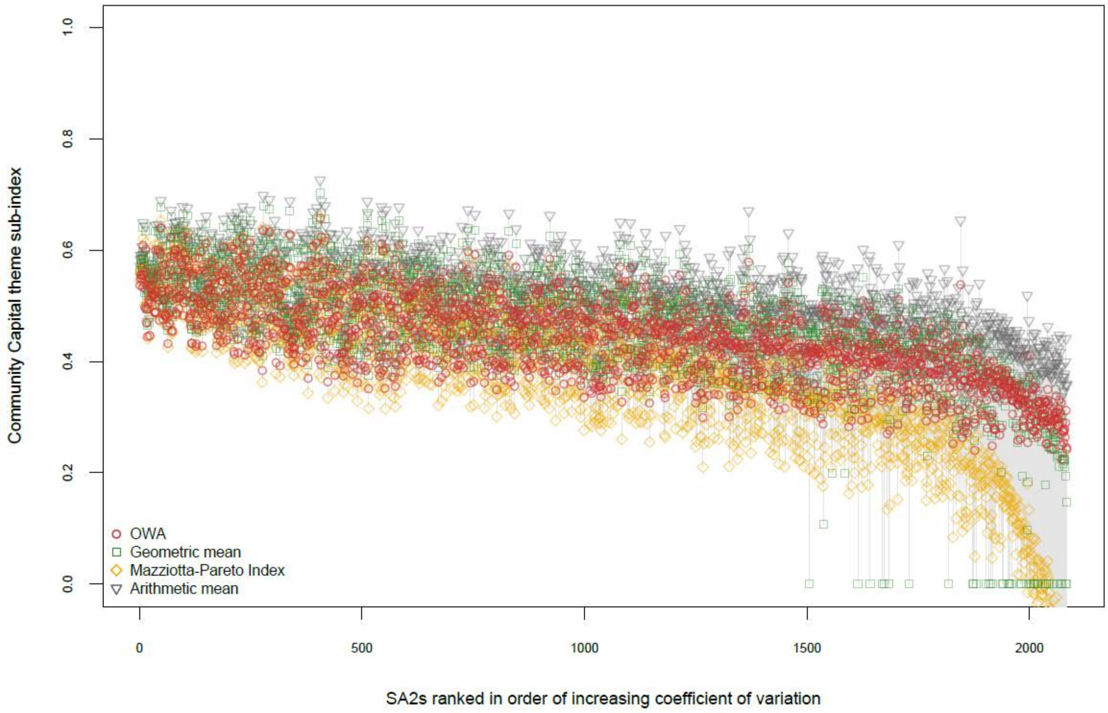


Figure 5.27: Comparison of aggregation methods for the community capital sub-index.

The example SA2s in Table 5.26 show that a high coefficient of variation across the 11 indicators results in a larger difference between the sub-index calculated with OWA and that calculated using the simple arithmetic mean of the indicators. This is a consequence of OWA restraining the extent to which high values on some indicators can compensate for low values on other indicators.

Table 5.26: Example SA2s showing community capital index sub-values obtained using different aggregation functions.

Indicator	Rescaled transformed Indicator values	
	High c.v. (Palm Island)	Low c.v. (Rochedale - Burbank)
Offences against persons, 2011-12, per 100,000 population	0.34	0.55
Offences against property, 2011-12, per 100,000 population	0.48	0.65
Support in crisis ASR, 2010, per 100	0.00	0.40
Safe walking in neighbourhood ASR, 2010, per 100	0.45	0.48
Difficulty accessing services ASR, 2010, per 100	0.93	0.67
Poor self-assessed health ASR, 2010, per 100	0.41	0.68
Raise $2,000 in week ASR, 2010, per 100	0.01	0.55
% Residents in same residence > 5 years	0.95	0.52
% Households with no motor vehicle	0.03	0.50
% Population undertaking voluntary work	0.18	0.63
% Jobless families	0.15	0.65
Economic Capital theme sub-index (OWA)	0.24	0.54
Economic Capital theme sub-index (Arithmetic mean)	0.36	0.57
Coefficient of variation	0.94	0.16

5.5.5 Mapped community capital sub-index

The mapped output of the community capital sub-index is shown in Figure 5.28. Maps showing State/Territory and major metropolitan area resolution are provided in Appendix 5J.

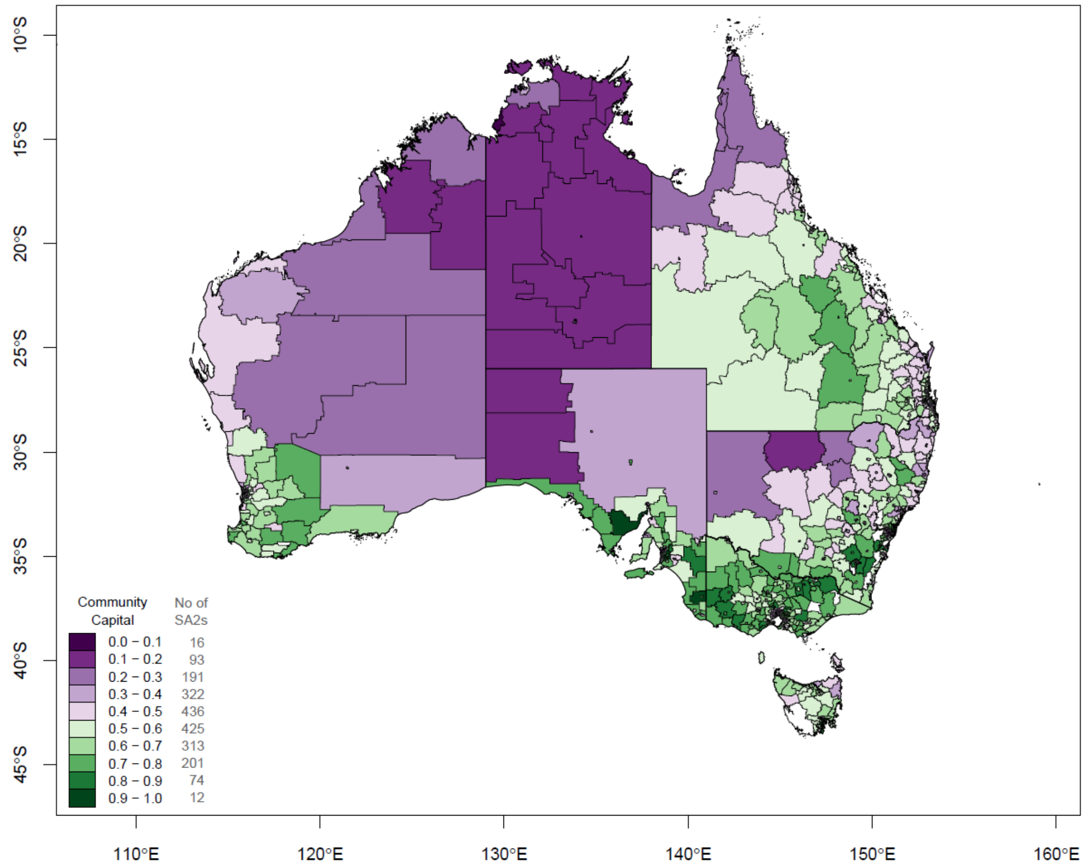


Figure 5.28: Mapped output of the community capital sub-index at a national level.

5.5.6 Indicator relationships with composite index

5.5.6.1 National level

The correlations at national level between individual indicators and the community capital sub-index are shown in Table 5.28. The magnitude of the correlation gives guidance as to which indicators have the most influence on the value of the community capital sub-index. The corresponding scatter plots and histograms are provided in Figure 5.29

Nationally, the support in crisis ASR 2010 per 100 and % population undertaking voluntary work indicators have the most positive influence on the value of the community capital sub-index. The sub-index is also influenced negatively to a moderate extent by % jobless families. So where, for example, the sub-index has a high value, it is likely that this reflects relatively high numbers of people with access to support in times of crisis, a high proportion of people undertaking voluntary work and a low percentage of jobless families. The opposite is likely to be the case when the community capital sub-index has a high value. These relationships are illustrated in the Figure 5.29. However, there will be exceptions to this pattern when smaller regions are considered.

Table 5.27: Correlations between indicators and the community capital sub-index values, at a national level.

Indicator	Correlation with community capital theme sub-index
Support in crisis ASR, 2010, per 100	0.68
% Population undertaking voluntary work	0.64
Raise $2,000 in week ASR, 2010, per 100	0.54
Safe walking in neighbourhood ASR, 2010, per 100	0.43
% Residents in same residence > 5 years	0.34
Difficulty accessing services ASR, 2010, per 100	0.12
Poor self-assessed health ASR, 2010, per 100	-0.38
Offences against persons, 2011-12, per 100,000 population	-0.40
Offences against property, 2011-12, per 100,000 population	-0.48
% Households with no motor vehicle	-0.50
% Jobless families	-0.57

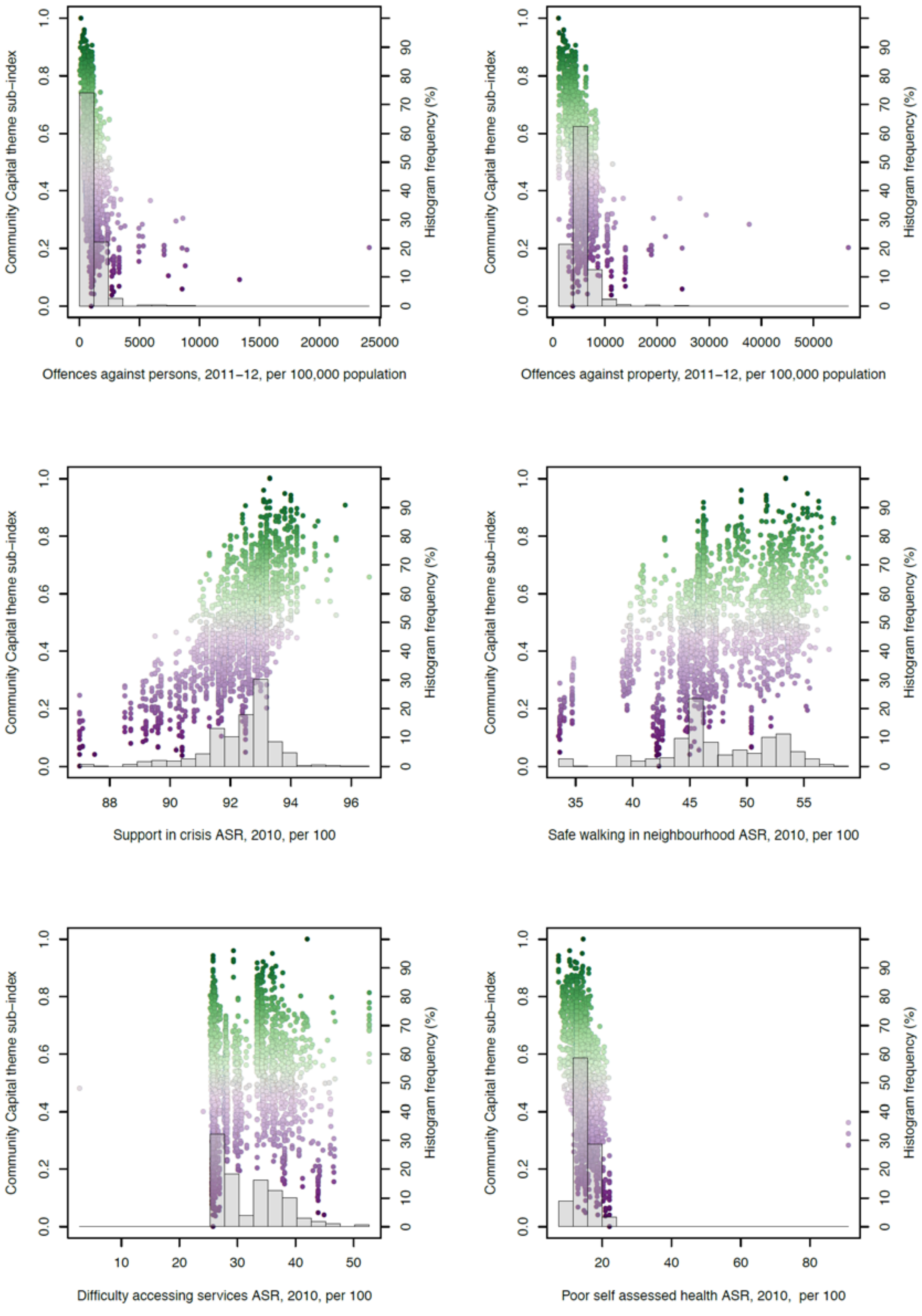
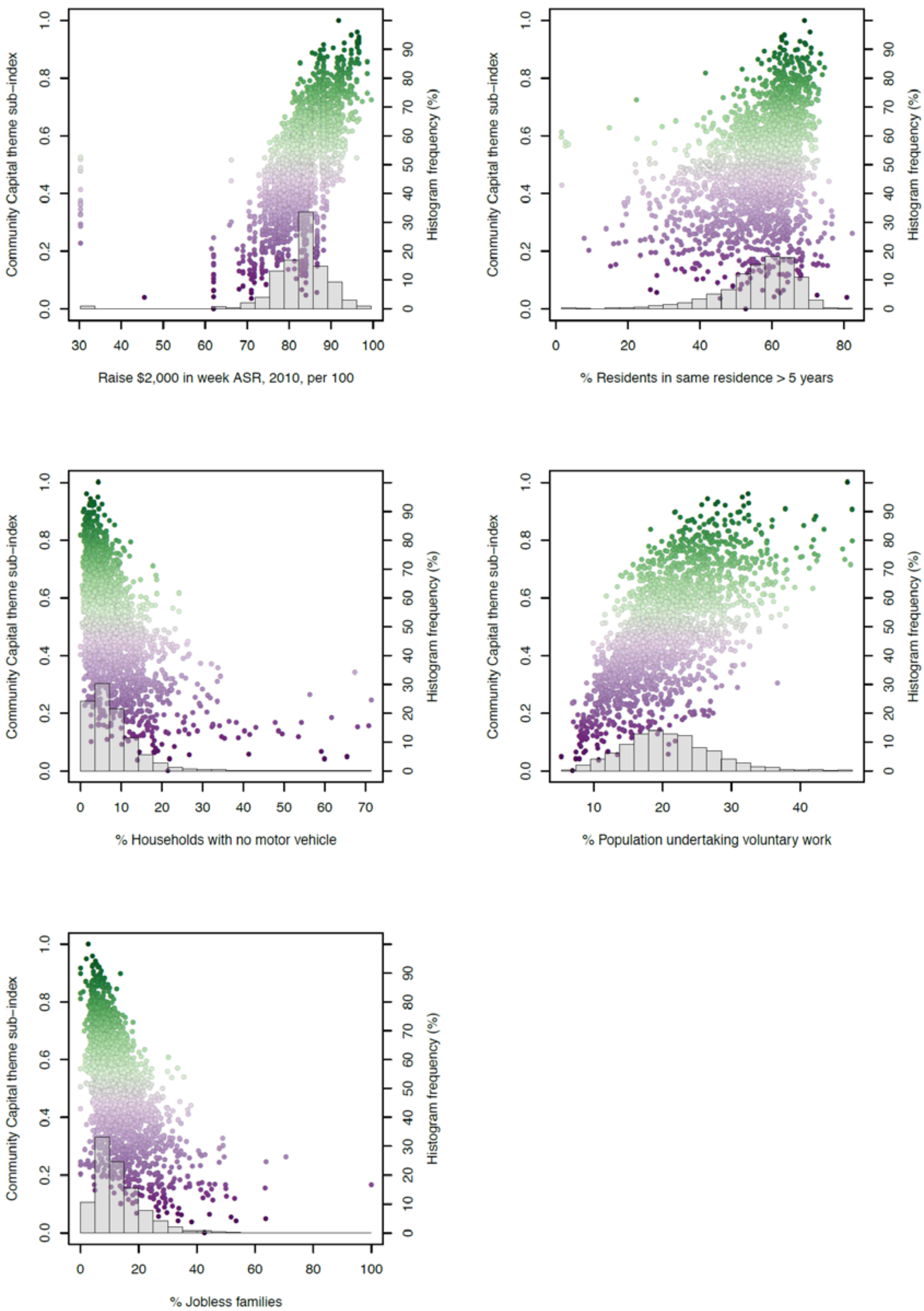


Figure 5.29: Scatterplots showing the relationship between community capital sub-index values and component indicators at a national level. Raw indicator values, without reversal or transformation are used.

Figure 5.29 (cont.)



5.5.6.2 Regional level

Disaggregation of the correlations between indicators and sub-index to SA4 level (larger geographic areas containing around 20 SA2s) shows whether there are any regional differences in the patterns of correlations between indicators that result in corresponding differences in the relationships between indicators and the community capital sub-index (Figure 5.30). The scatter plots suggest that the influences of the indicators on the theme sub-index are much the same in metropolitan areas as they are in regional and remote Australia (Figure 5.30).

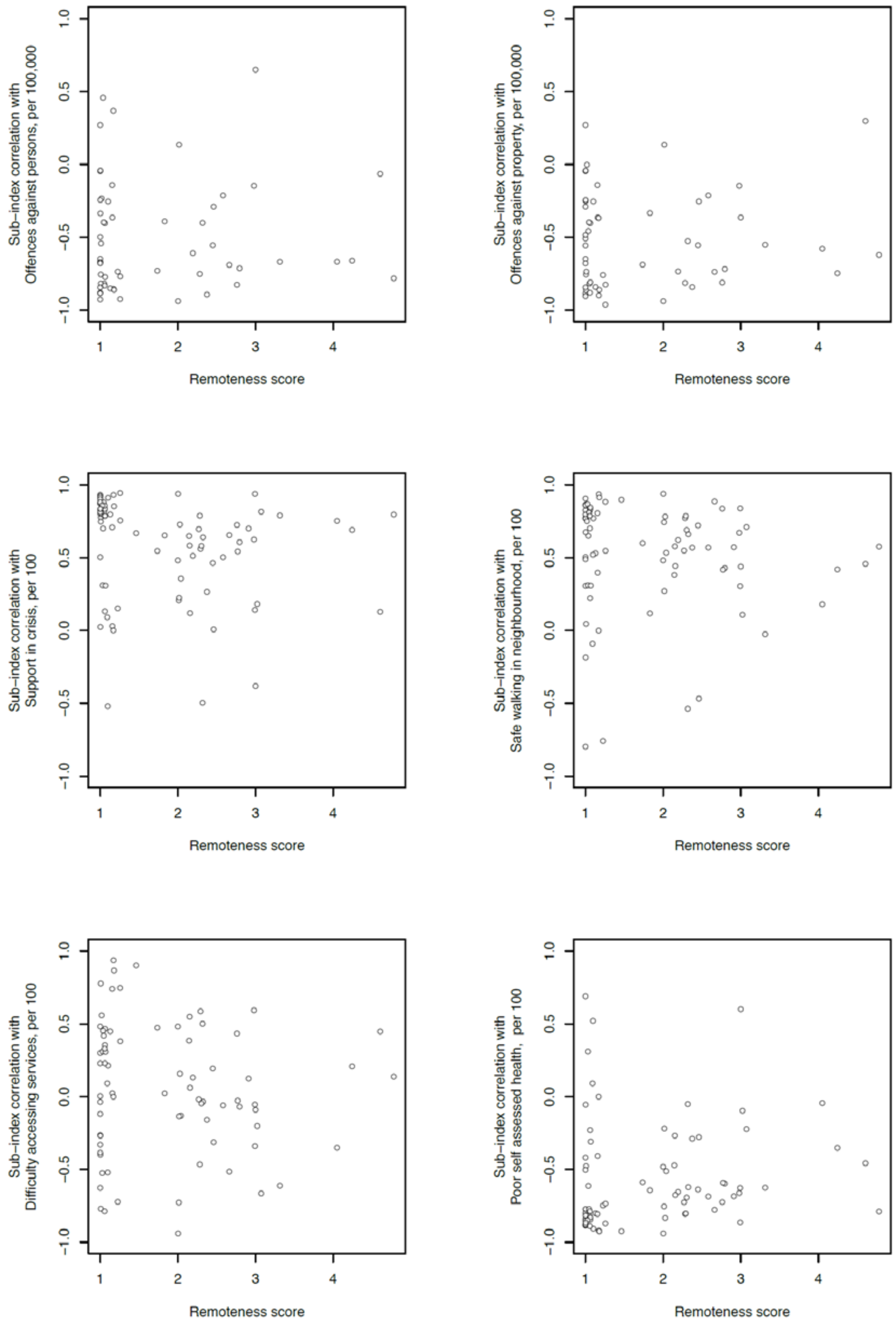
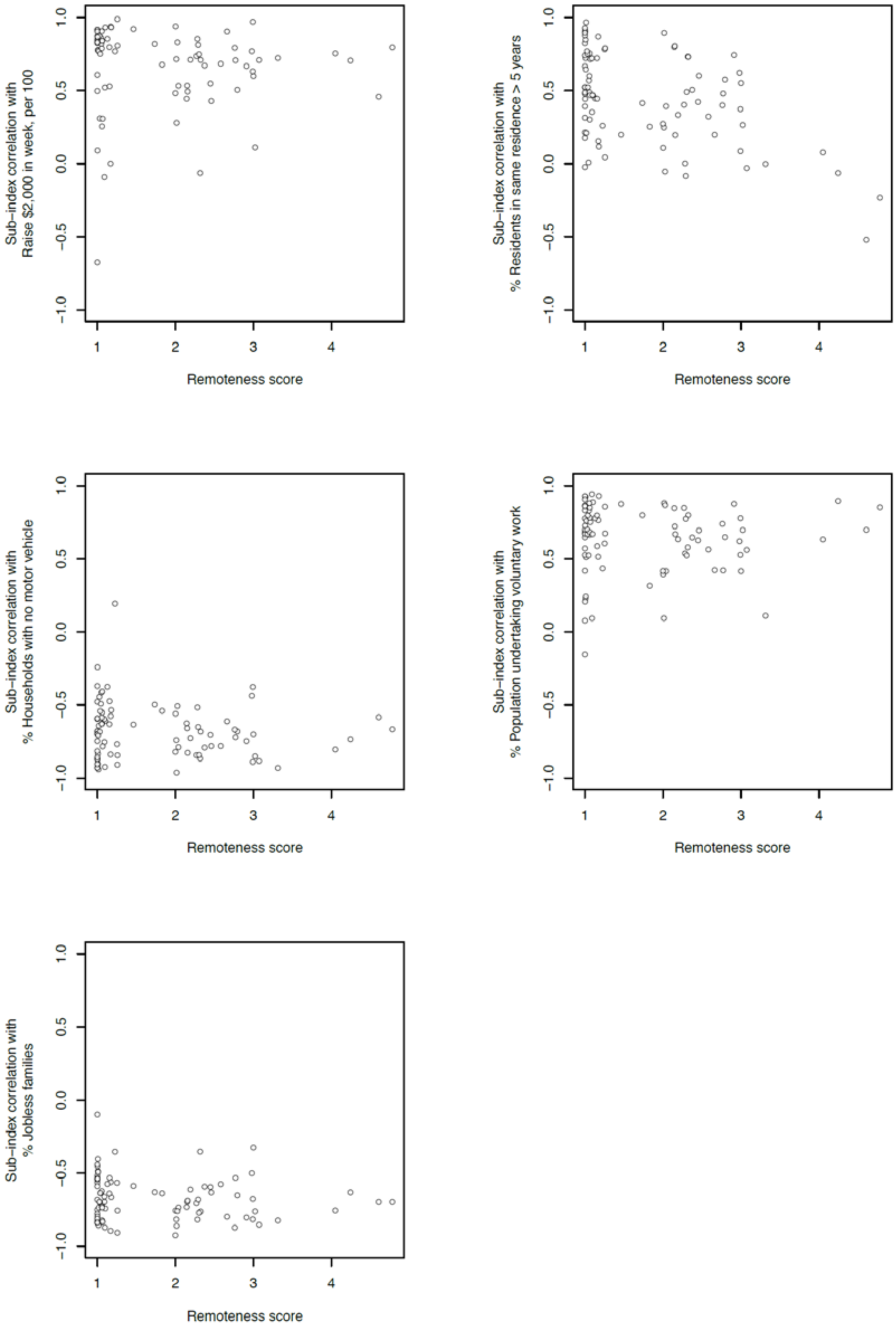


Figure 5.30: Correlation between indicators and community capital sub-index values, at a regional level. Remoteness of 1 is metropolitan areas, through to 5, very remote areas.

Figure 5.30 (cont.)



5.6 INFORMATION ACCESS

5.6.1 Transformation

The information access sub-index is calculated by aggregating the information access indicators. These three indicators required rescaling and transformation before aggregation. Transformation details are shown in Table 5.28 and the results of transformation in Table 5.29. Raw and transformed indicator values are outlined in Appendix 5K.

The mean area weighted ADSL coverage and % area with mobile phone coverage have extremely skewed distributions that, to various degrees, are resistant to normalisation by power transformations (Table 5.29). In the case of % area with mobile phone coverage, log and exponential transformations were also investigated, but gave no improvement on the best that was achievable with a power transformation.

Table 5.28: Transformation details for indicators used to form the information access sub-index.

Indicator	Transformation details		
	Skewness transform	Exponent	Coefficient for kurtosis transform
Mean area weighted ADSL coverage	Power transform	8.02	0.00
% area with mobile phone coverage	Power transform	75.00	0.00
Community engagement and hazard education	Power transform	1.80	0.29

Table 5.29: Transformation results for indicators used to form the information access sub-index.

Indicator	Raw data pre-transform			Post-transform		
	Skewness	Kurtosis	Outliers	Skewness	Kurtosis	Outliers
Mean area weighted ADSL coverage	-1.05	-0.37	0	0.00	-1.79	0
% area with mobile phone coverage	-2.50	5.66	53	-0.87	-1.22	0
Community engagement and hazard education	-1.28	2.27	0	-0.06	0.00	0

5.6.2 Correlation

The correlation plot shows that mean ADSL coverage and % area with mobile phone coverage are moderately well correlated, while both are virtually uncorrelated with information and engagement (Figure 5.31).

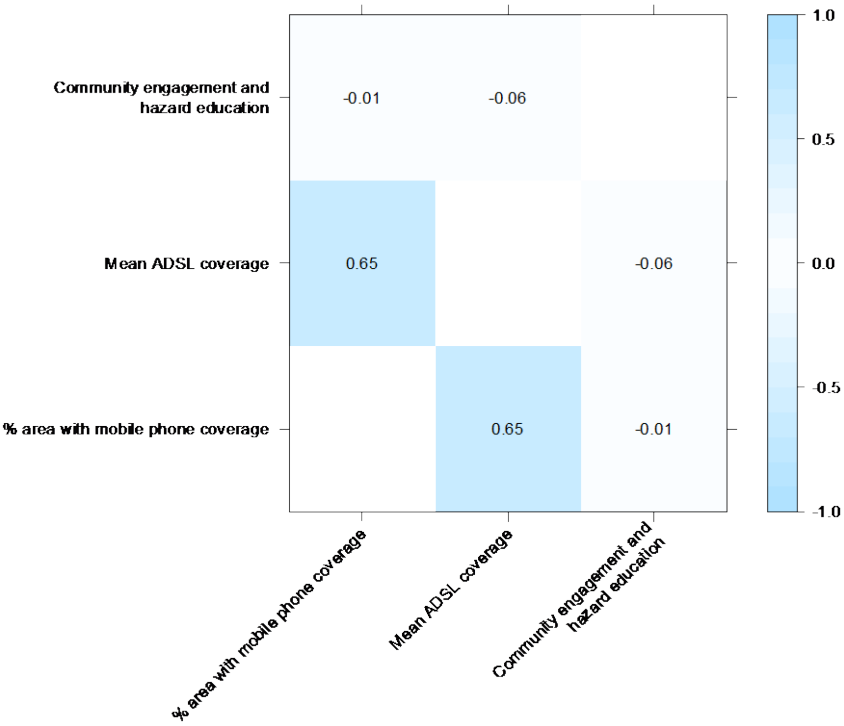


Figure 5.31: Correlation between indicators in the information access sub-index.

Regressions with each of the indicators against the remaining indicators suggests that the redundancy in the indicator set is not excessively high (Table 5.30).

Table 5.30: Regression analysis of each information access indicator as dependent variable against the remaining indicator values as independent variables.

Indicator denoted the dependent variable in the regression	R^2
Mean area weighted ADSL coverage	0.43
% area with mobile phone coverage	0.42
Community engagement and hazard education	0.00

5.6.3 Measurement model

A simple formative measurement model is appropriate, given that there is no latent factor that could be hypothesised to be causing the variation in the three indicators.

5.6.4 Aggregation

The information access theme, with three indicators, can feasibly be aggregated with the discrete Choquet integral. These indicators comprise two information access indicators (ADSL and mobile coverage) and one information supply indicator (i.e. the extent to which States make information available through their community engagement and hazard education policies and programs). For convenience in the specification of the fuzzy measure required for aggregation by the discrete Choquet integral, the three indicators are abbreviated to ADSL, mobile and information.

First, consider the indicators singly. It could be reasoned that all three are equally important in the role that information availability and accessibility play in coping capacity. In this case, the fuzzy measures for ADSL, mobile and information availability could be set at 0.33, 0.33 and 0.33 respectively. Alternatively, it might be reasoned that mobile coverage is more important than the other two because of the role it plays in emergencies. With this in mind, we can specify (using curly brackets to denote subsets of indicators:

{ADSL} – 0.3

{mobile} – 0.4

{information} – 0.3

Next, it could be reasoned that there is some redundancy between ADSL and Mobile. They both (assuming smart mobiles) allow access to information on the internet. So the fuzzy measure for {ADSL, mobile} will be less than the sum of the two fuzzy measures for these two indicators. If there is a lot of redundancy the fuzzy measure might be slightly more than 0.4, the value for {mobile} and if there is only a little redundancy, the fuzzy measure can be set to slightly less than 0.7. Assuming there is a fair amount of redundancy between the indicators:

{ADSL, mobile} – 0.45

Turning to the relationships between the communication indicators ADSL and mobile, and information, it can be reasoned that having both good communication and good information availability is going to be positive for coping capacity. However, mobile could be regarded as superior to ADSL because of its ability to receive SMS alerts when people are away from a terminus of the optic/copper network, as well as its immediacy in emergency situations. With this in mind, appropriate fuzzy measures are:

{ADSL, information} – 0.5

{Mobile, information} – 0.6

With the Choquet integral method, the fuzzy measure for {ADSL, mobile, information} is defined to be 1. In summary, the fully specified fuzzy measure is:

{ADSL} – 0.3

{mobile} – 0.4

{information} – 0.3

{ADSL, mobile} – 0.45

{ADSL, information} – 0.5

{mobile, information} – 0.6

{ADSL, mobile, information} – 1.0

This fuzzy measure has an orness of 0.425. To be consistent with the orness value of 0.375 used in OWA aggregations throughout the ANDRI calculations, where some restraint on compensatory effects is required, the fuzzy measure can be adjusted to have an orness of 0.375.

{ADSL} – 0.26

{mobile} – 0.35

{information} – 0.26

{ADSL, mobile} – 0.40

{ADSL, information} – 0.44

{Mobile, information} – 0.53

{ADSL, mobile, information} – 1.0

With the fuzzy measure so specified, it is possible to aggregate the three indicators for each SA2, using the Choquet integral. The composite index so obtained has a range 0 – 1. Calculating the difference between the Choquet composite index (henceforth shortened to CIc) and the arithmetic mean (henceforth shortened to CIm) and examining the instances where the difference is the largest, reveals how the CIc responds to the nuances of the hypothesised interactions between the indicators.

There are a number of SA2s in the ACT where the CIm is 0.67 and the CIc is 0.40. In these SA2s the (rescaled) values of ADSL, mobile and information are 1, 1, 0 respectively. Note that these are rescaled values so 0 is not necessarily zero, but rather the minimum value in the raw indicators. These SA2s have high or complete ADSL and mobile coverage but are in the territory with the lowest information availability. It could be argued that good communication can never make up for a lack of information to be accessed through that communication. In this case the CIc of 0.4 is a more reasonable aggregate figure than the arithmetic means of 0.67.

There are a number of SA2s around Australia where the CIm is less than the CIc. This arises in SA2s where the ADSL coverage is poor, there is 100% mobile coverage and information availability is fair to poor. In these cases, the higher fuzzy measure for {Mobile, Information} has raised the CIc above the CIm, the simple mean being pulled down by the poor ADSL coverage. This is consistent with expectations, since a relatively high fuzzy measure was assigned to

{Mobile, Information} to reflect the positive joint contribution these two make to coping capacity.

The discontinuities in the aggregation plot (Figure 5.32) are a consequence of using a State/Territory level indicator with only six values (community engagement and hazard education) and the influence it has when there are only three indicators being aggregated. Between the discontinuities, the relativities between the five aggregation methods are generally similar to that found in the aggregations for the other five themes. The values of the sub-index obtained with aggregation by discrete Choquet integral and OWA are comparable, consistent with expectations given that the same orness was used in both aggregations. Both are generally, but not always as discussed above, less than the arithmetic mean, reflecting the constraint on compensatory effects inherent with aggregation by the discrete Choquet integral.

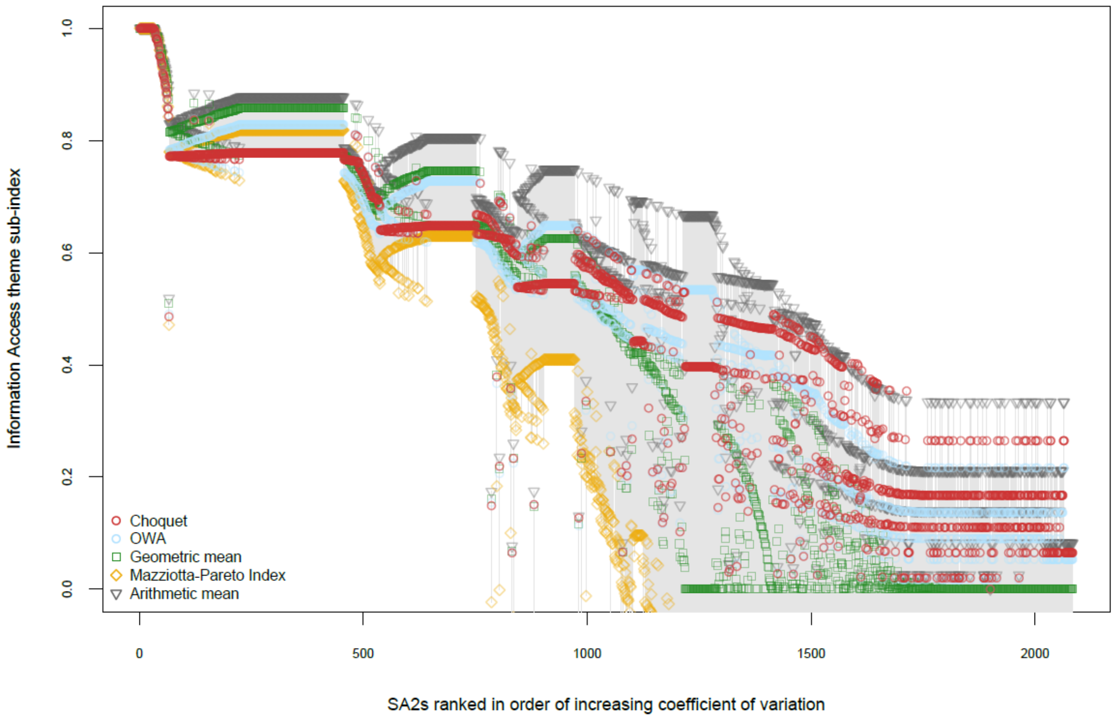


Figure 5.32: Comparison of aggregation methods for the information access sub-index.

The example SA2s in Table 5.31 show that a high coefficient of variation across the three indicators results in a larger difference between the sub-index calculated with the discrete Choquet integral and that calculated the simple arithmetic mean of the indicators. This is a consequence of the discrete Choquet integral restraining the extent to which high values on some indicators can compensate for low values on other indicators.

Table 5.31: Example SA2s showing information access sub-index values obtained using different aggregation functions.

Indicator	Rescaled transformed Indicator values	
	High c.v. (Tanami)	Low c.v. (Adelaide)
Mean area weighted ADSL coverage	0.00	1.00
% area with mobile phone coverage	0.00	1.00
Community engagement and hazard education	0.25	1.00
Information Access theme sub-index (Discrete Choquet integral)	0.06	1.00
Information Access theme sub-index (Arithmetic mean)	0.08	1.00
Coefficient of variation	1.73	0.00

5.6.5 Mapped information access sub-index

The mapped output of the information access sub-index is shown in Figure 5.33. Maps showing State/Territory and major metropolitan area resolution are provided in Appendix 5L.

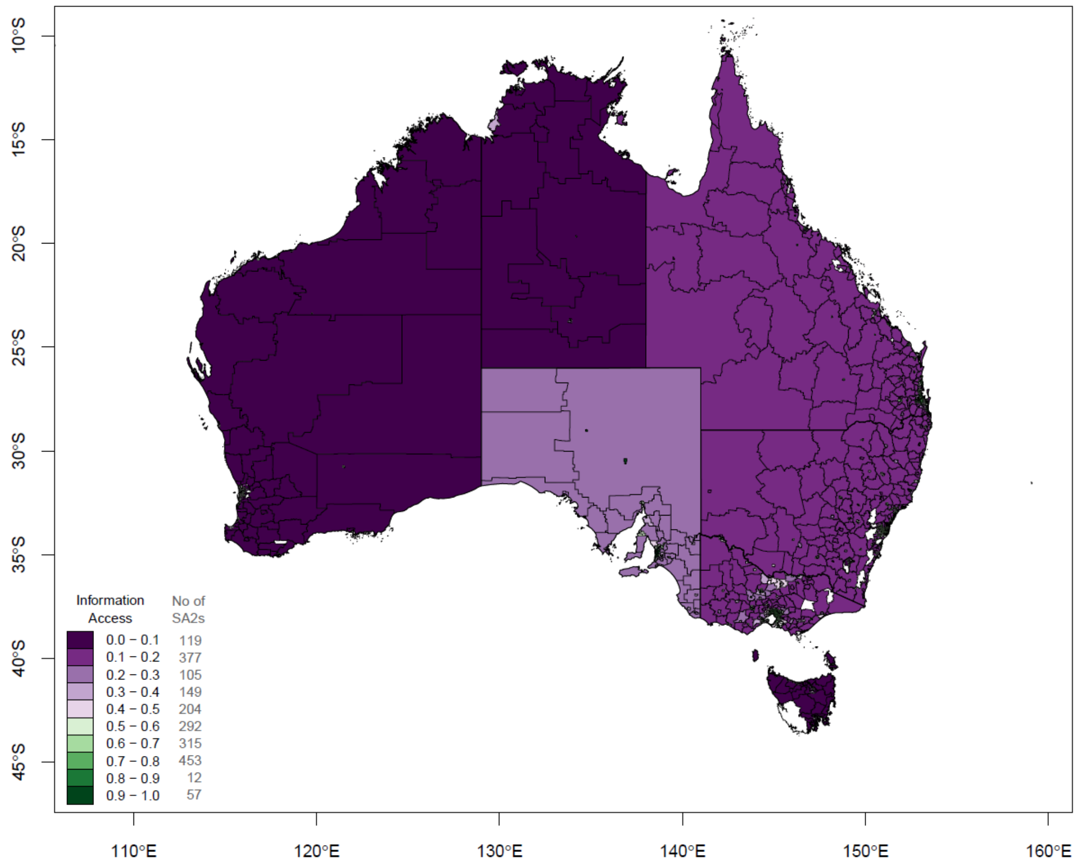


Figure 5.33: Mapped output of the information access sub-index at a national level.

5.6.6 Indicator relationships with composite index

5.6.6.1 National level

The correlations at national level between individual indicators and the information access sub-index are shown in Table 5.32. The magnitude of the correlation gives guidance as to which indicators have the most influence on the value of the information access sub-index. The corresponding scatter plots and histograms are given in Figure 5.34. In both cases, the raw indicator values, without reversal or transformation, are used.

The correlations and scatter plots show that, nationally, the mean area weighted ADSL coverage and the % area with mobile phone coverage have the most influence on the value of the information access sub-index. So where, for example, the sub-index has a high value, it is likely that this reflects relatively high levels of ADSL and mobile phone coverage. The scatter plots (Figure 5.34) show that the relationships between these two indicators and the sub-index are markedly non-linear, with the indicators having relatively little effect on the sub-index until they approach their maximum values.

Table 5.32: Correlations between indicators and the information access sub-index values, at a national level.

Indicator	Correlation with information access theme sub-index
Mean area weighted ADSL coverage	0.83
% area with mobile phone coverage	0.63
Community engagement and hazard education	0.24

5.6.6.2 Regional level

Disaggregation of the correlations between indicators and sub-index to SA4 level (larger geographic areas containing around 20 SA2s) shows whether there are any regional differences in the patterns of correlations between indicators that result in corresponding differences in the relationships between indicators and the information access theme sub-index (Figure 5.35).

The scatter plots (Figure 5.35) suggest that the influences of the indicators on the theme sub-index are much the same in metropolitan areas as they are in regional and remote Australia.

Disaggregation of the correlations between indicators and sub-index to SA4 level is not possible for all the indicators in the information access theme because the indicator community engagement and hazard education is based on disaggregation from State level data. Thus, the groups of SA2s within a SA4 can have the same value for the indicators and/or the theme sub-index.

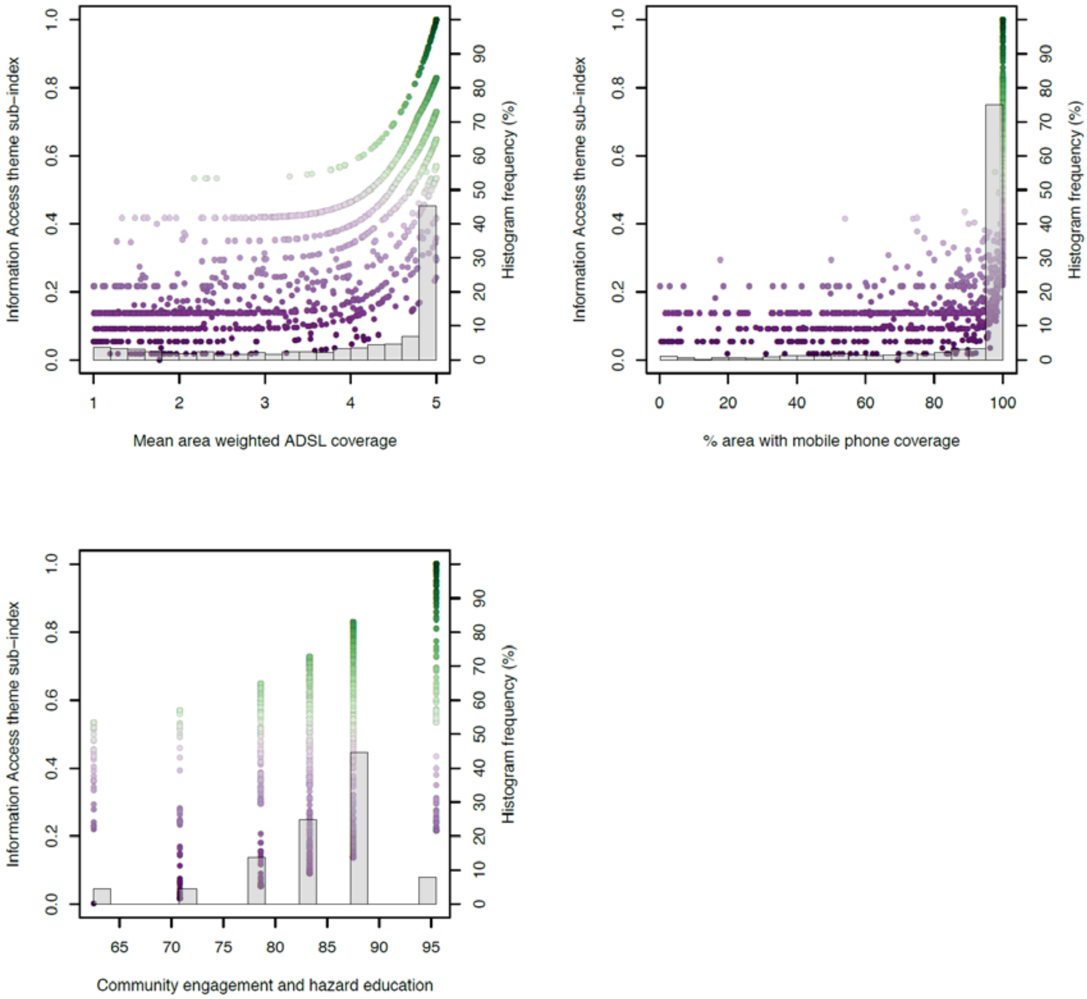


Figure 5.34: Scatterplots showing the relationships between information access sub-index values and component indicators, at a national level. Raw indicator values, without reversal or transformation are used.

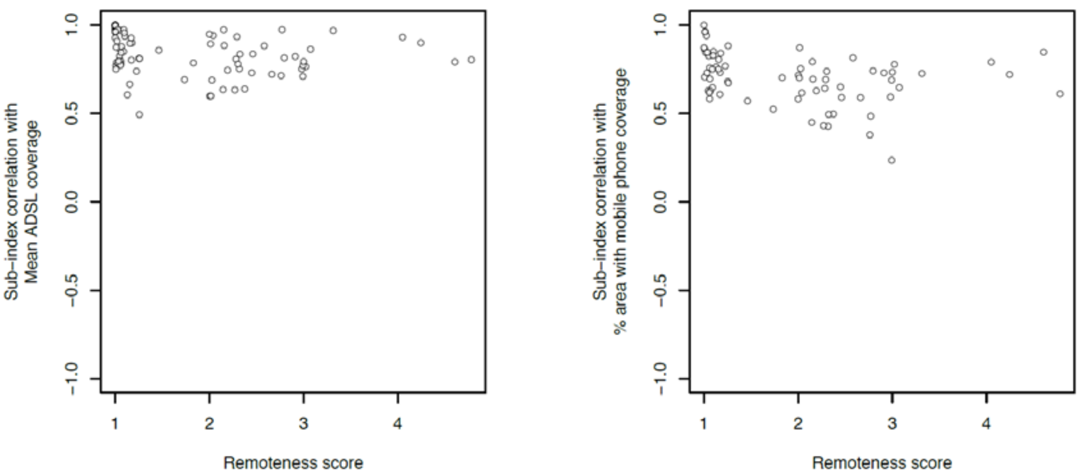


Figure 5.35: Correlation between indicators and selected information access sub-index values, at a regional level. Remoteness of 1 is metropolitan areas through to 5, very remote areas.

5.7 SOCIAL AND COMMUNITY ENGAGEMENT

5.7.1 Transformation

The social and community engagement sub-index is calculated by aggregating the social and community engagement indicators. These indicators all required rescaling and transformation before aggregation. Transformation details are shown in Table 5.33 and the results of transformation in Table 5.34. Raw and transformed indicator values are outlined in Appendix 5M.

Table 5.33: Transformation details for indicators used to form the social and community engagement sub-index.

Indicator	Transformation details		
	Skewness transform	Exponent	Coefficient for kurtosis transform
Percent population with life satisfaction scale 70 and above	Power transform	2.28	0.01
Percent population with high generalised trust	Power transform	0.46	0.21
Gross in and out migration as percent of population	Power transform	0.28	0.24
Percent of population with post school qualification	Power transform	1.28	0.00
Percent of population over 15 in further education	Power transform	0.21	0.22
Participation in personal interest learning	Power transform	0.42	0.66

Table 5.34: Transformation results for indicators used to form the social and community engagement sub-index.

Indicator	Raw data pre-transform			Post-transform		
	Skewness	Kurtosis	Outliers	Skewness	Kurtosis	Outliers
Percent population with life satisfaction scale 70 and above	-0.83	2.72	43	0.00	-0.00	16
Percent population with high generalised trust	0.99	1.84	75	0.02	0.00	7
Gross in and out migration as percent of population	2.51	19.01	57	-0.11	0.00	3
Percent of population with post school qualification	-0.27	0.32	17	0.00	-0.05	13
Percent of population over 15 in further education	3.09	18.70	85	0.02	0.00	5
Participation in personal interest learning	1.86	3.19	319	0.12	-0.00	0

5.7.2 Correlation

The correlation plot shows that the six indicators are only weakly correlated with each other, with the exception of percentage of population with a post-school qualification and percentage of population over 15 in further education (Figure 5.36). There are also moderate correlations between the former indicator and trust – total percent agree and with life satisfaction scale 70 and above. This is consistent with a Kaiser-Meyer-Olkin measure of sampling adequacy of 0.57, which indicates that PCA is very unlikely to produce well differentiated components. For these reasons, PCA was not carried out on the six indicators.

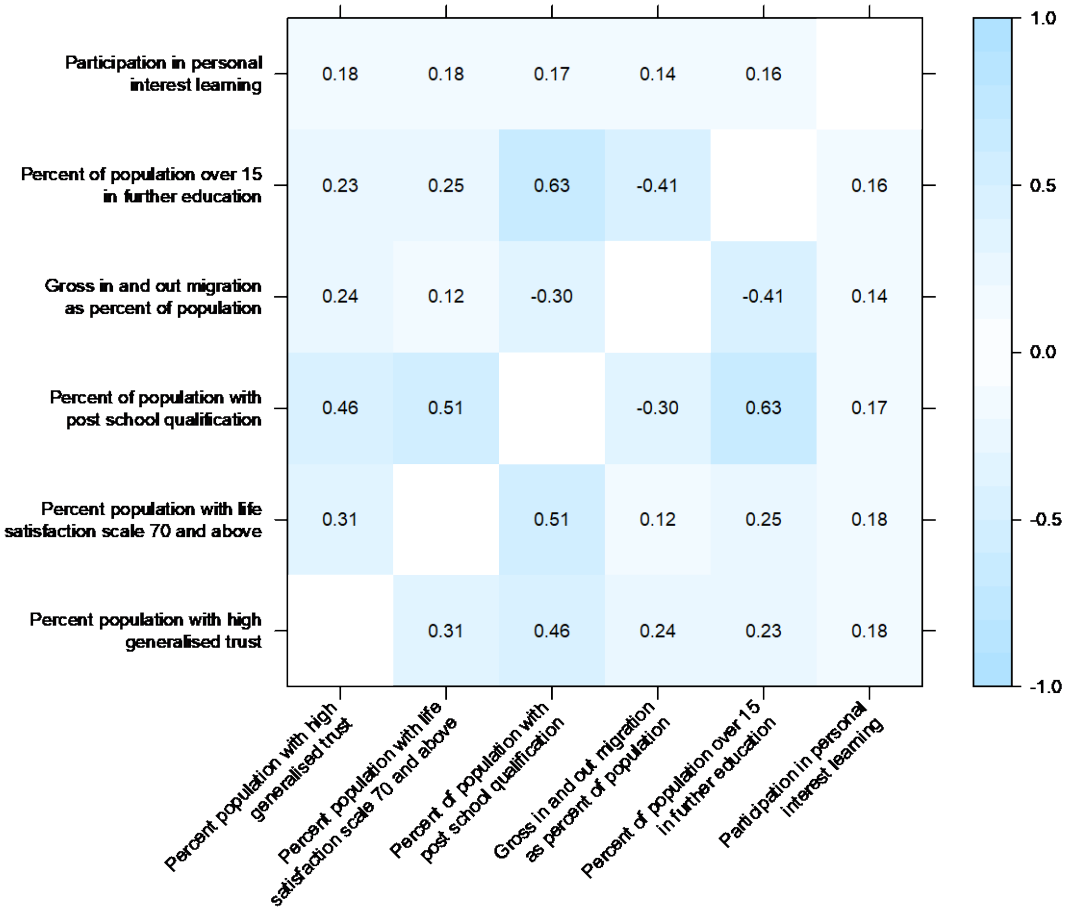


Figure 5.36: Correlation between indicators in the social and community engagement sub-index.

Regressions between each indicator as dependent variable and the remaining indicators as independent variables show that none of the indicators, with the exception of percent of population with a post-school qualification are well predicted by the remaining indicators (Table 5.35). The R^2 of 0.64 for this latter indicator was not considered high enough to warrant removal of this indicator from the indicator set.

Table 5.35: Regression analysis of each social and community engagement indicator as dependent variable against the remaining indicator values as independent variables.

Indicator denoted the dependent variable in the regression	R^2
Percent of population with post school qualification	0.64
Percent of population over 15 in further education	0.45
Gross in and out migration as percent of population	0.41
Percent population with high generalised trust	0.36
Percent population with life satisfaction scale 70 and above	0.35
Participation in personal interest learning	0.08

5.7.3 Measurement model

The six social and community engagement indicators can be, on substantive grounds, formed into three groups. Three of the indicators (percent of population with post-school qualification, percent of population over 15 in further education, and participation in personal interest learning) all relate to participation in education.

Two indicators (life satisfaction scale 70 and above, and trust – total percent agree) could be considered to both be manifestations of a latent social variable, and structured as a reflective model. However, they are not highly correlated as would be expected if both were manifestations of the same latent social variable. For this reason the two indicators were treated as part of a formative model.

After grouping these indicators, there remains a single indicator, gross in and out migration, which is substantively distinct from, and uncorrelated with, the other indicators.

Since the six social and community engagement indicators did not have a strong multi-factor structure and did not have a strong single factor structure, but could be grouped on substantive grounds, a two level formative model for aggregation was chosen.

5.7.4 Aggregation

With a two-level formative model, with two sub-indices and an indicator in the lower level, there are three aggregations to consider. First, the nature of the three educational participation indicators suggests that some compensation among indicators is acceptable. For example, a low percentage of the population with post-school qualifications could be compensated for by a high percentage in further education, since much of the current participation will convert into qualifications in due course. For this reason, the educational participation sub-index was obtained by Ordered Weighted Averaging (OWA) with an orness of 0.375 and a weighting vector of {0.47, 0.32, 0.22} (see Chapter 3).

Life satisfaction and trust were considered to have limited potential for compensatory effects. For example, in peri-urban lifestyle block communities where most residents commute to work and keep to themselves on weekends, low levels of trust would contribute to low resilience, regardless of residents being well off and satisfied with their life. For this reason, the satisfaction and trust sub-index was obtained by OWA with an orness of 0.125 and a weighting vector of {0.88, 0.12} (see Chapter 3).

For the aggregation of the educational participation sub-index, the life satisfaction and trust sub-index and the gross in and out migration indicator, lack of specific knowledge of the nature of possible compensatory effects among these quite disparate indicators precluded the use of the discrete Choquet integral. However, it would seem reasonable to assume that, overall, the potential for compensatory effects is limited. This assumption was reflected in the choice of aggregation by OWA with an orness of 0.125 and a weighting vector of {0.79, 0.17, 0.04} (see Chapter 3).

As expected, the sub-index values obtained with the arithmetic mean tend to be higher than the other aggregation methods (Figure 5.37). The sub-index values for the two-level formative model are generally lower than for the other aggregation methods, reflecting the restraint on compensatory effects imposed by the choice of low orness values in some of the OWA aggregations within the two-level formative model. The sub-index values obtained with geometric mean are pulled down close to zero whenever one of the indicators is close to zero, and this occurs for higher values of the coefficient of variation of the six indicators.

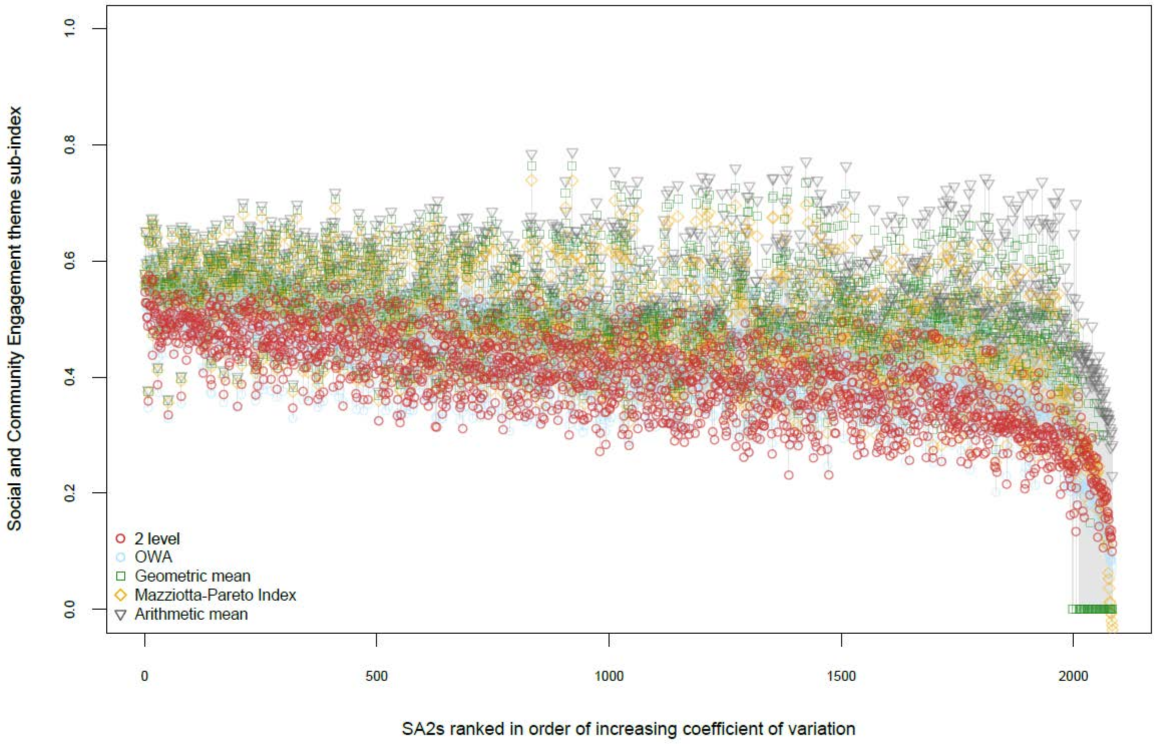


Figure 5.37: Comparison of aggregation methods for the social and community engagement sub-index.

The example SA2s in Table 5.36 show that a high coefficient of variation across the six indicators results in a larger difference between the sub-index calculated with a two level OWA model than that calculated with the simple arithmetic mean of the indicators. This is a consequence of OWA restraining the extent to which high values on some indicators can compensate for low values on other indicators.

Table 5.36: Example SA2s showing social and community engagement sub-index values obtained using different aggregation functions.

Indicator	Rescaled transformed Indicator values	
	High c.v. (Yuendumu - Anmatjere)	Low c.v. (Jindabyne - Berridale)
Percent population with life satisfaction scale 70 and above	0.08	0.54
Percent population with high generalised trust	0.73	0.63
Gross in and out migration as percent of population	0.52	0.54
Percent of population with post school qualification	0.01	0.54
Percent of population over 15 in further education	0.37	0.60
Participation in personal interest learning	0.00	0.62
Social and Community Engagement theme sub-index (2 level OWA)	0.11	0.55
Social and Community theme sub-index (Arithmetic mean)	0.28	0.58
Coefficient of variation	1.06	0.07

5.7.5 Mapped social and community engagement sub-index

The mapped output of the social and community engagement sub-index is shown in Figure 5.38. Maps showing State/Territory and major metropolitan area resolution are provided in Appendix 5N.

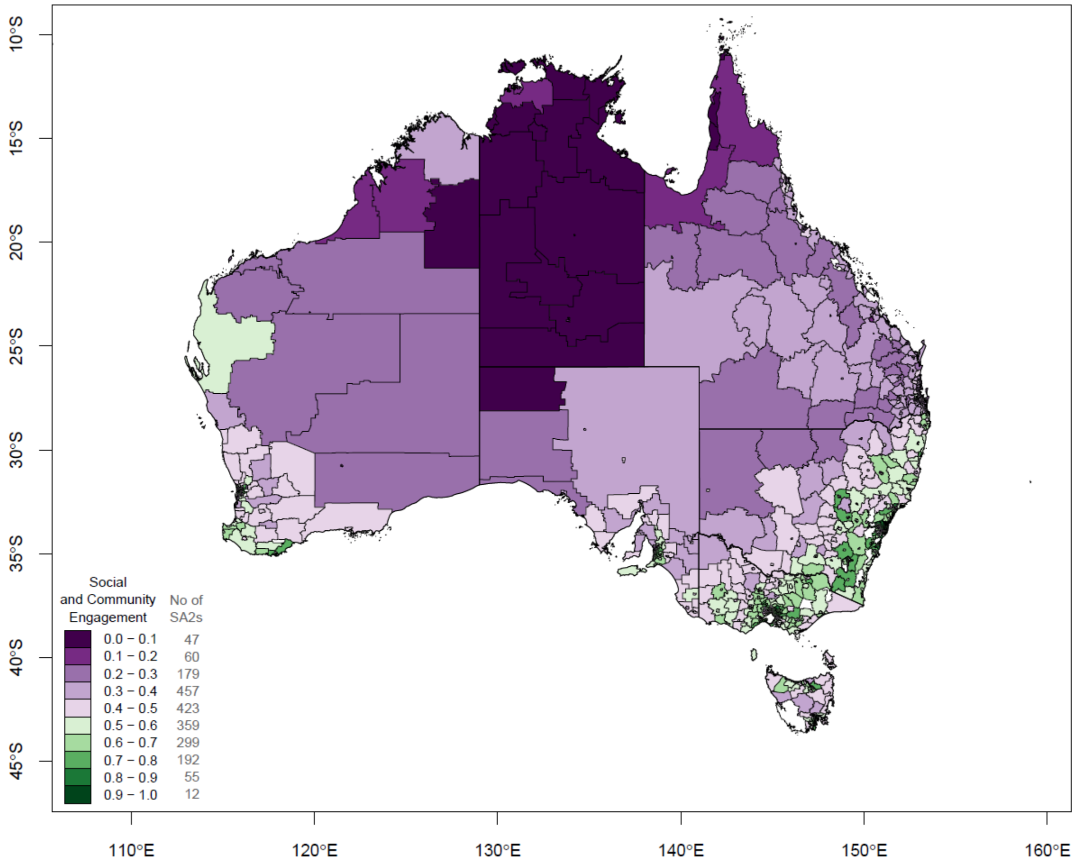


Figure 5.38: Mapped output of the social and community engagement sub-index at a national level.

5.7.6 Indicator relationships with composite index

5.7.6.1 National level

The correlations at national level between individual indicators and the social and community engagement sub-index are shown in Table 5.37. The magnitude of the correlation gives guidance as to which indicators have the most influence on the value of the social and community engagement sub-index. The corresponding scatter plots and histograms are given in Figure 5.39.

Gross in and out migration and percent population with life satisfaction scale 70 and above have the most influence of the value of the social and community engagement sub-index (Table 5.37). This means that, nationally, high values of the sub-index are likely to be associated with relatively low values of the former indicator and high values of the latter. This is reflected in the scatter plots for the two indicators (Figure 5.39).

Table 5.37: Correlations between indicators and the social and community engagement sub-index values, at a national level.

Indicator	Correlation with social and community engagement theme sub-index
Percent population with life satisfaction scale 70 and above	0.58
Percent population with high generalised trust	0.35
Percent of population with post school qualification	0.25
Participation in personal interest learning	0.13
Percent of population over 15 in further education	-0.04
Gross in and out migration as percent of population	-0.69

5.7.6.2 Regional level

Disaggregation of the correlations between indicators and sub-index to SA4 level (larger geographic areas containing around 20 SA2s) shows whether there are any regional differences in the patterns of correlations between indicators that result in corresponding differences in the relationships between indicators and the social and community engagement sub-index (Figure 5.40).

With the exception of gross in and out migration percentage, the scatter plots in Figure 5.40 suggest that the influences of the indicators on the theme sub-index are much the same in metropolitan areas as they are in regional and remote Australia. Gross in and out migration percentage, has a strong negative influence on the theme sub-index in metropolitan areas, but is less influential in regional areas. In remote areas, it has a moderate positive influence on the theme sub-index.

Disaggregation of the correlations between indicators and sub-index to SA4 level is not possible for all the indicators in the social and community engagement theme. The participation in personal interest learning indicator, is based on disaggregation from State level data, and groups of SA2s within a SA4 have the same value for the indicators and/or the theme sub-index.

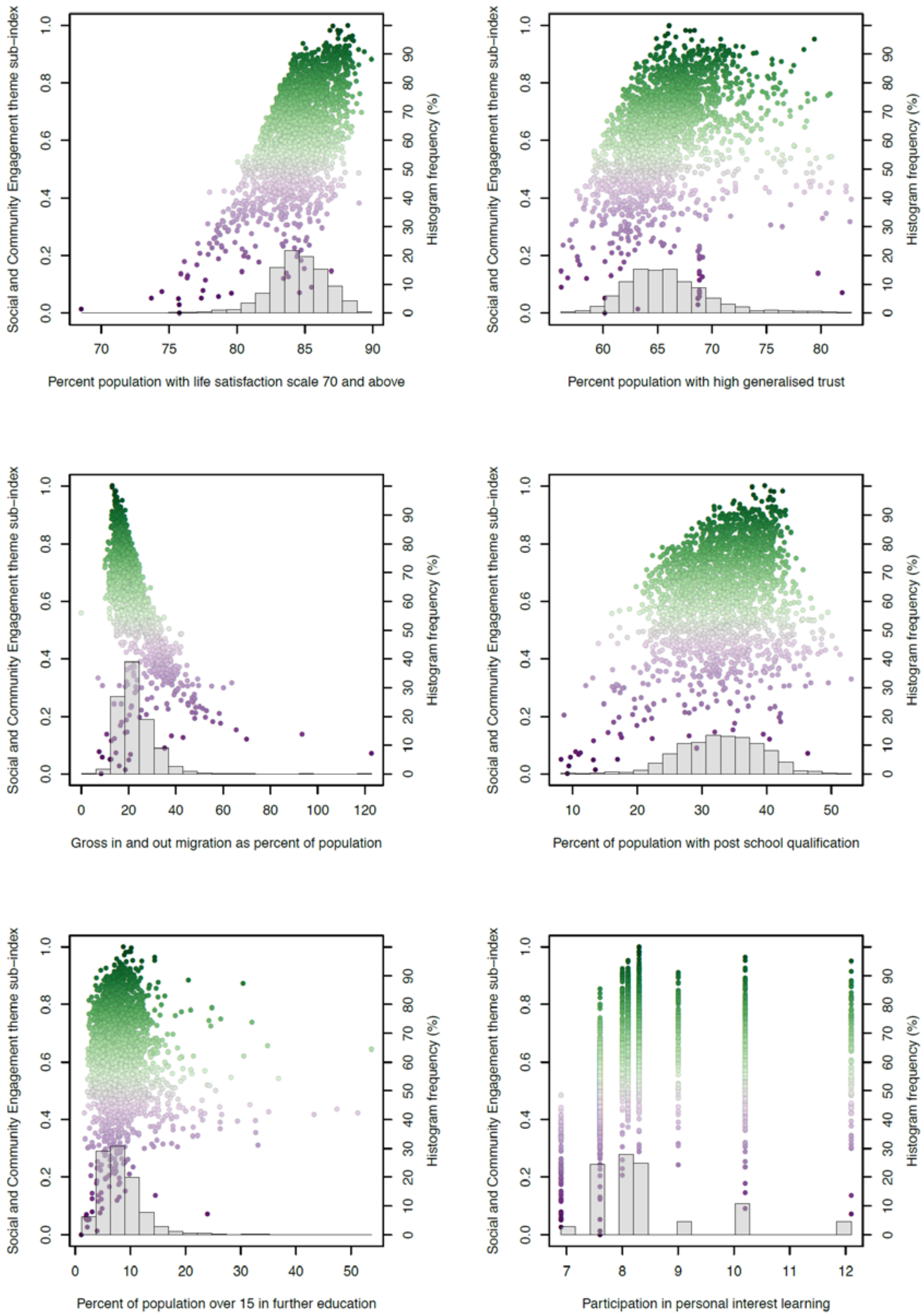


Figure 5.39: Scatterplots showing the relationships between social and community engagement index values and component indicators at a national level. Raw indicator values, without reversal or transformation are used.

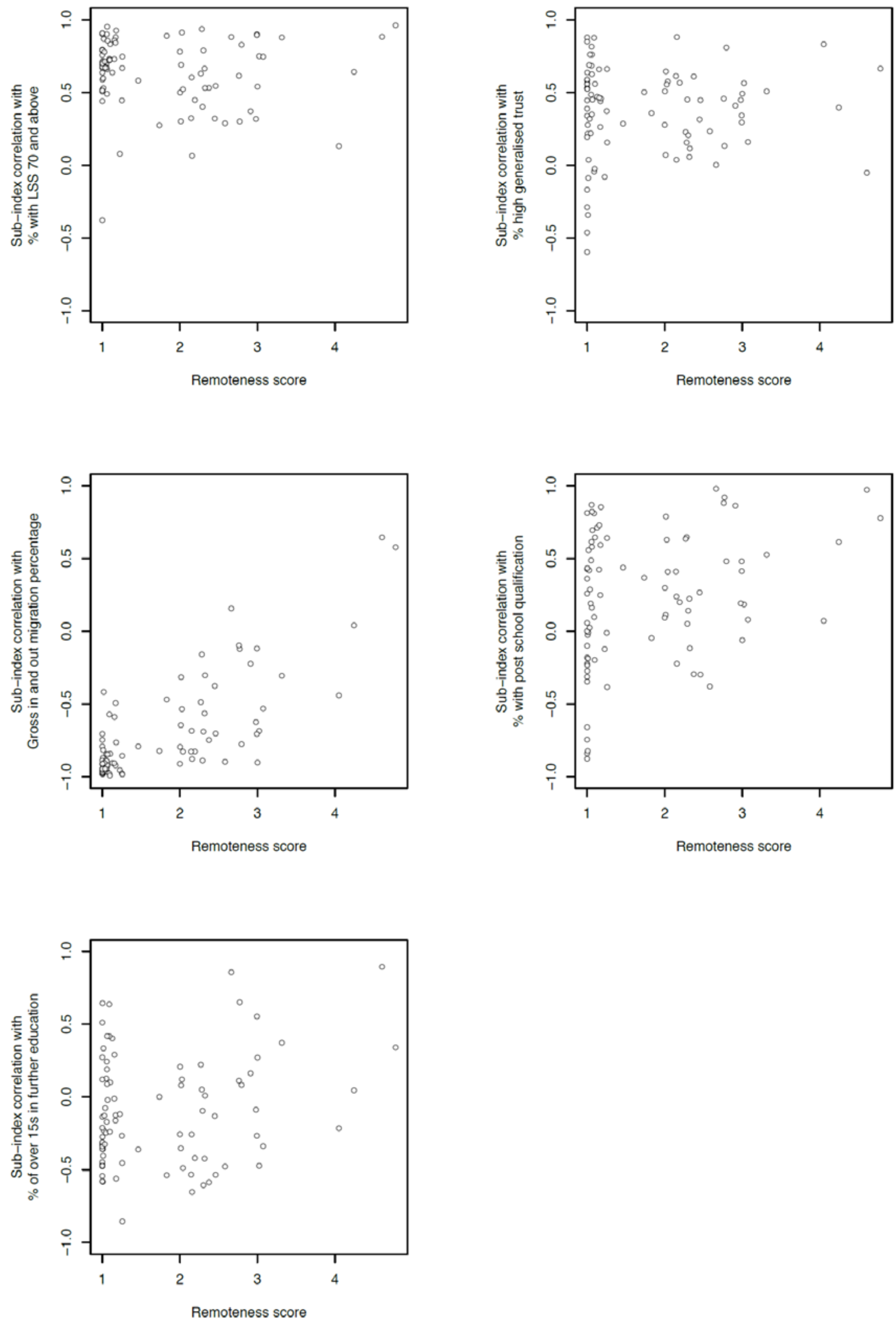


Figure 5.40: Correlation between indicators and social and community engagement sub-index values, at a regional level. Remoteness of 1 is metropolitan areas through to 5, very remote areas.

5.8 GOVERNANCE AND LEADERSHIP

5.8.1 Transformation

The governance and leadership sub-index is calculated by aggregating the governance and leadership indicators. Three of the four indicators required rescaling and transformation before aggregation. Transformation details are shown in Table 5.38 and the results of transformation in Table 5.39. Raw and transformed indicator values are outlined in Appendix 5O.

Table 5.38: Transformation details for indicators used to form the governance and leadership sub-index.

Indicator	Transformation details		
	Skewness transform	Exponent	Coefficient for kurtosis transform
Presence of research organisations	Power transform	0.00	0.00
Business Dynamo Sub-index	Power transform	0.48	0.32
Local economic development support	Power transform	0.64	0.00
Governance, policy and leadership score	No transform	-	-

Table 5.39: Transformation results for indicators used to form the governance and leadership sub-index.

Indicator	Raw data pre-transform			Post-transform		
	Skewness	Kurtosis	Outliers	Skewness	Kurtosis	Outliers
Presence of research organisations	10.44	183.02	18	0.16	-1.98	0
Business Dynamo Sub-index	1.07	2.35	12	0.10	0.00	6
Local economic development support	0.89	1.14	0	-0.00	-0.01	0
Governance, policy and leadership score	-0.61	-1.20	0	-0.61	-1.20	0

5.8.2 Correlation

The correlation plot shows that the four indicators are only weakly correlated with each other (Figure 5.41). This is confirmed by a Kaiser-Meyer-Olkin measure of sampling adequacy is only 0.49, which indicates that PCA is very unlikely to produce well differentiated components. For these reasons, PCA was not carried out on the four indicators.

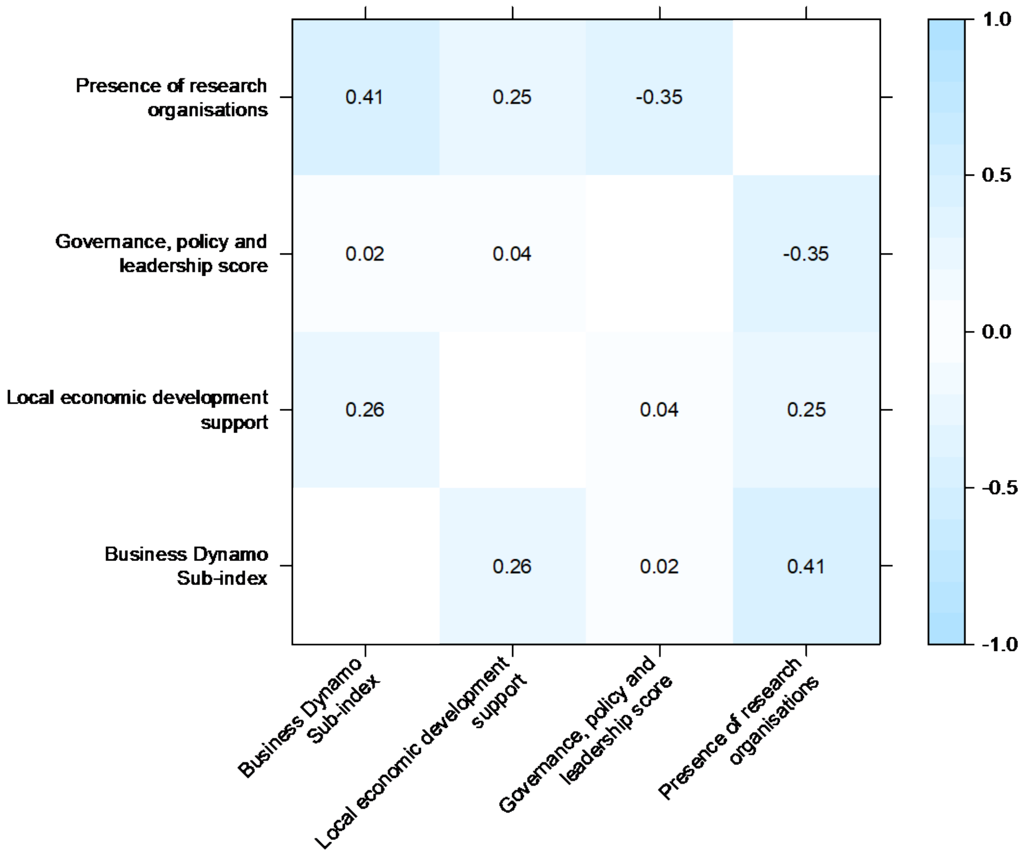


Figure 5.41: Correlation between indicators in the governance and leadership sub-index.

Regressions between each indicator as dependent variable and the remaining indicators as independent variables show that none of the indicators are well predicted by the remaining indicators (Table 5.40).

Table 5.40: Regression analysis of each governance and leadership indicator as dependent variable against the remaining indicator values as independent variables.

Indicator denoted the dependent variable in the regression	R^2
Presence of research organisations	0.33
Business Dynamo Sub-index	0.22
Governance, policy and leadership score	0.17
Local economic development support	0.10

5.8.3 Measurement model

Since the four governance and leadership indicators did not have a strong multi-factor structure, did not have a strong single factor structure, and could not be grouped on substantive grounds, a simple formative model for aggregation was chosen.

5.8.4 Aggregation

The nature of the governance and leadership indicators suggests that some compensation among indicators is acceptable. Indeed, the motivation behind local economic development support is the idea that this support can compensate for other disadvantages that a community might suffer. Accordingly, the governance and leadership sub-index was obtained by Ordered Weighted Averaging with an orness of 0.375. This results in a weighting vector of {0.37, 0.28, 0.20, 0.15} (see Chapter 3).

As expected, the sub-index values obtained with the arithmetic mean tend to be higher than the other aggregation methods (Figure 5.42). Except where the coefficient of variation across indicators is low, the Mazziotta-Pareto Index lies well below the other methods of aggregation, producing negative values when the coefficient of variation is large. The sub-index values obtained with the geometric mean are pulled down close to zero whenever one of the indicators is close to zero, and this occurs for higher values of the coefficient of variation of the four indicators. Due to the governance and leadership score only being defined at State level, there are groups of SA2s with identical sub-index values.

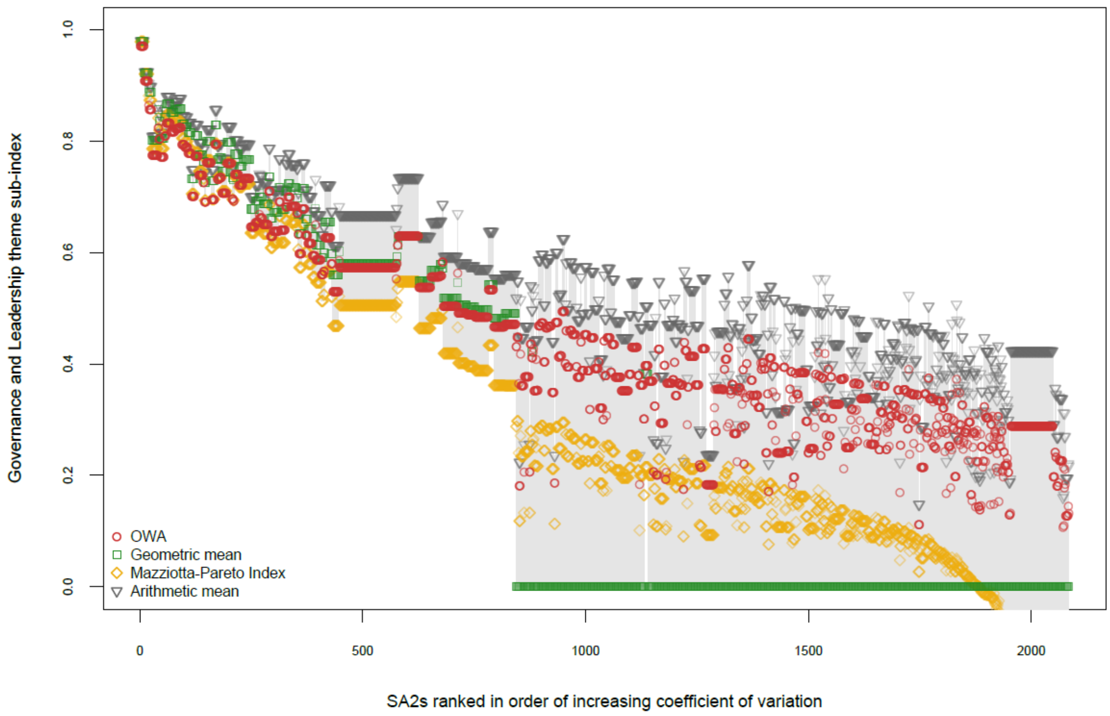


Figure 5.42: Comparison of aggregation methods for the governance and leadership sub-index.

The example SA2s in Table 5.41 show that a high coefficient of variation across the four indicators results in a larger difference between the sub-index calculated with the single level OWA model and that calculated with the simple arithmetic mean of the indicators. This is a consequence of the OWA restraining the extent to which high values on some indicators can compensate for low values on other indicators.

Table 5.41: Example SA2s showing governance and leadership sub-index values obtained using different aggregation functions.

Indicator	Rescaled transformed Indicator values	
	High c.v. (APY Lands)	Low c.v. (Melbourne)
Presence of research organisations	0.00	1.00
Business Dynamo Sub-index	0.00	0.93
Local economic development support	0.06	0.99
Governance, policy and leadership score	0.81	1.00
Governance and Leadership theme sub-index (OWA)	0.13	0.97
Governance and Leadership theme sub-index (Arithmetic mean)	0.22	0.98
Coefficient of variation	1.83	0.04

5.8.5 Mapped governance and leadership sub-index

The mapped output of the governance and leadership index is shown in Figure 5.43. Maps showing State/Territory and major metropolitan area resolution are provided in Appendix 5P.

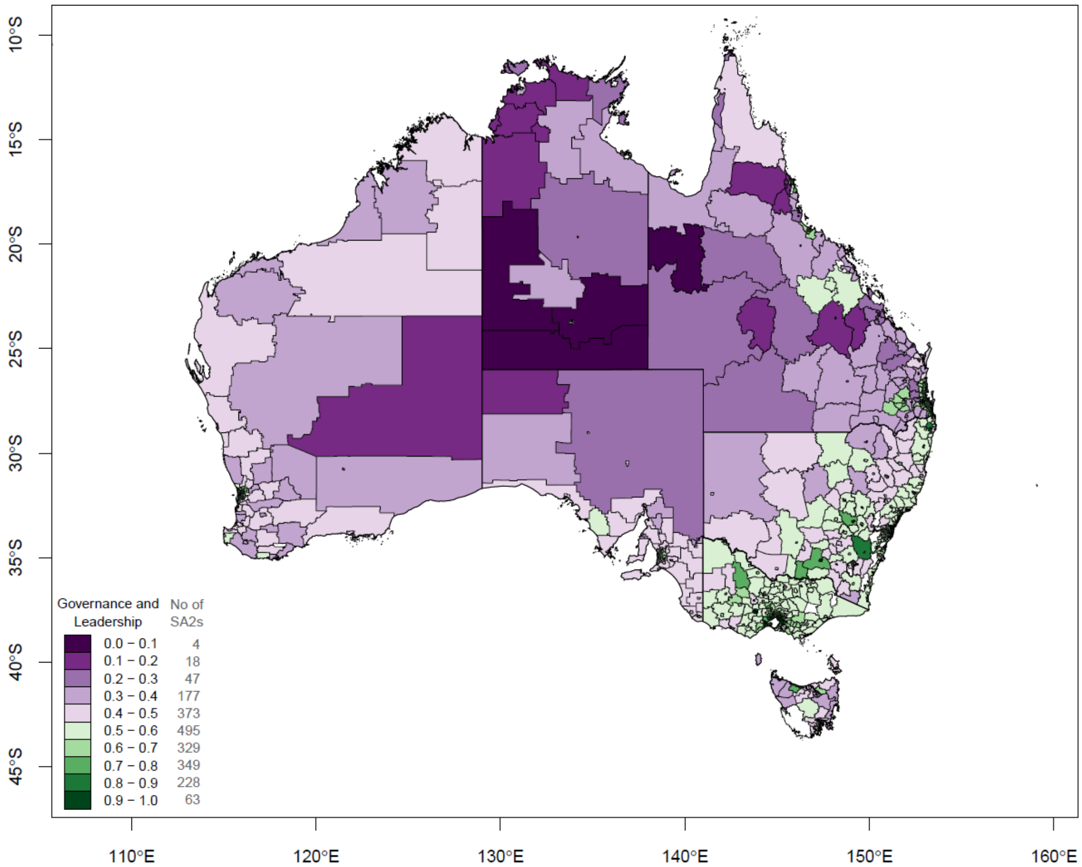


Figure 5.43: Mapped output of the governance and leadership sub-index at a national level.

5.8.6 Indicator relationships with composite index

5.8.6.1 National level

The correlations at national level between individual indicators and the governance and leadership sub-index are shown in Table 5.42. The magnitude of the correlation gives guidance as to which indicators have the most influence on the value of the governance and leadership sub-index. The corresponding scatter plots and histograms are given in Figure 5.44. In both cases, the raw indicator values, without reversal or transformation, are used.

Table 5.42 shows that local economic development support and the business dynamo sub-index indicators have the most influence on the value of the governance and leadership sub-index. This means that, nationally, high values of the sub-index are likely to be associated with relatively high values of these two indicators. This is reflected in the scatter plots for the two indicators (Figure 5.44).

Table 5.42: Correlations between indicators and the governance and leadership sub-index values, at a national level.

Indicator	Correlation with governance and leadership theme sub-index
Local economic development support	0.60
Business Dynamo Sub-index	0.57
Presence of research organisations	0.42
Governance, policy and leadership score	0.23

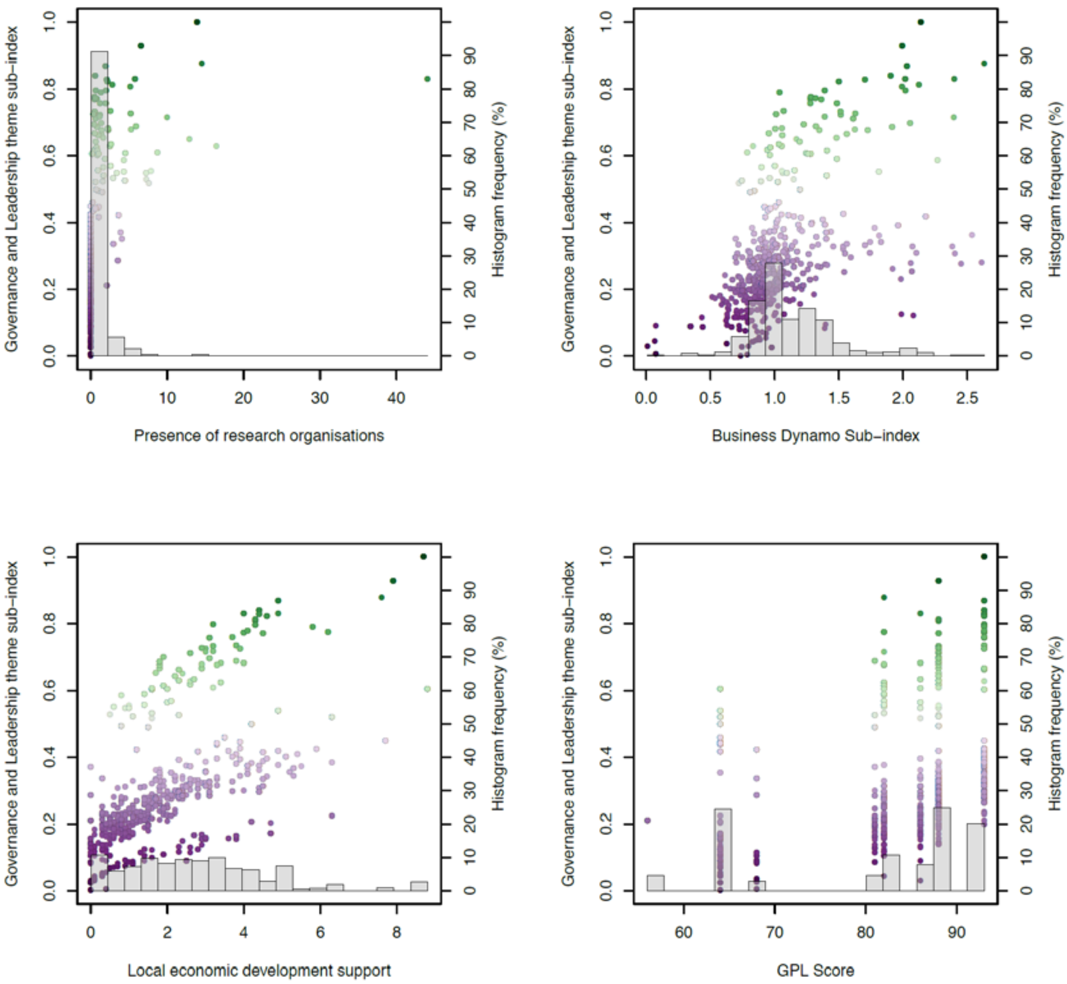


Figure 5.44: Scatterplots showing the relationships between governance and leadership sub-index values and component indicators, at a national level. Raw indicator values, without reversal or transformation are used.

5.8.6.2 Regional level

Disaggregation of the correlations between indicators and sub-index to SA4 level (larger geographic areas containing around 20 SA2s) shows whether there are any regional differences in the patterns of correlations between indicators that result in corresponding differences in the relationships between indicators and the governance and leadership sub-index (Figure 5.45). The scatter plots in Figure 5.45 suggest that the influences of the indicators on the sub-index are much the same in metropolitan areas as they are in regional and remote Australia.

Disaggregation of the correlations between indicators and sub-index to SA4 level is not possible for all the indicators in the governance and leadership theme because for the governance and leadership score, as it is based on disaggregation from State level data, the groups of SA2s within a SA4 have the same value for the indicators and/or the theme sub-index.

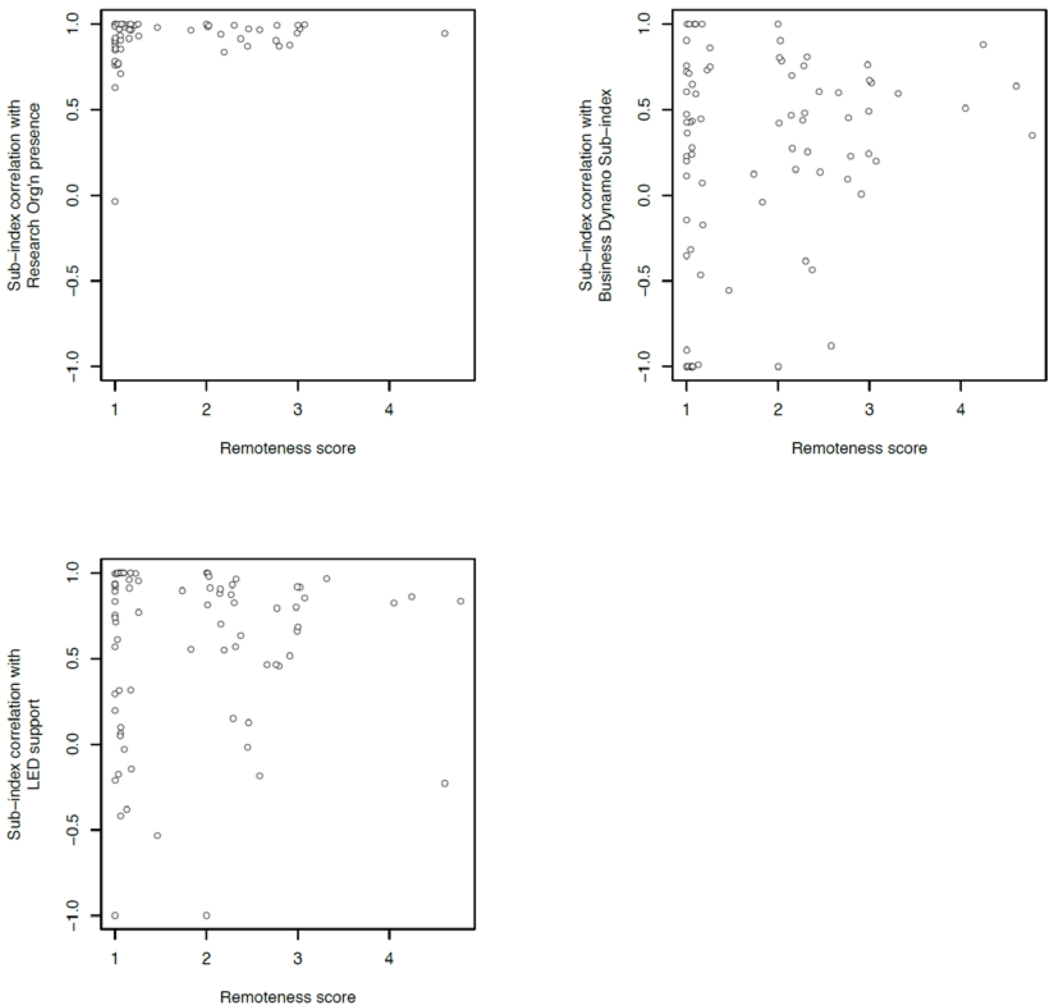
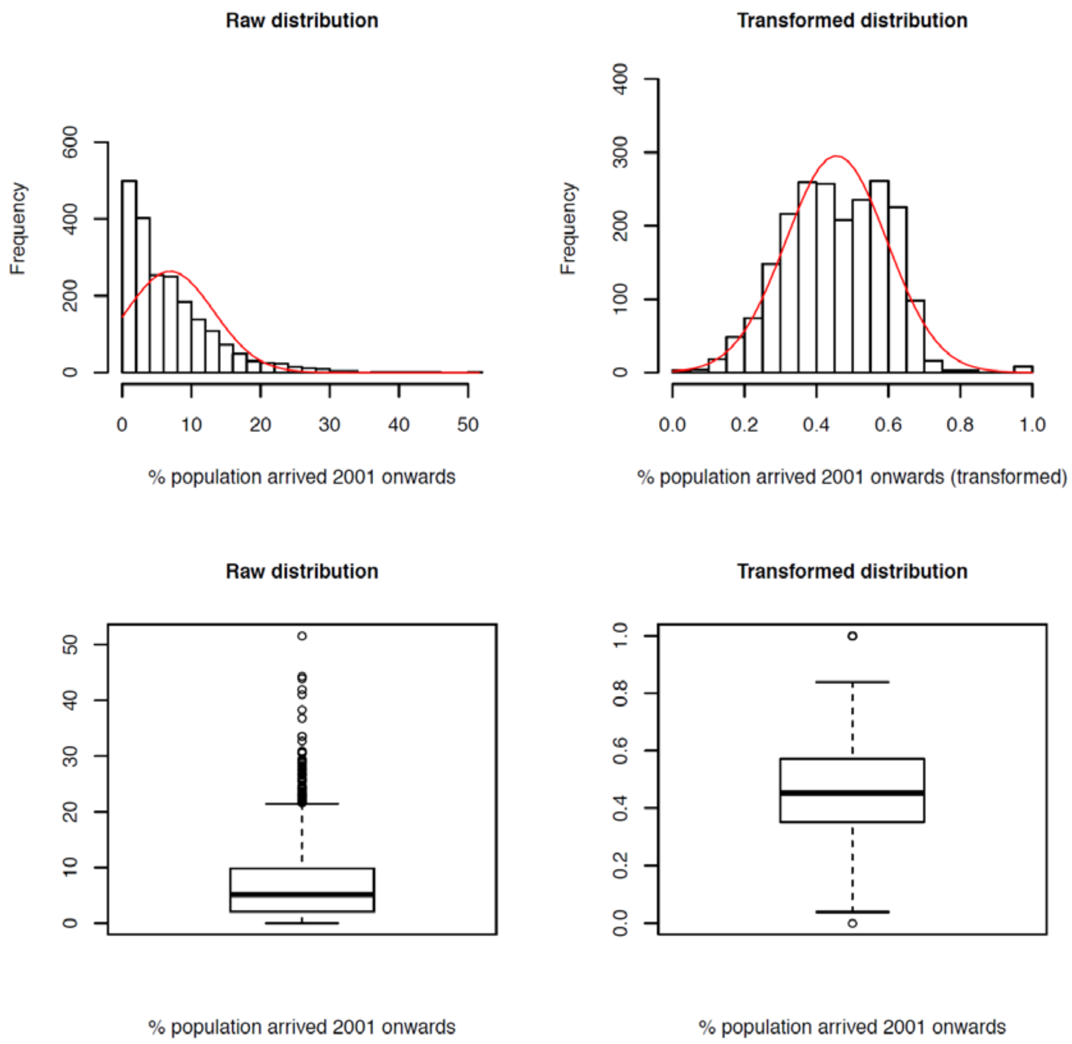


Figure 5.45: Correlation between indicators and the governance and leadership sub-index values, at a regional level. Remoteness of 1 is metropolitan areas through to 5, very remote areas.

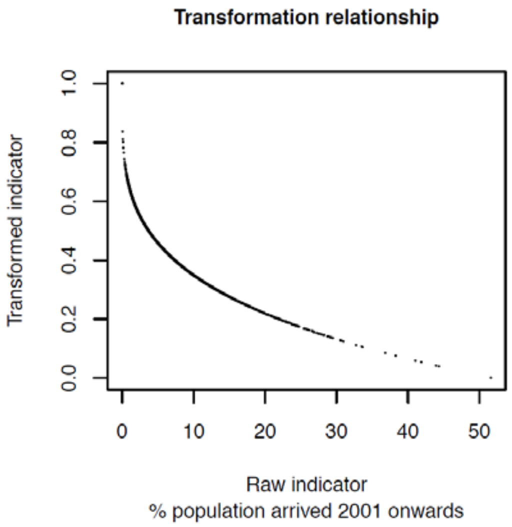
APPENDIX 5A – SOCIAL CHARACTER TRANSFORMATION DETAILS

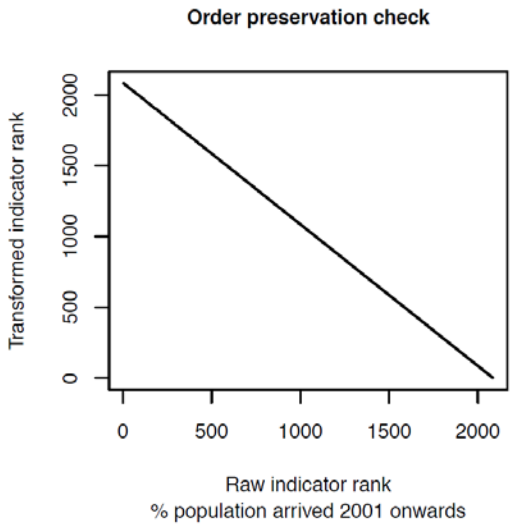
Appendix 5A shows the raw and transformed indicators used to compute the social character sub-index.

Appendix 5A


Raw distribution
Frequency
0
200
400
600
0
10
20
30
40
50
% population arrived 2001 onwards
Transformed distribution
Frequency
0
100
200
300
400
0.0
0.2
0.4
0.6
0.8
1.0
% population arrived 2001 onwards (transformed)
Raw distribution
0
10
20
30
40
50
% population arrived 2001 onwards
Transformed distribution
0.0
0.2
0.4
0.6
0.8
1.0
% population arrived 2001 onwards

Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.26
Pre–transform skewness: 1.8
Post–transform skewness: –0.0

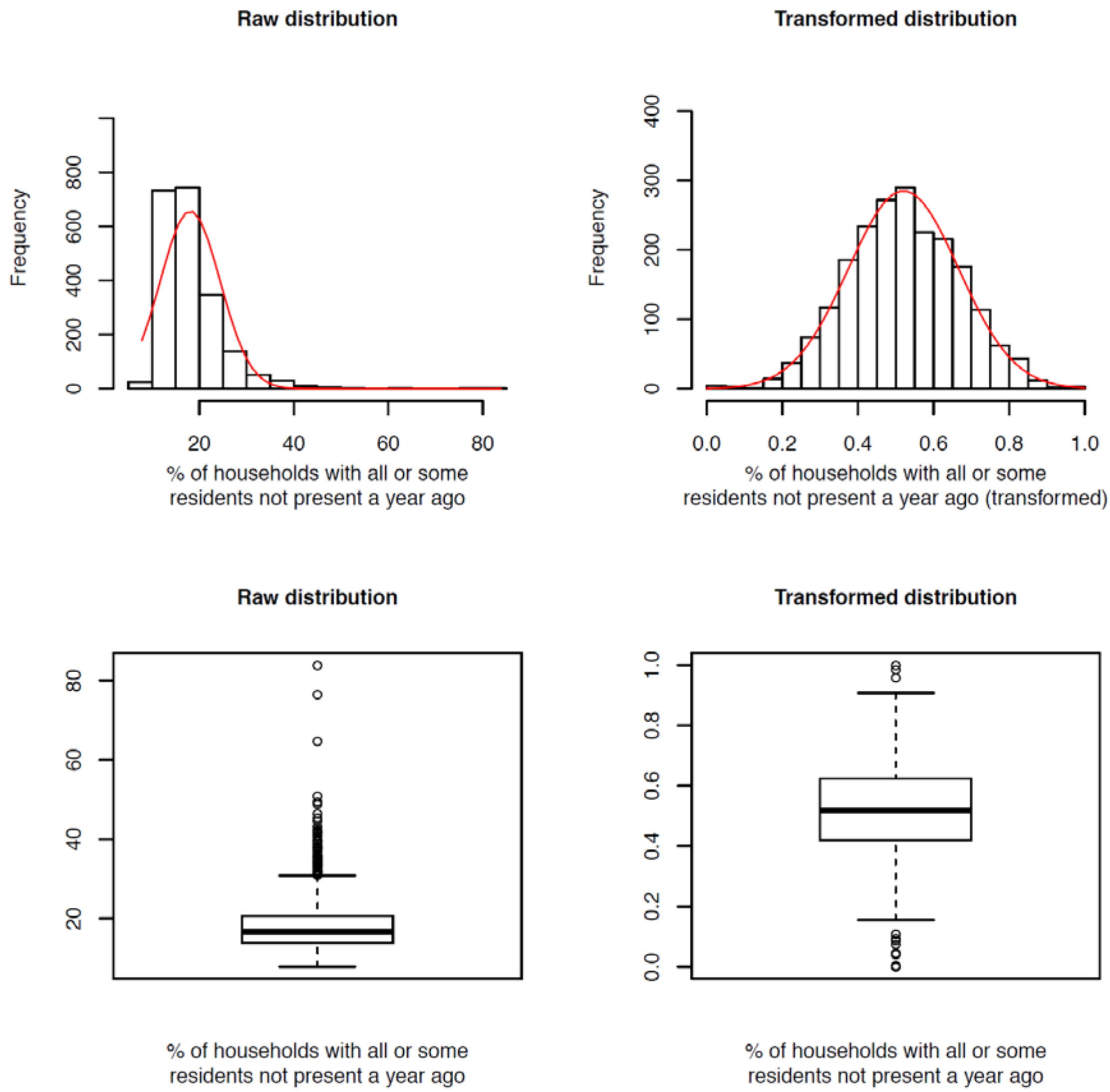
Kurtosis:
Coefficient: 0.01
Pre–transform kurtosis: 4.7
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 25
Post–transform outlier count: 8

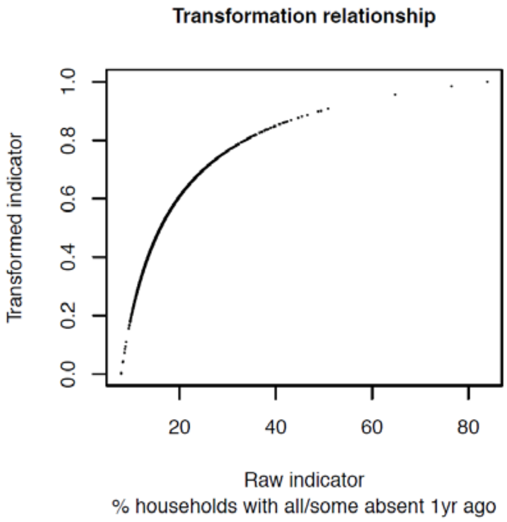
OUTLIER DETAILS

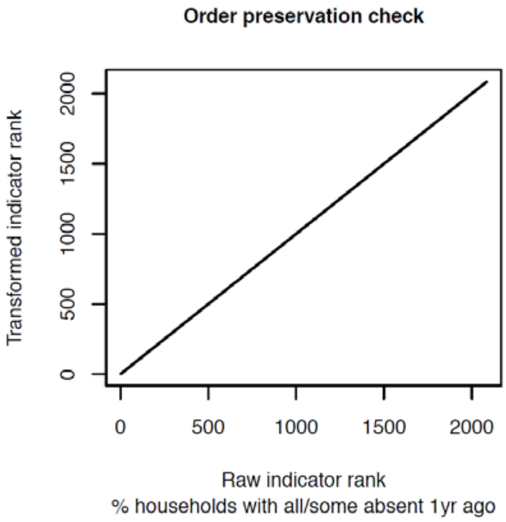
SA2	Value
Yarrabah	0.00
Aurukun	0.00
Kowanyama – Pormpuraaw	0.00
Northern Peninsula	0.00
Palm Island	0.00
Western	0.00
Thamarrurr	0.00
Tiwi Islands	0.00

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: −0.75
Pre−transform skewness: 2.3
Post−transform skewness: 0.0

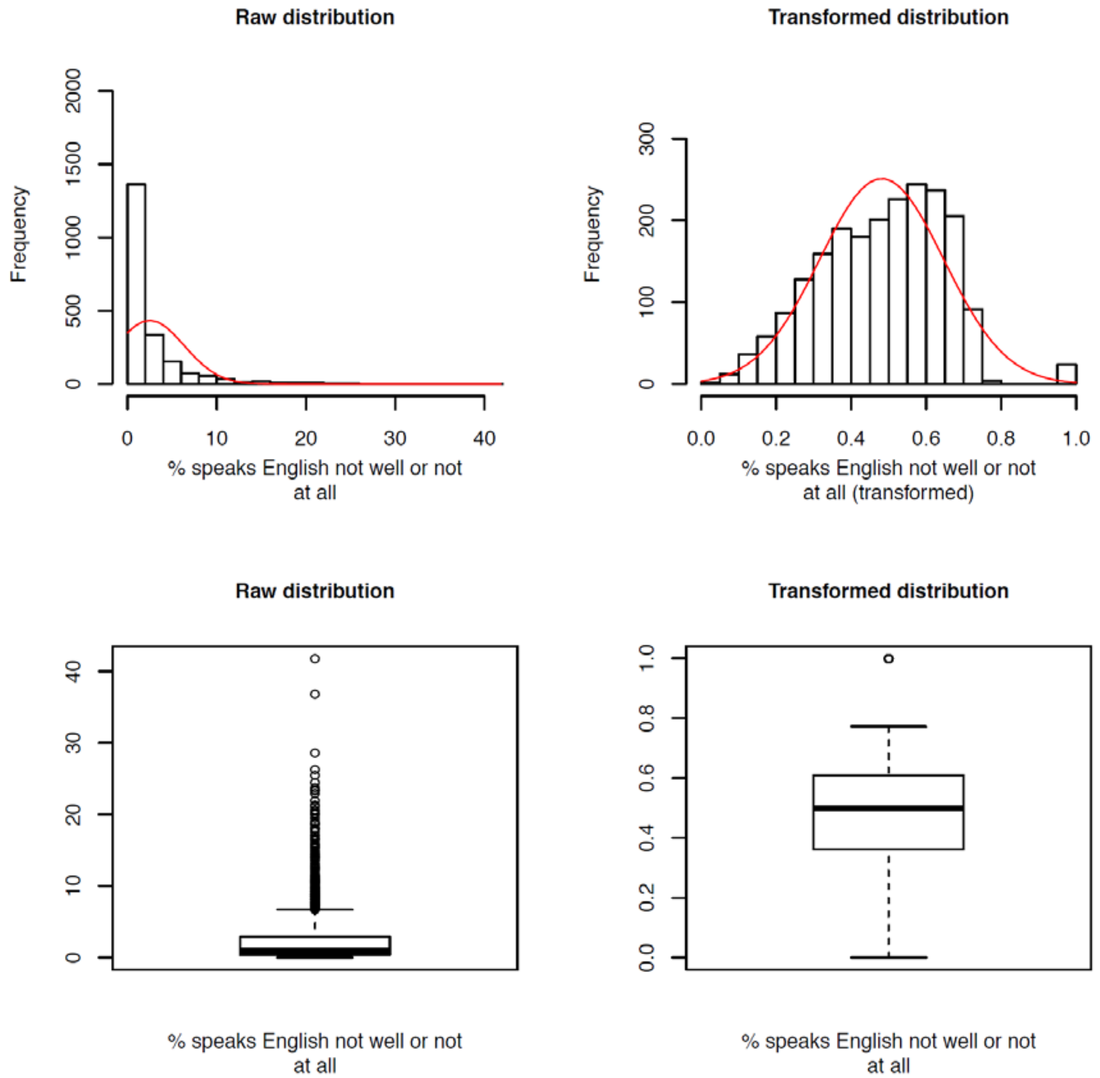
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 12.3
Post−transform kurtosis: −0.1

Outliers:
Pre−transform outlier count: 22
Post−transform outlier count: 4

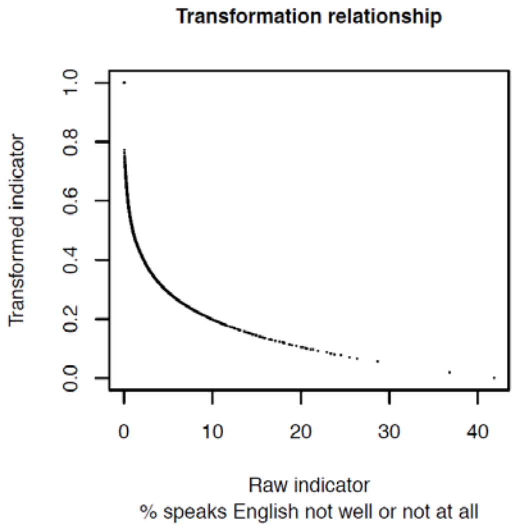
OUTLIER DETAILS

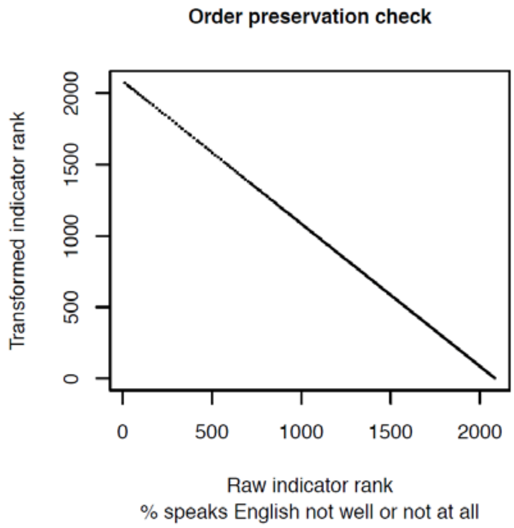
SA2	Value
Wattleup	7.83
One Tree Hill	7.87
Ararat Region	8.19
Crace	83.90

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

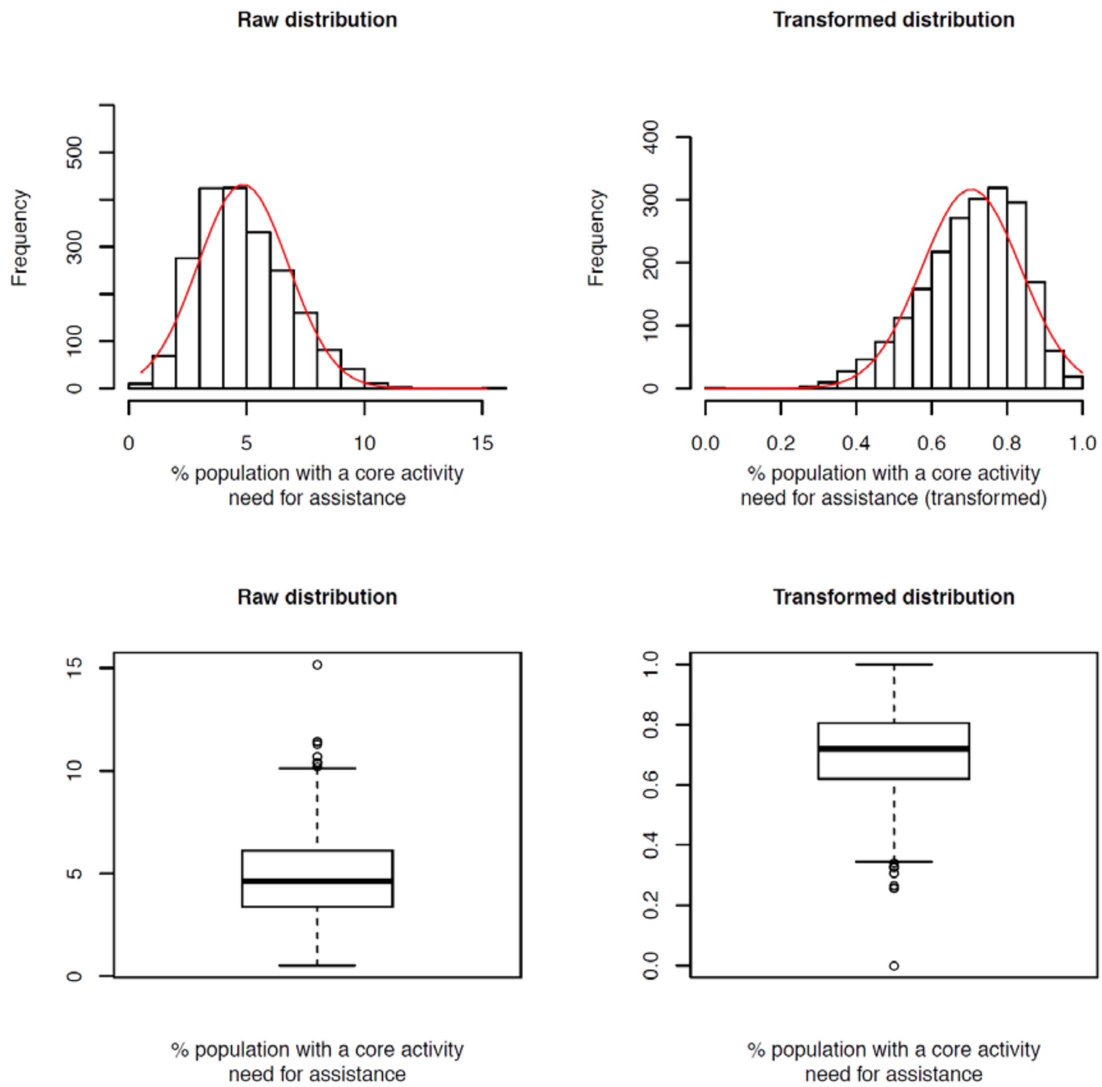
Reversed

Skewness:
Power transform, exponent: 0.18
Pre–transform skewness: 3.4
Post–transform skewness: –0.1

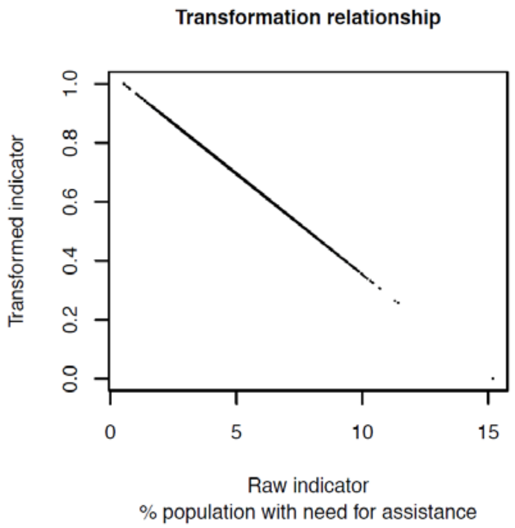
Kurtosis:
Coefficient: 0.23
Pre–transform kurtosis: 16.7
Post–transform kurtosis: 0.0

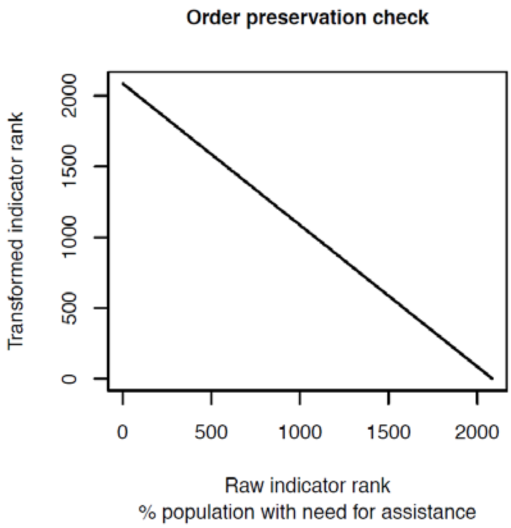
Outliers:
Pre–transform outlier count: 44
Post–transform outlier count: 0

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
No transform
Pre–transform skewness: 0.6
Post–transform skewness: –0.6

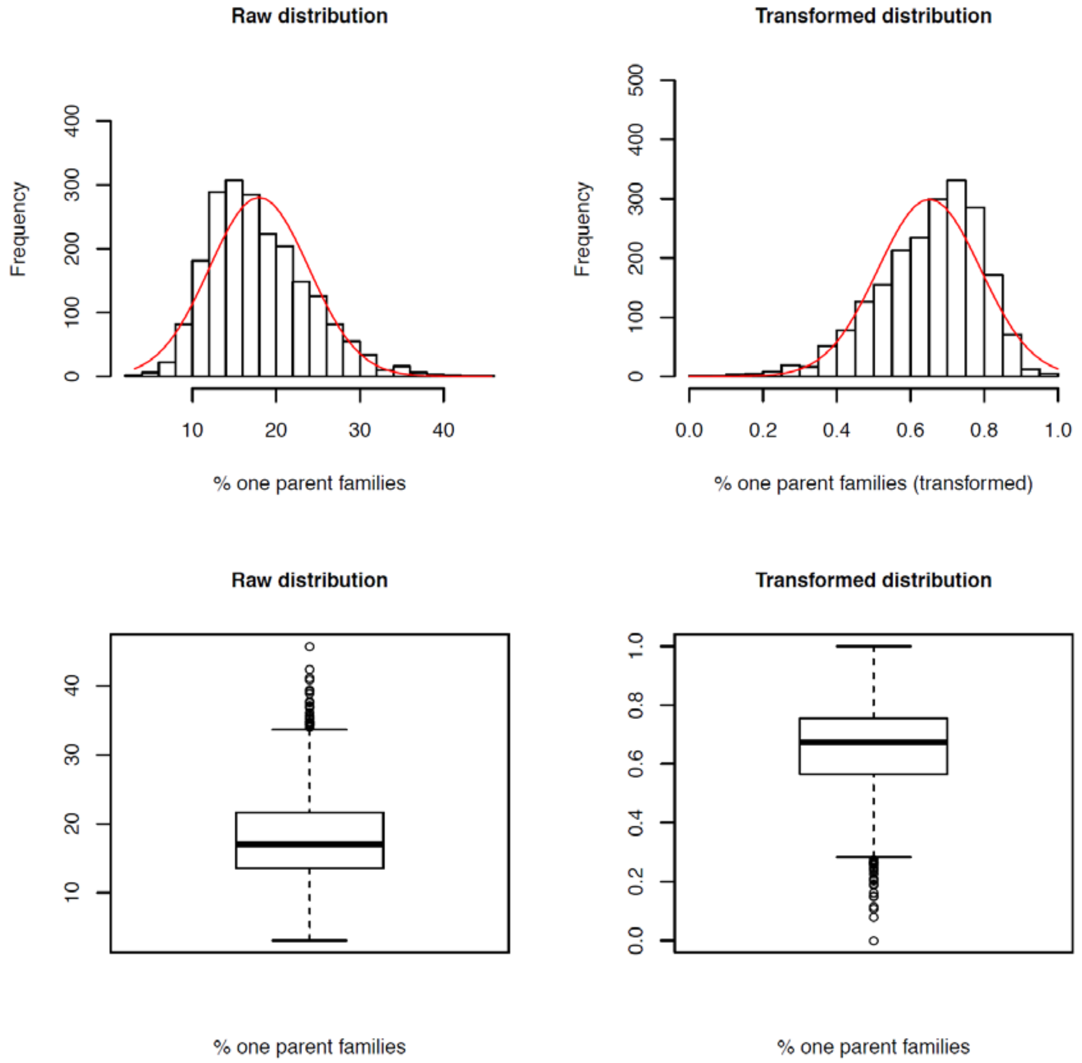
Kurtosis:
No transform
Pre–transform kurtosis: 0.2
Post–transform kurtosis: 0.2

Outliers:
Pre–transform outlier count: 4
Post–transform outlier count: 4

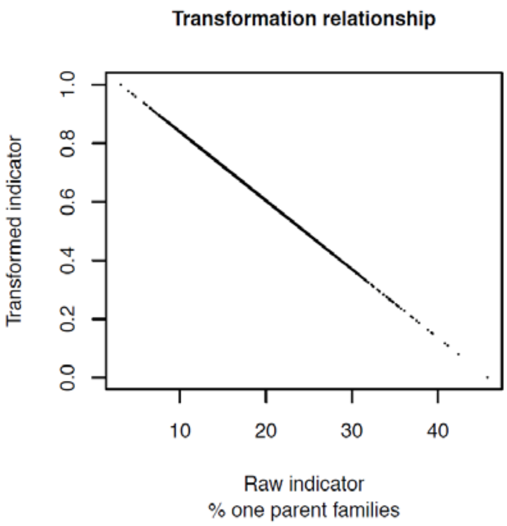
OUTLIER DETAILS

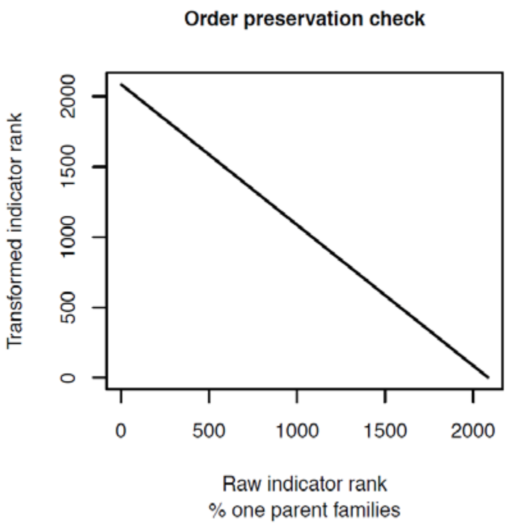
SA2	Value
Riverview	11.29
Point Vernon	11.41
Tuncurry	11.43
Stockton – Fullerton Cove	15.18

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
No transform
Pre−transform skewness: 0.7
Post−transform skewness: −0.7

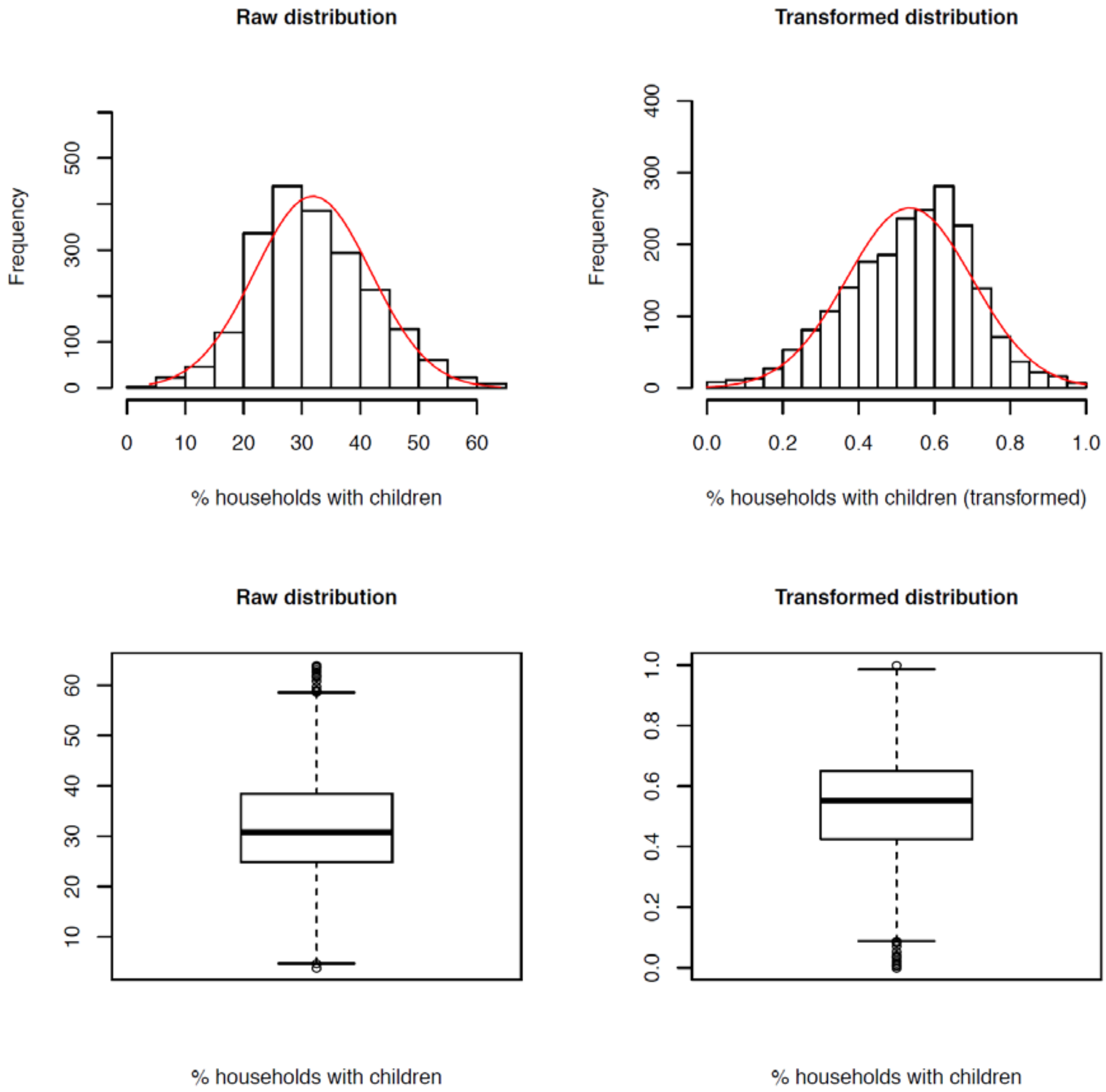
Kurtosis:
No transform
Pre−transform kurtosis: 0.5
Post−transform kurtosis: 0.5

Outliers:
Pre−transform outlier count: 9
Post−transform outlier count: 9

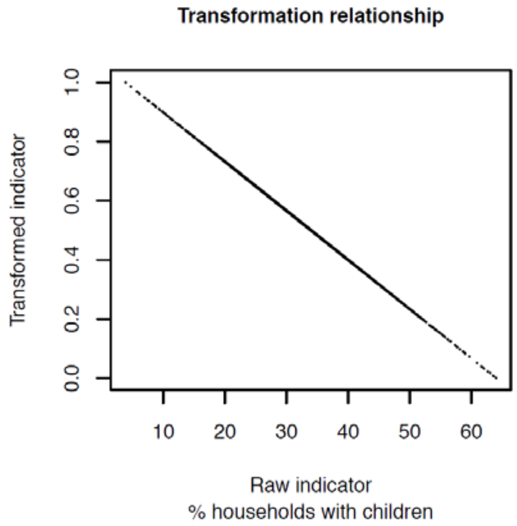
OUTLIER DETAILS

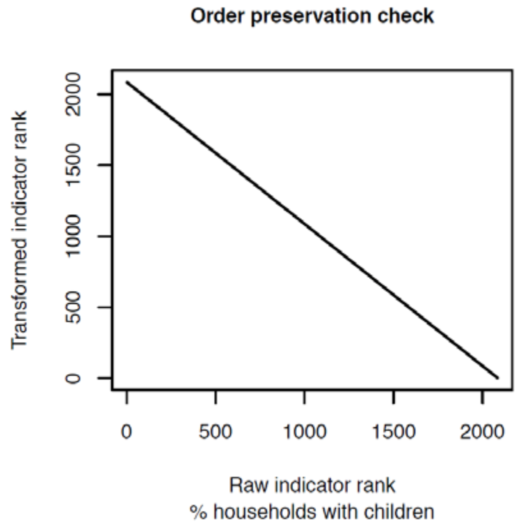
SA2	Value
Riverview	37.50
Smithfield − Elizabeth North	37.77
Caloundra − Kings Beach	38.83
Elizabeth	39.23
Collingwood	39.37
Ravenswood	40.80
Bridgewater − Gagebrook	41.12
Yarrabah	42.36
Manoora	45.74

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

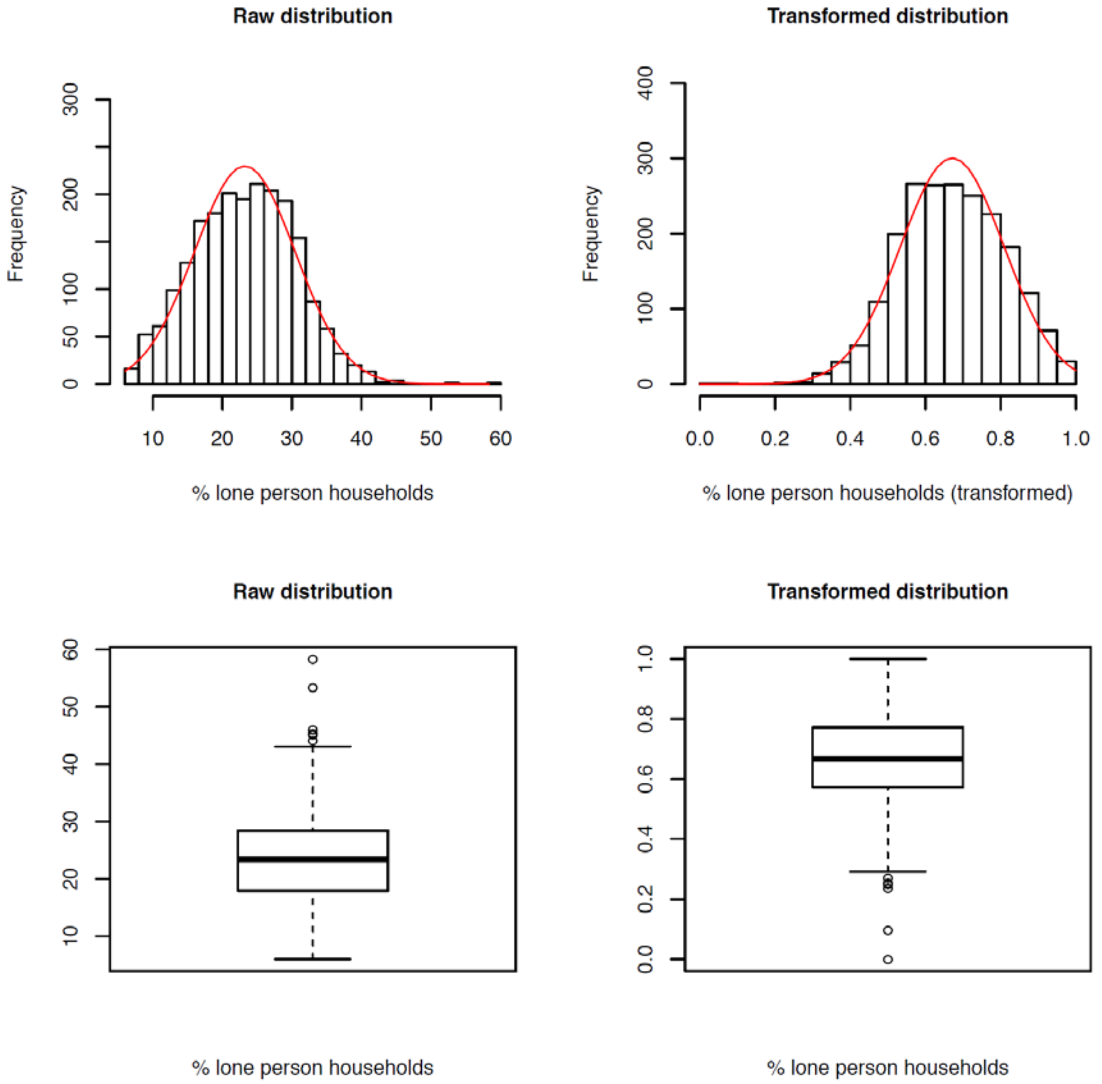
Reversed

Skewness:
No transform
Pre−transform skewness: 0.3
Post−transform skewness: −0.3

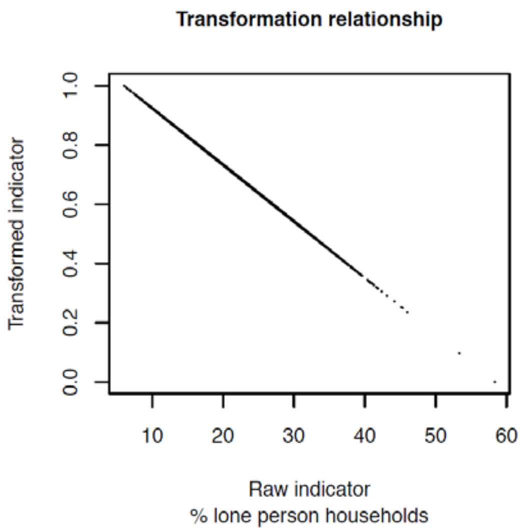
Kurtosis:
No transform
Pre−transform kurtosis: 0.0
Post−transform kurtosis: 0.0

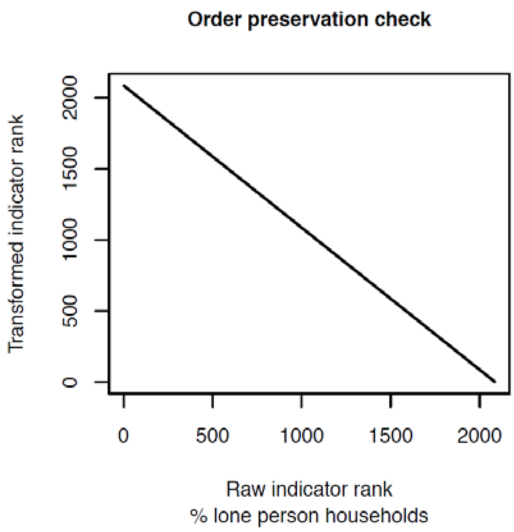
Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
No transform
Pre−transform skewness: 0.1
Post−transform skewness: −0.1

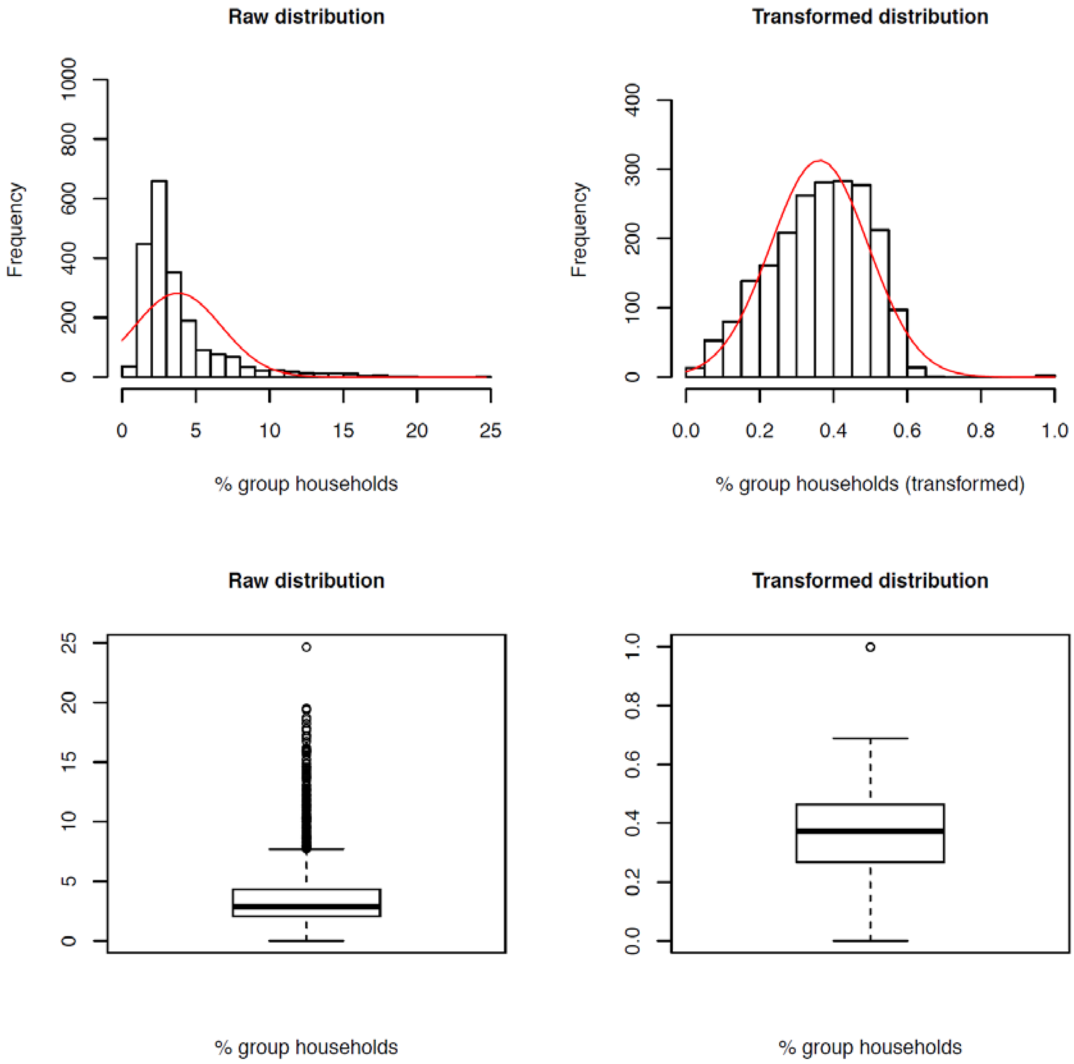
Kurtosis:
No transform
Pre−transform kurtosis: −0.1
Post−transform kurtosis: −0.1

Outliers:
Pre−transform outlier count: 2
Post−transform outlier count: 2

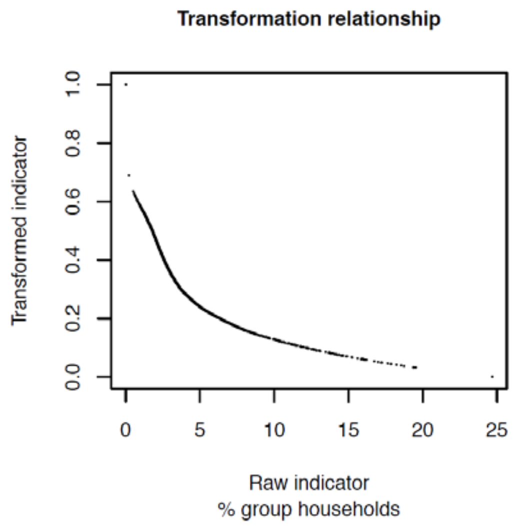
OUTLIER DETAILS

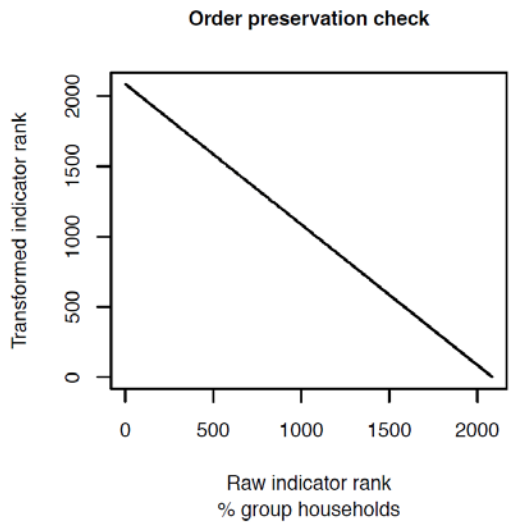
SA2	Value
Potts Point – Woolloomooloo	53.30
ACT – East	58.33

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.18
Pre–transform skewness: 2.5
Post–transform skewness: −0.2

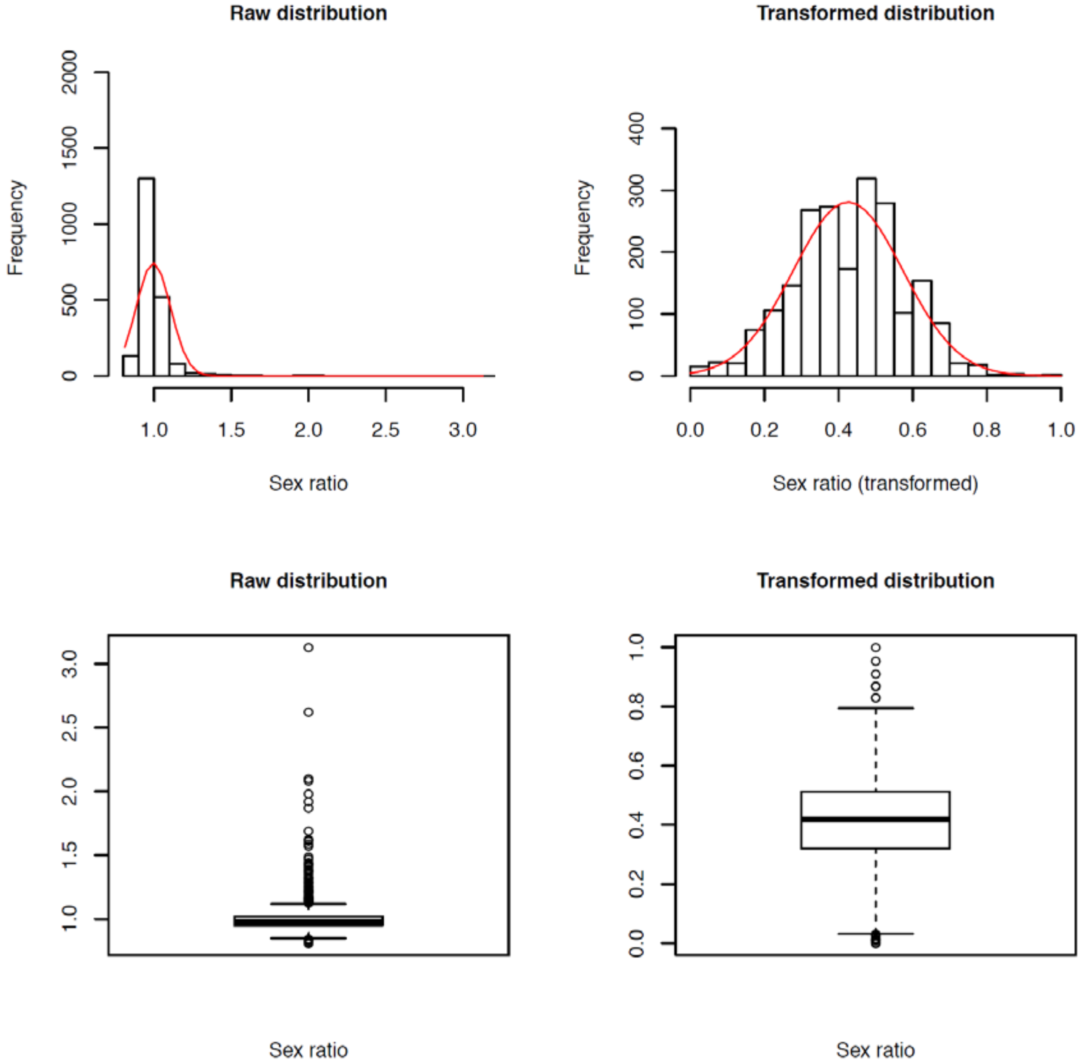
Kurtosis:
Coefficient: 0.34
Pre–transform kurtosis: 7.3
Post–transform kurtosis: −0.0

Outliers:
Pre–transform outlier count: 49
Post–transform outlier count: 3

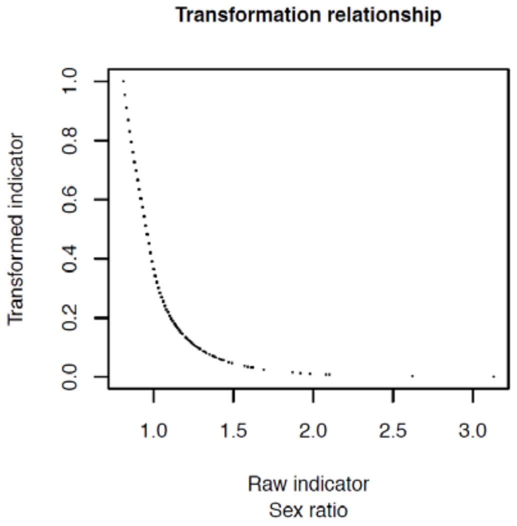
OUTLIER DETAILS

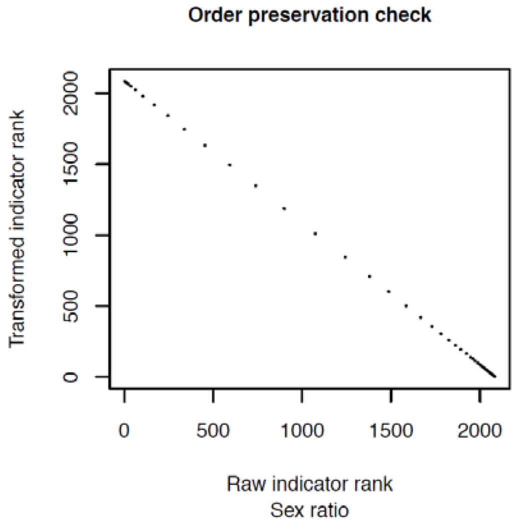
SA2	Value
Western	0.00
Hall	0.00
O'Malley	0.00

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: −4.71
Pre−transform skewness: 7.6
Post−transform skewness: −0.0

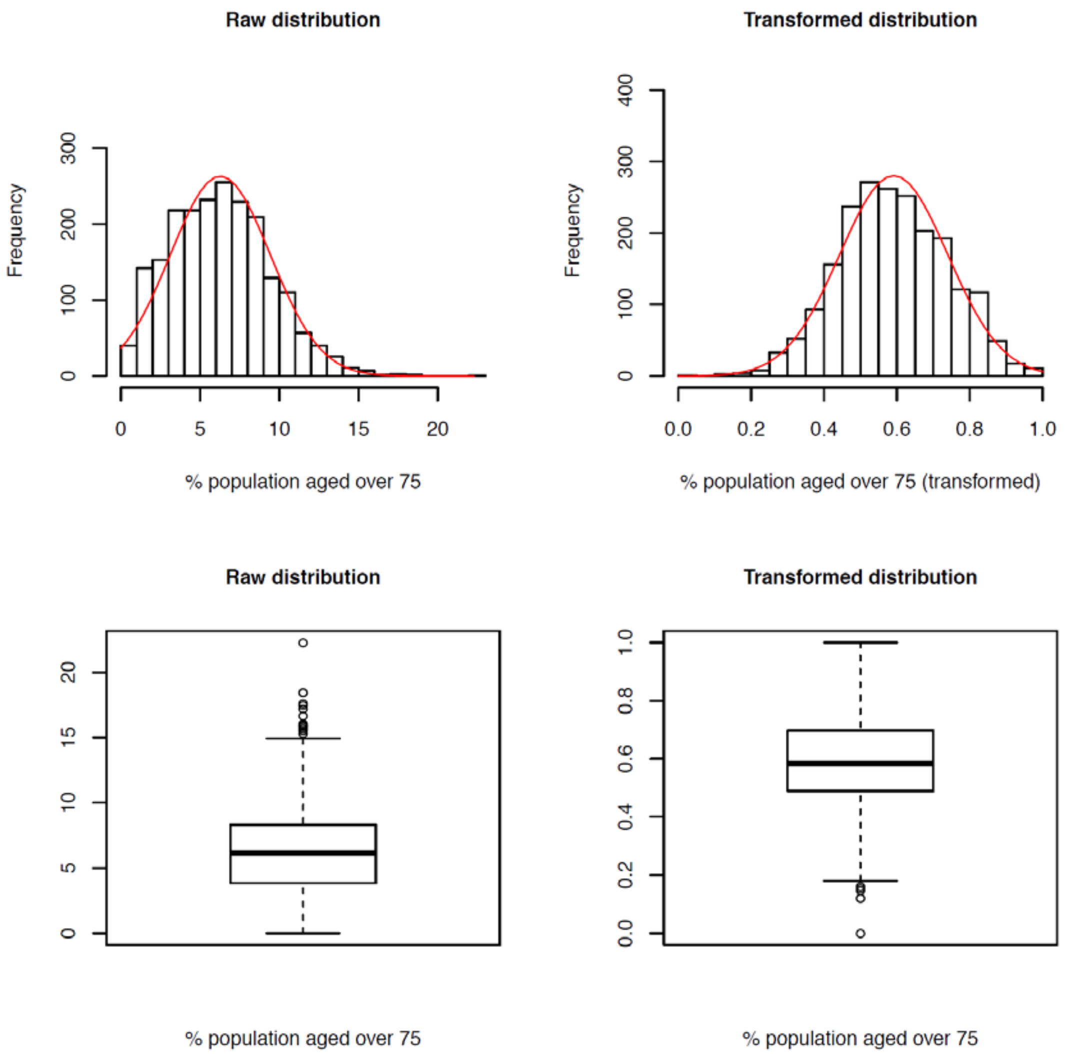
Kurtosis:
Coefficient: 0.20
Pre−transform kurtosis: 103.7
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 26
Post−transform outlier count: 2

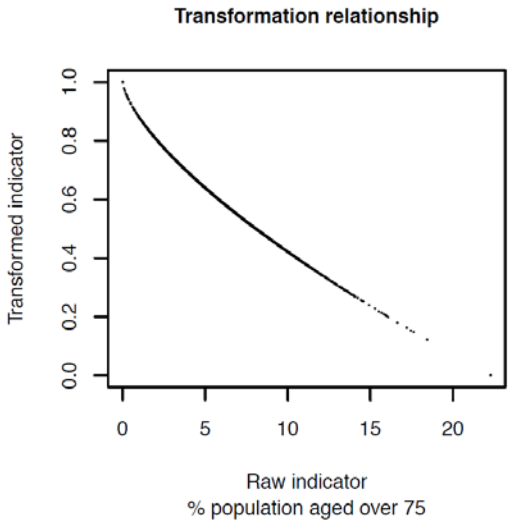
OUTLIER DETAILS

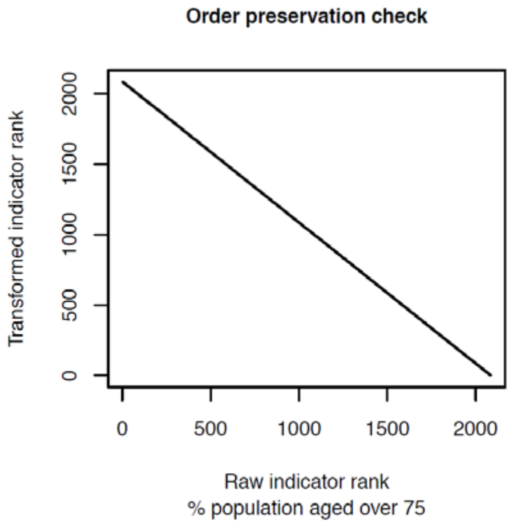
SA2	Value
Deakin	0.81
Woollahra	0.82

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.68
Pre−transform skewness: 0.5
Post−transform skewness: −0.0

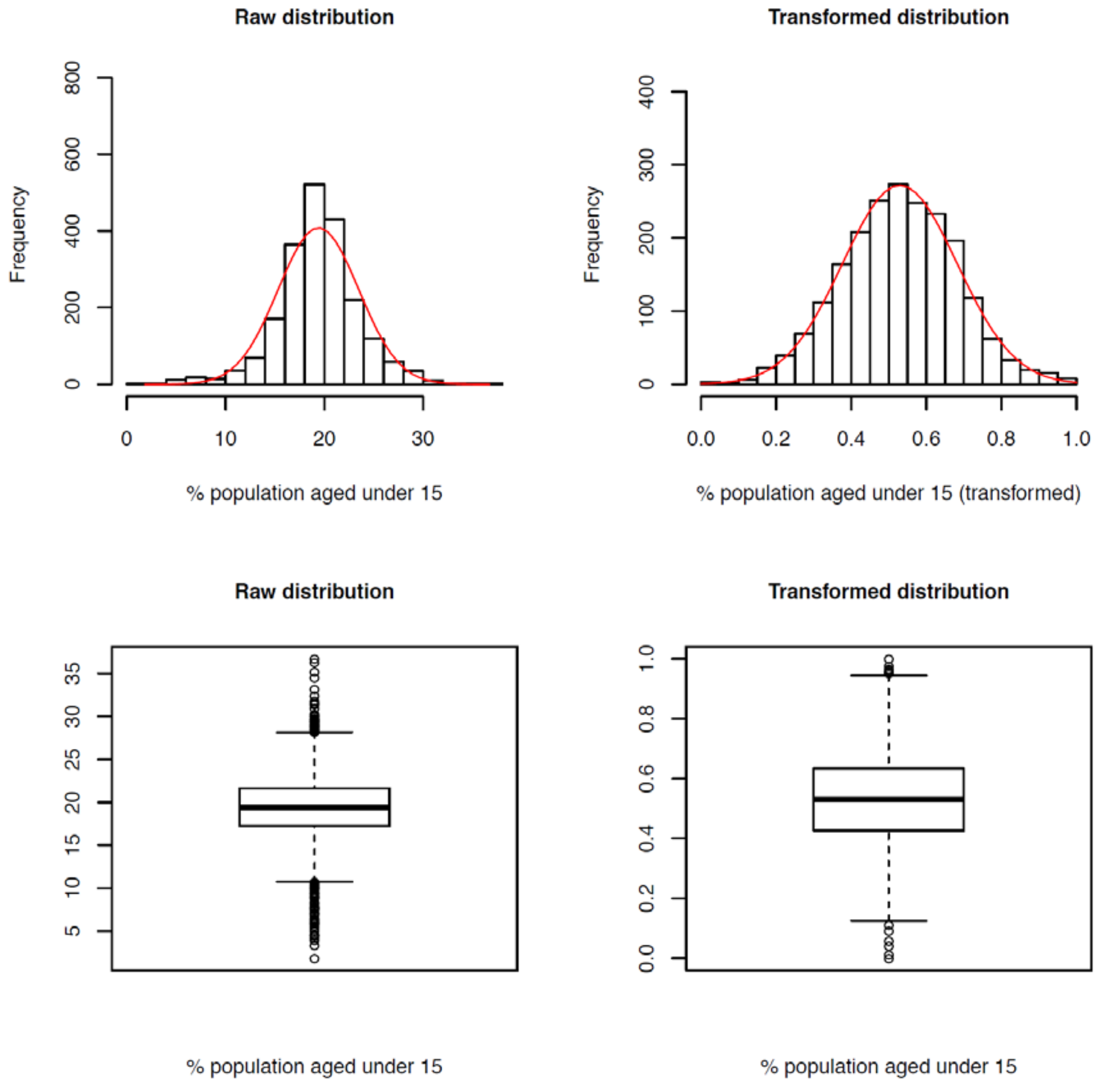
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 0.2
Post−transform kurtosis: −0.2

Outliers:
Pre−transform outlier count: 6
Post−transform outlier count: 1

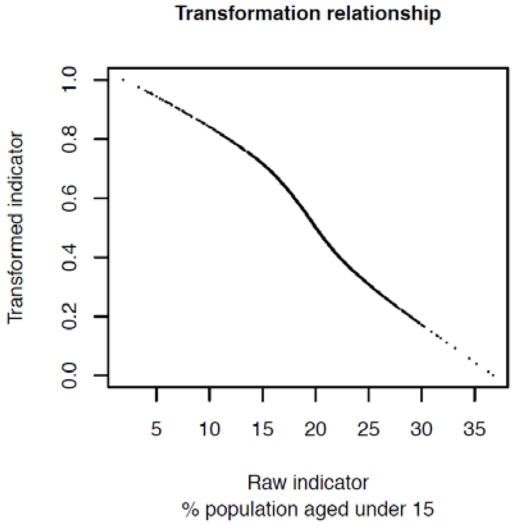
OUTLIER DETAILS

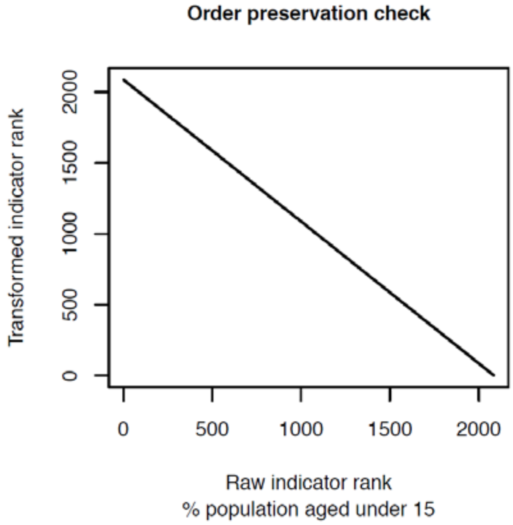
SA2	Value
Tuncurry	22.29

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 1.16
Pre–transform skewness: –0.2
Post–transform skewness: –0.0

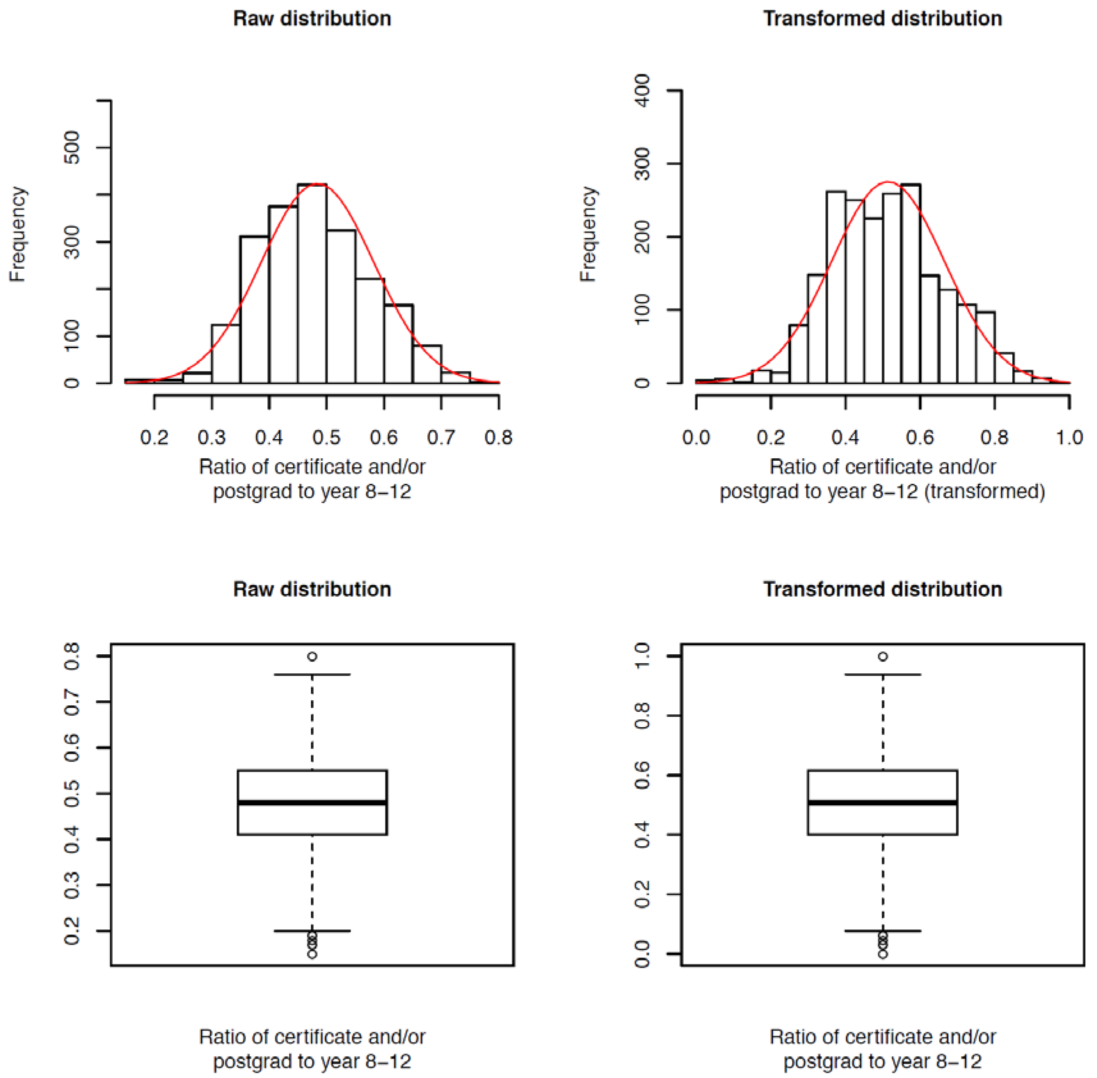
Kurtosis:
Coefficient: 0.27
Pre–transform kurtosis: 1.9
Post–transform kurtosis: 0.0

Outliers:
Pre–transform outlier count: 19
Post–transform outlier count: 2

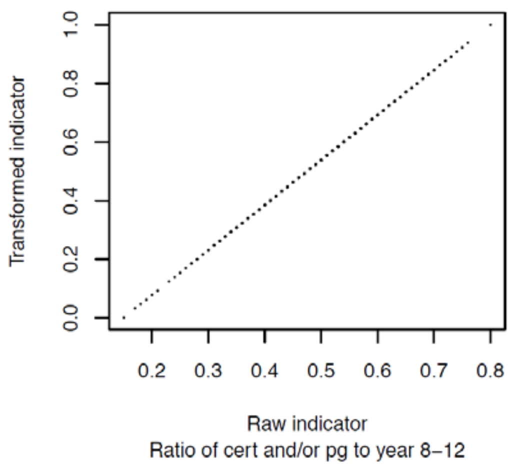
OUTLIER DETAILS

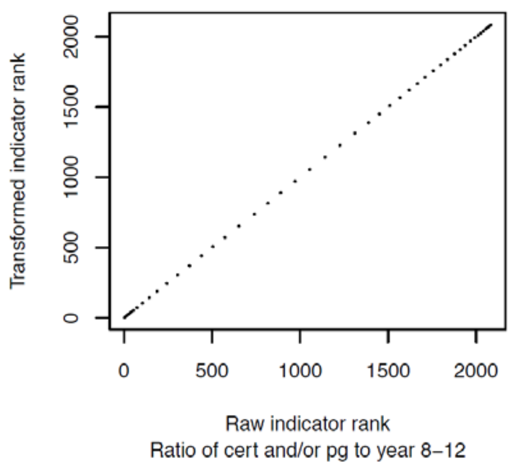
SA2	Value
Torres Strait Islands	36.28
Thamarrurr	36.72

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
No transform
Pre–transform skewness: 0.2
Post–transform skewness: 0.2

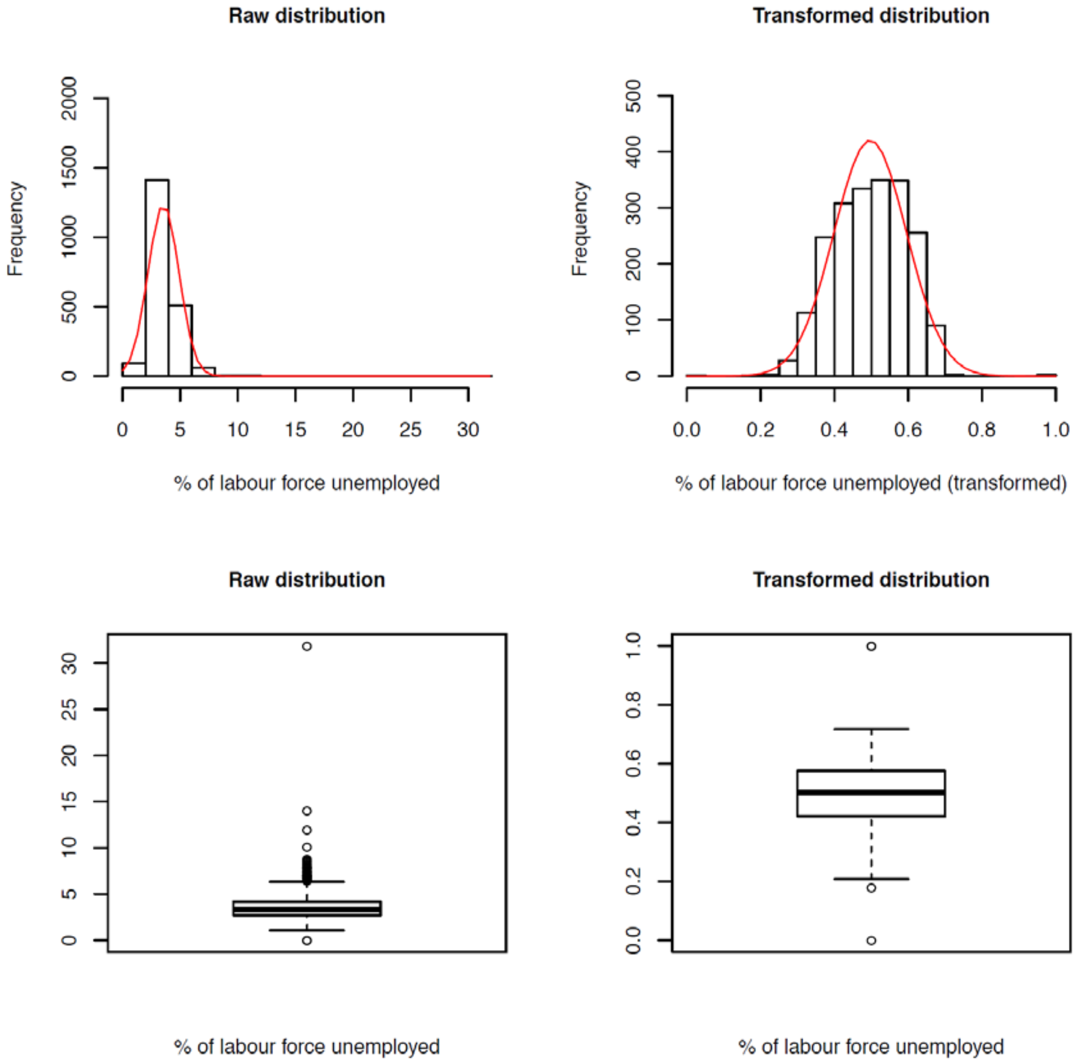
Kurtosis:
No transform
Pre–transform kurtosis: –0.2
Post–transform kurtosis: –0.2

Outliers:
Pre–transform outlier count: 1
Post–transform outlier count: 1

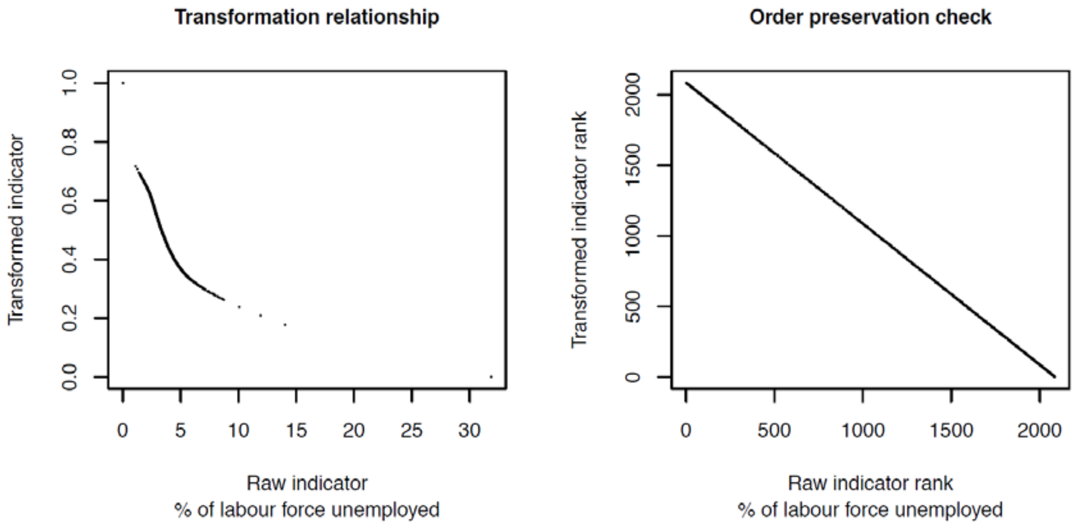
OUTLIER DETAILS

SA2	Value
Aurukun	0.15

Appendix 5A (cont.)



Appendix 5A (cont.)



TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.31
Pre−transform skewness: 5.5
Post−transform skewness: −0.1

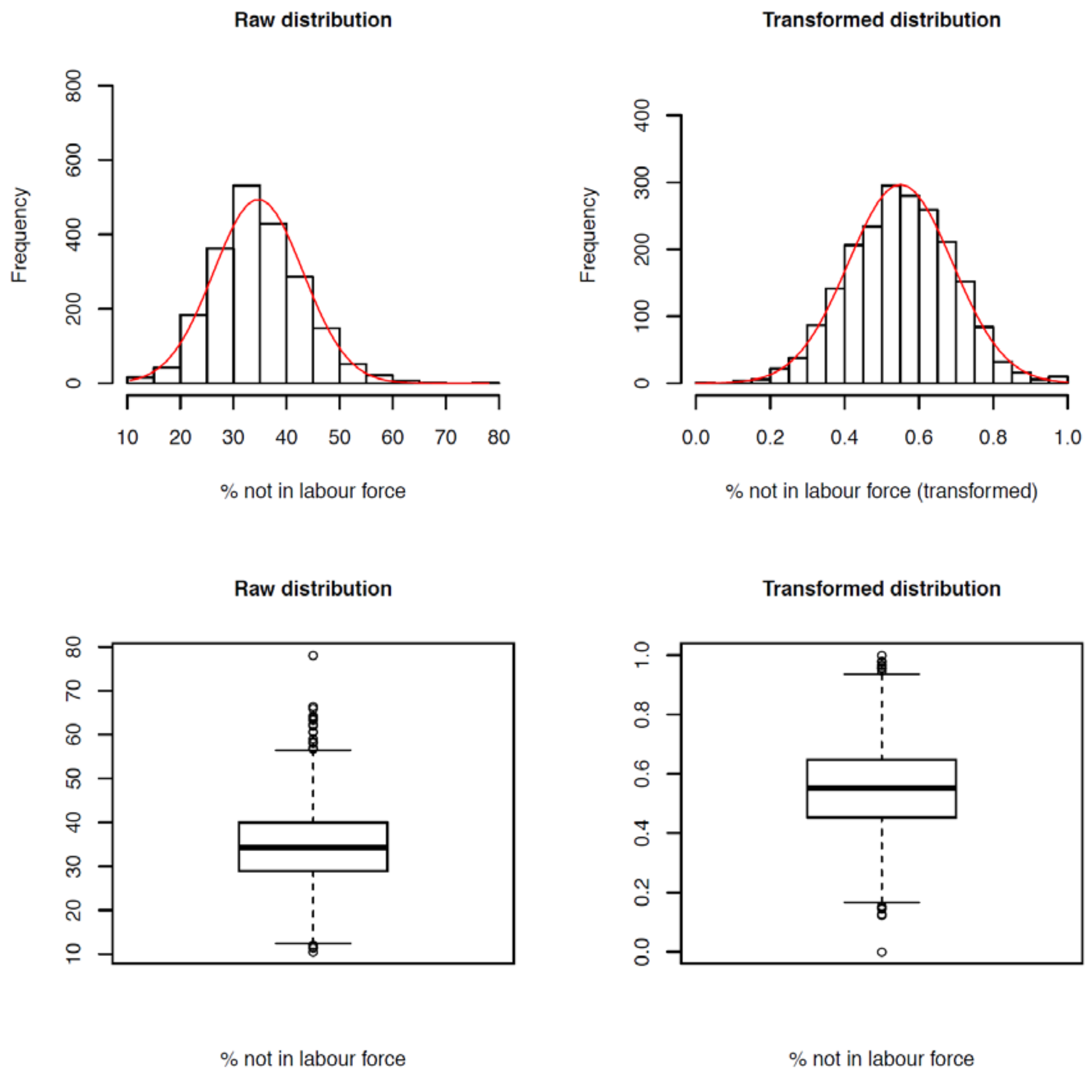
Kurtosis:
Coefficient: 0.25
Pre−transform kurtosis: 96.5
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 10
Post−transform outlier count: 3

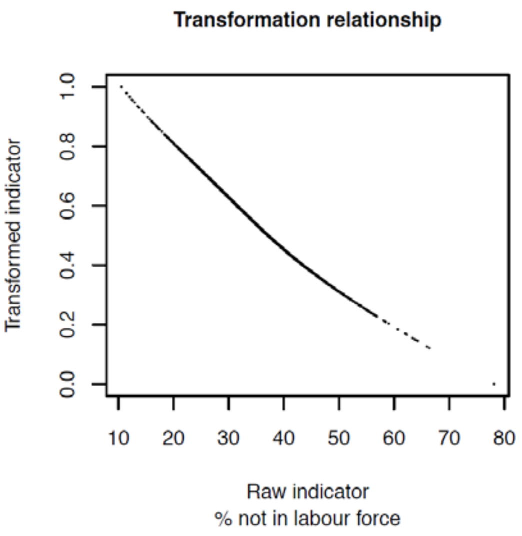
OUTLIER DETAILS

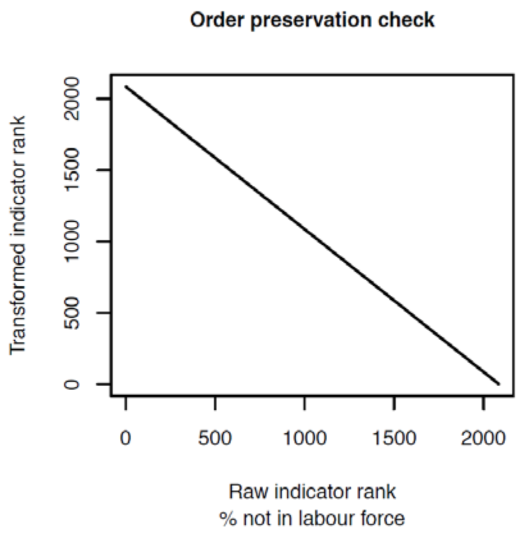
SA2	Value
Western	0.00
Hall	0.00
Yarrabah	31.86

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.59
Pre−transform skewness: 0.4
Post−transform skewness: −0.0

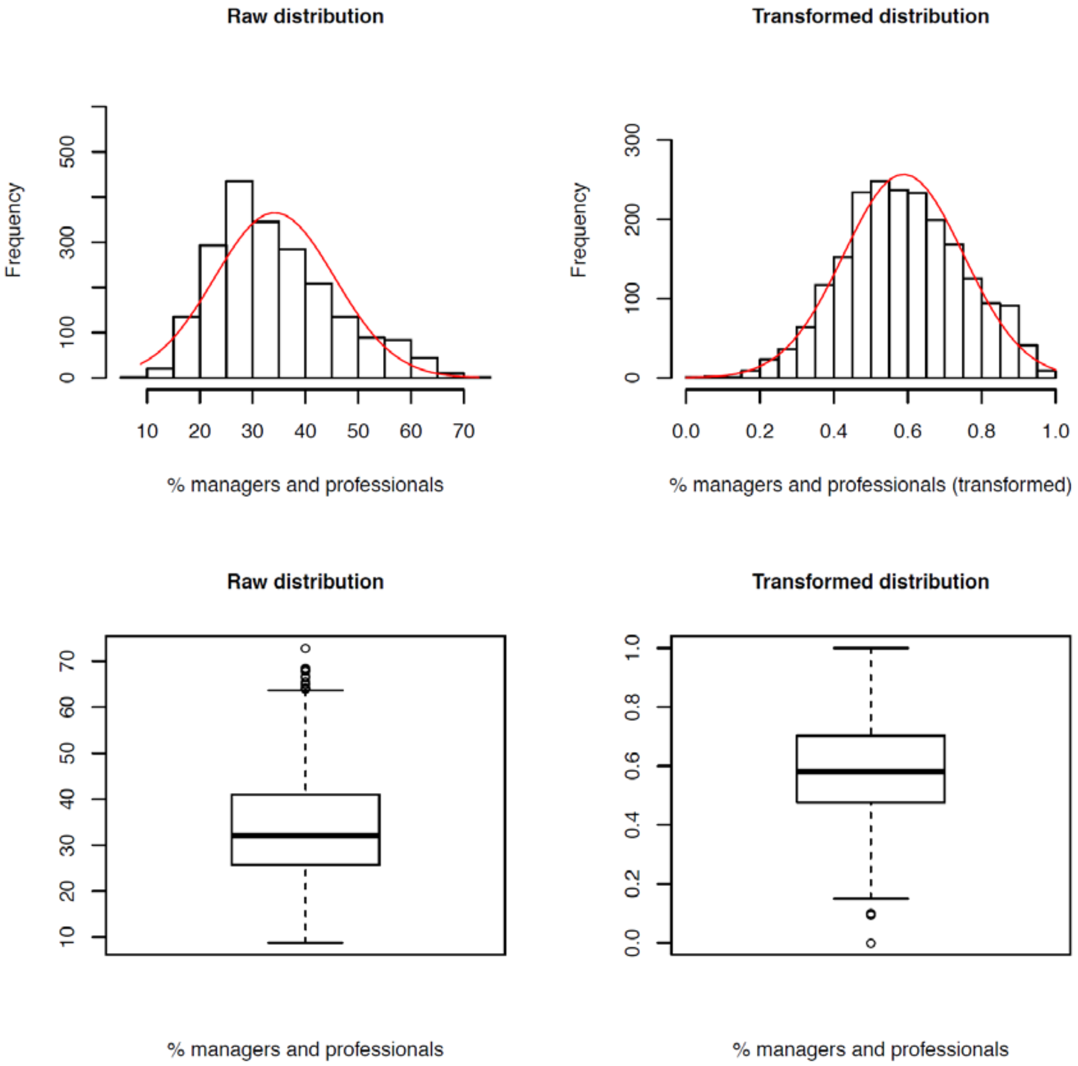
Kurtosis:
Coefficient: 0.08
Pre−transform kurtosis: 0.6
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 7
Post−transform outlier count: 1

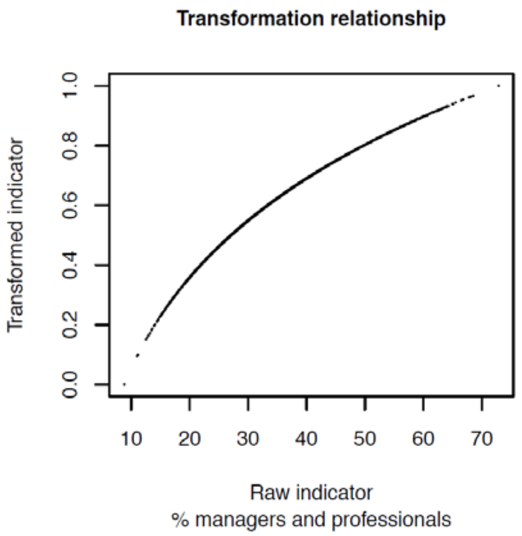
OUTLIER DETAILS

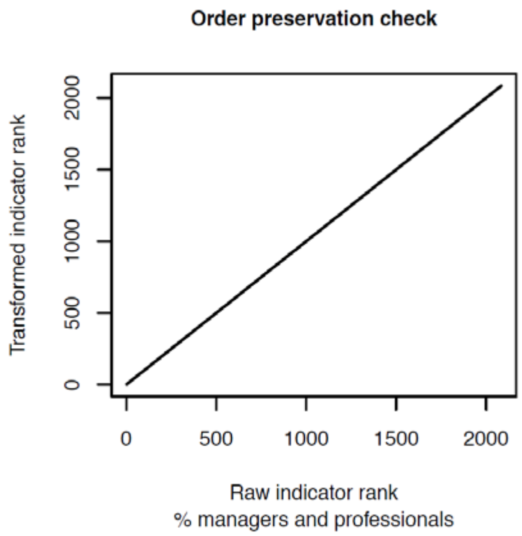
SA2	Value
Wacol	78.09

Appendix 5A (cont.)



Appendix 5A (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.12
Pre–transform skewness: 0.7
Post–transform skewness: 0.0

Kurtosis:
Coefficient: 0.00
Pre–transform kurtosis: –0.1
Post–transform kurtosis: –0.3

Outliers:
Pre–transform outlier count: 1
Post–transform outlier count: 1

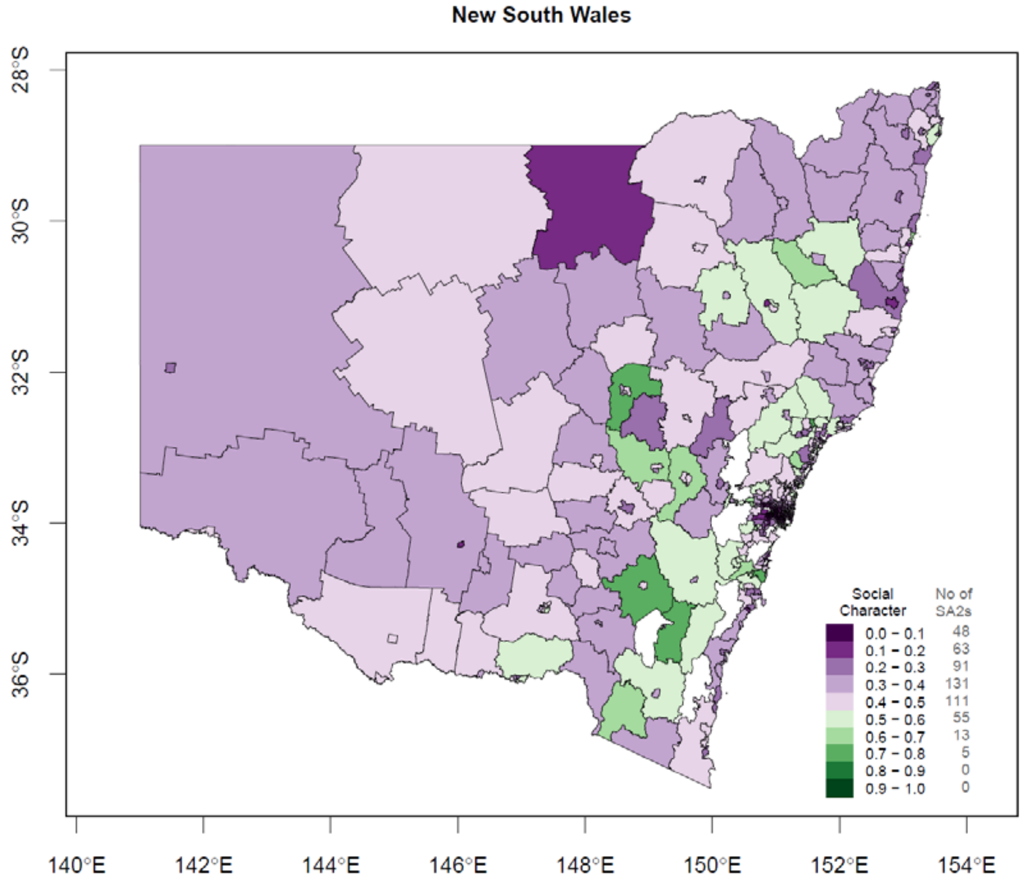
OUTLIER DETAILS

SA2	Value
Bridgewater – Gagebrook	8.78

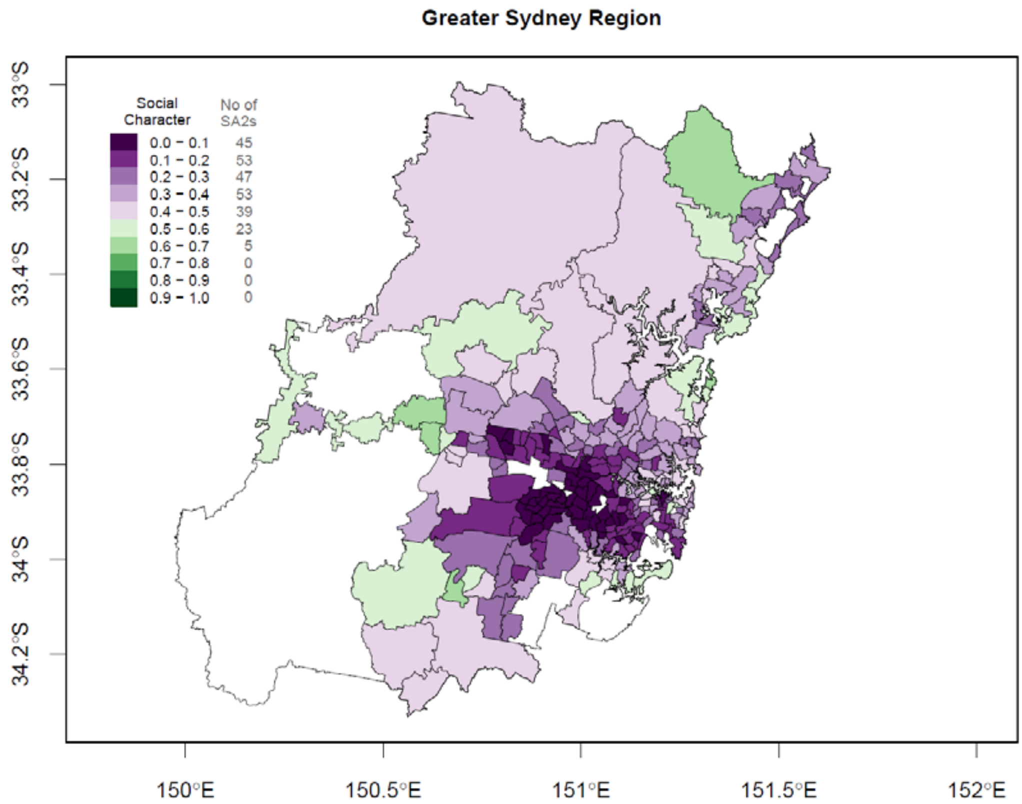
APPENDIX 5B – MAPS: SOCIAL CHARACTER SUB-INDEX BY STATE/TERRITORY AND METROPOLITAN AREAS

Appendix 5B maps the social character sub-index at the resolution of individual States and Territories, and major metropolitan areas.

Appendix 5B

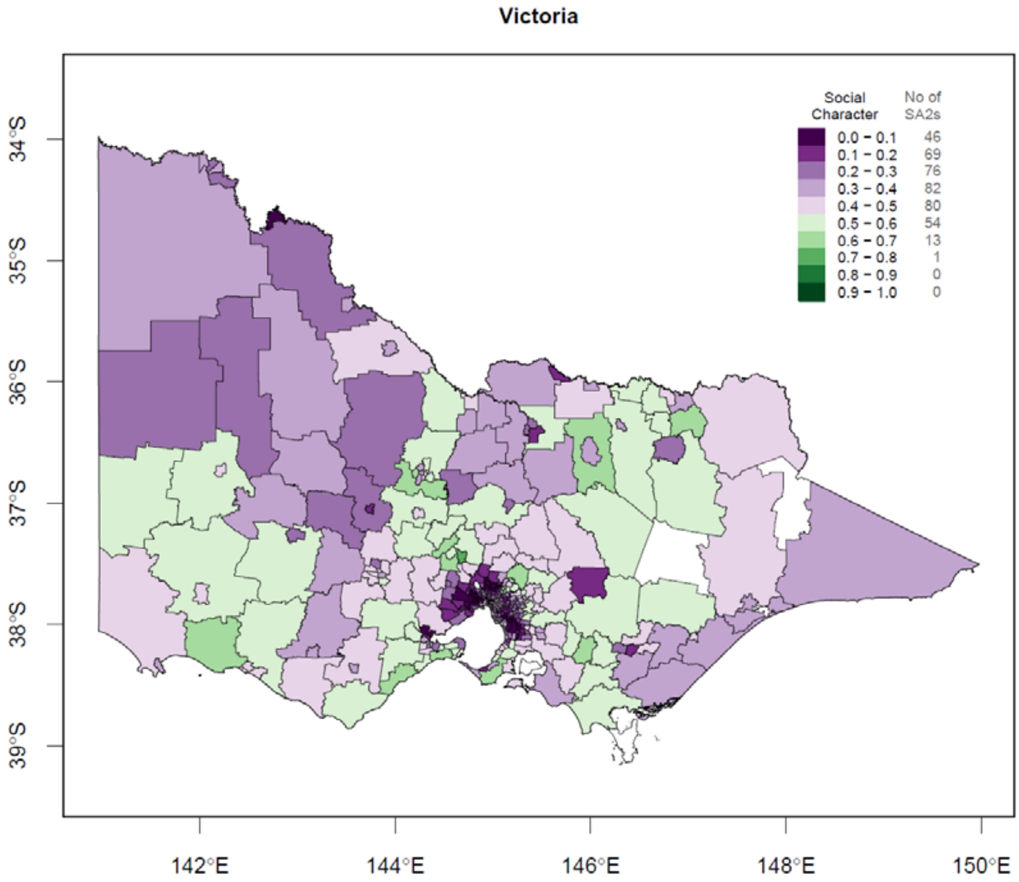


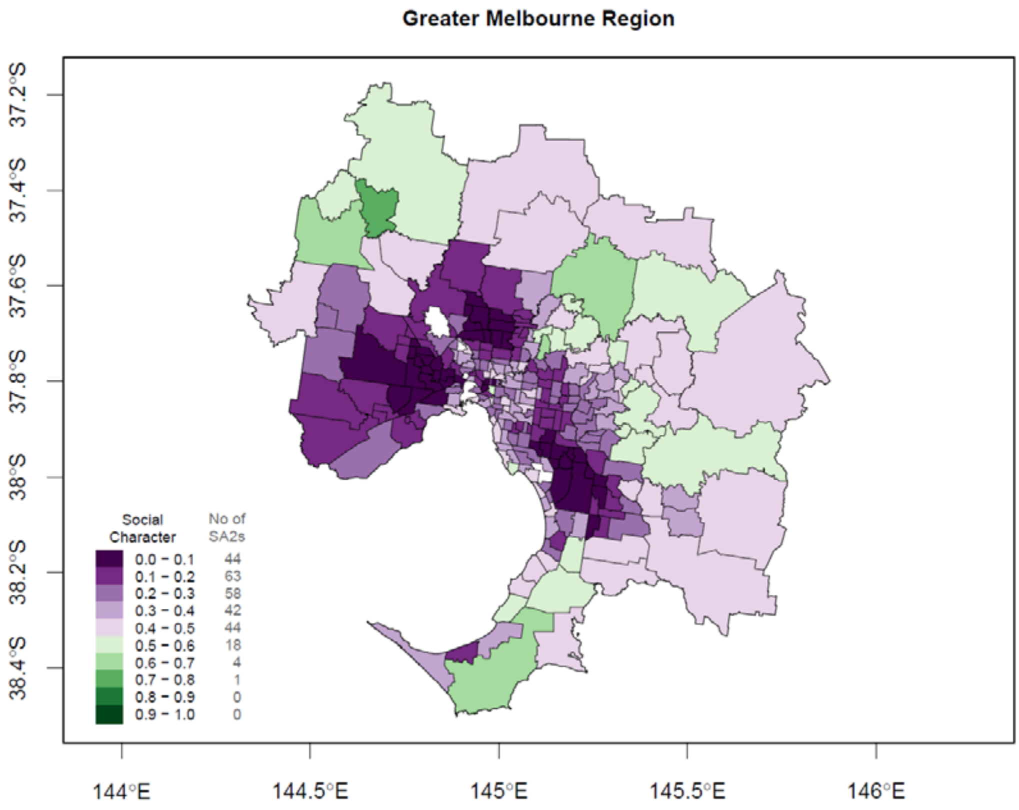
New South Wales
28°S
30°S
32°S
34°S
36°S
140°E
142°E
144°E
146°E
148°E
150°E
152°E
154°E
Social Character
No of SA2s
0.0 – 0.1 48
0.1 – 0.2 63
0.2 – 0.3 91
0.3 – 0.4 131
0.4 – 0.5 111
0.5 – 0.6 55
0.6 – 0.7 13
0.7 – 0.8 5
0.8 – 0.9 0
0.9 – 1.0 0



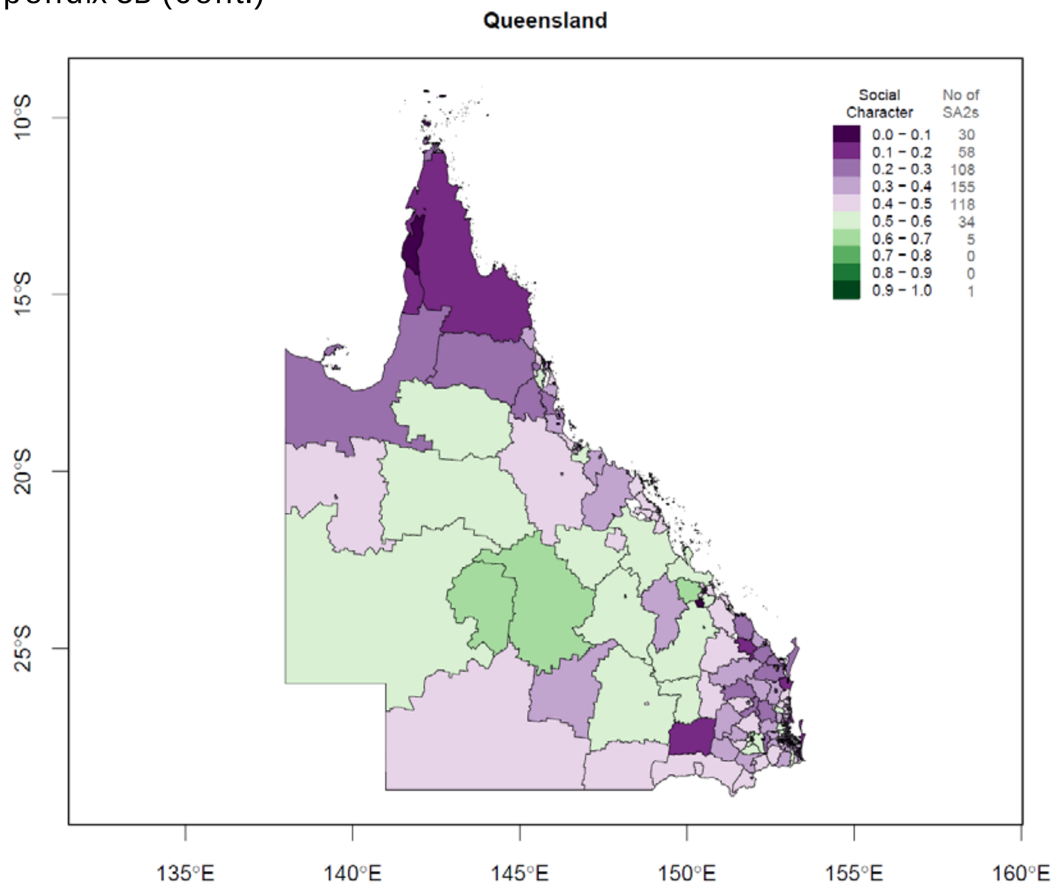
Greater Sydney Region
33°S
33.2°S
33.4°S
33.6°S
33.8°S
34°S
34.2°S
150°E
150.5°E
151°E
151.5°E
152°E
Social Character
No of SA2s
0.0 – 0.1 45
0.1 – 0.2 53
0.2 – 0.3 47
0.3 – 0.4 53
0.4 – 0.5 39
0.5 – 0.6 23
0.6 – 0.7 5
0.7 – 0.8 0
0.8 – 0.9 0
0.9 – 1.0 0

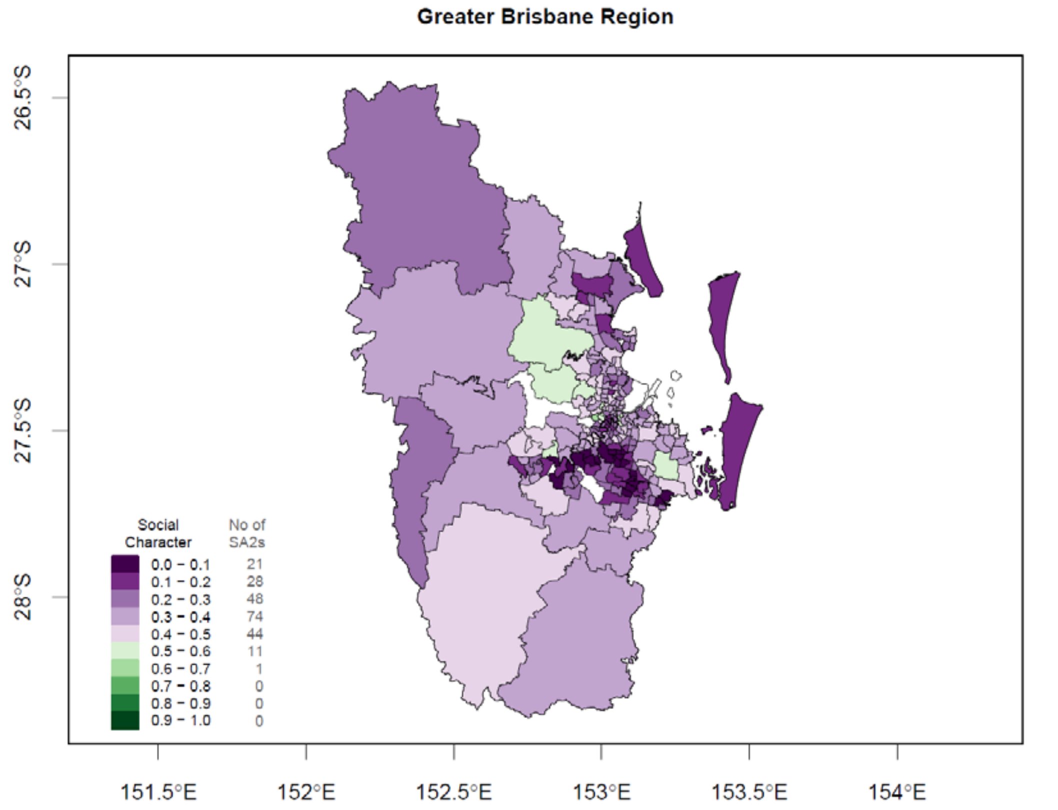
Appendix 5B (cont.)



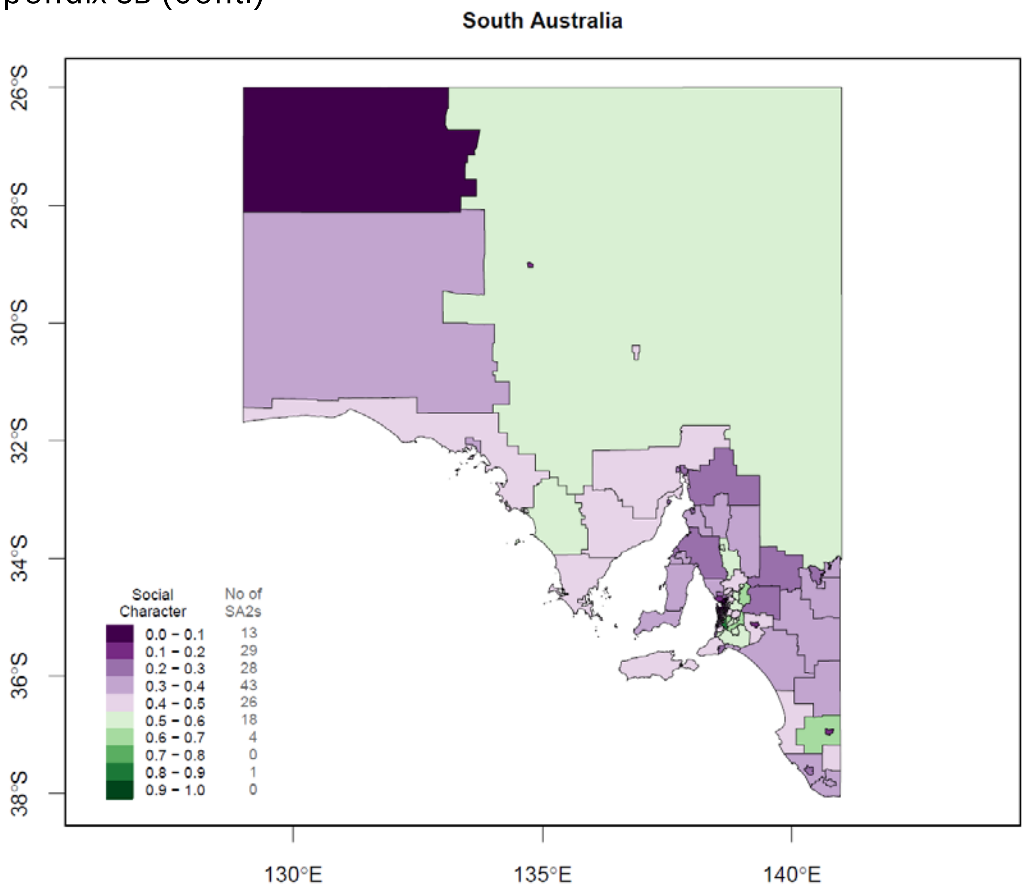


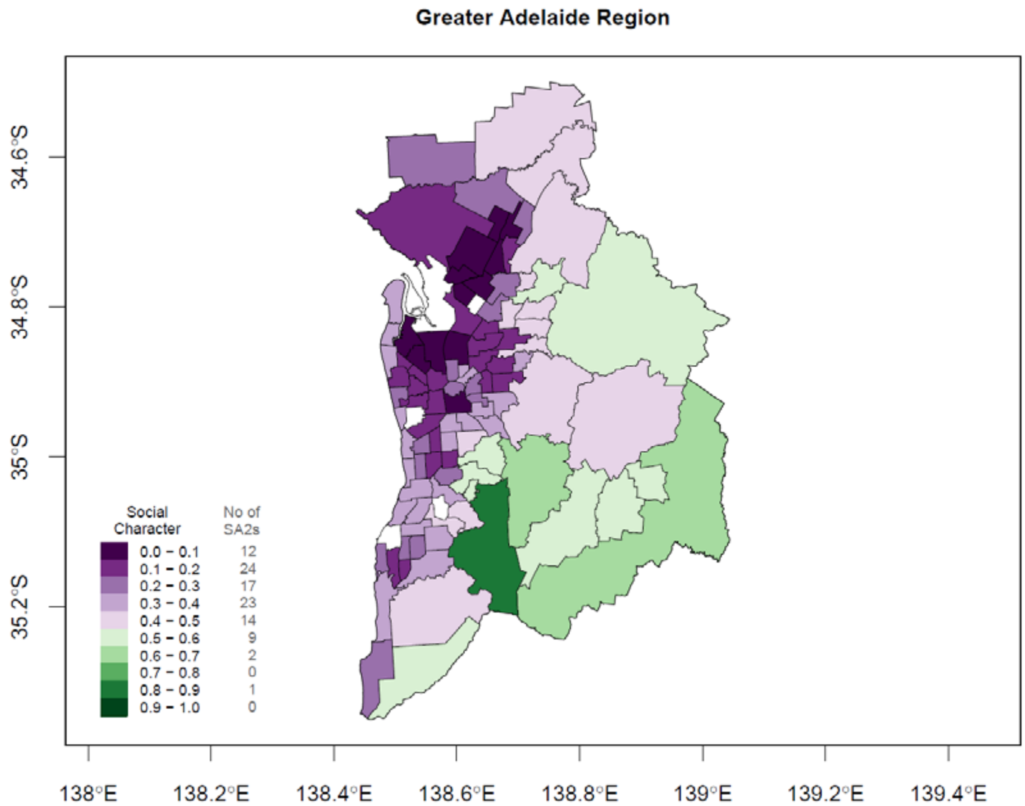
Appendix 5B (cont.)



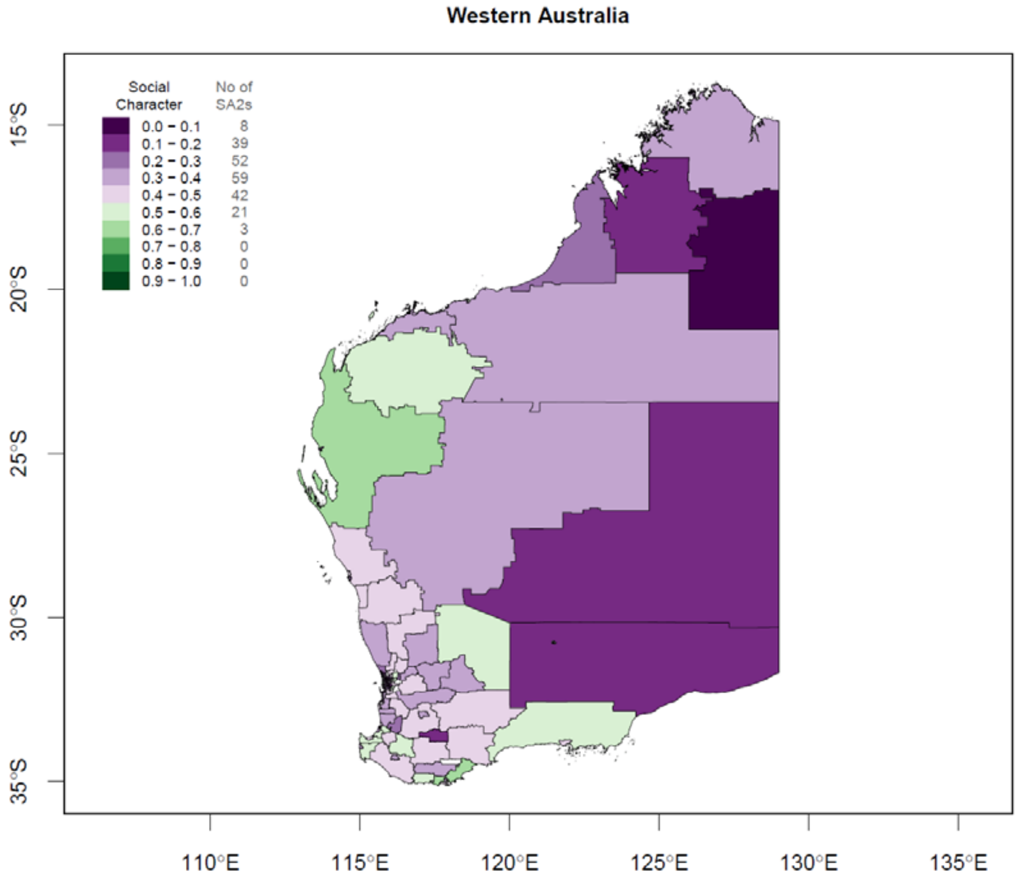


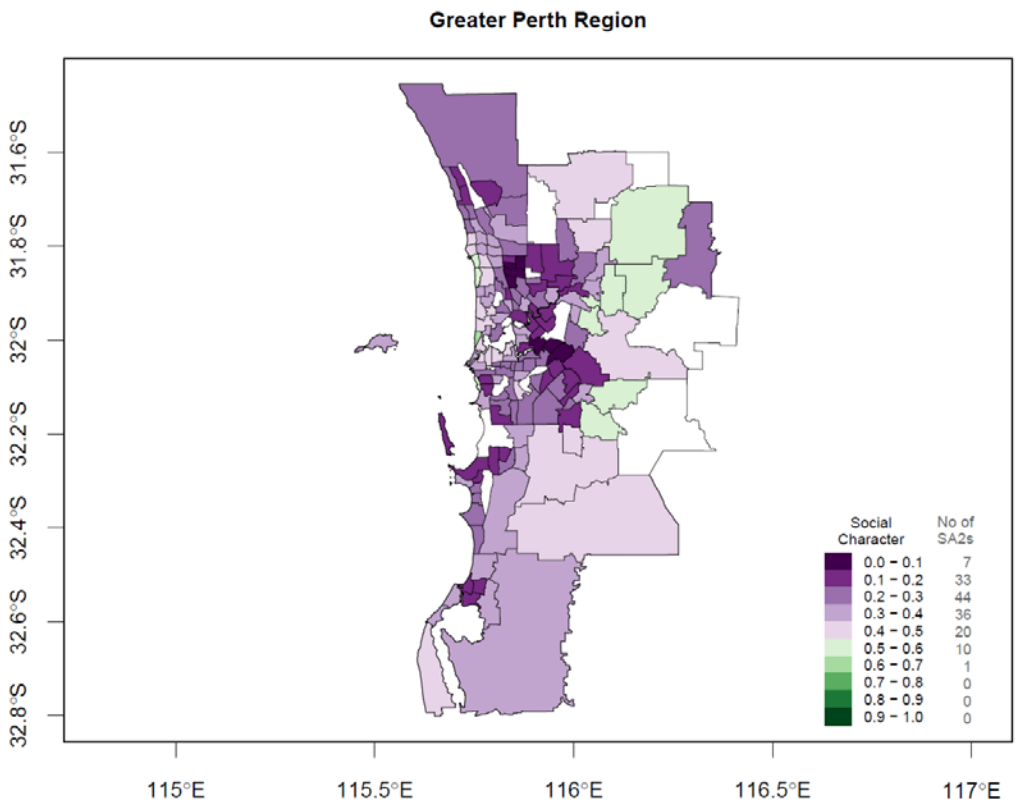
Appendix 5B (cont.)





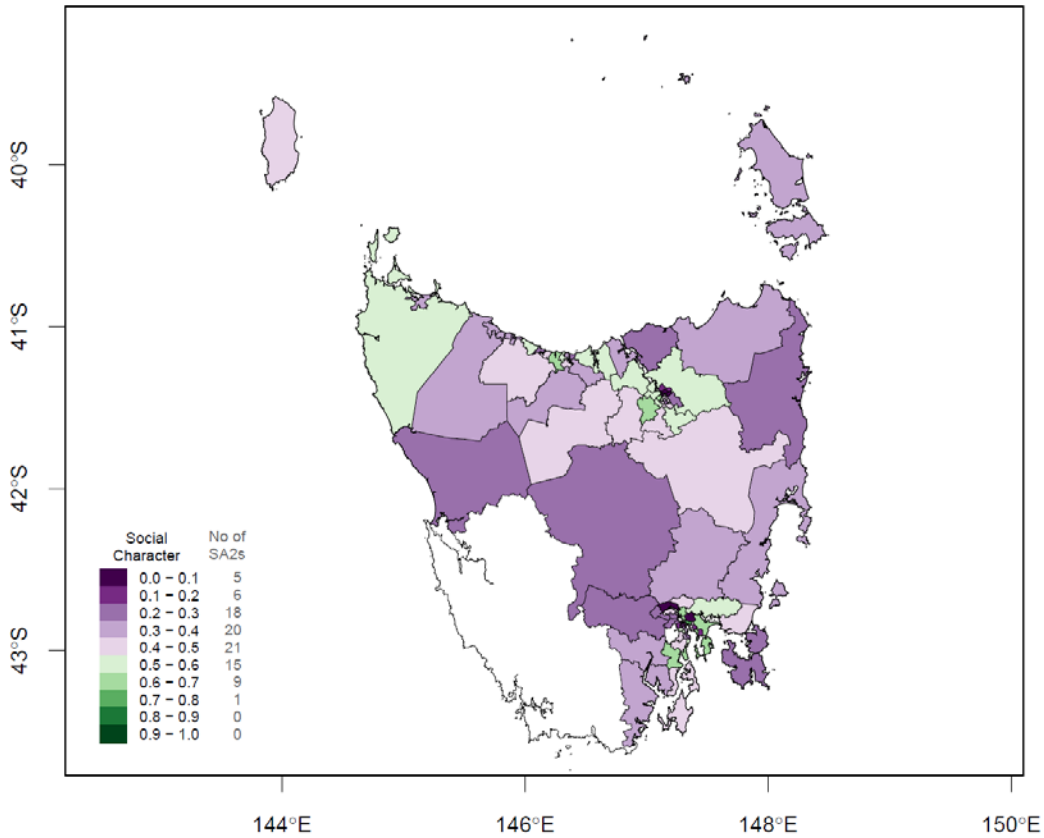
Appendix 5B (cont.)



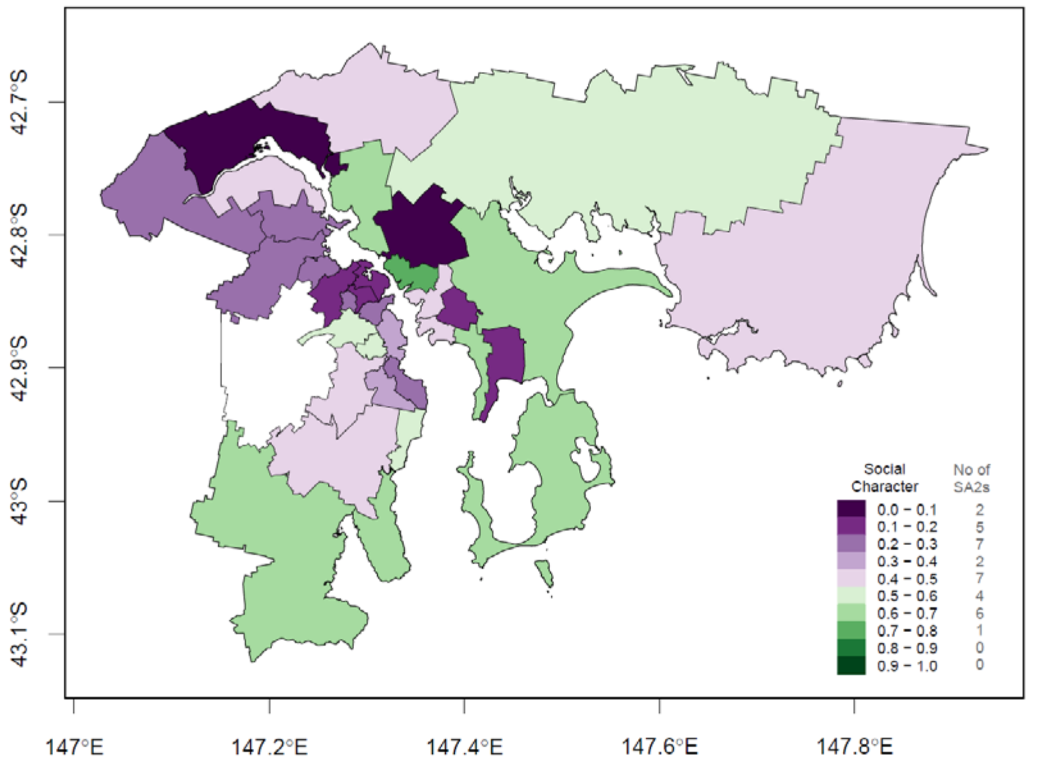


Appendix 5B (cont.)

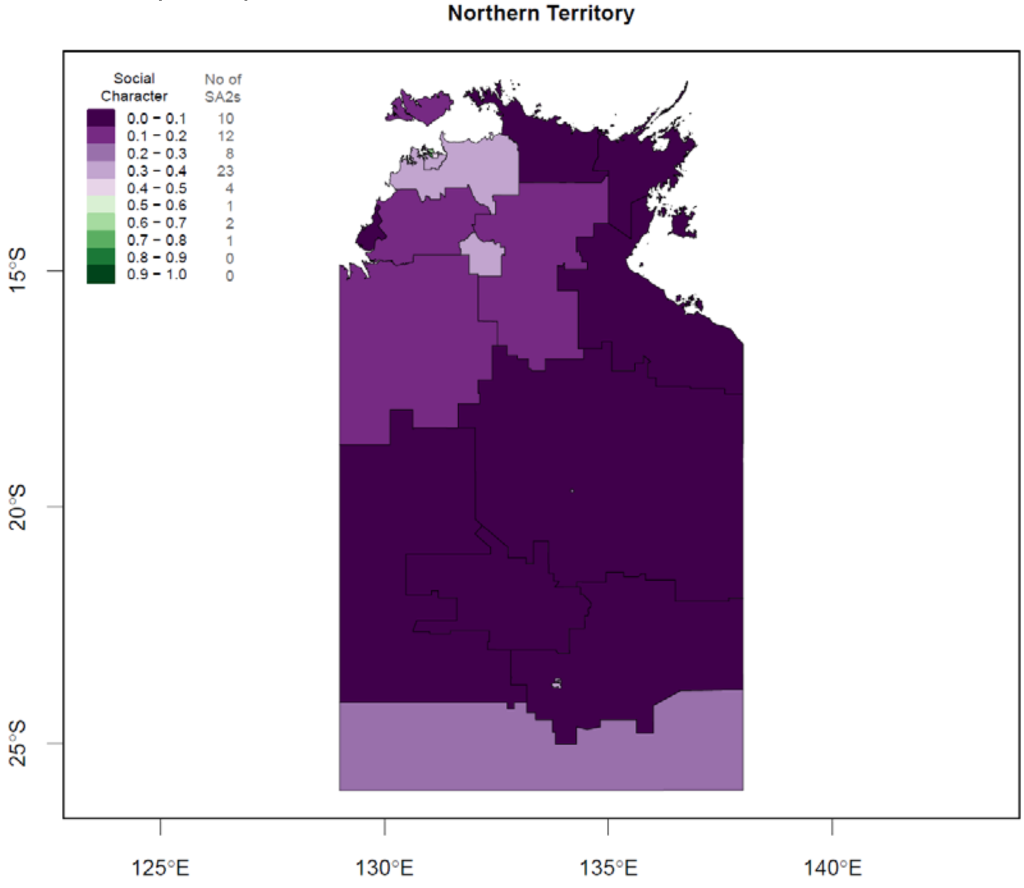
Tasmania

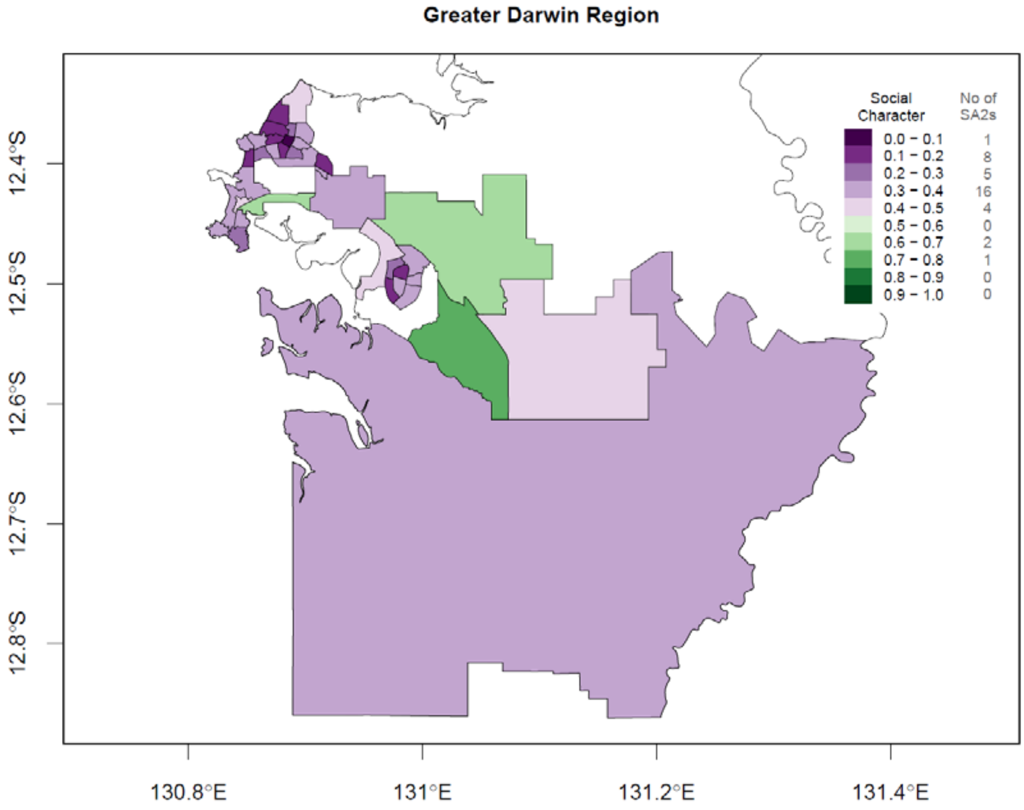


Greater Hobart Region

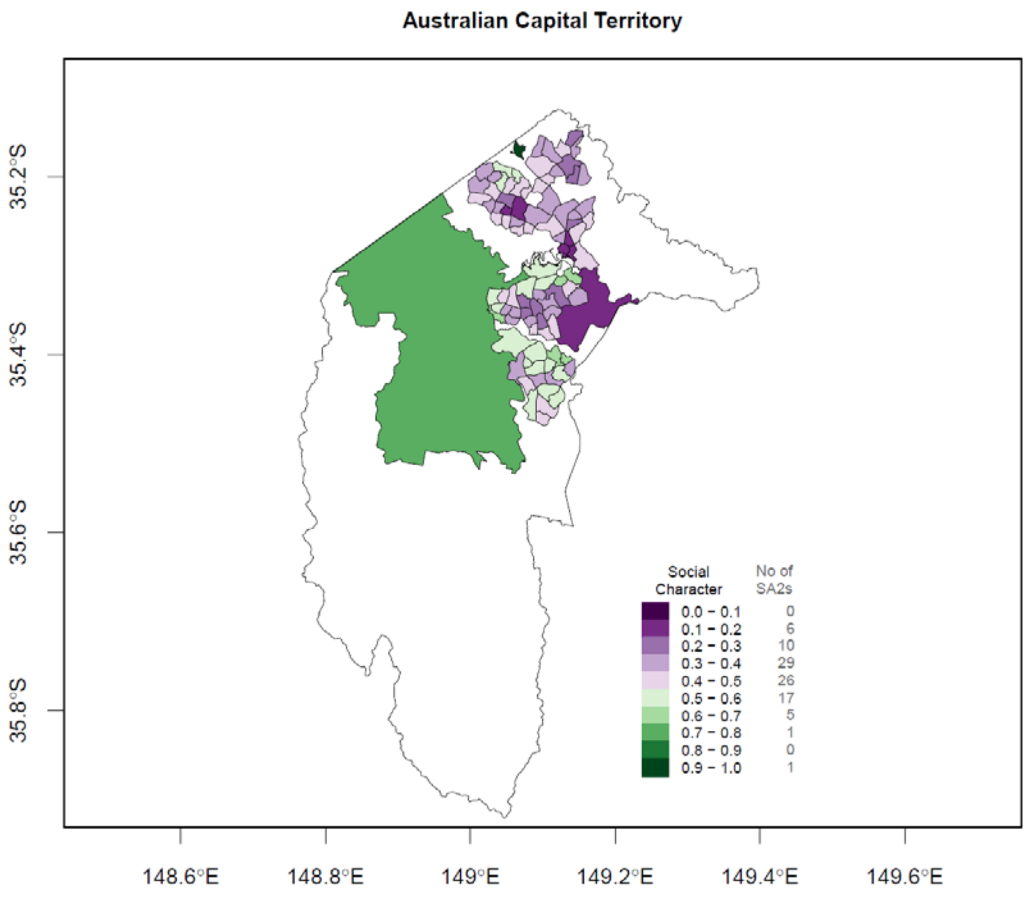


Appendix 5B (cont.)





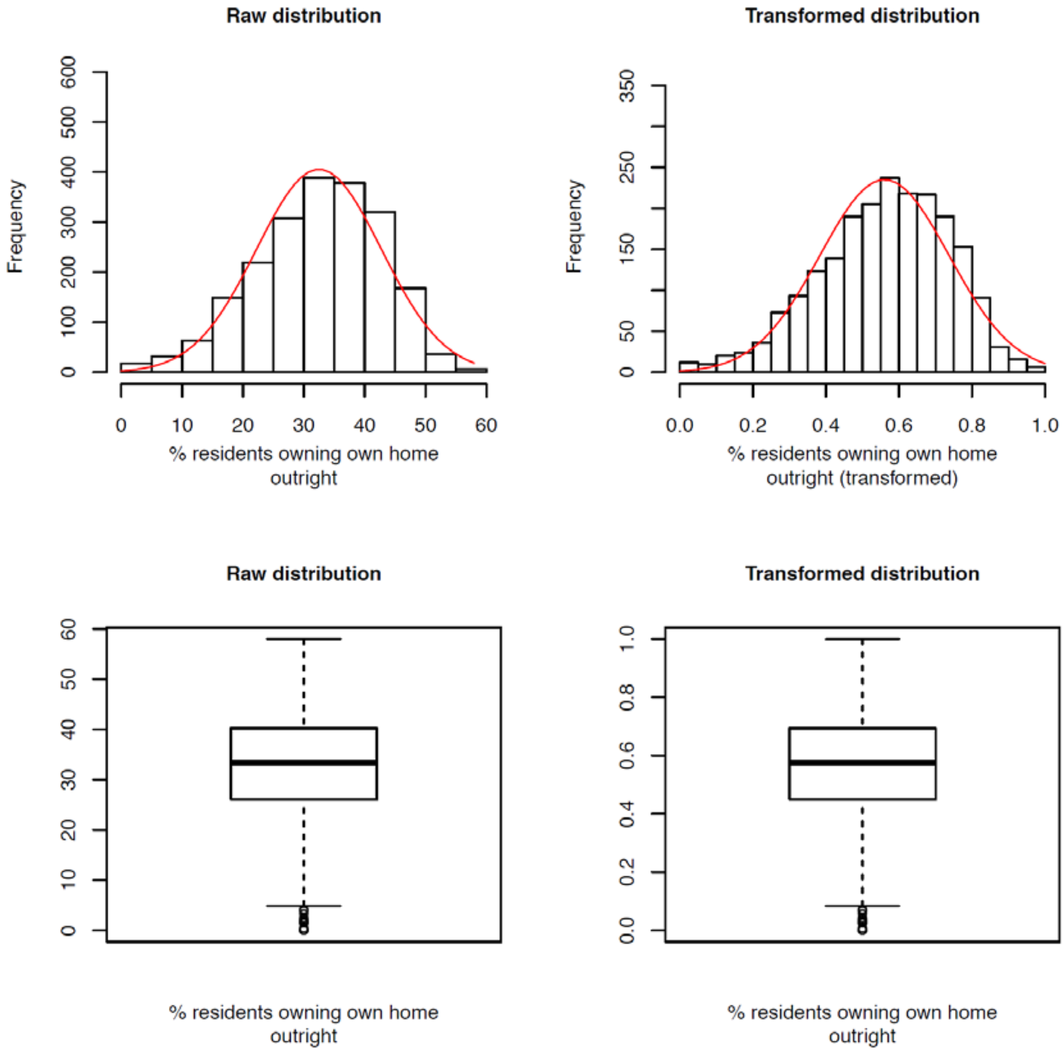
Appendix 5B (cont.)



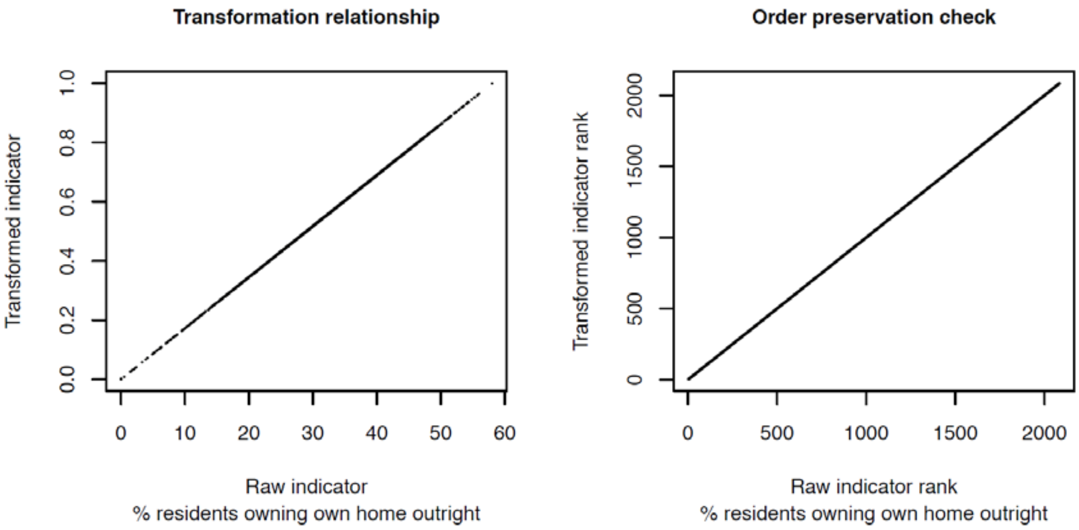
APPENDIX 5C – ECONOMIC CAPITAL TRANSFORMATION DETAILS

Appendix 5C shows the raw and transformed indicators used to compute the economic capital sub-index.

Appendix 5C


Raw distribution
Frequency
0
100
200
300
400
500
600
0
10
20
30
40
50
60
% residents owning own home
outright
Transformed distribution
Frequency
0
50
150
250
350
0.0
0.2
0.4
0.6
0.8
1.0
% residents owning own home
outright (transformed)
Raw distribution
0
10
20
30
40
50
60
% residents owning own home
outright
Transformed distribution
0.0
0.2
0.4
0.6
0.8
1.0
% residents owning own home
outright

Appendix 5C (cont.)



TRANSFORMATION DETAILS

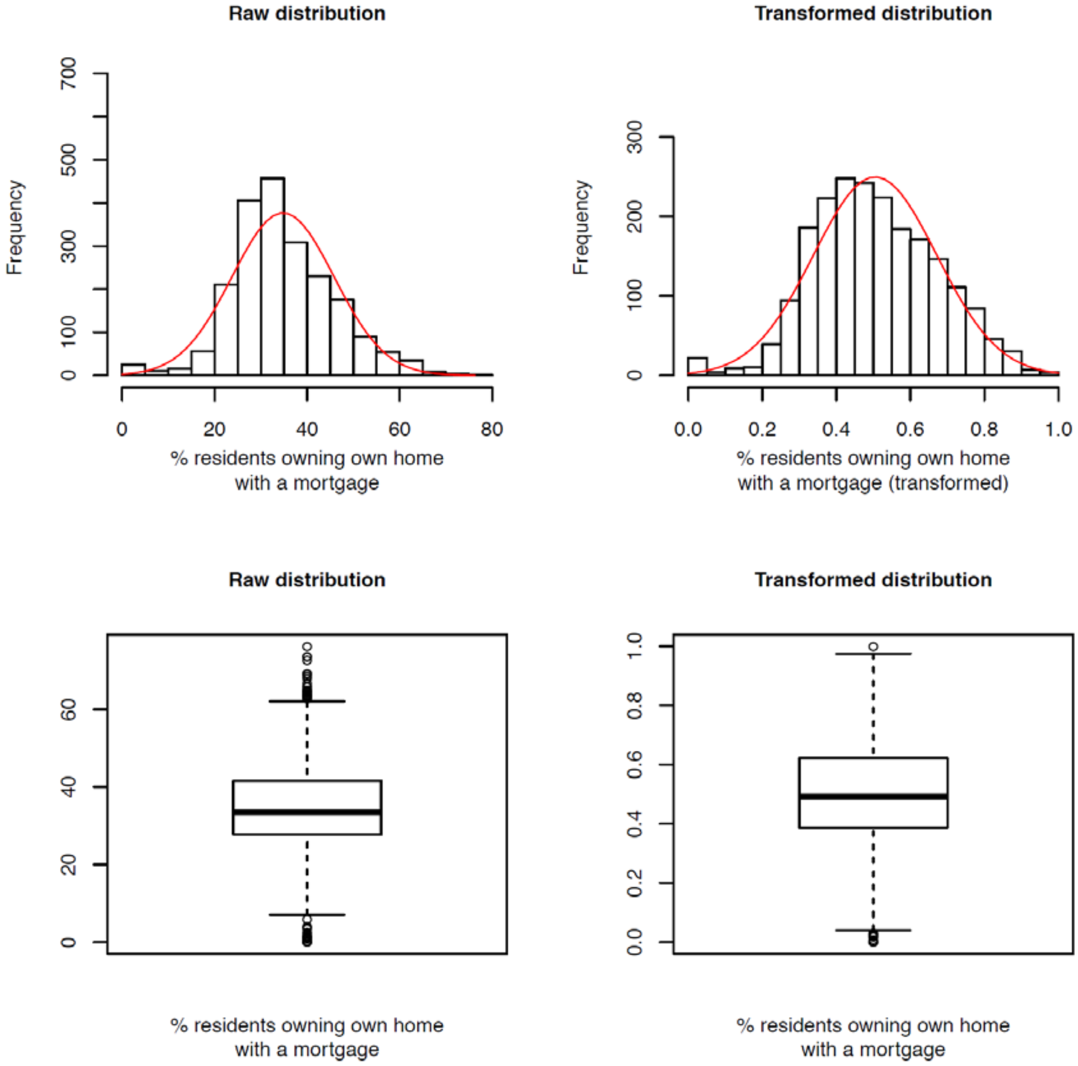
Unreversed

Skewness:
No transform
Pre–transform skewness: –0.4
Post–transform skewness: –0.4

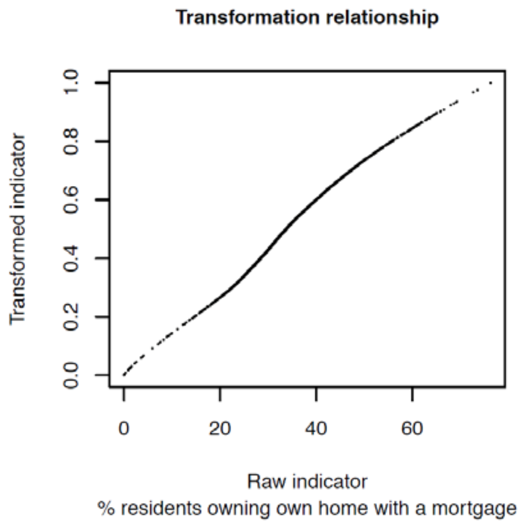
Kurtosis:
No transform
Pre–transform kurtosis: –0.1
Post–transform kurtosis: –0.1

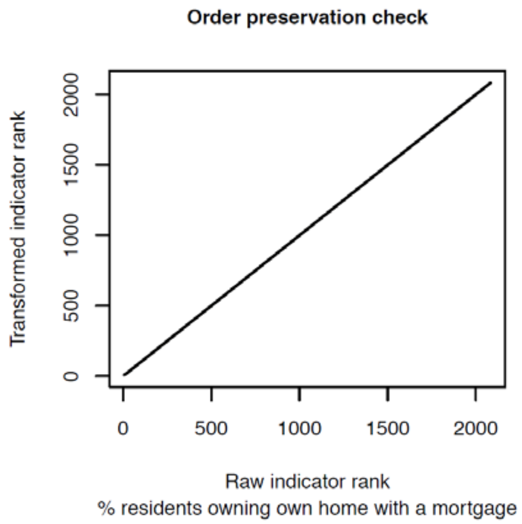
Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

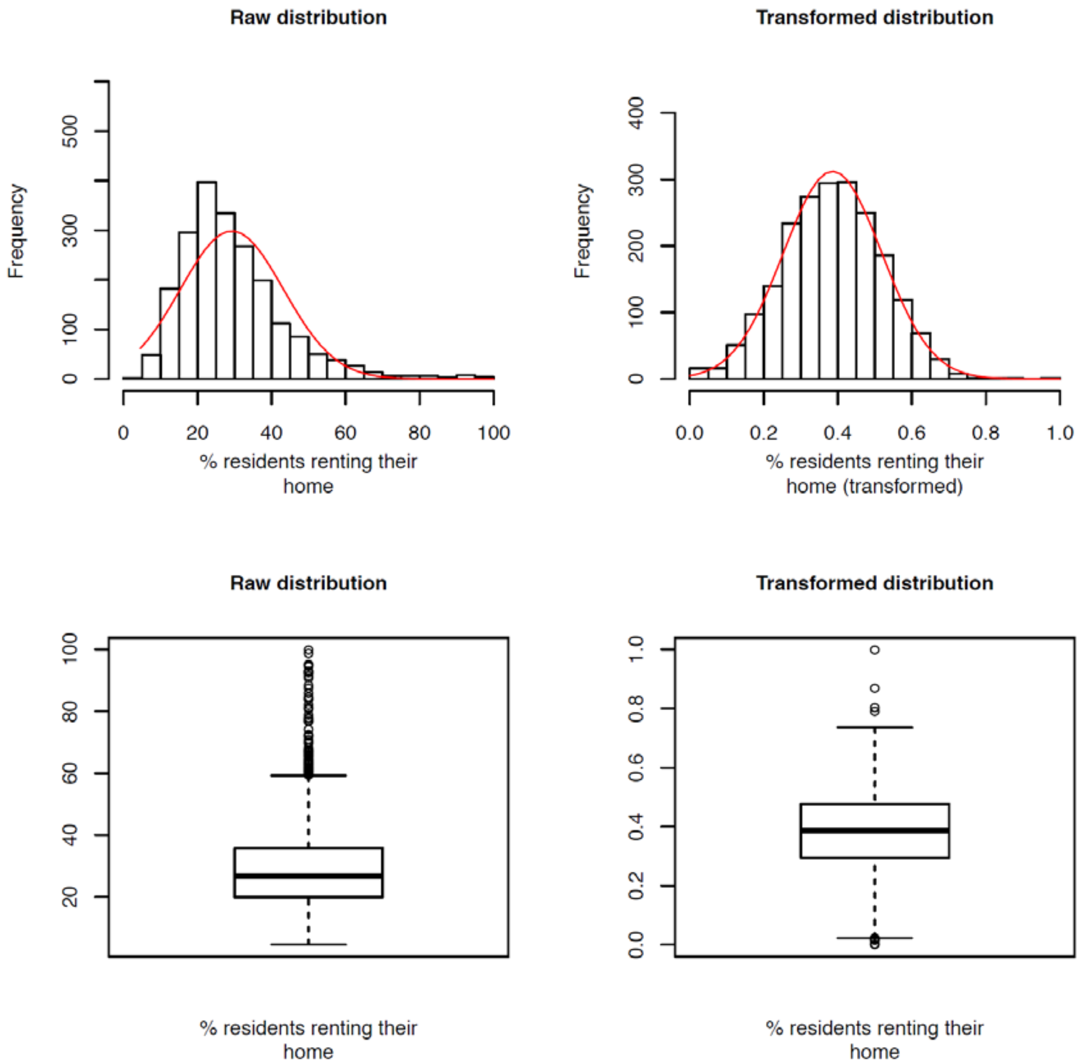
Unreversed

Skewness:
Power transform, exponent: 0.86
Pre–transform skewness: 0.3
Post–transform skewness: 0.0

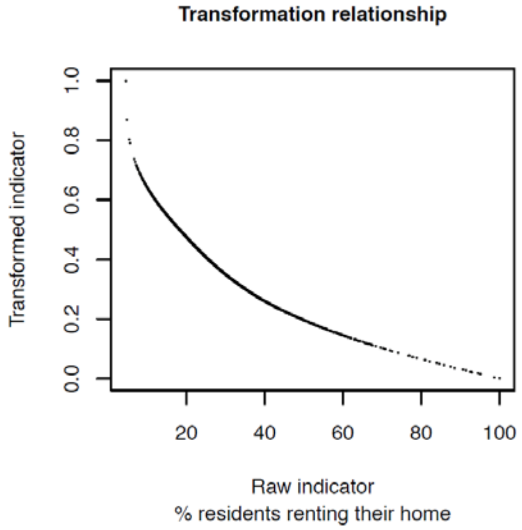
Kurtosis:
Coefficient: 0.23
Pre–transform kurtosis: 0.8
Post–transform kurtosis: 0.0

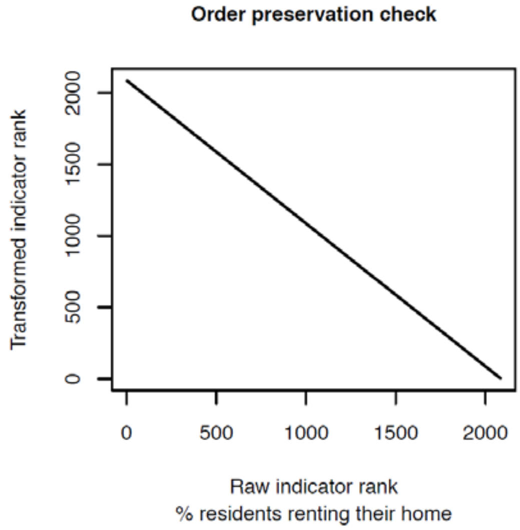
Outliers:
Pre–transform outlier count: 4
Post–transform outlier count: 0

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.32
Pre–transform skewness: 1.4
Post–transform skewness: –0.0

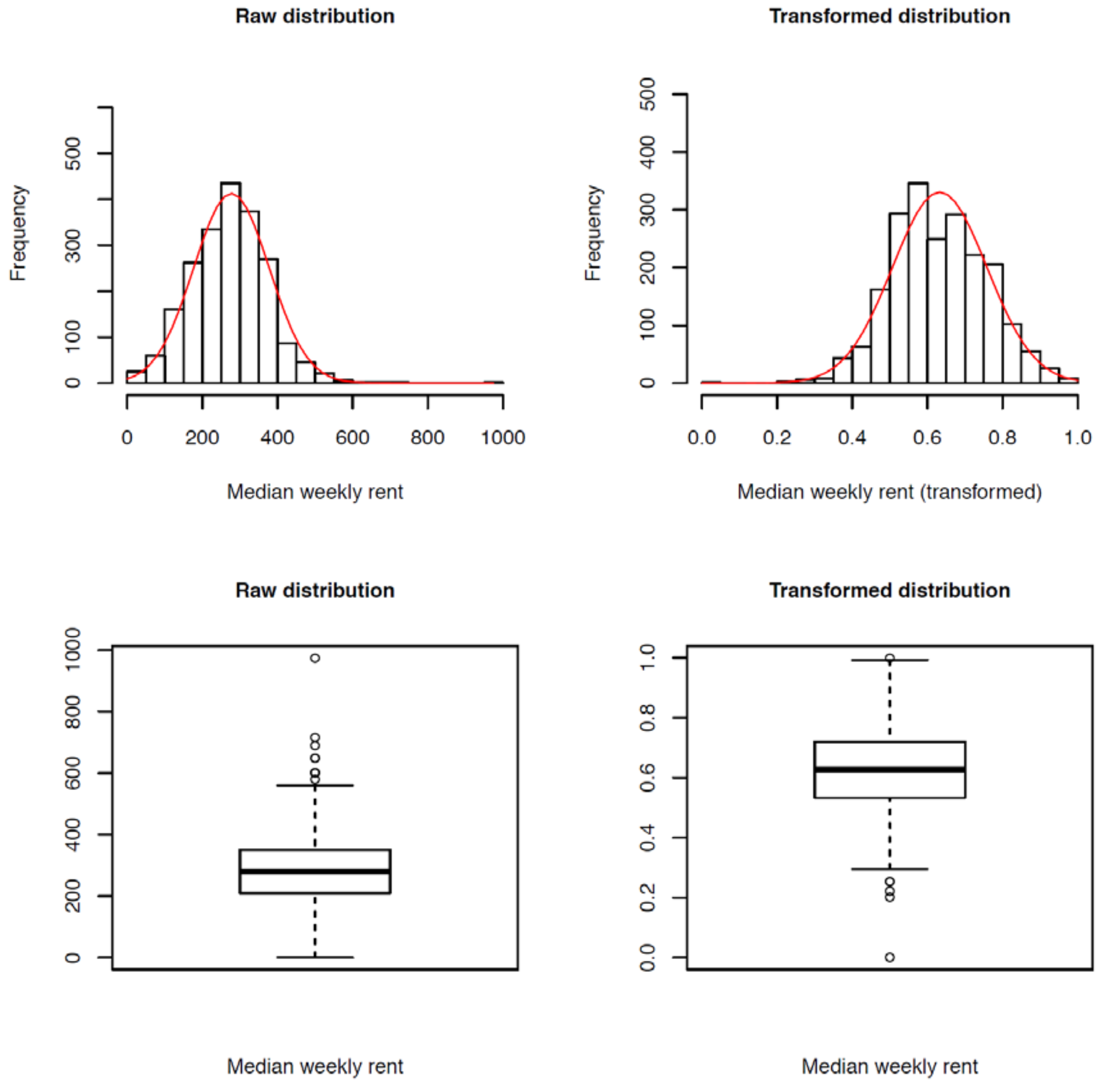
Kurtosis:
Coefficient: 0.13
Pre–transform kurtosis: 3.3
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 27
Post–transform outlier count: 2

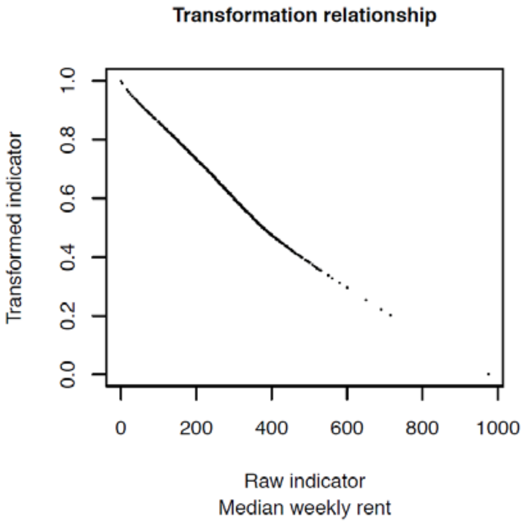
OUTLIER DETAILS

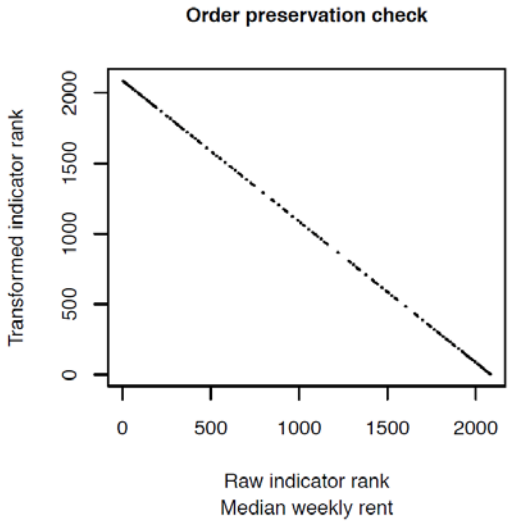
SA2	Value
Narre Warren North	4.51
Smythes Creek	4.74

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.82
Pre−transform skewness: 0.3
Post−transform skewness: 0.0

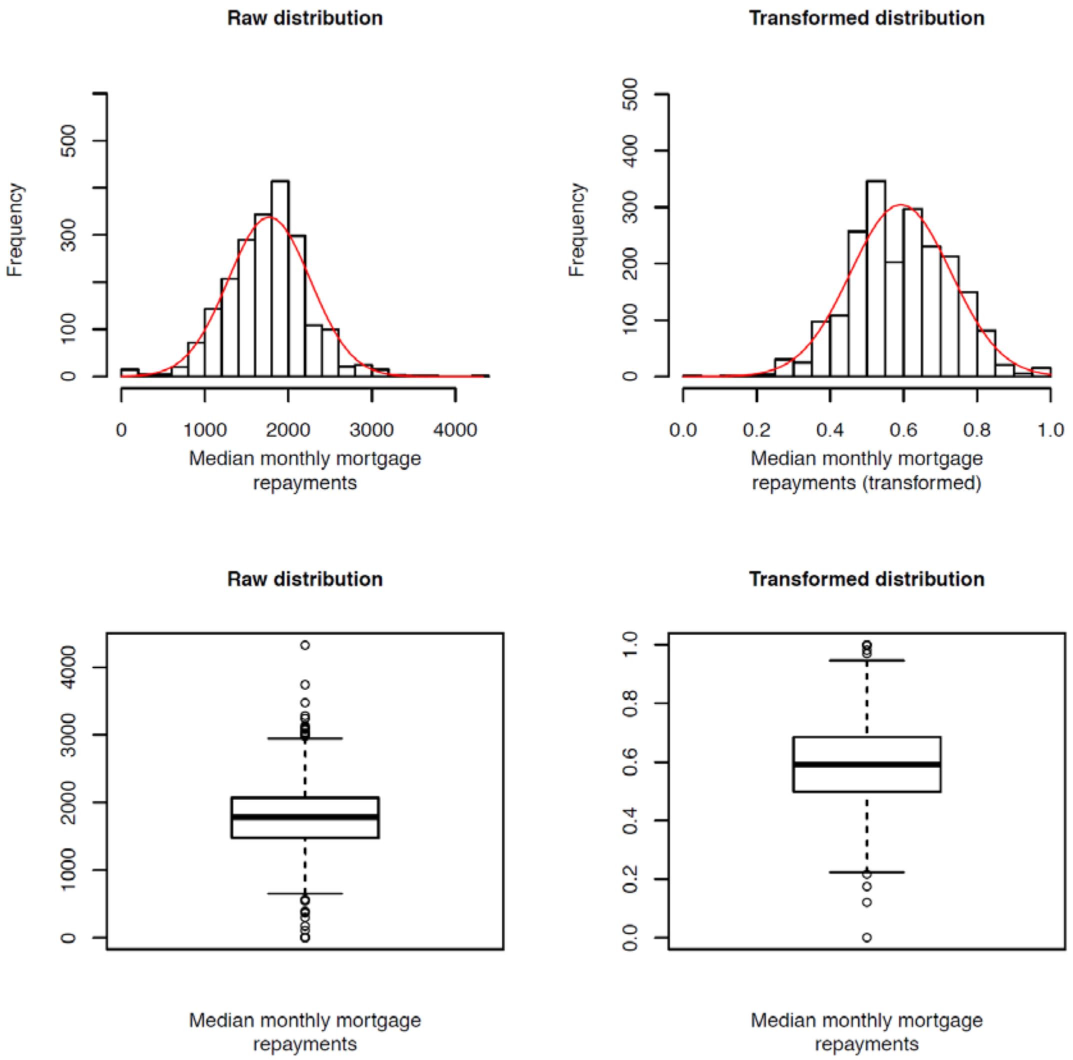
Kurtosis:
Coefficient: 0.12
Pre−transform kurtosis: 1.3
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 5
Post−transform outlier count: 2

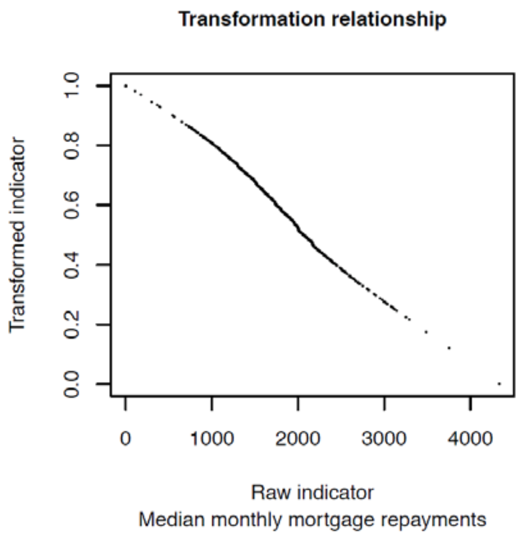
OUTLIER DETAILS

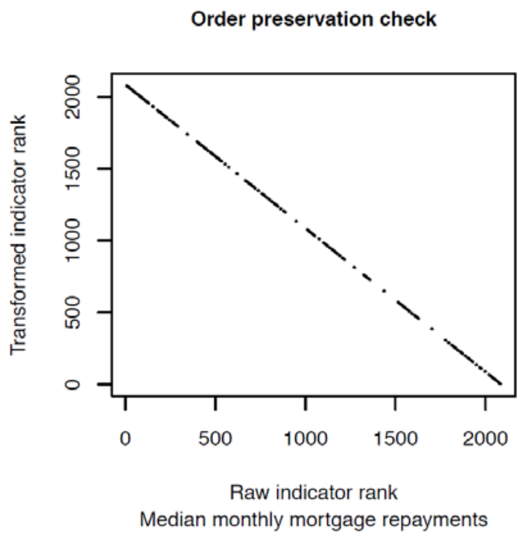
SA2	Value
North Coogee	715.00
O'Malley	975.00

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 1.04
Pre−transform skewness: −0.1
Post−transform skewness: 0.0

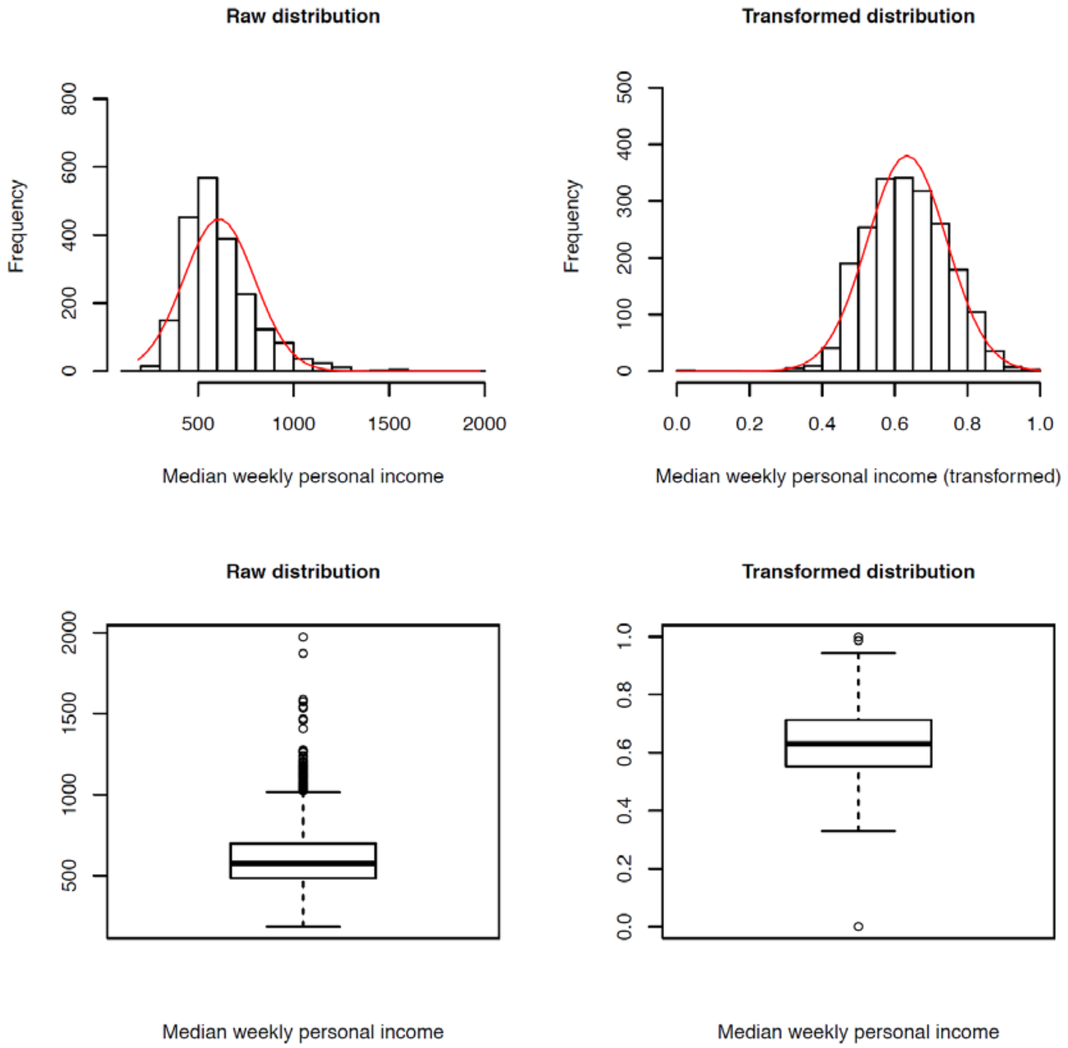
Kurtosis:
Coefficient: 0.16
Pre−transform kurtosis: 1.1
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 17
Post−transform outlier count: 2

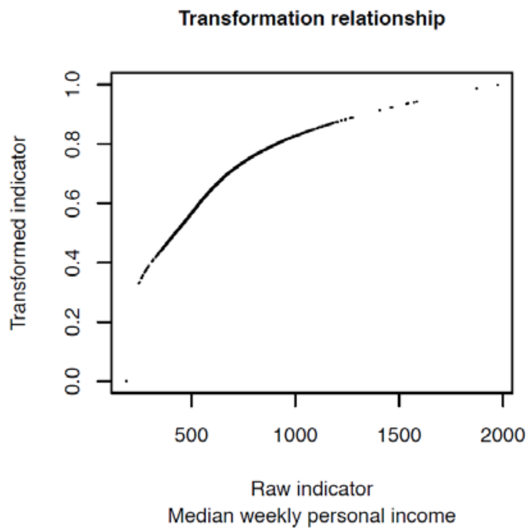
OUTLIER DETAILS

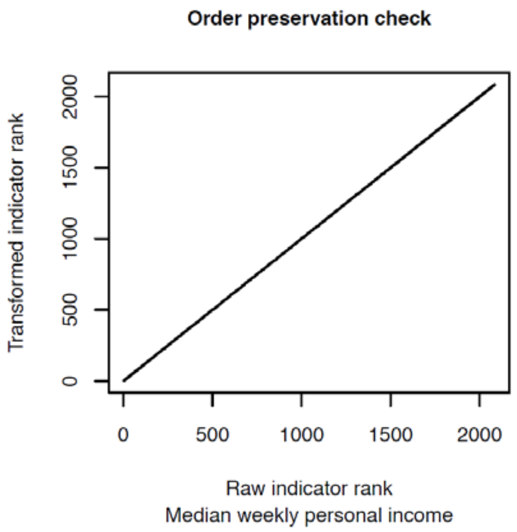
SA2	Value
O'Malley	3750.00
North Coogee	4333.00

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.28
Pre–transform skewness: 1.5
Post–transform skewness: 0.1

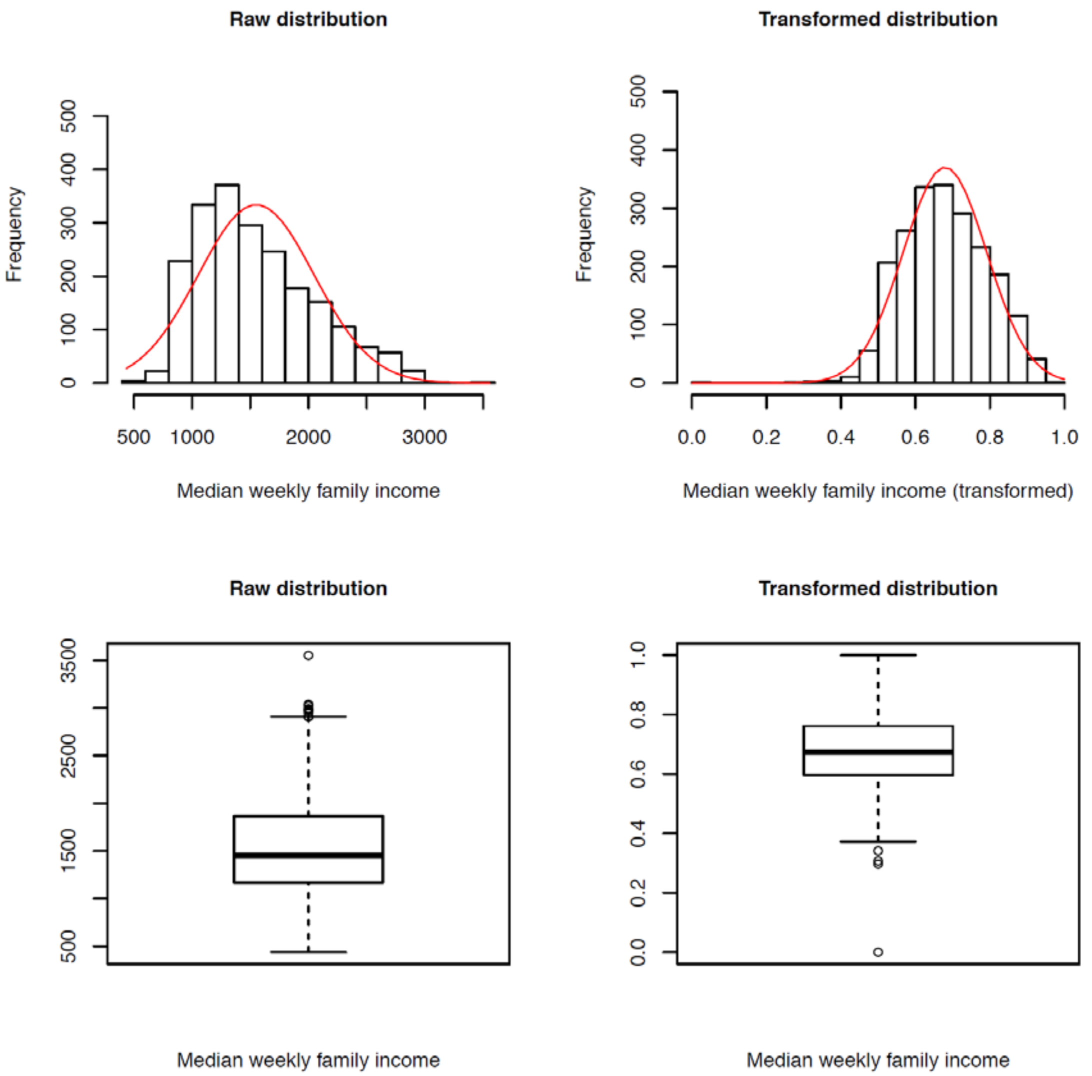
Kurtosis:
Coefficient: 0.18
Pre–transform kurtosis: 4.3
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 16
Post–transform outlier count: 2

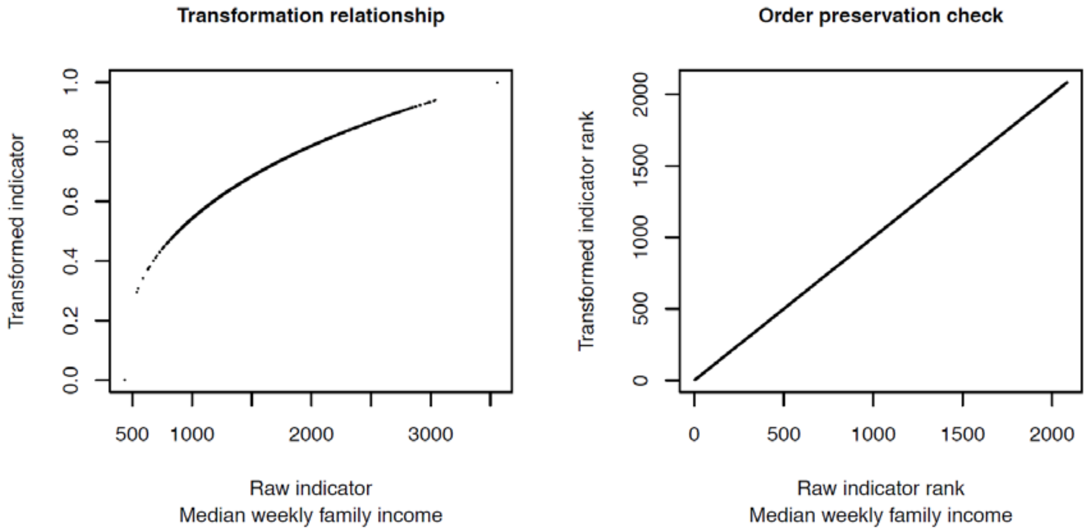
OUTLIER DETAILS

SA2	Value
Thamarrurr	186.00
East Pilbara	1974.00

Appendix 5C (cont.)



Appendix 5C (cont.)



TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.35
Pre–transform skewness: 0.7
Post–transform skewness: 0.0

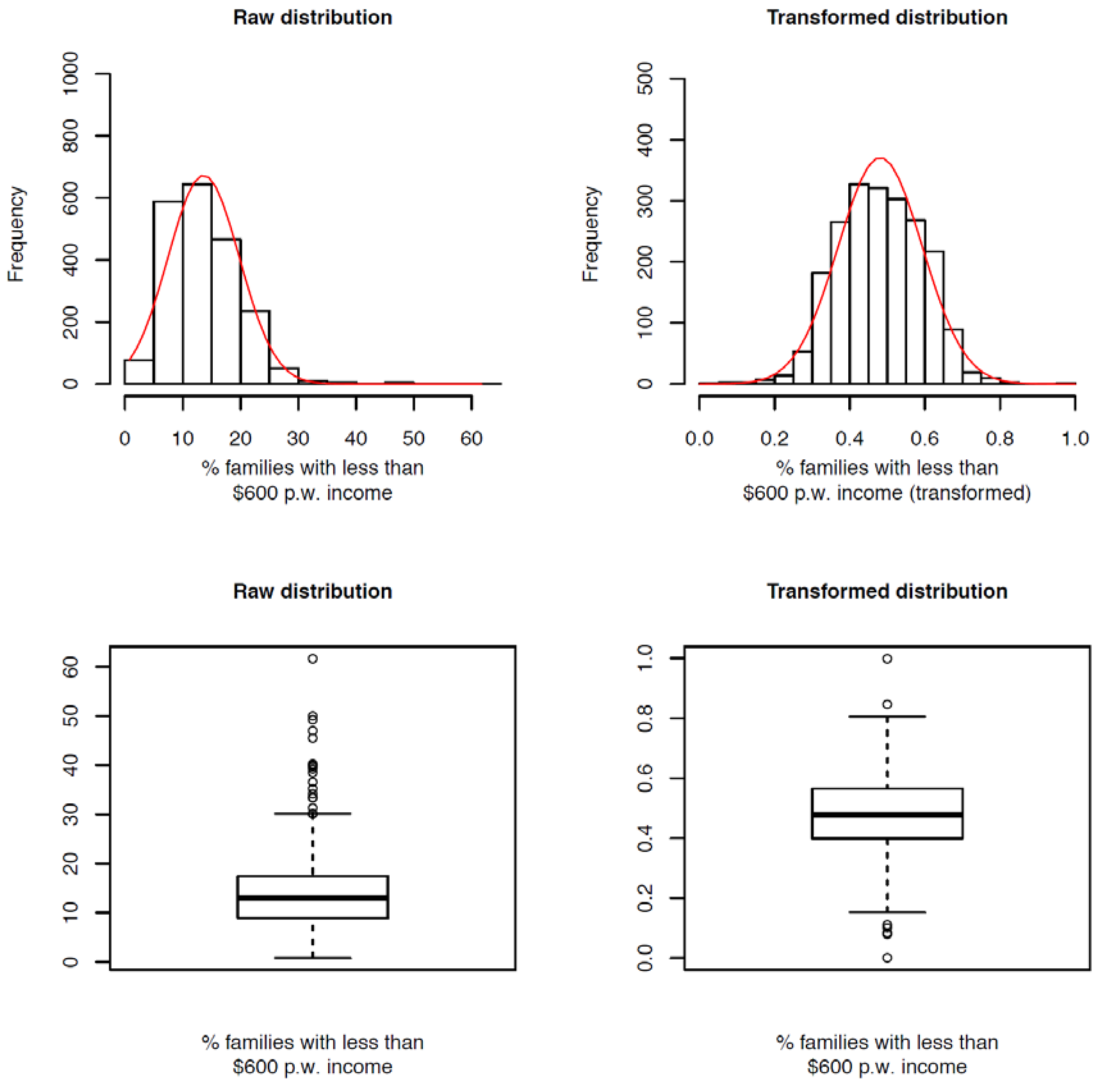
Kurtosis:
Coefficient: 0.02
Pre–transform kurtosis: −0.1
Post–transform kurtosis: 0.0

Outliers:
Pre–transform outlier count: 1
Post–transform outlier count: 3

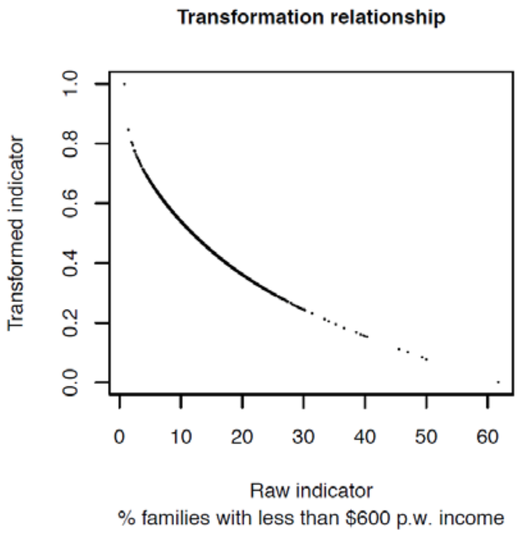
OUTLIER DETAILS

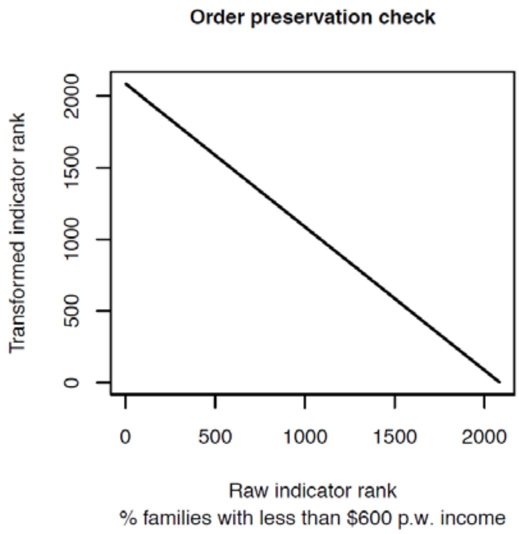
SA2	Value
Thamarrurr	435.00
Tanami	536.00
Sandover – Plenty	547.00

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.40
Pre–transform skewness: 1.1
Post–transform skewness: 0.0

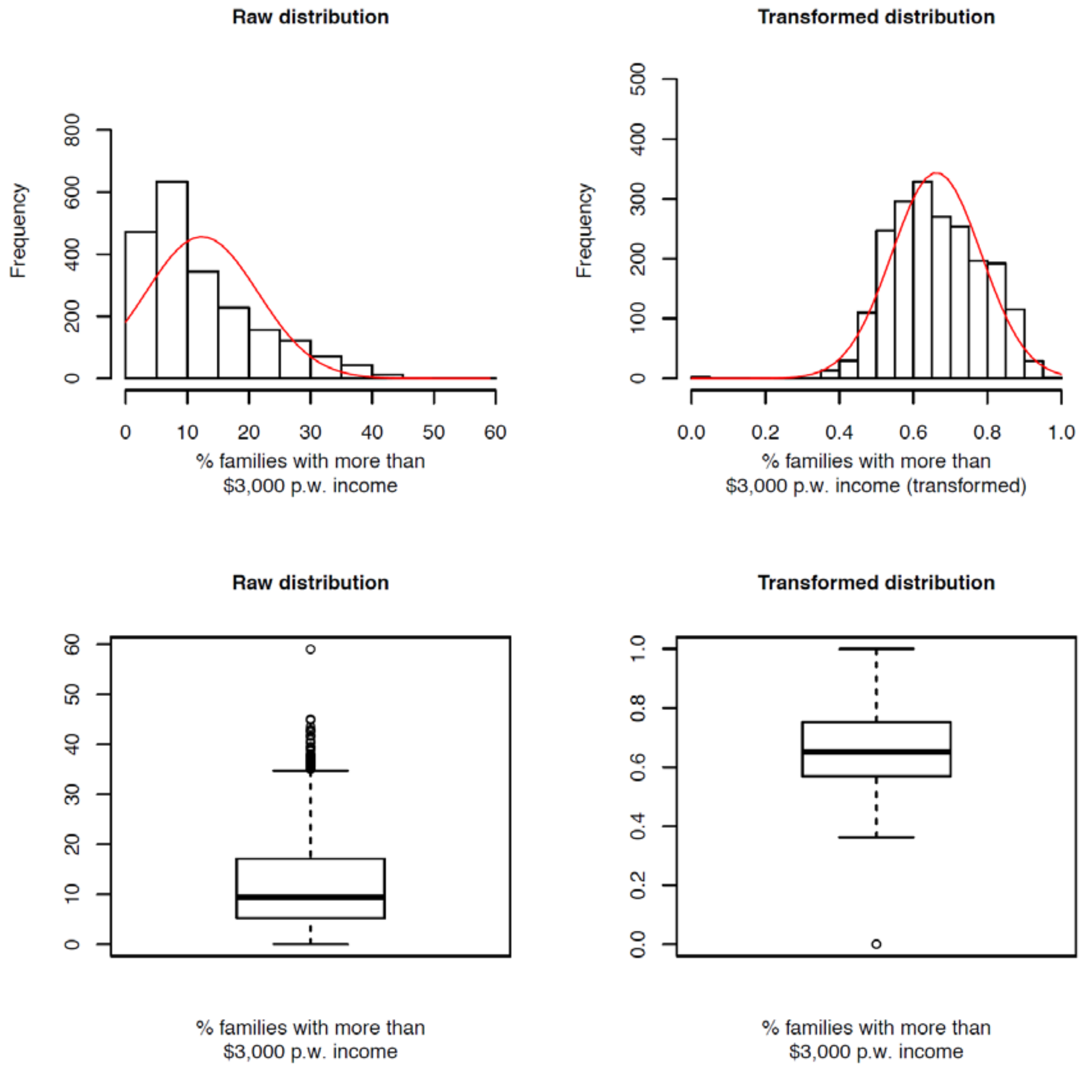
Kurtosis:
Coefficient: 0.05
Pre–transform kurtosis: 3.5
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 13
Post–transform outlier count: 6

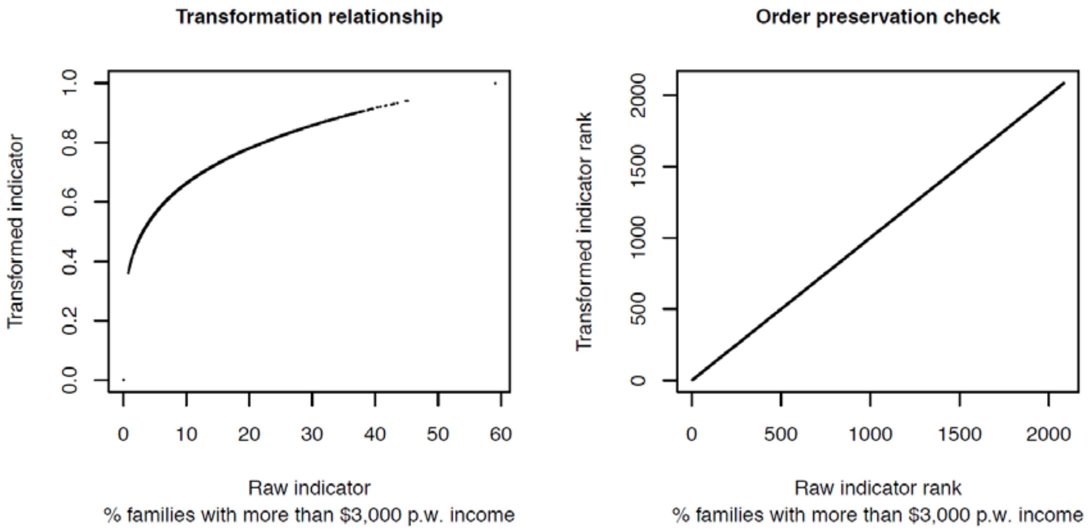
OUTLIER DETAILS

SA2	Value
Forrest	0.78
Sandover – Plenty	45.54
Tanami	46.97
Tiwi Islands	49.29
Western	50.00
Thamarrurr	61.70

Appendix 5C (cont.)



Appendix 5C (cont.)



TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.23
Pre–transform skewness: 1.2
Post–transform skewness: 0.0

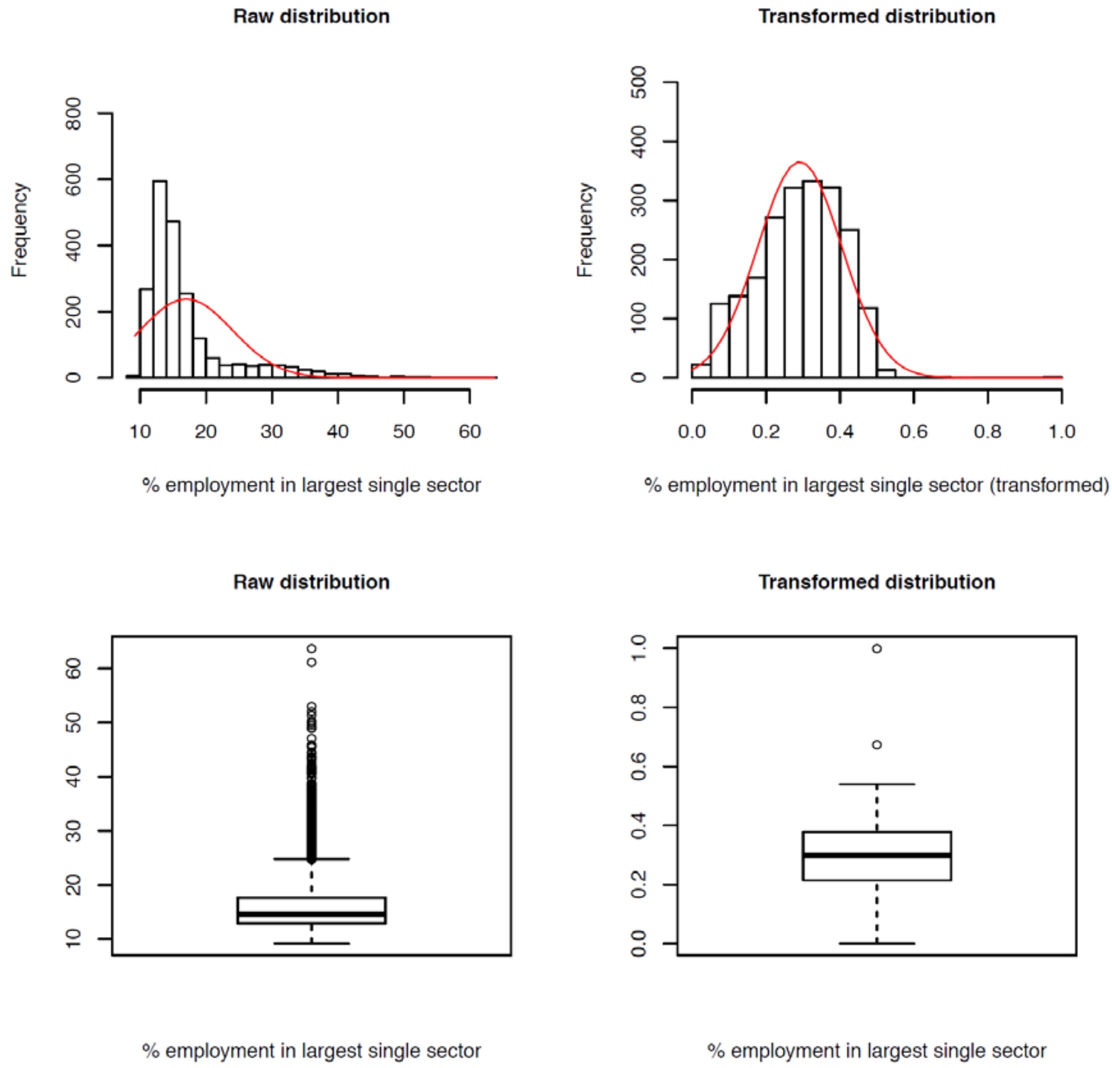
Kurtosis:
Coefficient: 0.02
Pre–transform kurtosis: 0.8
Post–transform kurtosis: 0.0

Outliers:
Pre–transform outlier count: 8
Post–transform outlier count: 2

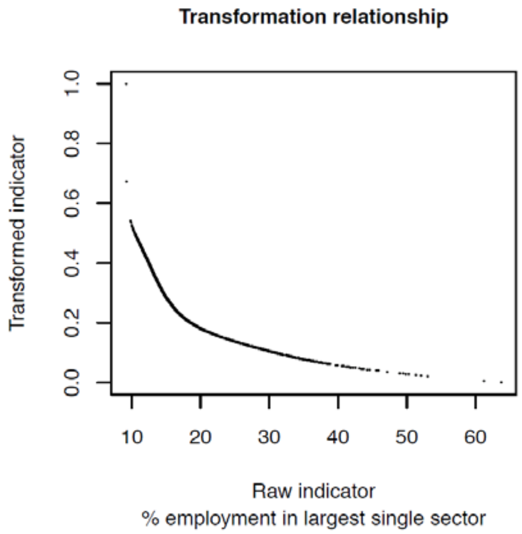
OUTLIER DETAILS

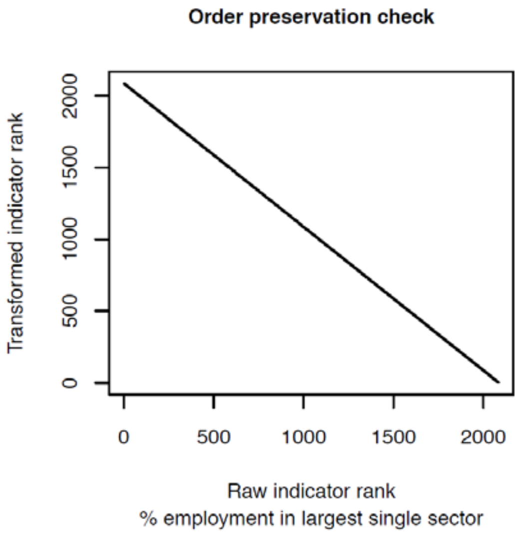
SA2	Value
Upper Yarra Valley	0.00
Western	0.00

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.12
Pre−transform skewness: 2.3
Post−transform skewness: −0.2

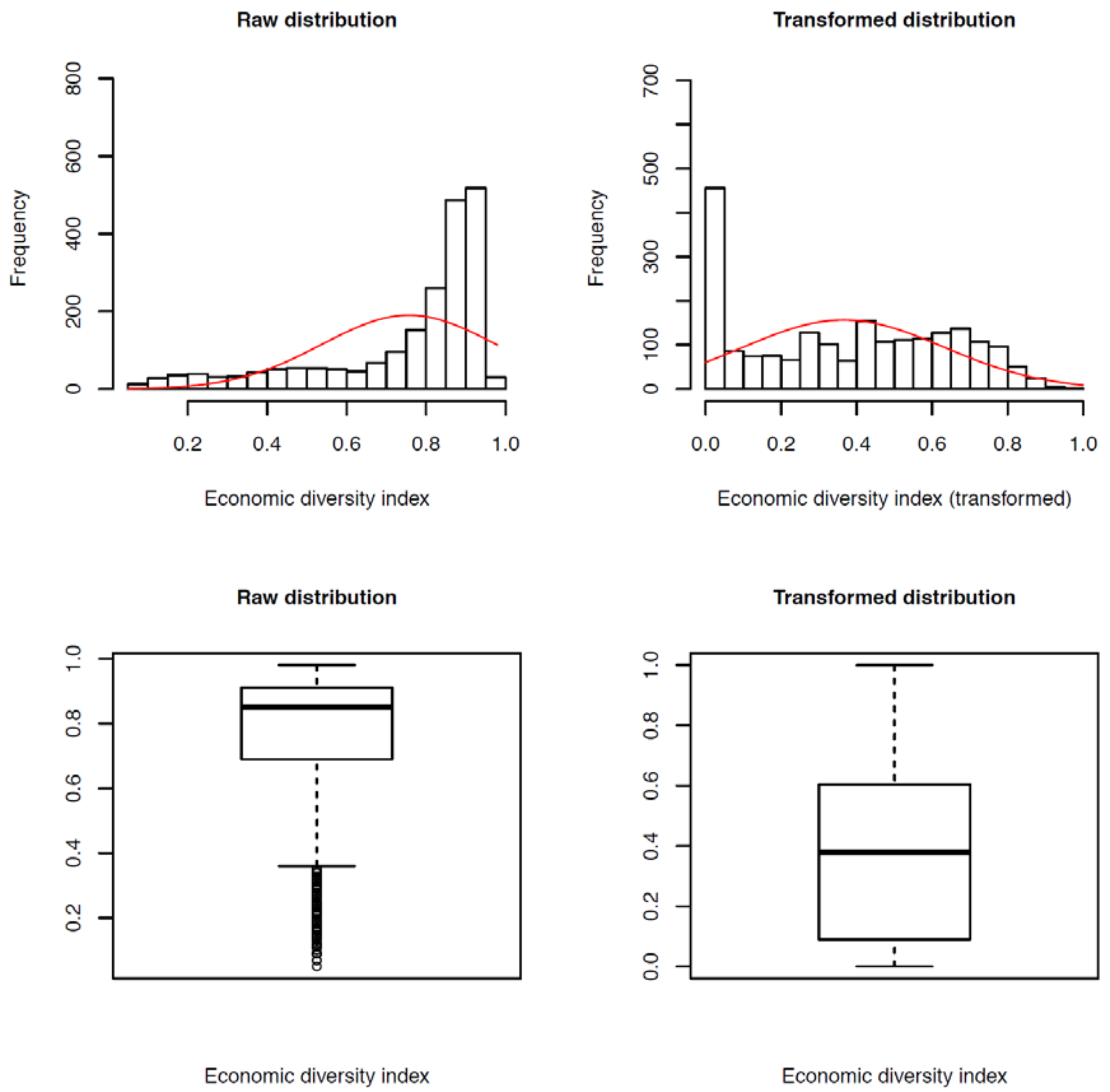
Kurtosis:
Coefficient: 0.26
Pre−transform kurtosis: 5.8
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 34
Post−transform outlier count: 2

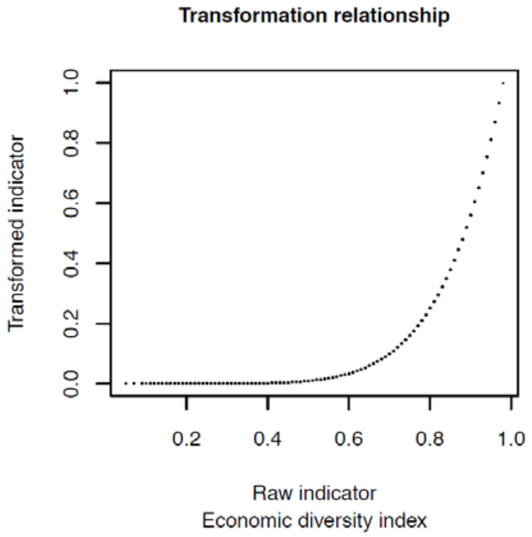
OUTLIER DETAILS

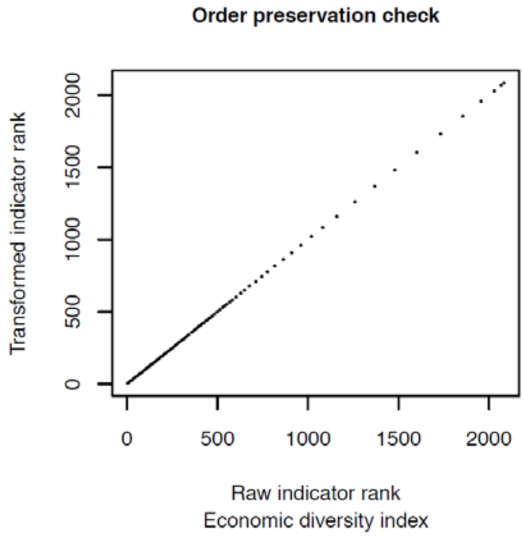
SA2	Value
Belmont – Ascot – Redcliffe	9.17
Rivervale – Kewdale – Cloverdale	9.21

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

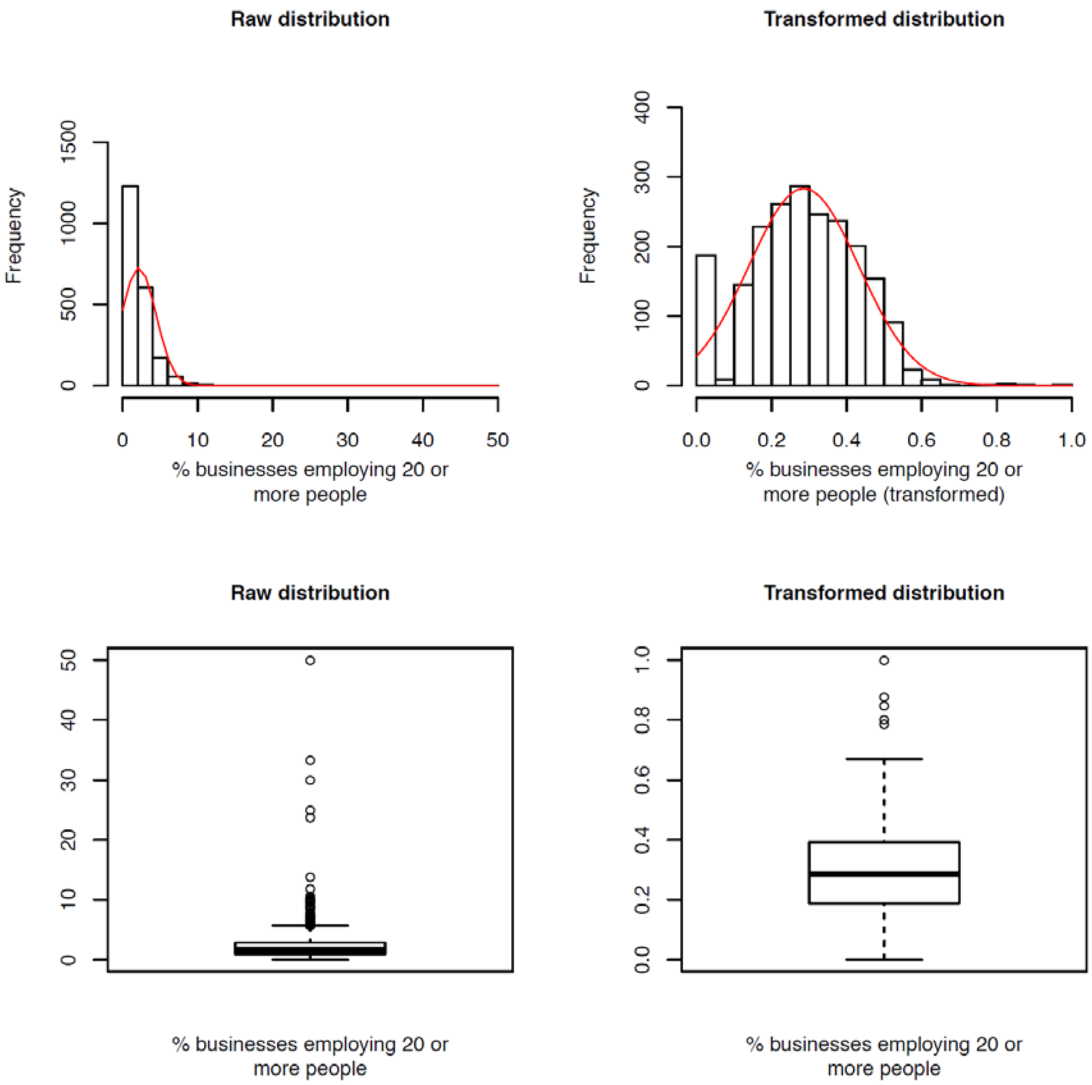
Unreversed

Skewness:
Power transform, exponent: 6.44
Pre−transform skewness: −1.5
Post−transform skewness: 0.0

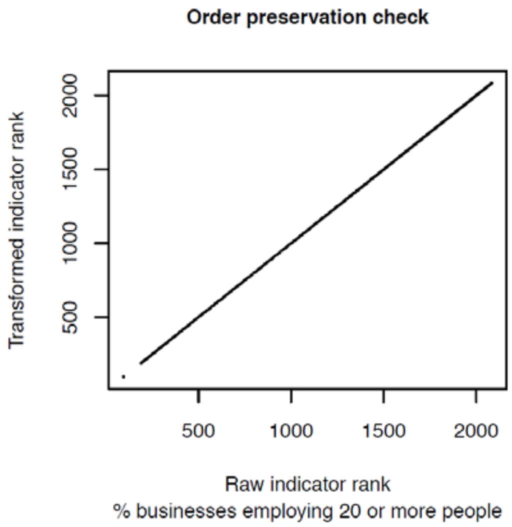
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 1.1
Post−transform kurtosis: −1.3

Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

Appendix 5C (cont.)



Appendix 5C (cont.)



TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.43
Pre−transform skewness: 7.9
Post−transform skewness: −0.1

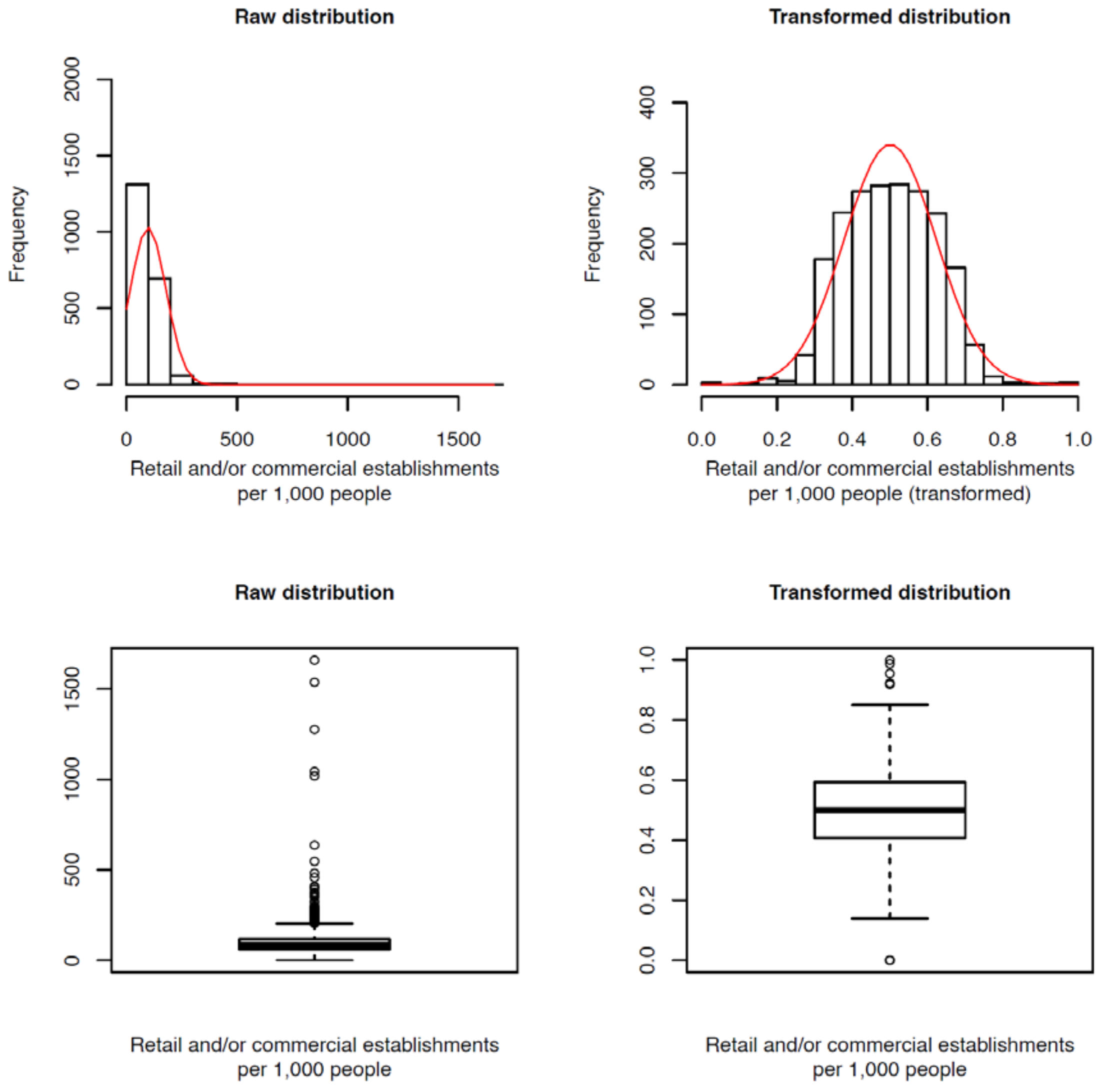
Kurtosis:
Coefficient: 0.29
Pre−transform kurtosis: 126.8
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 13
Post−transform outlier count: 5

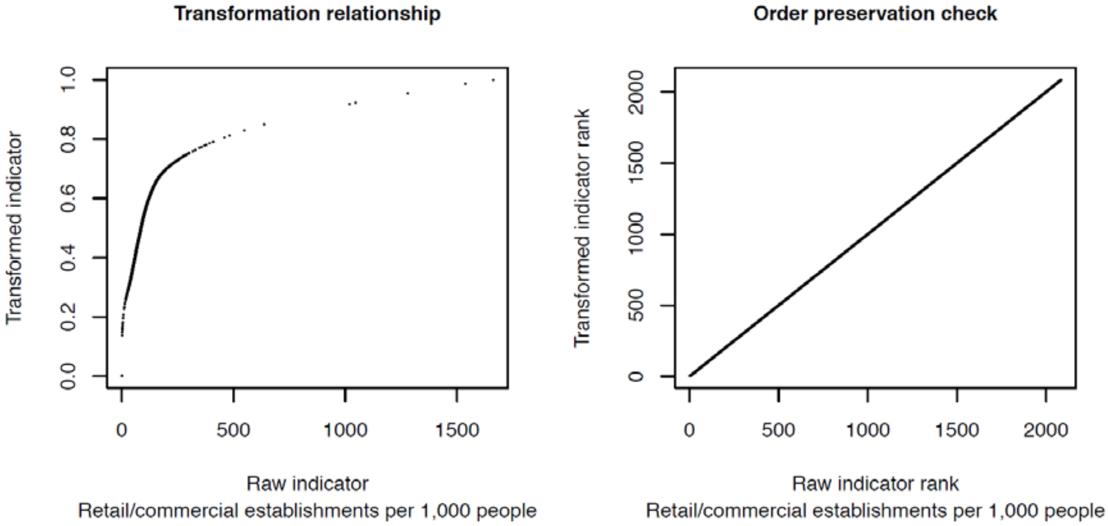
OUTLIER DETAILS

SA2	Value
Petermann – Simpson	23.68
Palm Island	25.00
Victoria River	30.00
Tiwi Islands	33.33
Tanami	50.00

Appendix 5C (cont.)



Appendix 5C (cont.)



TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.23
Pre–transform skewness: 9.8
Post–transform skewness: 0.0

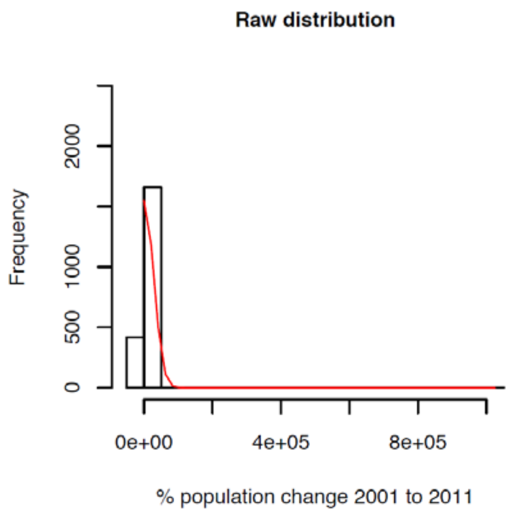
Kurtosis:
Coefficient: 0.34
Pre–transform kurtosis: 155.2
Post–transform kurtosis: –0.0

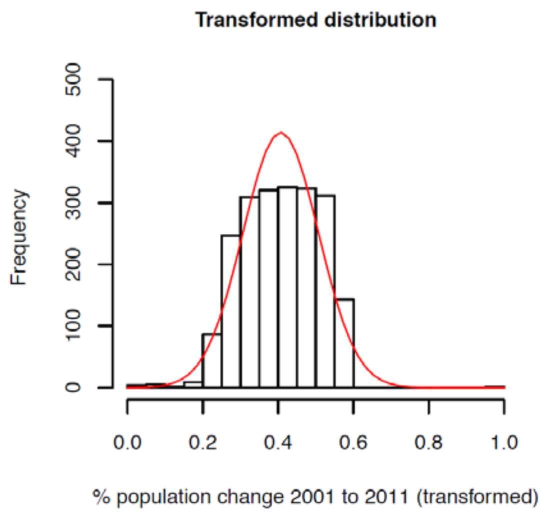
Outliers:
Pre–transform outlier count: 14
Post–transform outlier count: 8

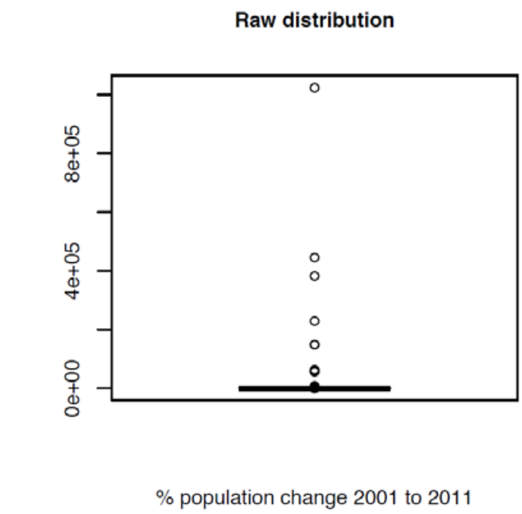
OUTLIER DETAILS

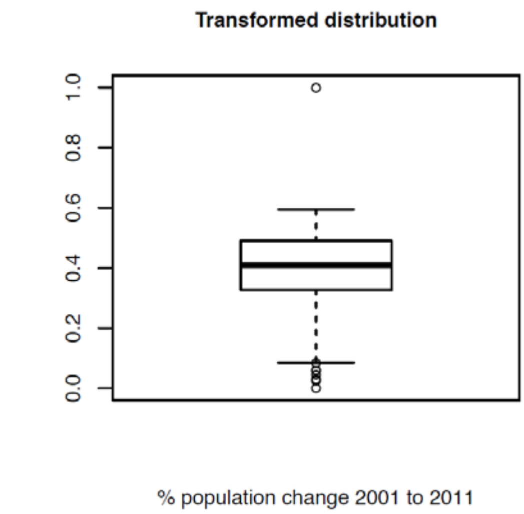
SA2	Value
Western	0.00
APY Lands	0.00
Thamarrurr	0.00
Melbourne	1018.82
Adelaide	1045.90
Brisbane City	1278.26
ACT – East	1536.61
Sydney – Haymarket – The Rocks	1661.16

Appendix 5C (cont.)

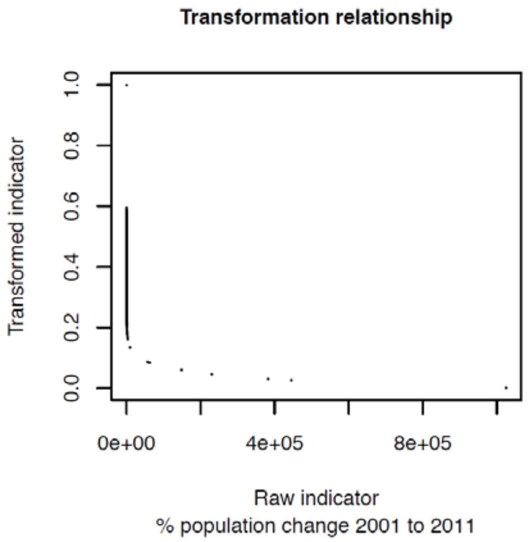


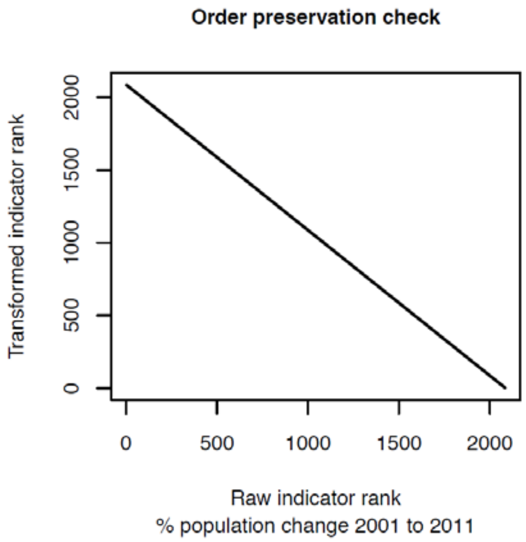






Appendix 5C (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.05
Pre–transform skewness: 30.7
Post–transform skewness: –0.1

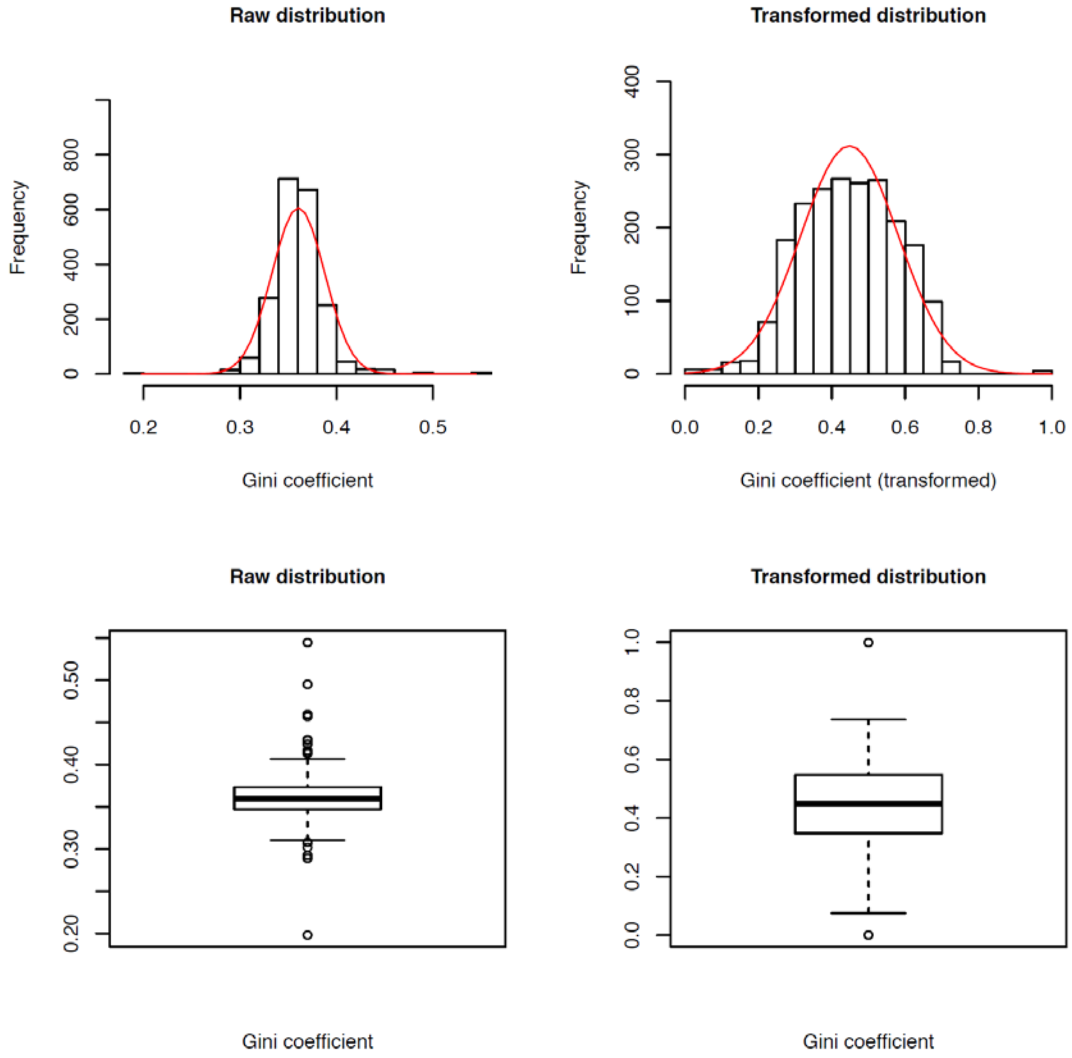
Kurtosis:
Coefficient: 0.44
Pre–transform kurtosis: 1073.4
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 6
Post–transform outlier count: 7

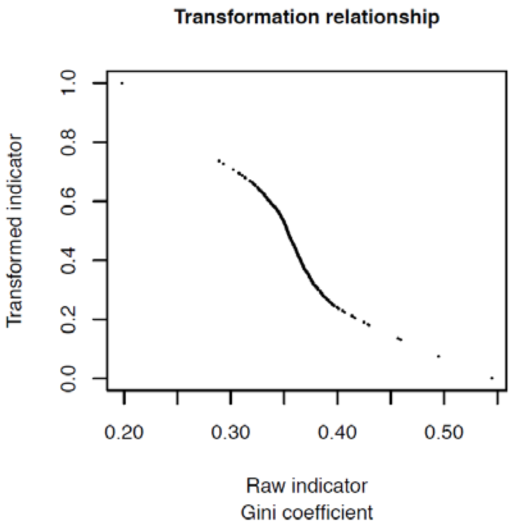
OUTLIER DETAILS

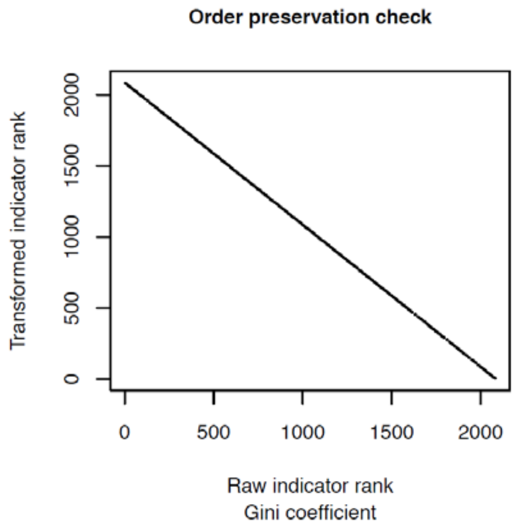
SA2	Value
Coober Pedy	–33.17
Bonner	148100.00
Casey	148500.00
Forde	230400.00
Franklin	382000.00
Harrison	444700.00
Springfield Lakes	1024600.00

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.73
Pre−transform skewness: 1.1
Post−transform skewness: −0.0

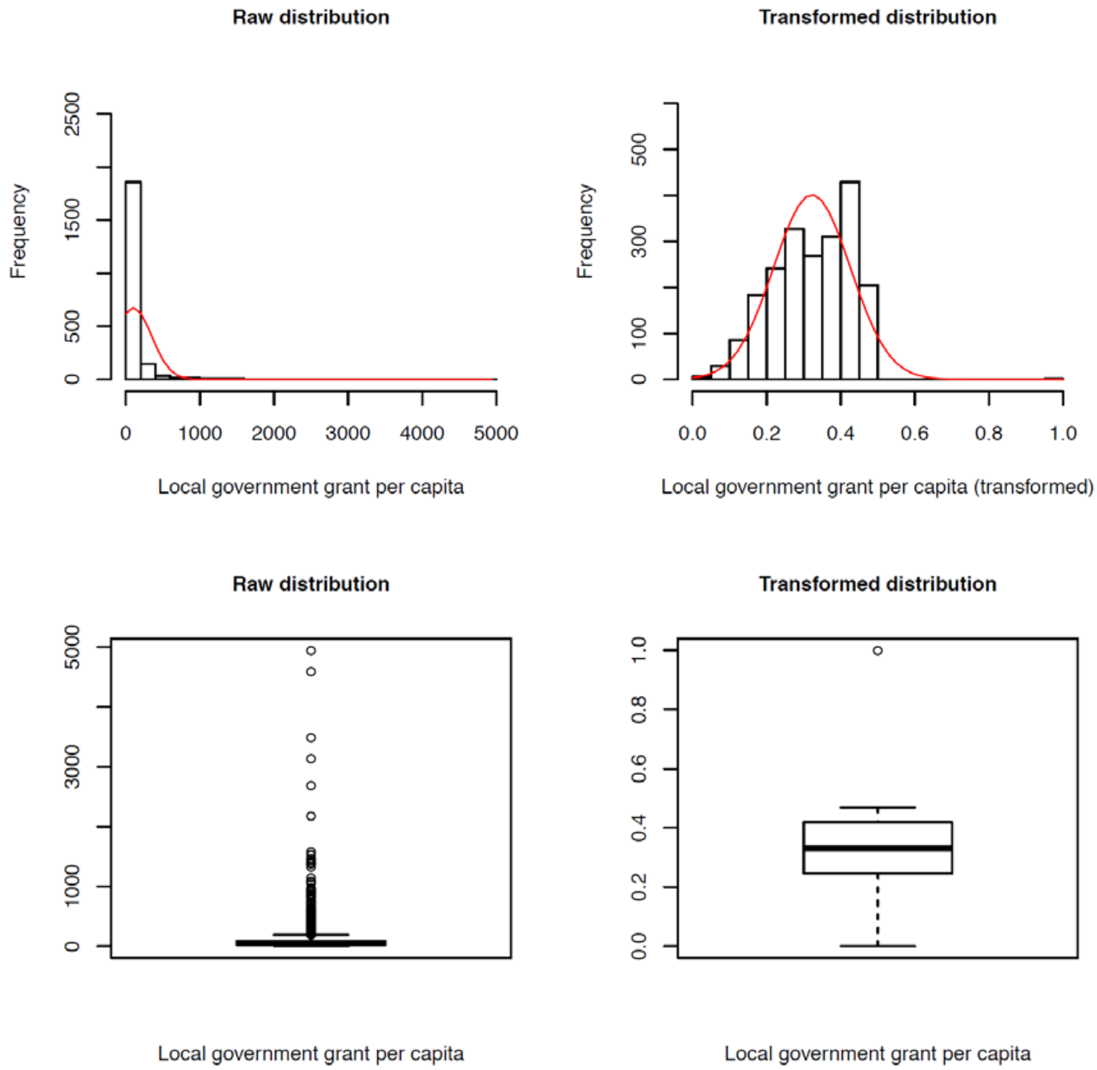
Kurtosis:
Coefficient: 0.44
Pre−transform kurtosis: 9.7
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 32
Post−transform outlier count: 10

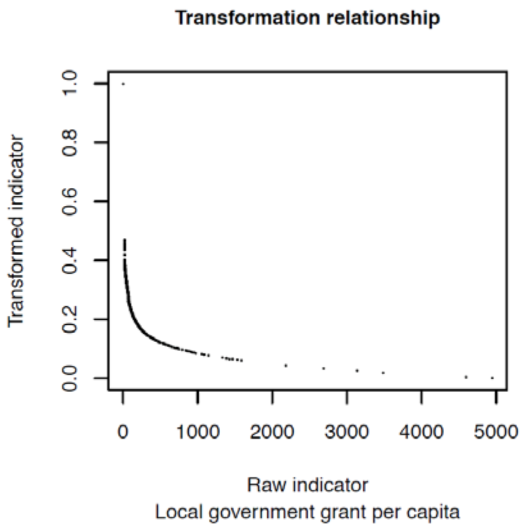
OUTLIER DETAILS

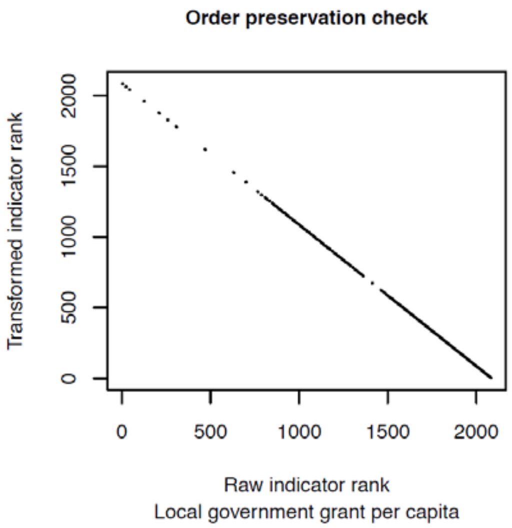
SA2	Value
Buderim – North	0.20
Buderim – South	0.20
Mountain Creek	0.20
Sippy Downs	0.20
Clifton – Greenmount	0.54
Southern Downs – East	0.54
Southern Downs – West	0.54
Stanthorpe	0.54
Stanthorpe Region	0.54
Warwick	0.54

Appendix 5C (cont.)



Appendix 5C (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.07
Pre–transform skewness: 10.8
Post–transform skewness: –0.3

Kurtosis:
Coefficient: 0.29
Pre–transform kurtosis: 164.0
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 23
Post–transform outlier count: 1

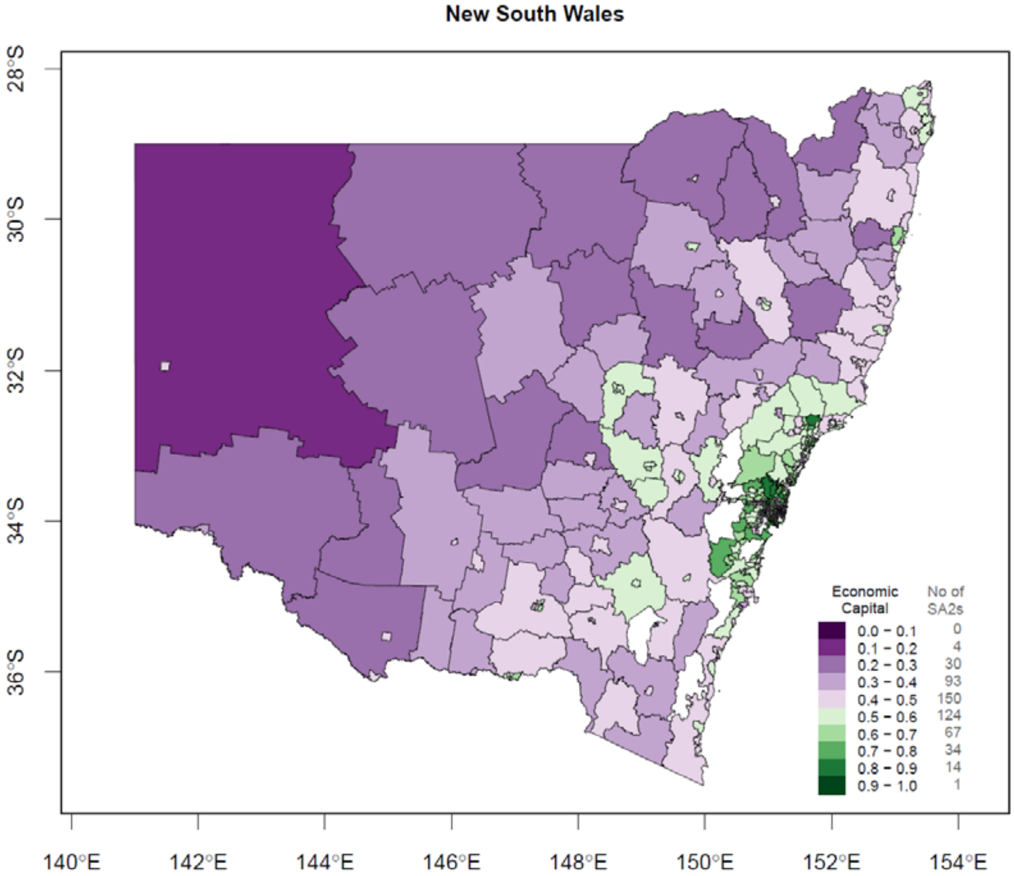
OUTLIER DETAILS

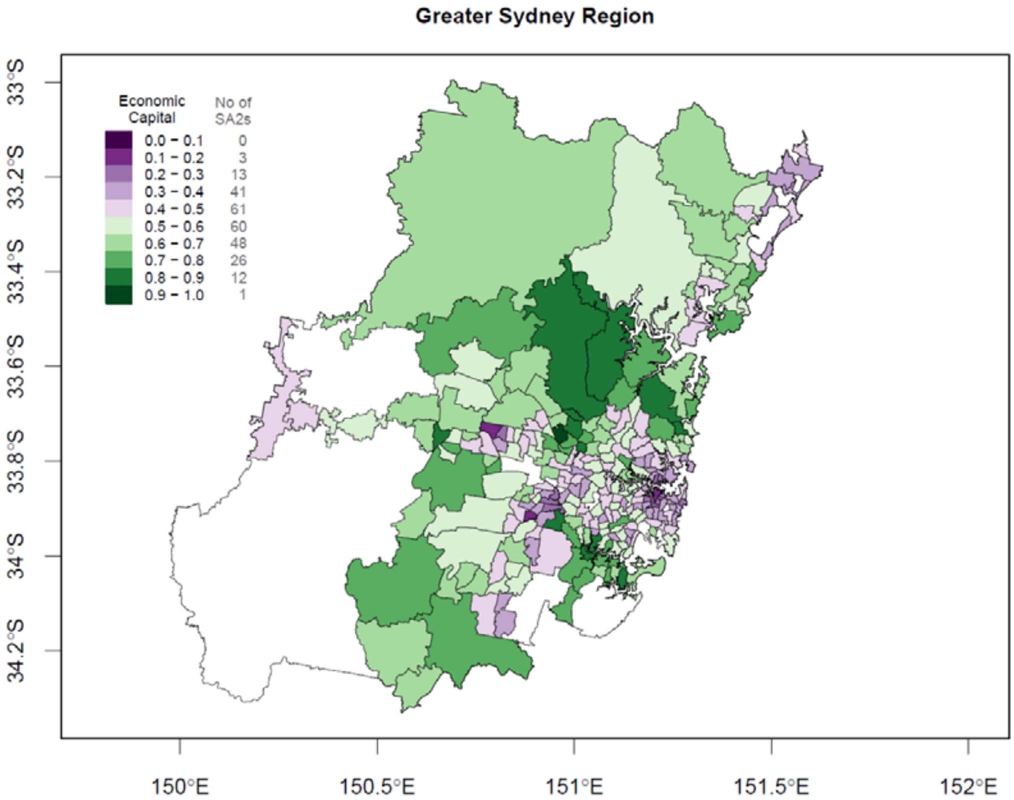
SA2	Value
Weipa	0.20

APPENDIX 5D – MAPS: ECONOMIC CAPITAL SUB-INDEX BY STATE/TERRITORY AND METROPOLITAN AREAS

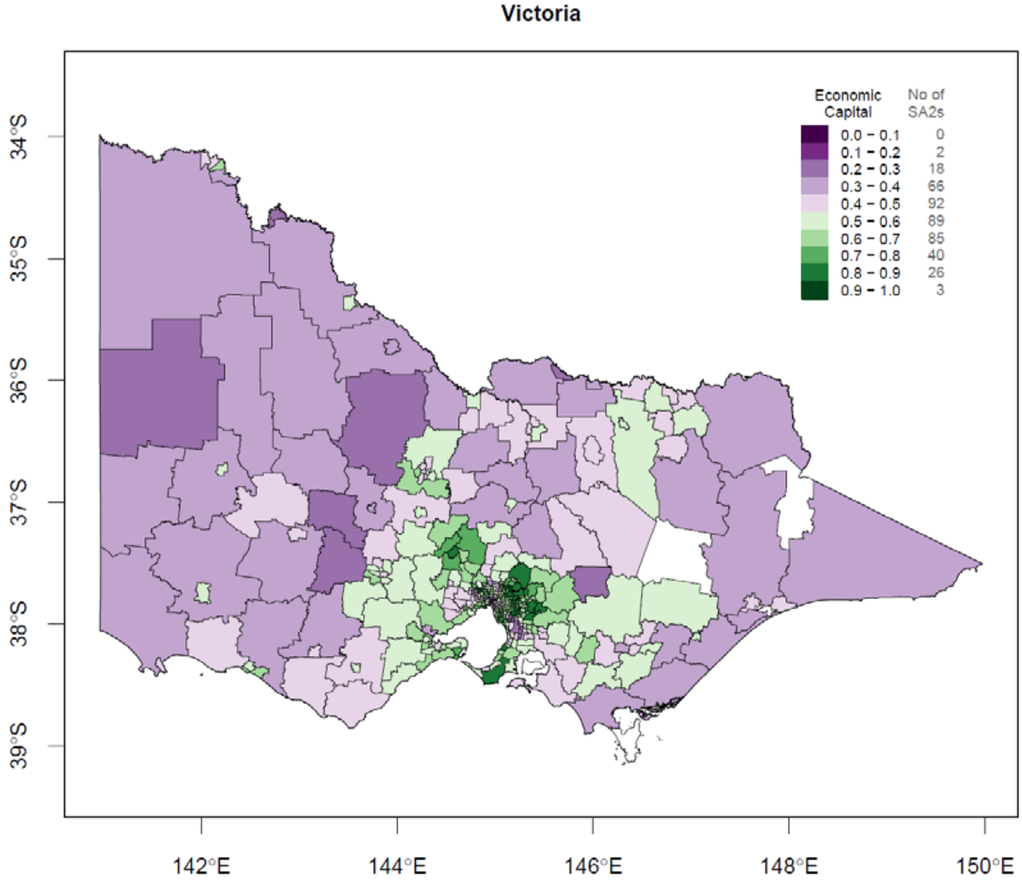
Appendix 5D maps the economic capital sub-index at the resolution of individual States and Territories, and major metropolitan areas.

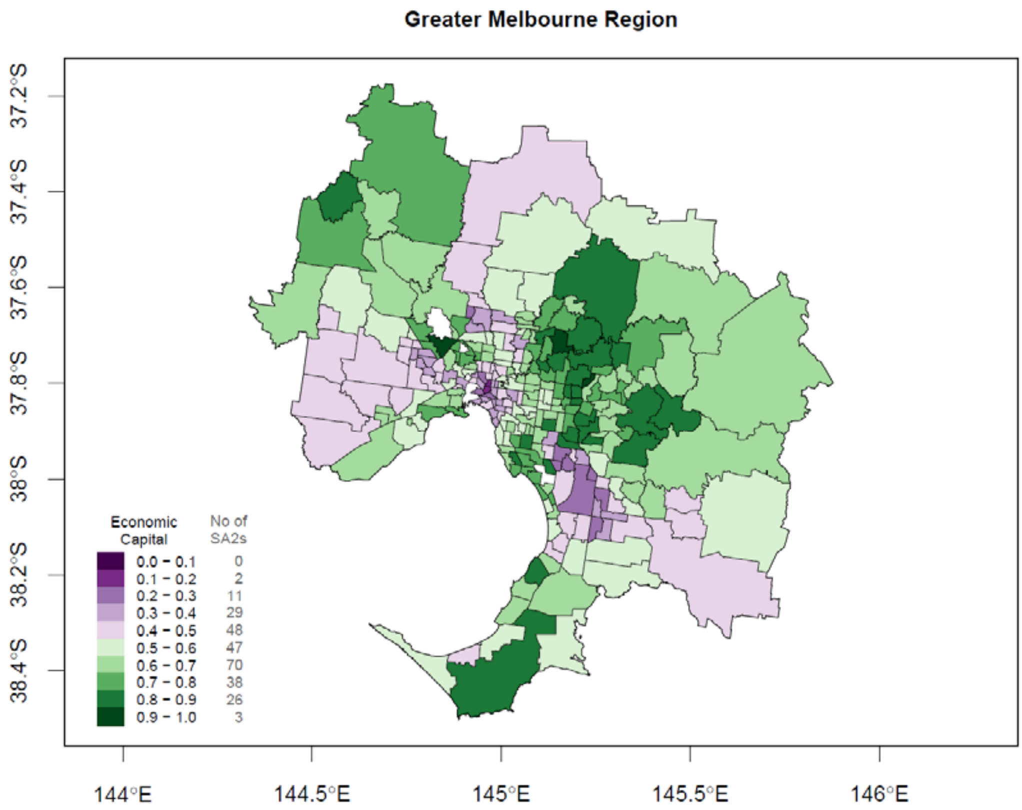
Appendix 5D


New South Wales
28°S
30°S
32°S
34°S
36°S
140°E
142°E
144°E
146°E
148°E
150°E
152°E
154°E
Economic Capital
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 4
0.2 – 0.3 30
0.3 – 0.4 93
0.4 – 0.5 150
0.5 – 0.6 124
0.6 – 0.7 67
0.7 – 0.8 34
0.8 – 0.9 14
0.9 – 1.0 1

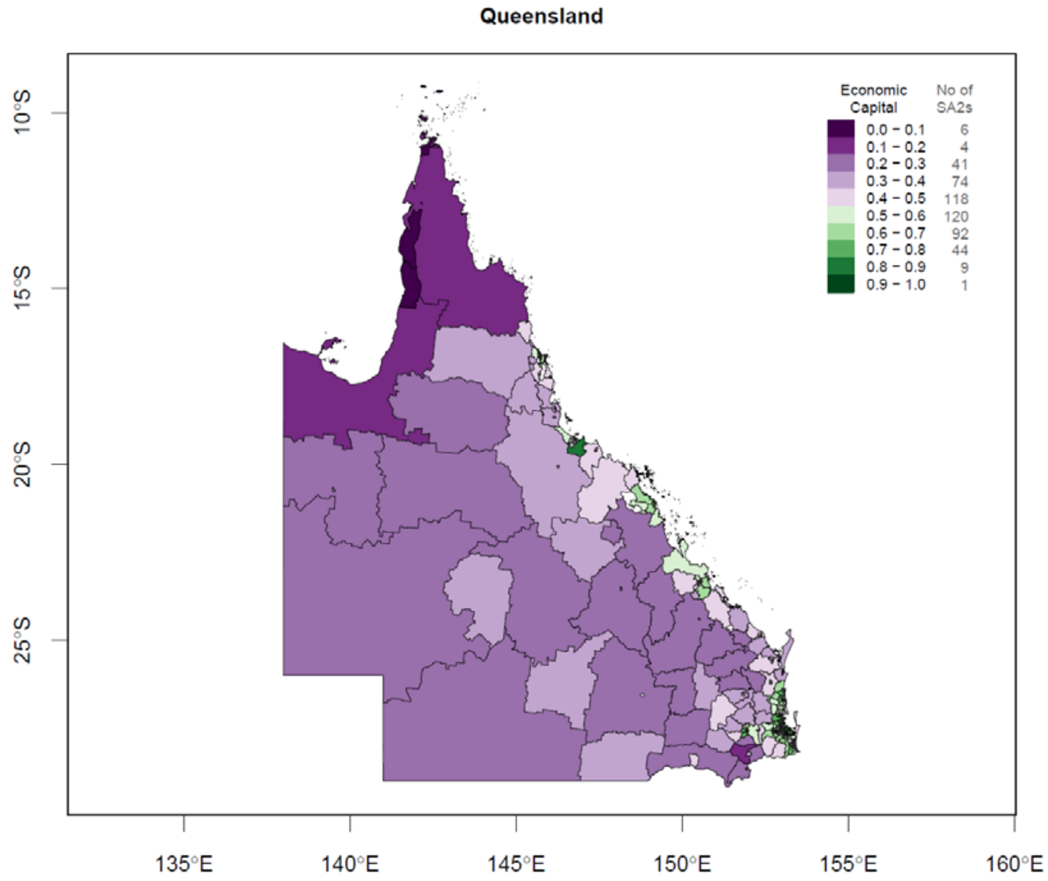

Greater Sydney Region
33°S
33.2°S
33.4°S
33.6°S
33.8°S
34°S
34.2°S
150°E
150.5°E
151°E
151.5°E
152°E
Economic Capital
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 3
0.2 – 0.3 13
0.3 – 0.4 41
0.4 – 0.5 61
0.5 – 0.6 60
0.6 – 0.7 48
0.7 – 0.8 26
0.8 – 0.9 12
0.9 – 1.0 1

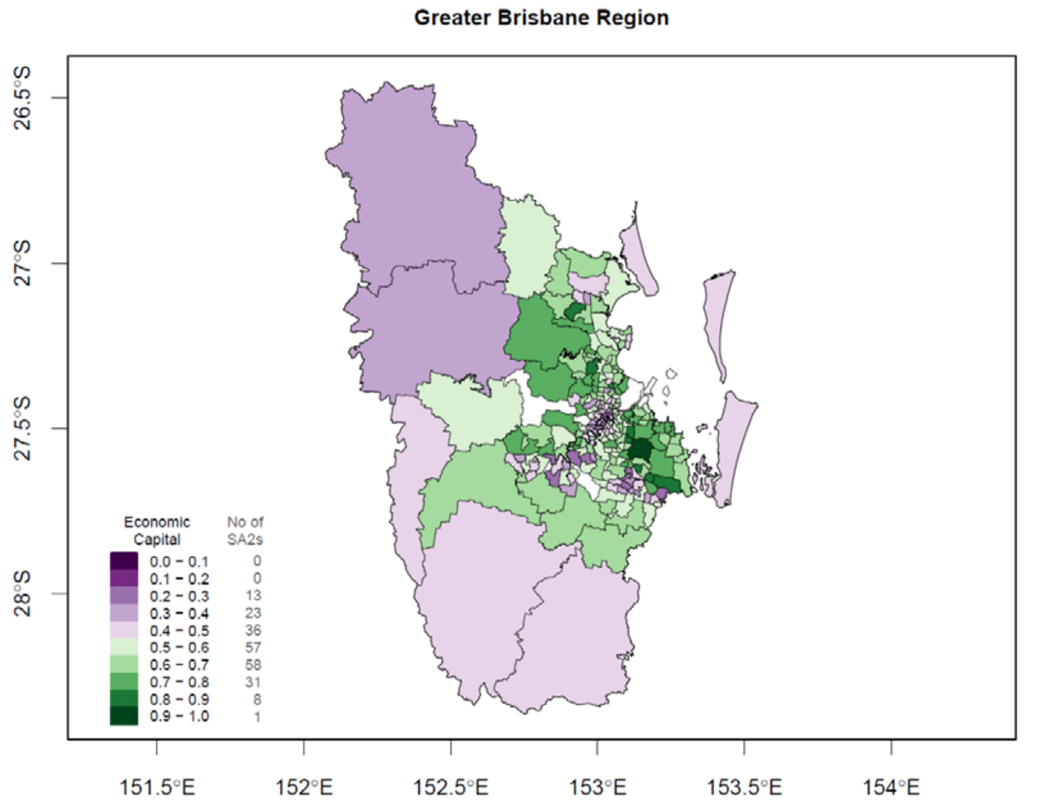
Appendix 5D (cont.)



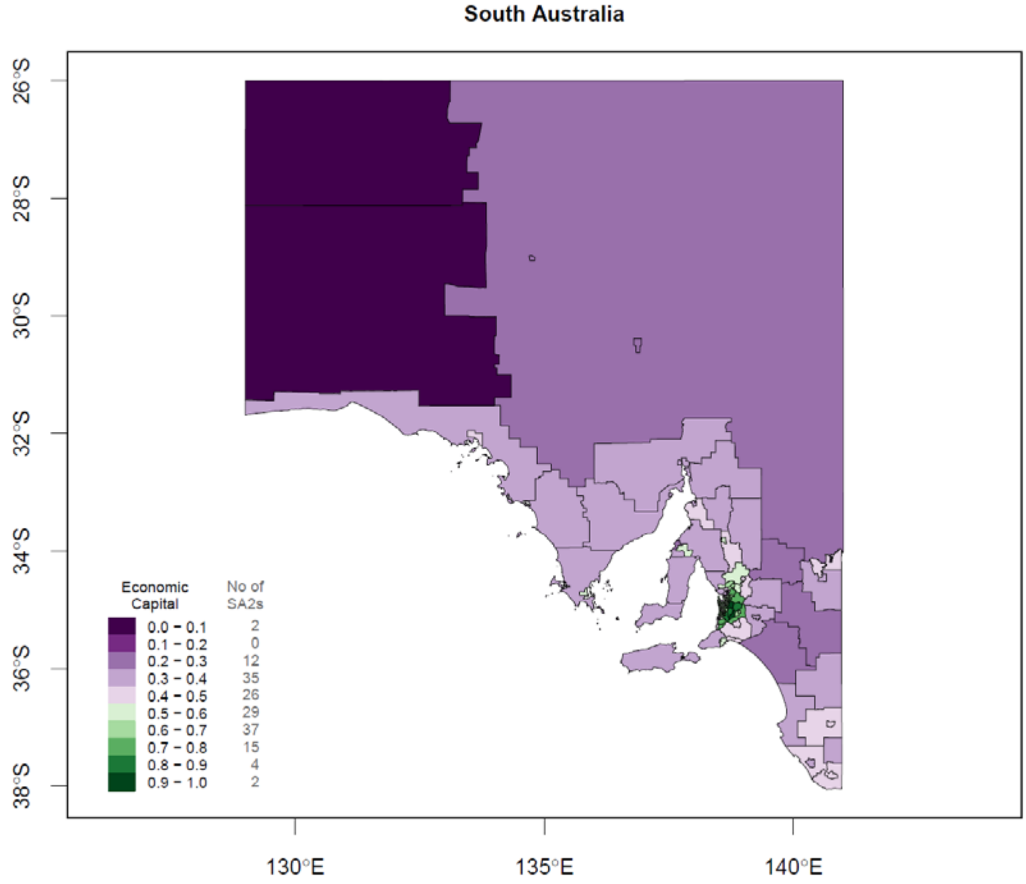


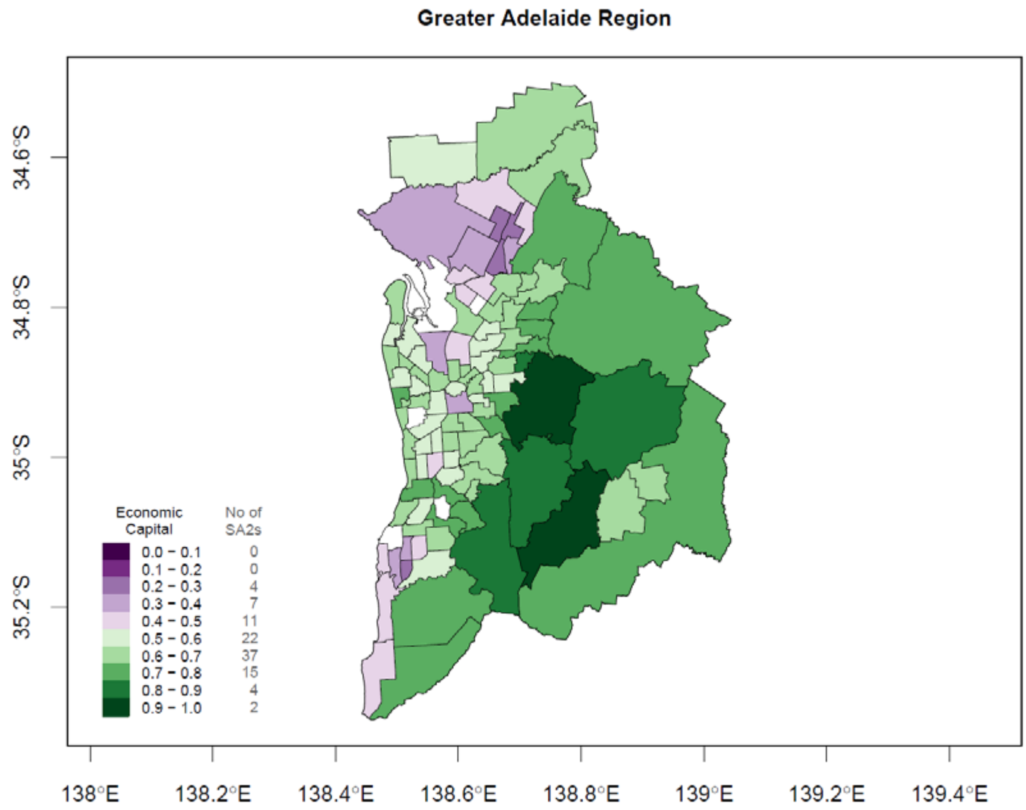
Appendix 5D (cont.)



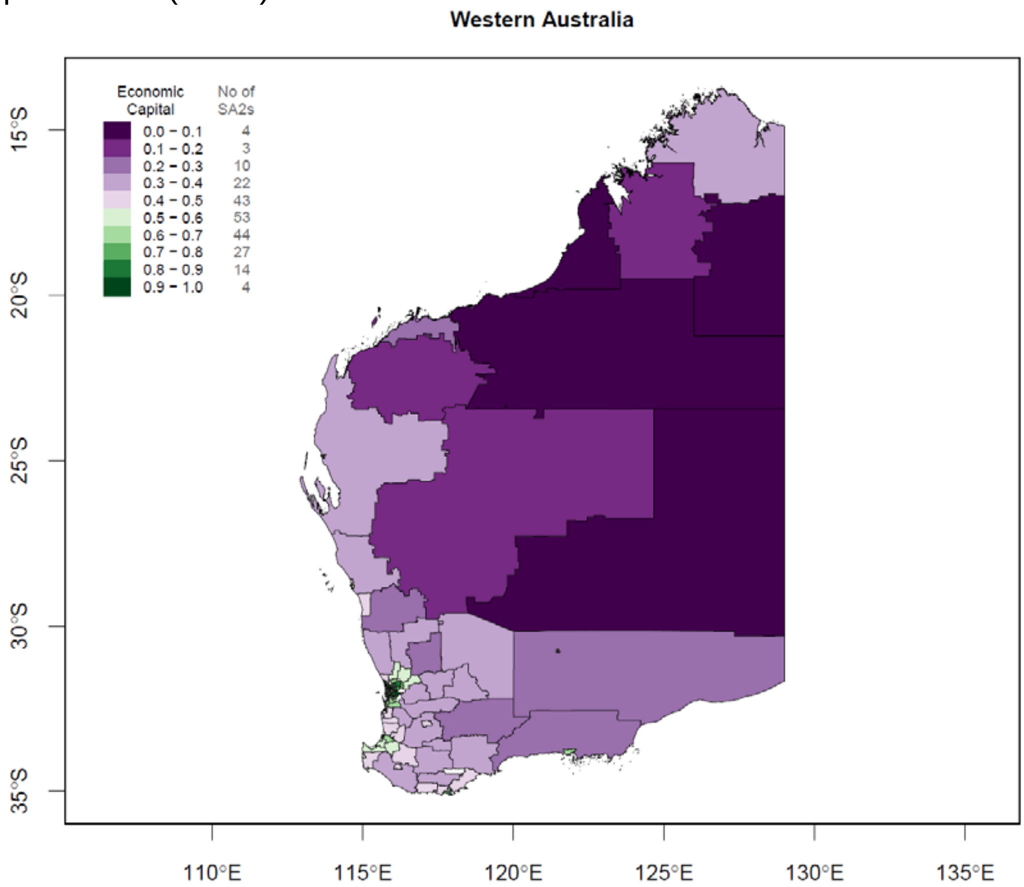


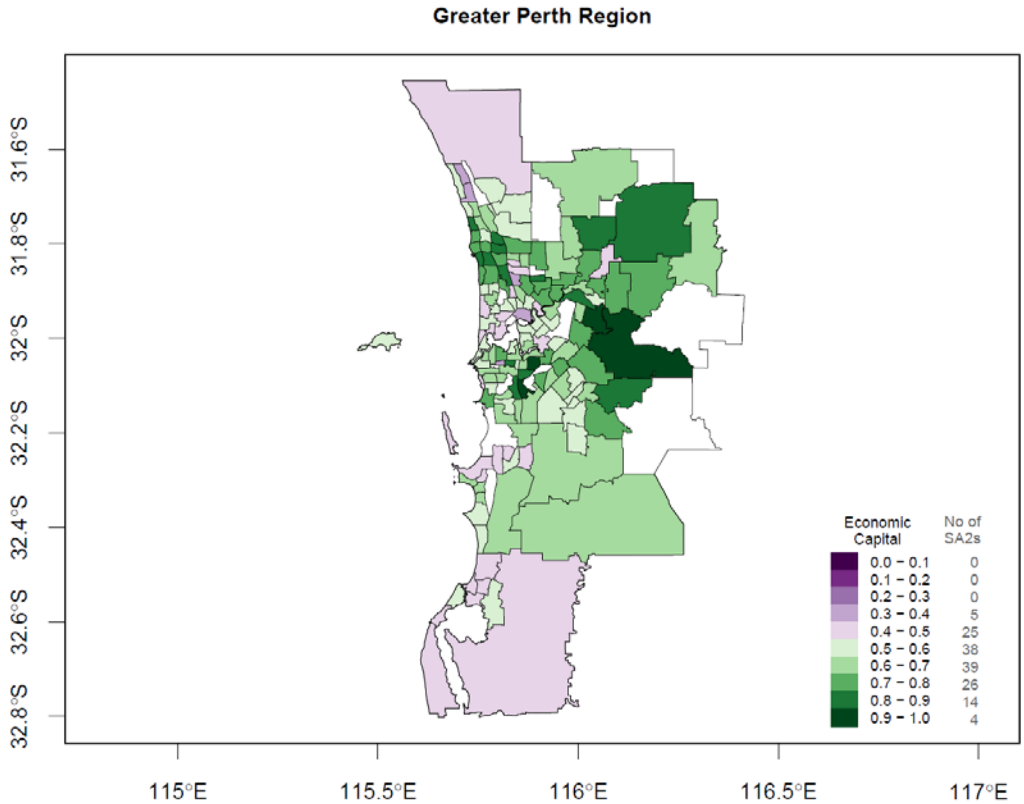
Appendix 5D (cont.)



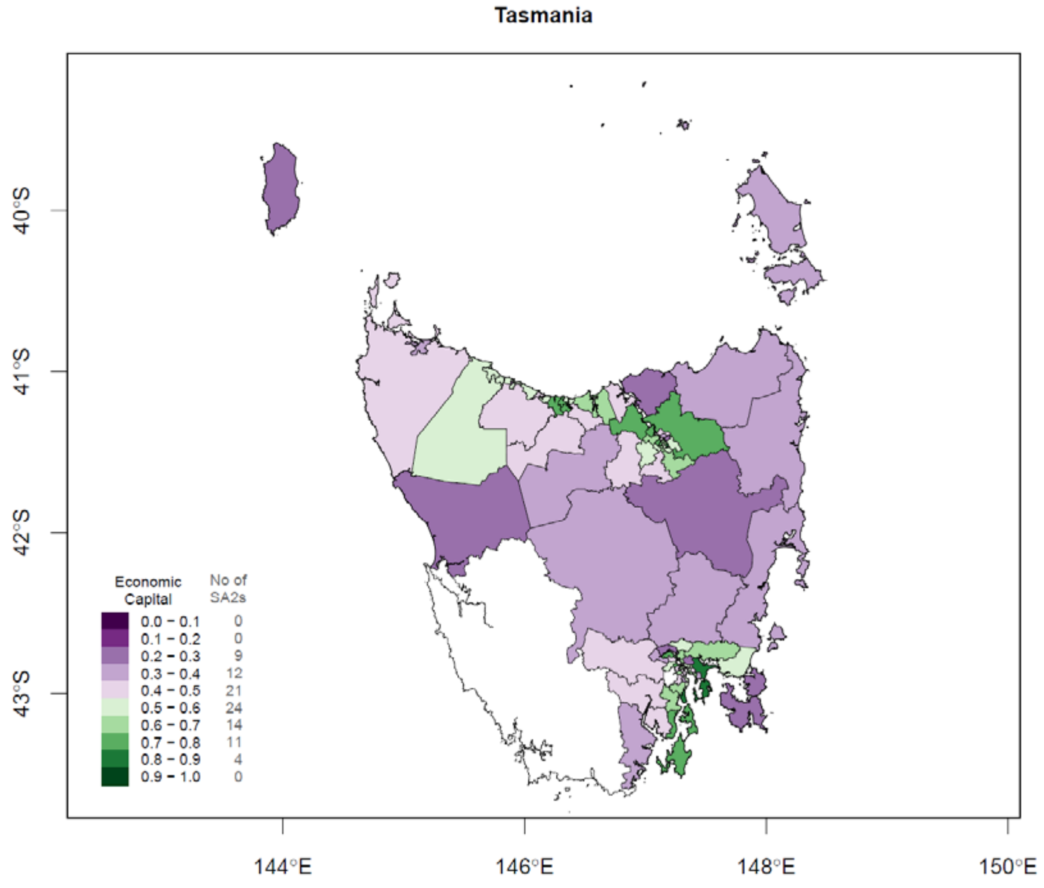


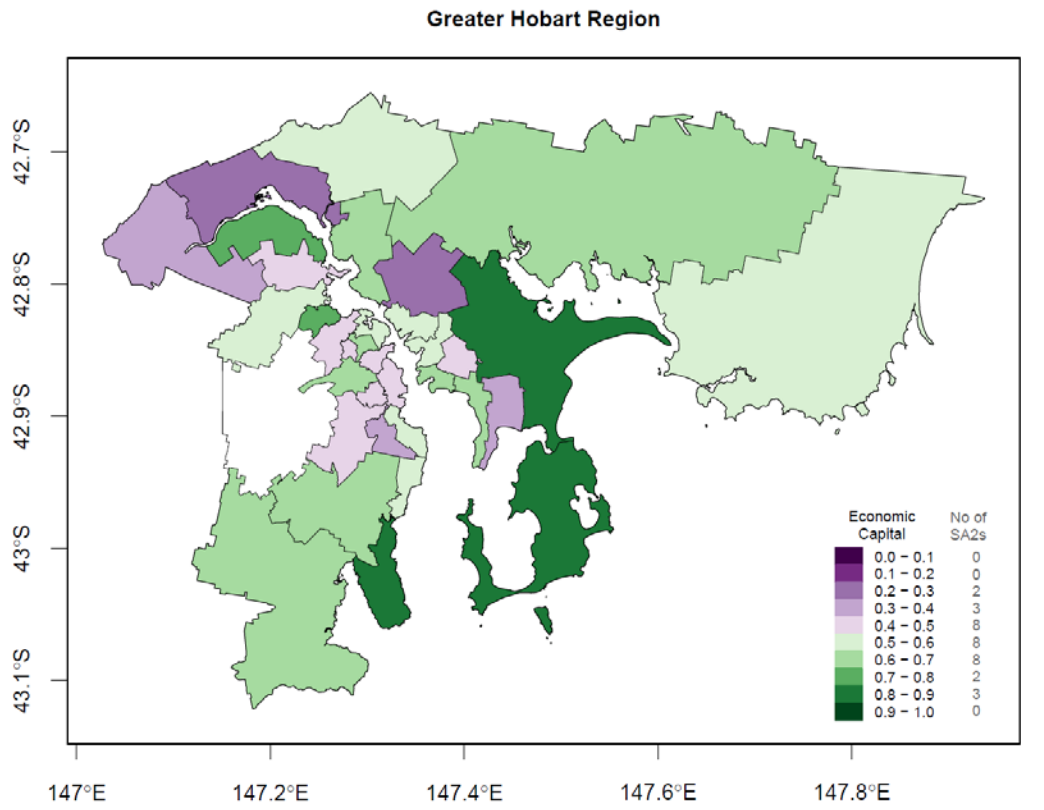
Appendix 5D (cont.)



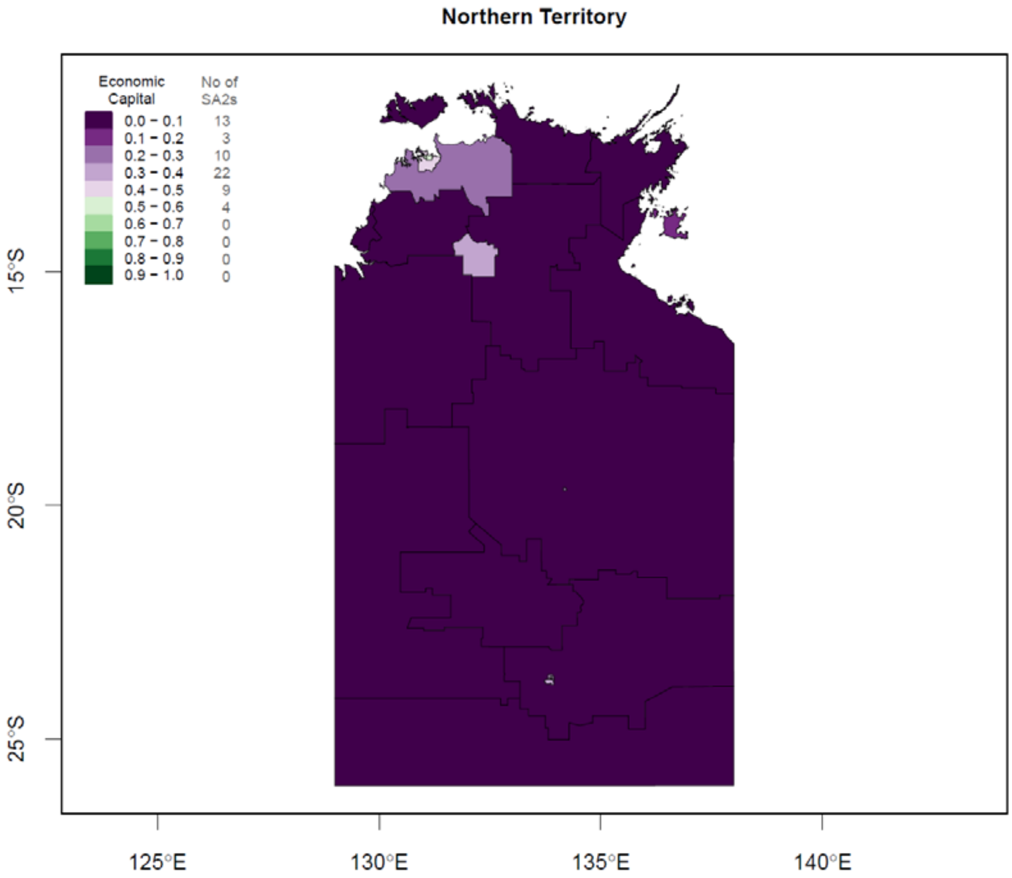


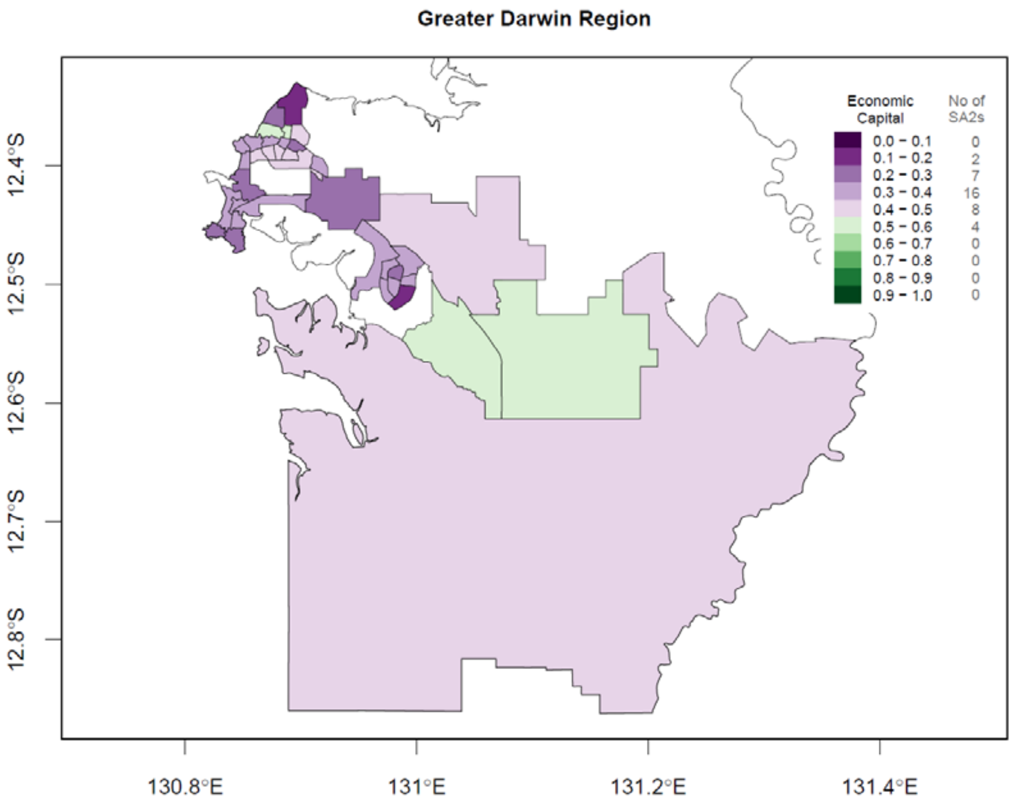
Appendix 5D (cont.)



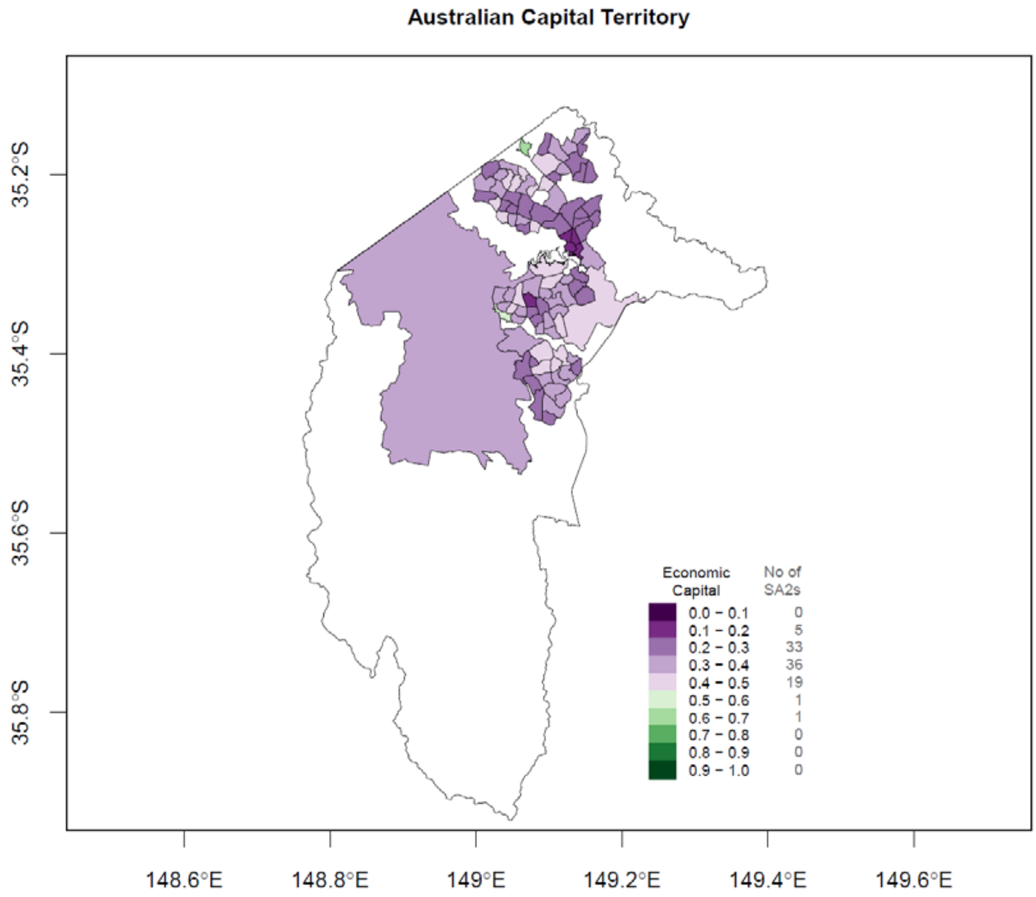


Appendix 5D (cont.)





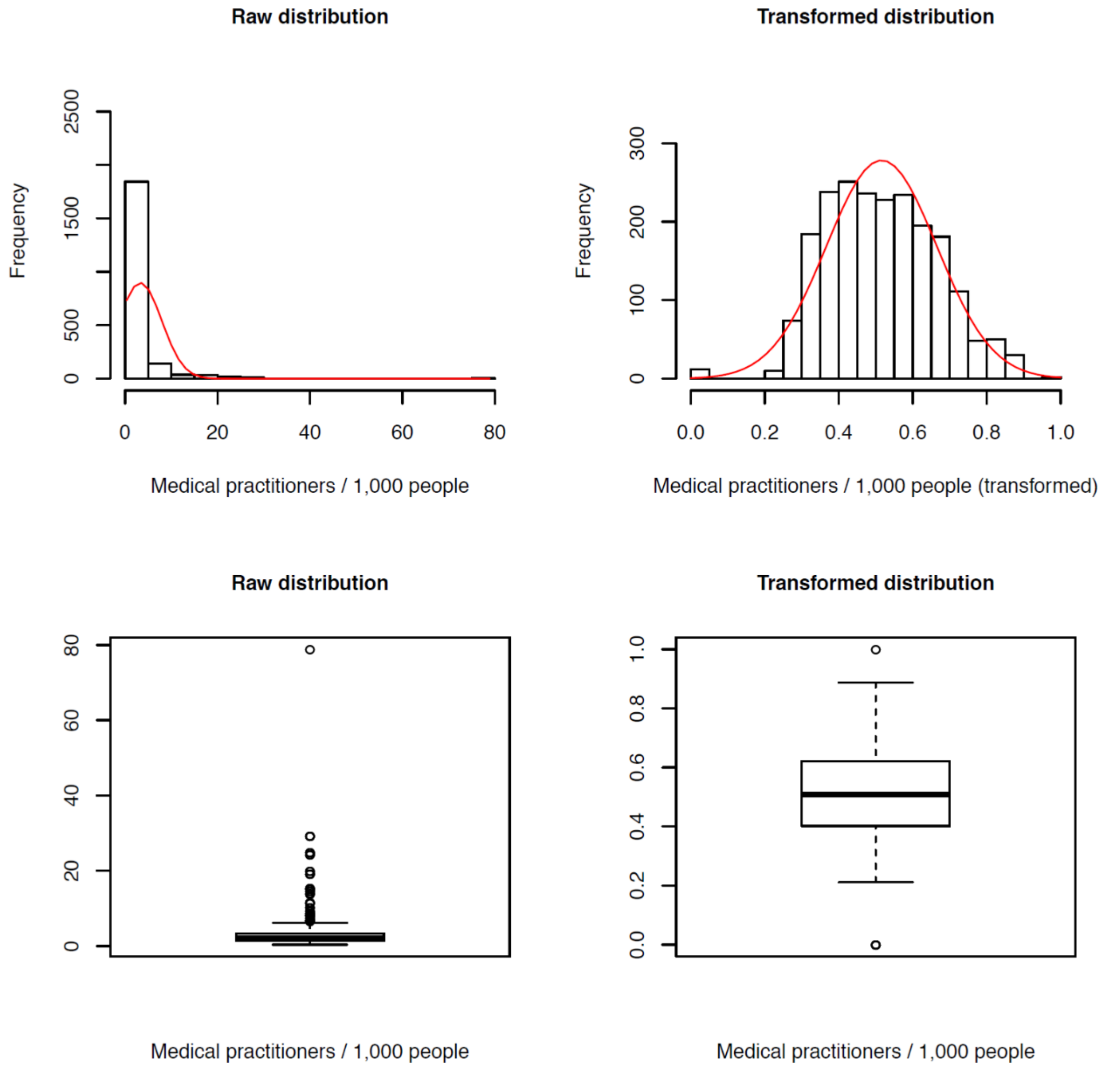
Appendix 5D (cont.)



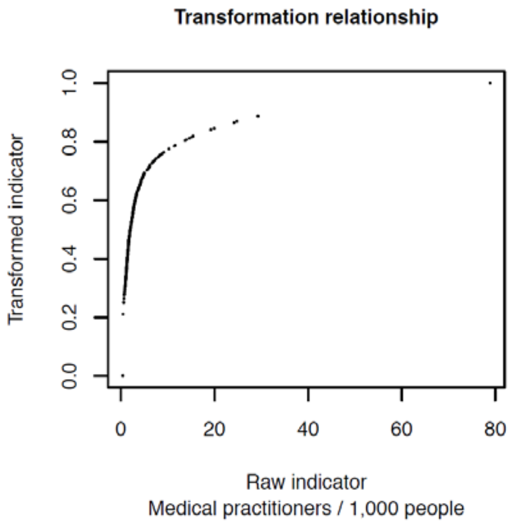
APPENDIX 5E – EMERGENCY SERVICES TRANSFORMATION DETAILS

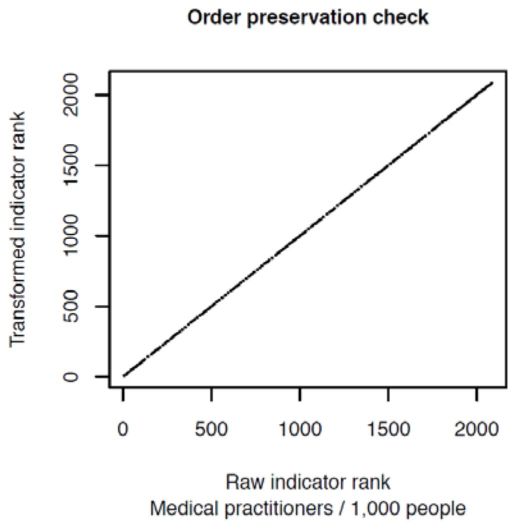
Appendix 5E shows the raw and transformed indicators used to compute the emergency services sub-index.

Appendix 5E


Raw distribution
Transformed distribution
Frequency
0
500
1500
2500
0
20
40
60
80
Medical practitioners / 1,000 people
0
100
200
300
0.0
0.2
0.4
0.6
0.8
1.0
Medical practitioners / 1,000 people (transformed)
Raw distribution
Transformed distribution
0
20
40
60
80
Medical practitioners / 1,000 people
0.0
0.2
0.4
0.6
0.8
1.0
Medical practitioners / 1,000 people

Appendix 5E (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.17
Pre–transform skewness: 6.7
Post–transform skewness: 0.1

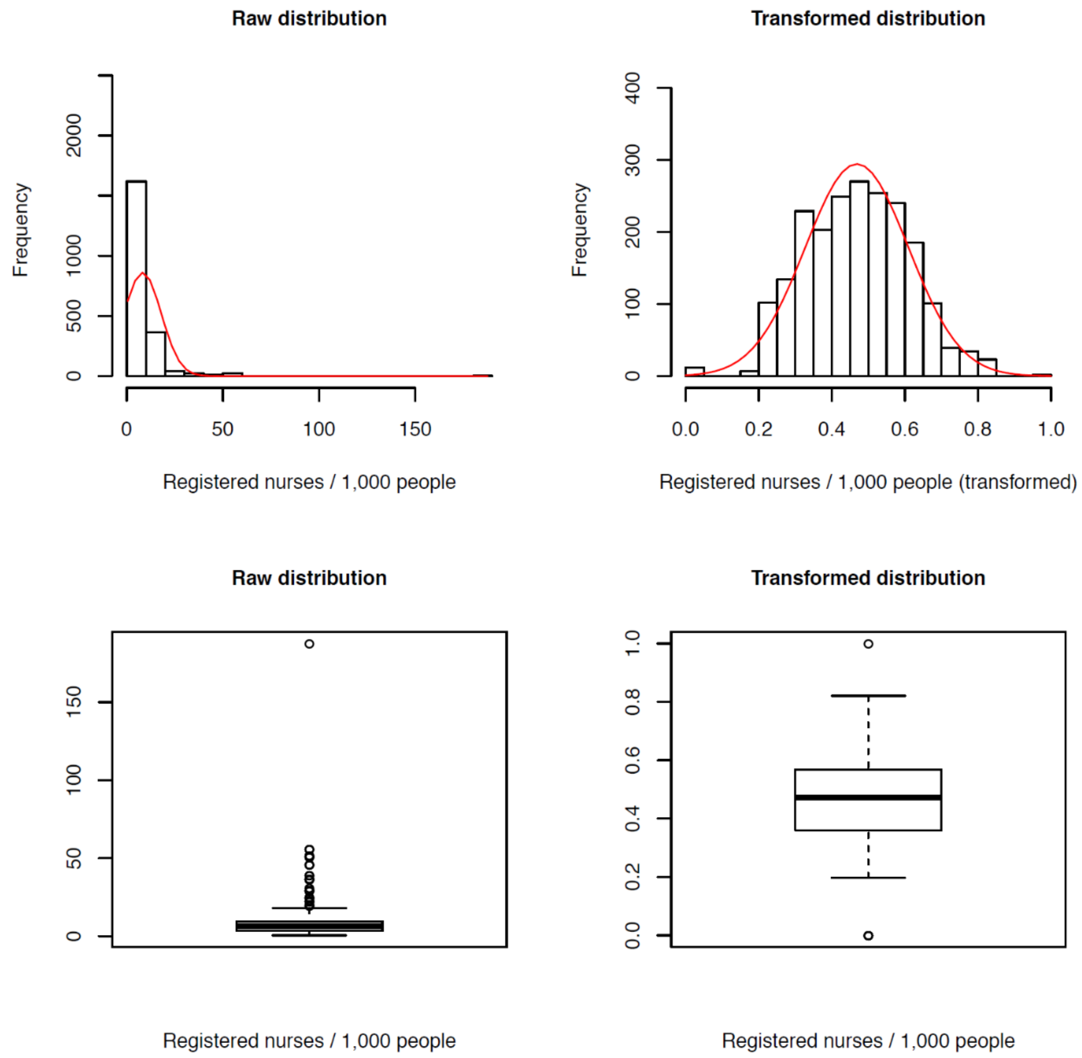
Kurtosis:
Coefficient: 0.43
Pre–transform kurtosis: 76.9
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 50
Post–transform outlier count: 12

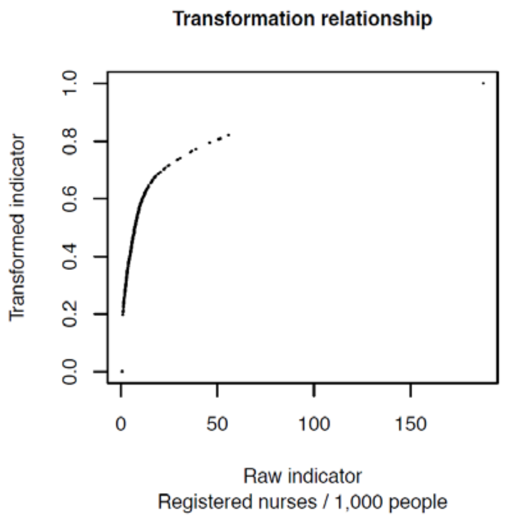
OUTLIER DETAILS

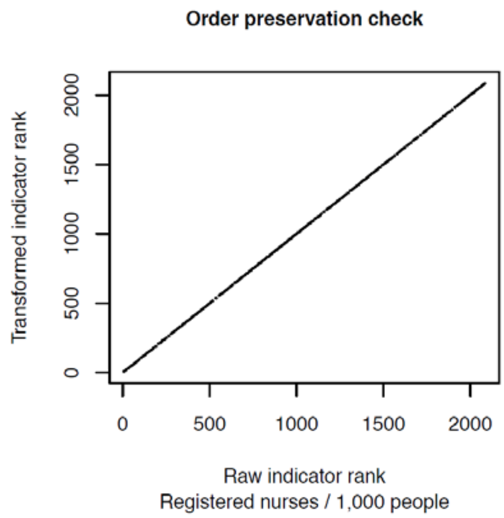
SA2	Value
Amaroo	0.35
Bonner	0.35
Casey	0.35
Crace	0.35
Forde	0.35
Franklin	0.35
Gungahlin	0.35
Hall	0.35
Harrison	0.35
Ngunnawal	0.35
Nicholls	0.35
Palmerston	0.35

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.22
Pre−transform skewness: 7.9
Post−transform skewness: 0.0

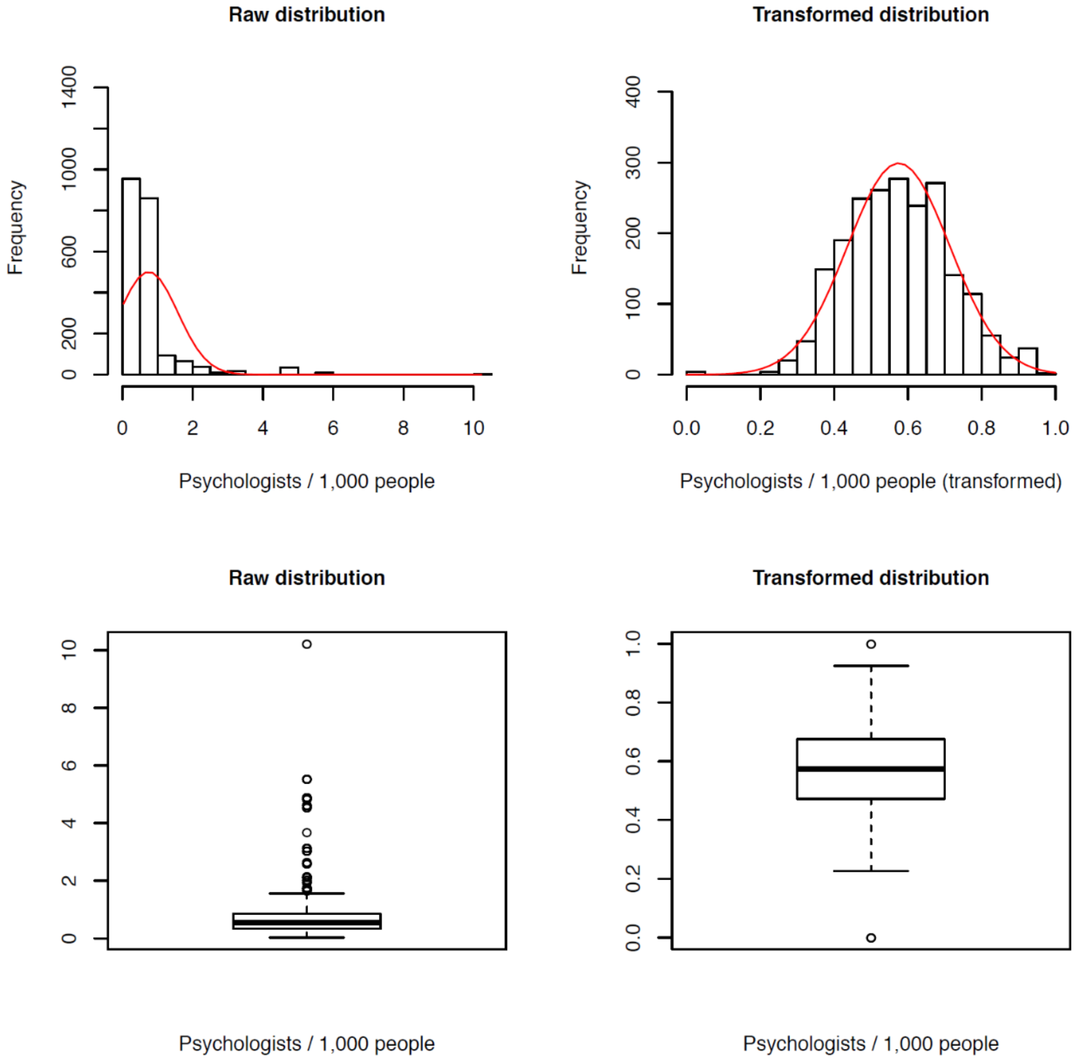
Kurtosis:
Coefficient: 0.33
Pre−transform kurtosis: 118.7
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 37
Post−transform outlier count: 14

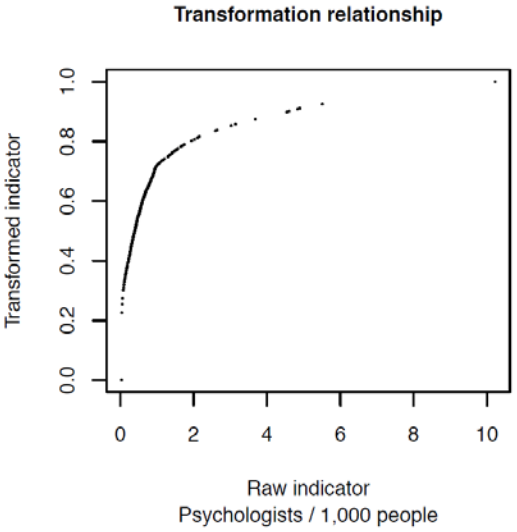
OUTLIER DETAILS

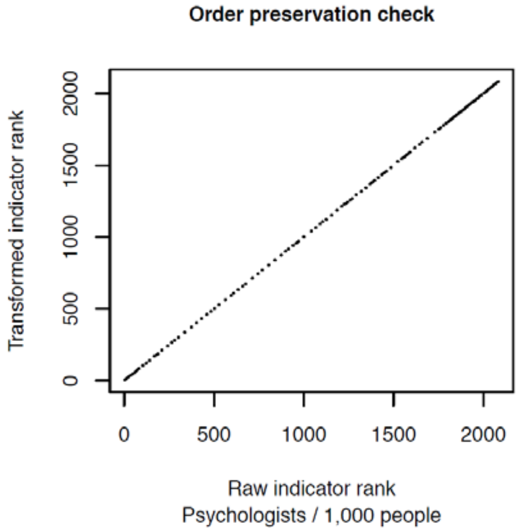
SA2	Value
Amaroo	0.55
Bonner	0.55
Casey	0.55
Crace	0.55
Forde	0.55
Franklin	0.55
Gungahlin	0.55
Hall	0.55
Harrison	0.55
Ngunnawal	0.55
Nicholls	0.55
Palmerston	0.55
Adelaide	187.61
North Adelaide	187.61

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.17
Pre–transform skewness: 4.4
Post–transform skewness: 0.1

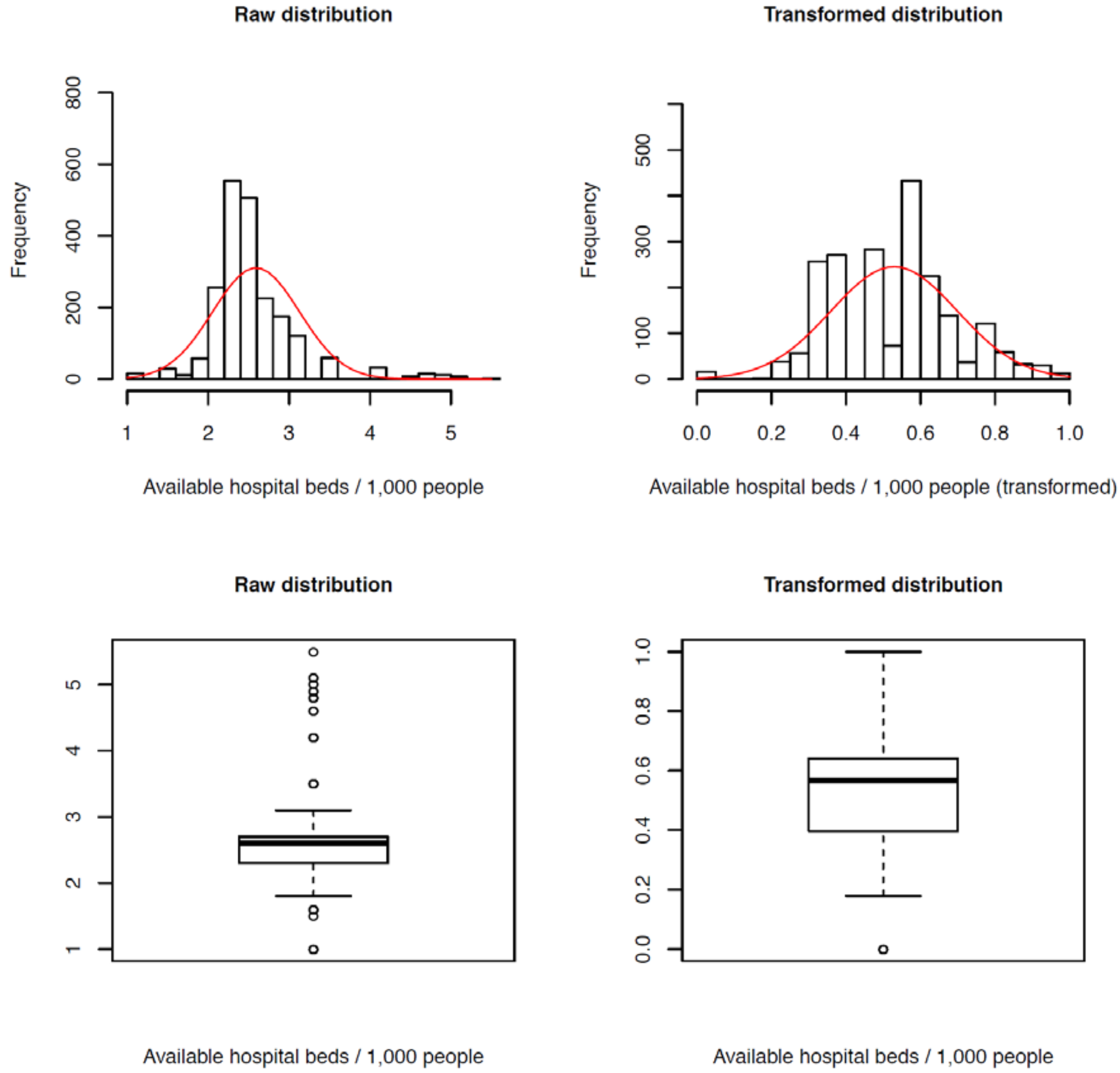
Kurtosis:
Coefficient: 0.35
Pre–transform kurtosis: 28.1
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 46
Post–transform outlier count: 4

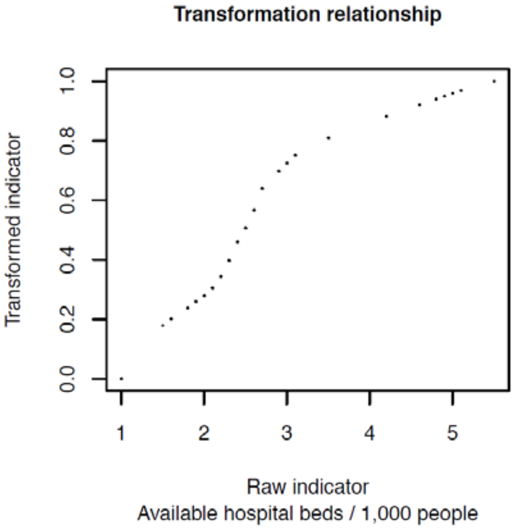
OUTLIER DETAILS

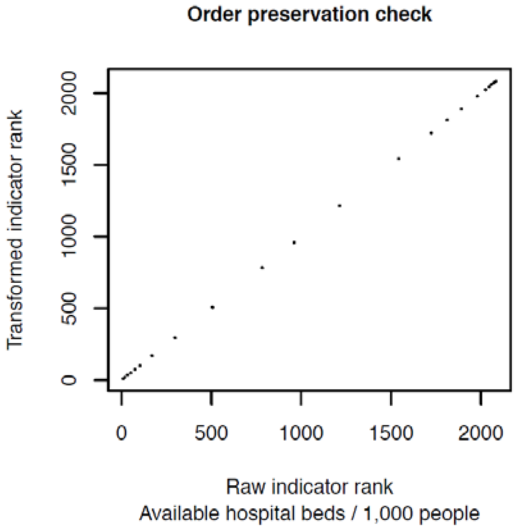
SA2	Value
Howard Springs	0.03
Humpty Doo	0.03
Virginia	0.03
Weddell	0.03

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

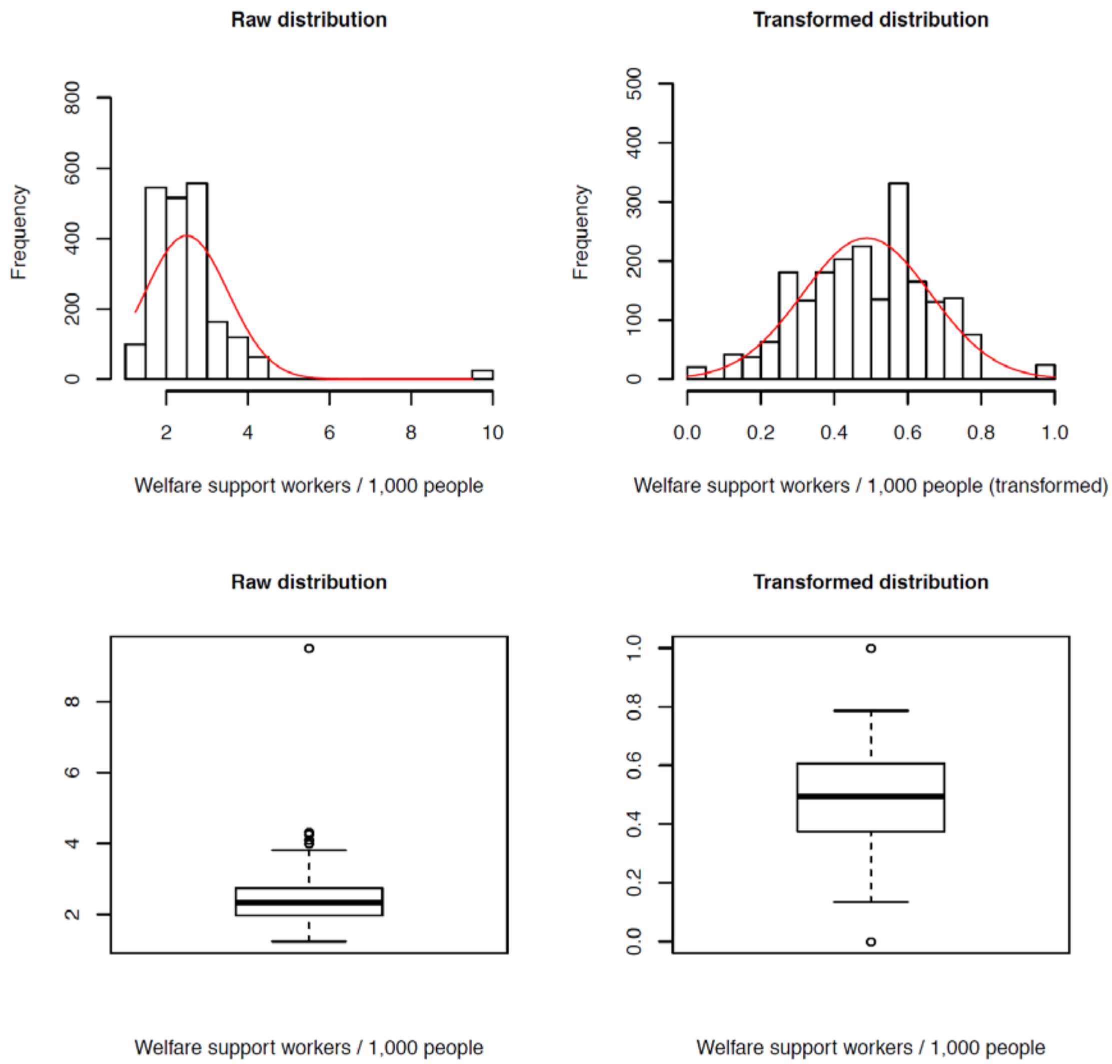
Unreversed

Skewness:
Power transform, exponent: 0.56
Pre−transform skewness: 1.8
Post−transform skewness: 0.1

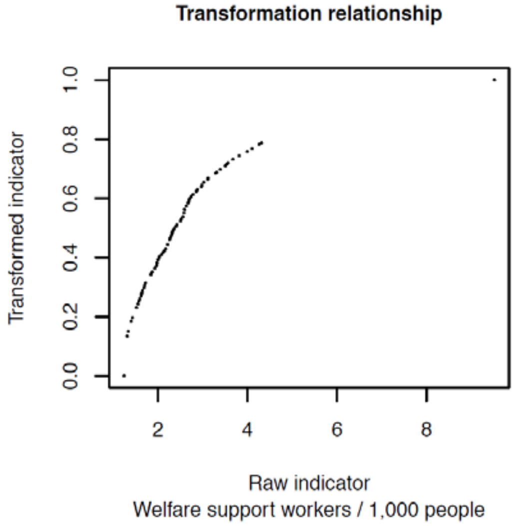
Kurtosis:
Coefficient: 0.64
Pre−transform kurtosis: 6.8
Post−transform kurtosis: −0.0

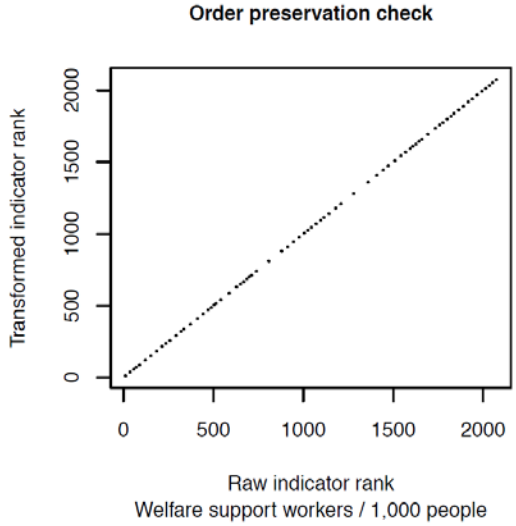
Outliers:
Pre−transform outlier count: 43
Post−transform outlier count: 0

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

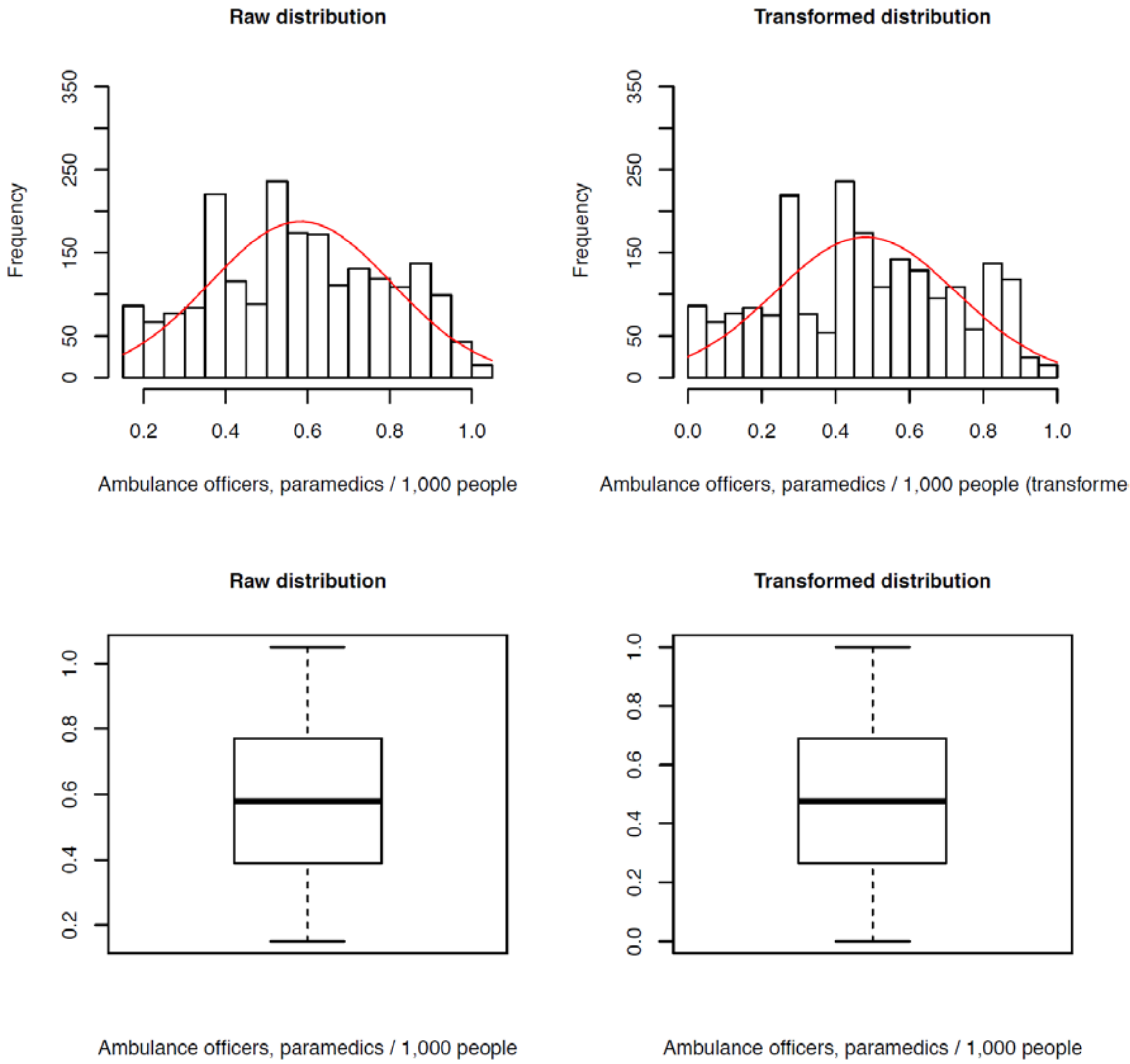
Unreversed

Skewness:
Power transform, exponent: 0.35
Pre–transform skewness: 3.9
Post–transform skewness: –0.0

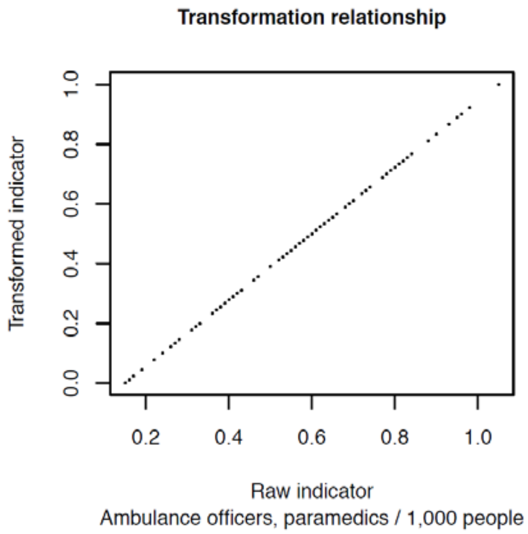
Kurtosis:
Coefficient: 0.41
Pre–transform kurtosis: 23.6
Post–transform kurtosis: –0.0

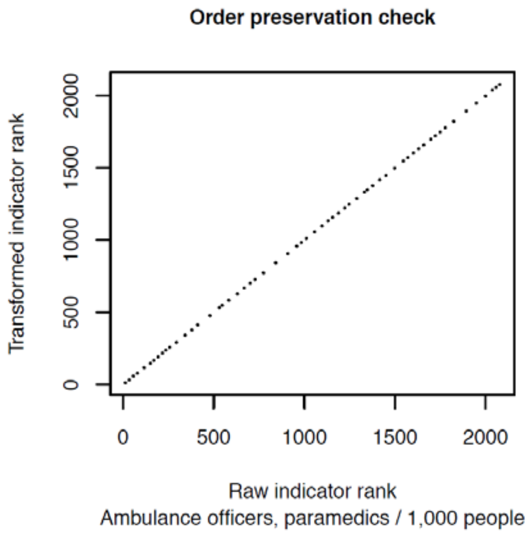
Outliers:
Pre–transform outlier count: 24
Post–transform outlier count: 0

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

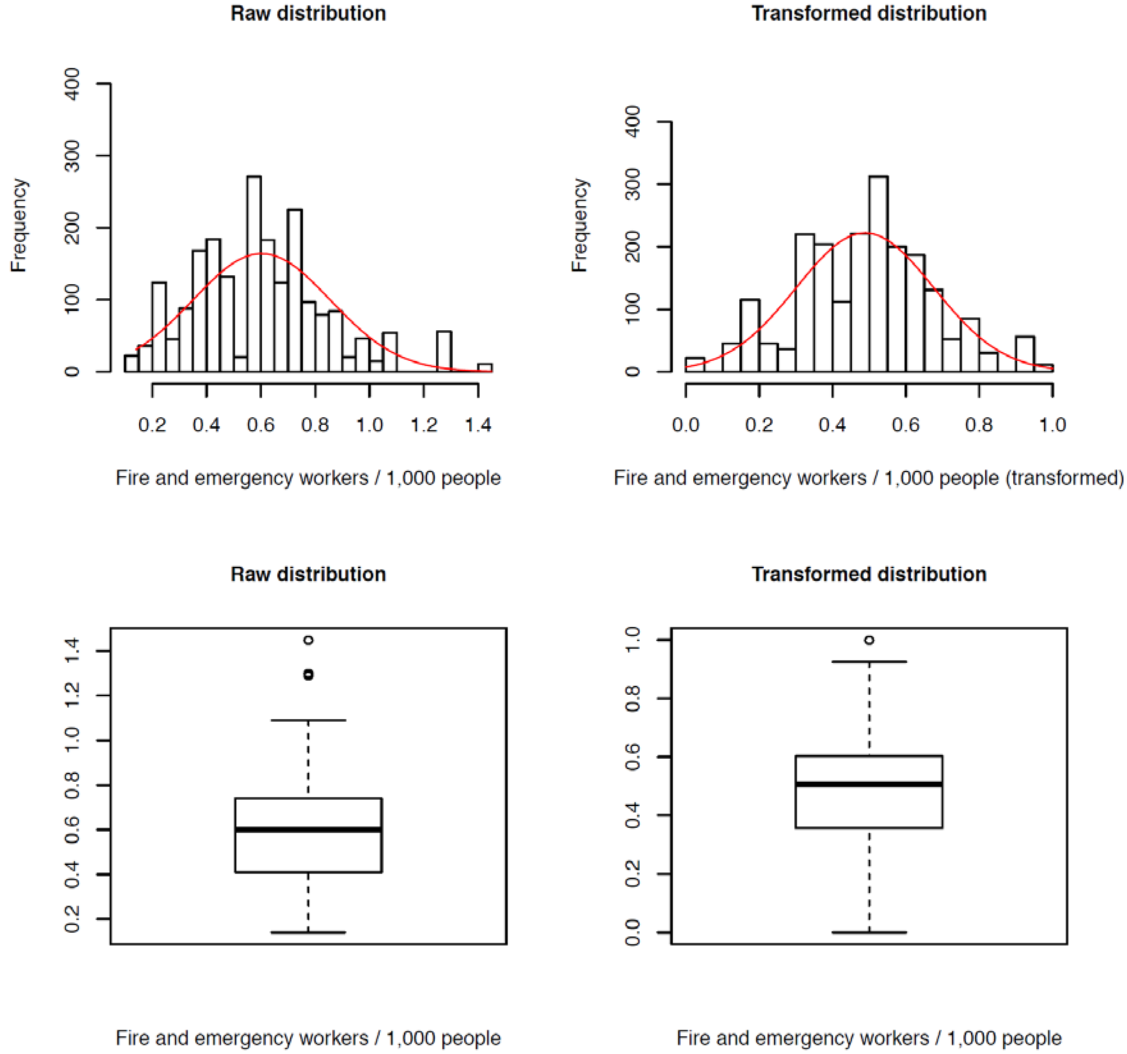
Unreversed

Skewness:
No transform
Pre–transform skewness: –0.0
Post–transform skewness: –0.0

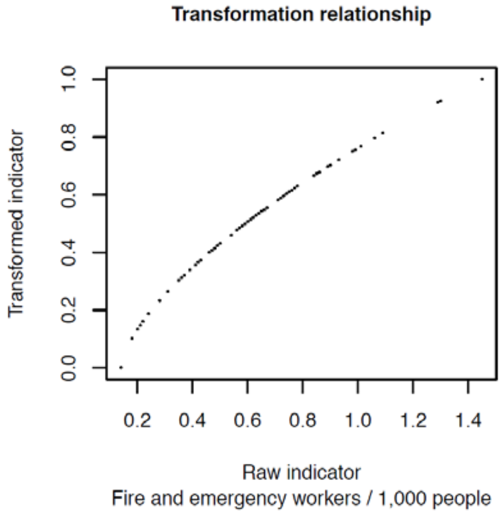
Kurtosis:
No transform
Pre–transform kurtosis: –0.9
Post–transform kurtosis: –0.9

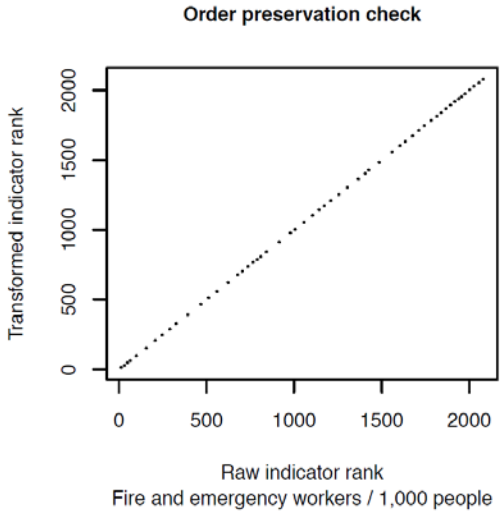
Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

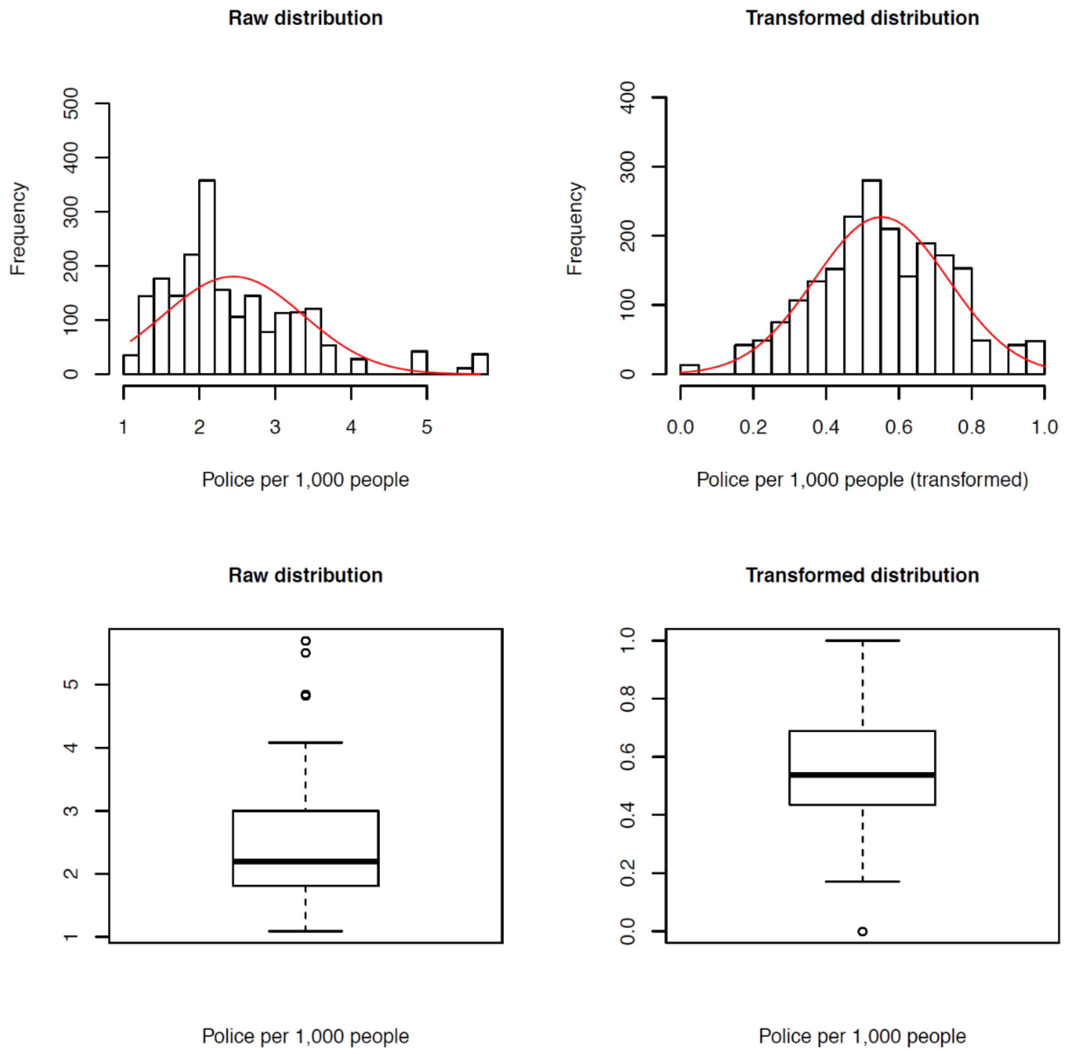
Unreversed

Skewness:
Power transform, exponent: 0.65
Pre−transform skewness: 0.6
Post−transform skewness: −0.0

Kurtosis:
Coefficient: 0.01
Pre−transform kurtosis: 0.5
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 11
Post−transform outlier count: 0

Appendix 5E (cont.)



Appendix 5E (cont.)

TRANSFORMATION DETAILS

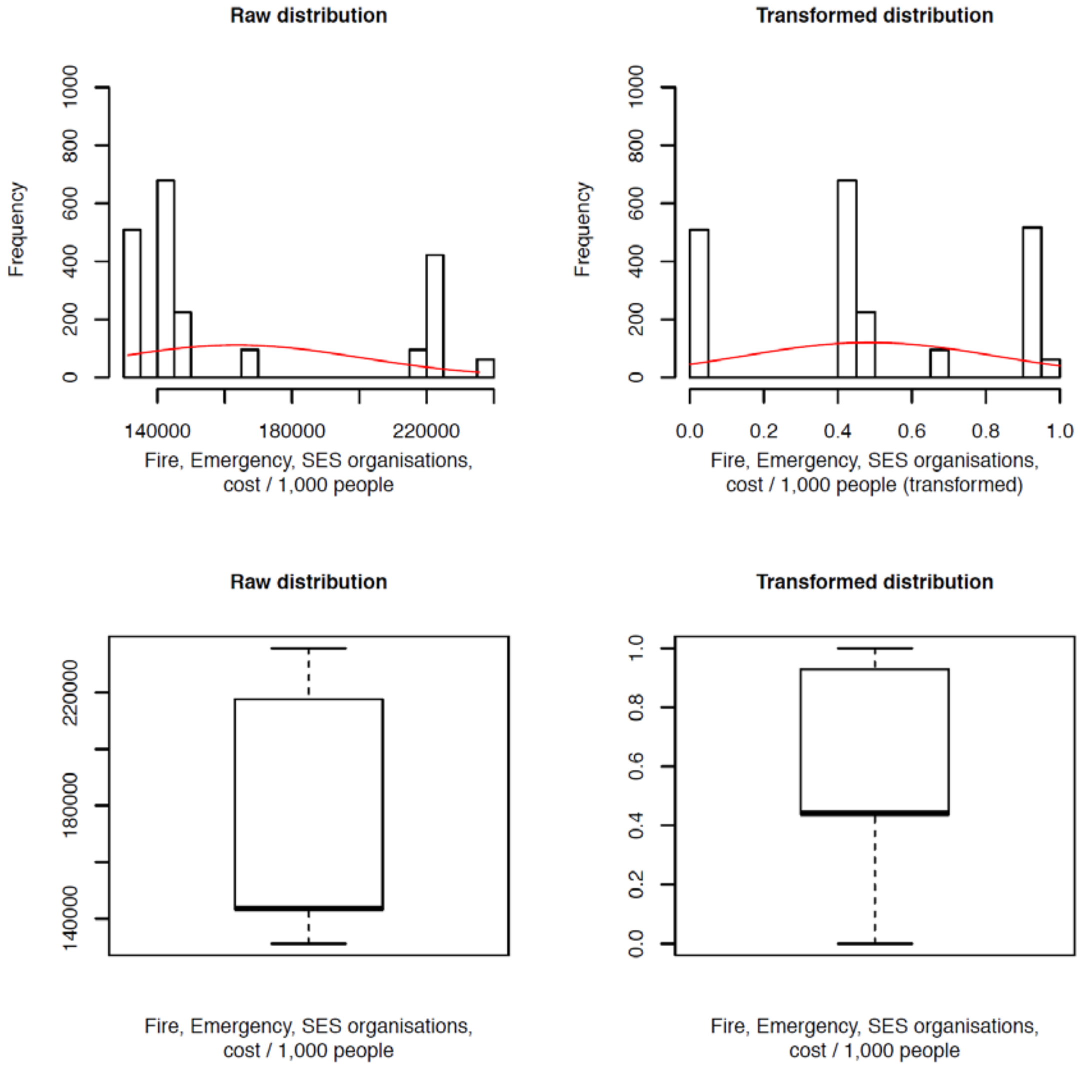
Unreversed

Skewness:
Power transform, exponent: 0.43
Pre−transform skewness: 1.3
Post−transform skewness: 0.0

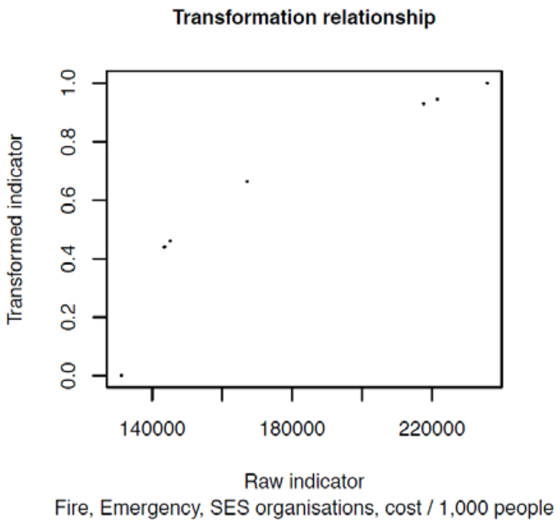
Kurtosis:
Coefficient: 0.08
Pre−transform kurtosis: 2.1
Post−transform kurtosis: −0.0

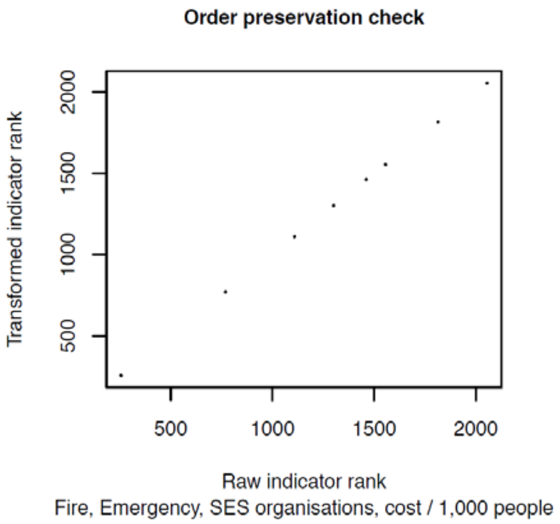
Outliers:
Pre−transform outlier count: 48
Post−transform outlier count: 0

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

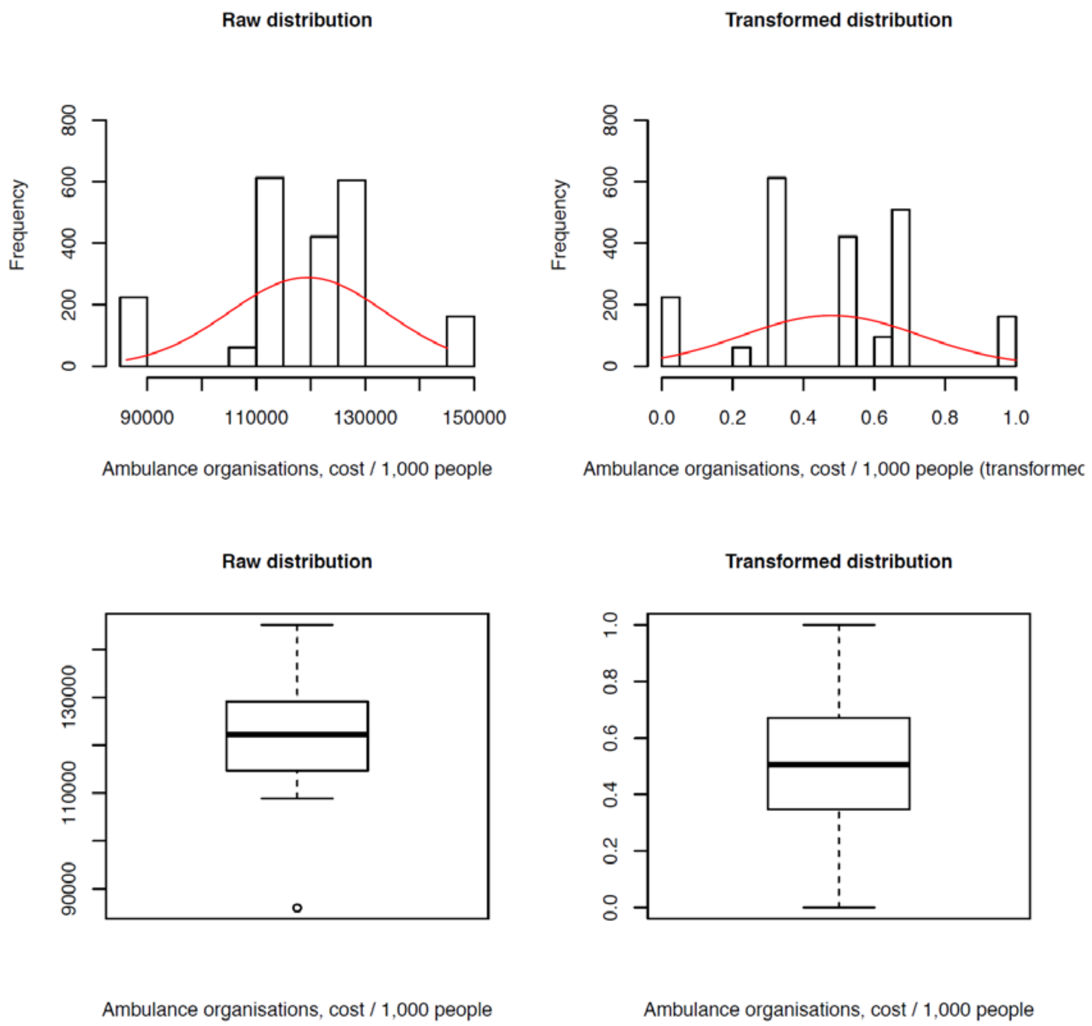
Unreversed

Skewness:
Power transform, exponent: 0.38
Pre–transform skewness: 0.9
Post–transform skewness: –0.0

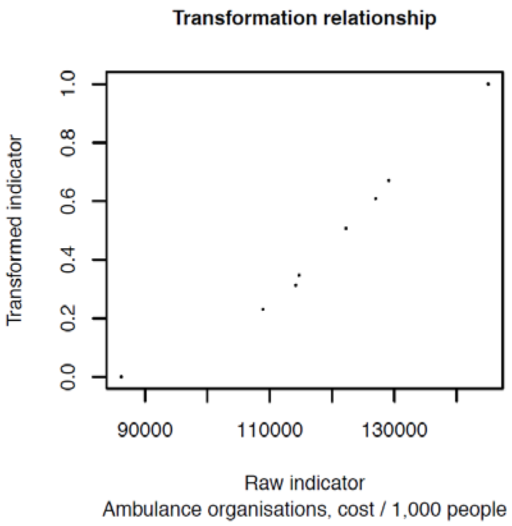
Kurtosis:
Coefficient: 0.00
Pre–transform kurtosis: –1.0
Post–transform kurtosis: –1.1

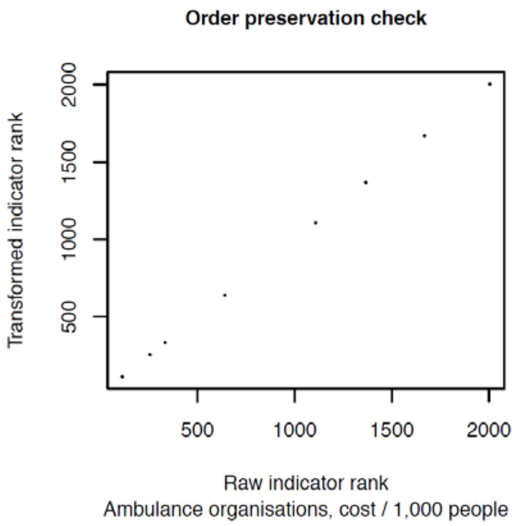
Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

Appendix 5E (cont.)



Appendix 5E (cont.)





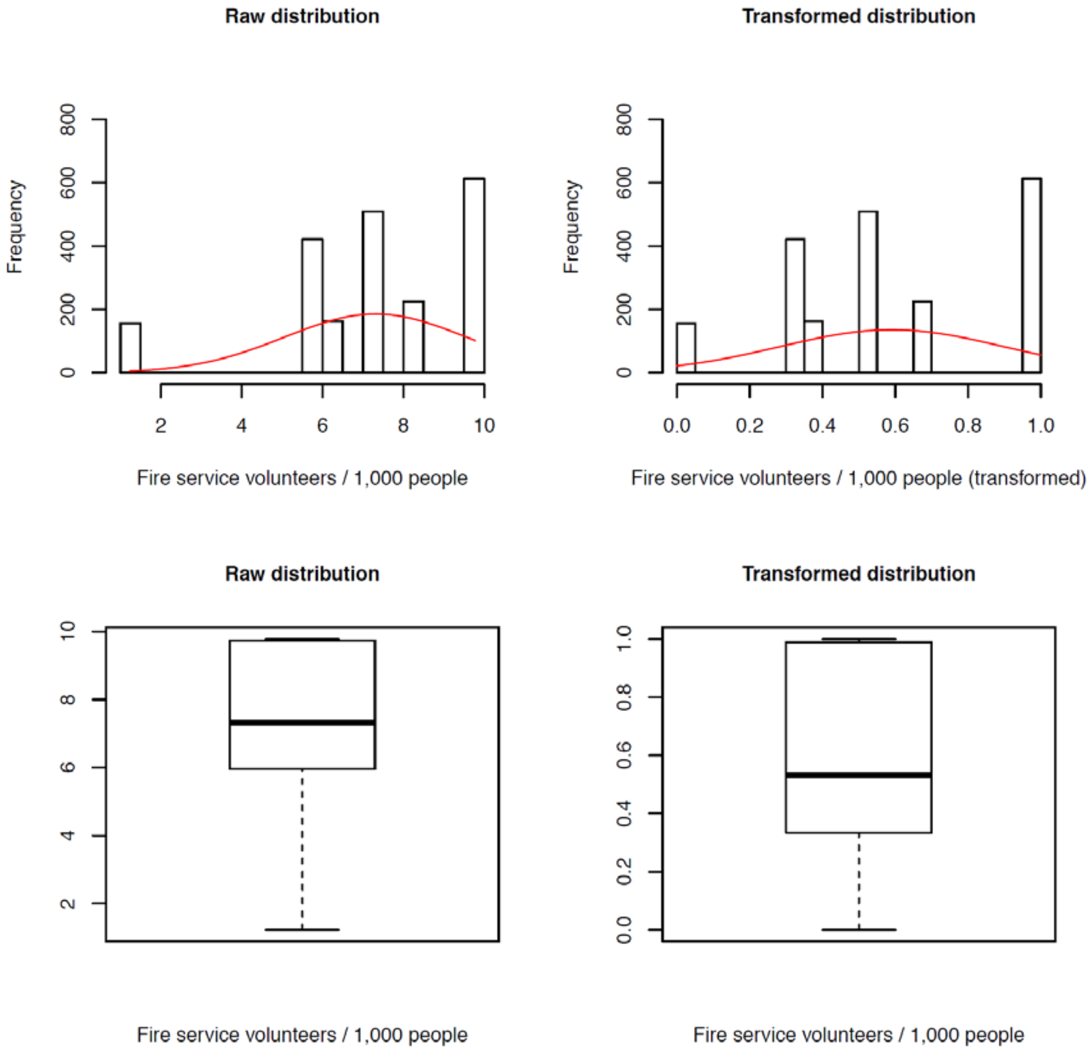
TRANSFORMATION DETAILS
Unreversed

Skewness:
Power transform, exponent: 1.41
Pre–transform skewness: –0.8
Post–transform skewness: –0.0

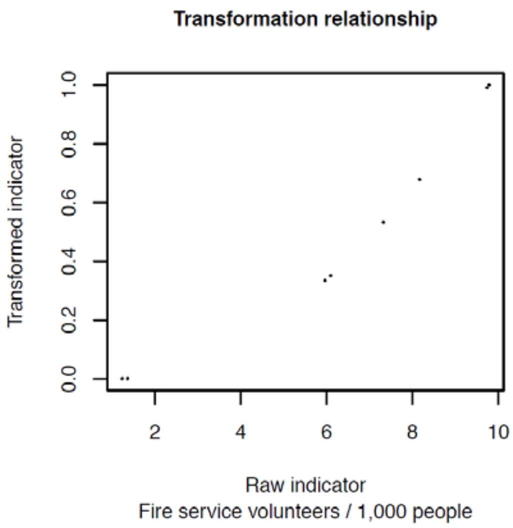
Kurtosis:
Coefficient: 0.20
Pre–transform kurtosis: 0.9
Post–transform kurtosis: –0.0

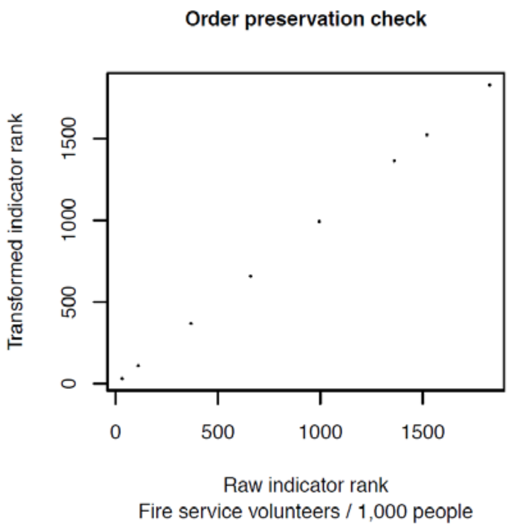
Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

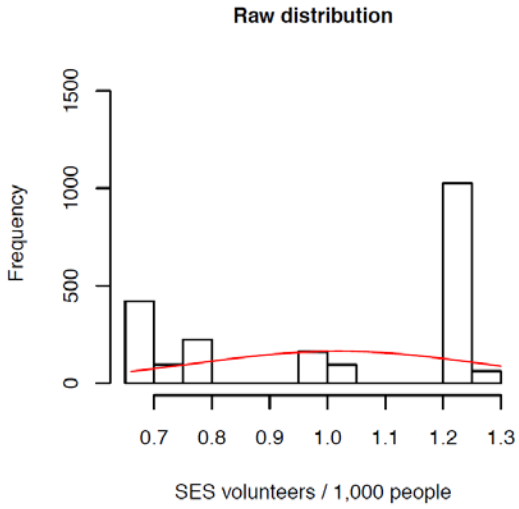
Unreversed

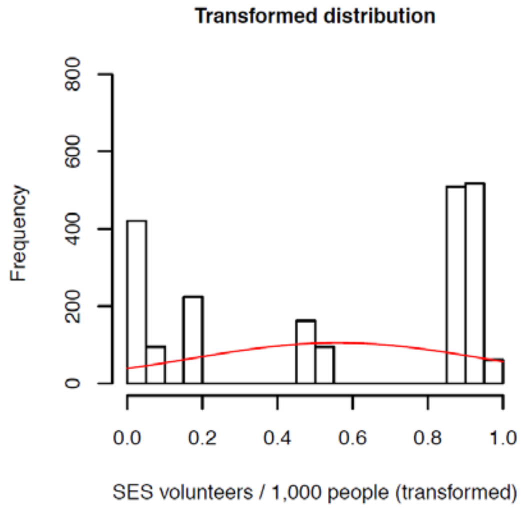
Skewness:
Power transform, exponent: 1.86
Pre−transform skewness: −1.1
Post−transform skewness: 0.0

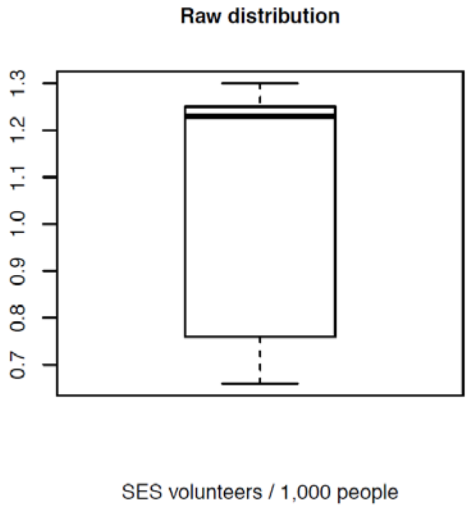
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 1.3
Post−transform kurtosis: −0.9

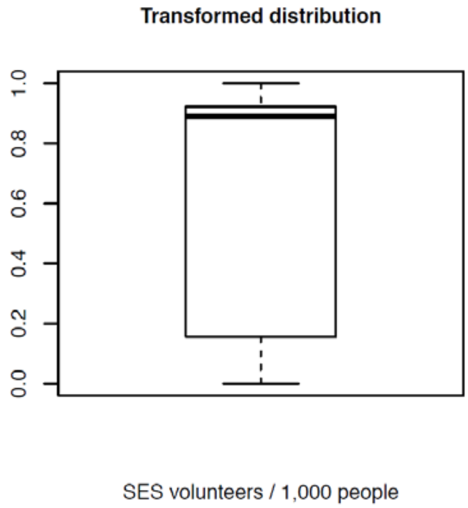
Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

Appendix 5E (cont.)

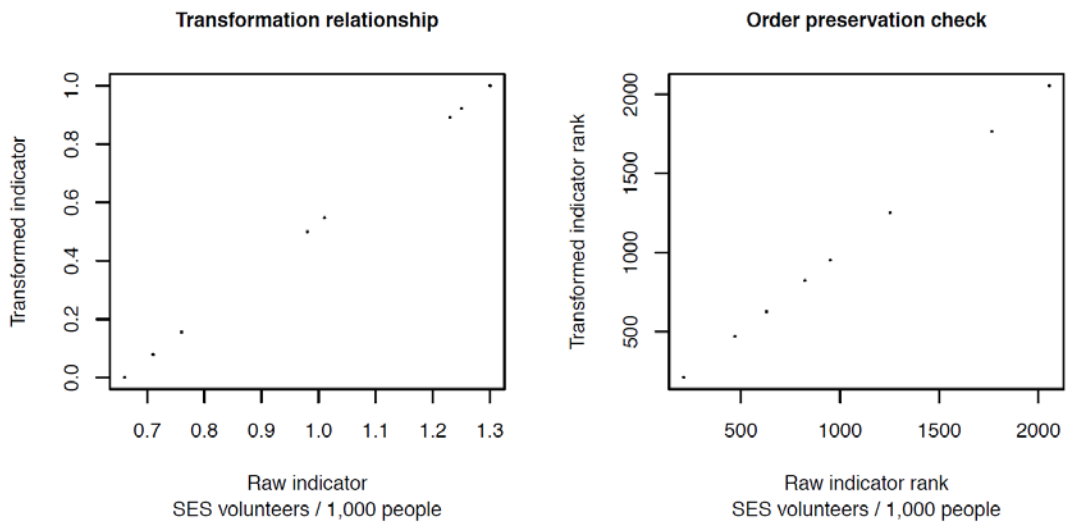








Appendix 5E (cont.)



TRANSFORMATION DETAILS

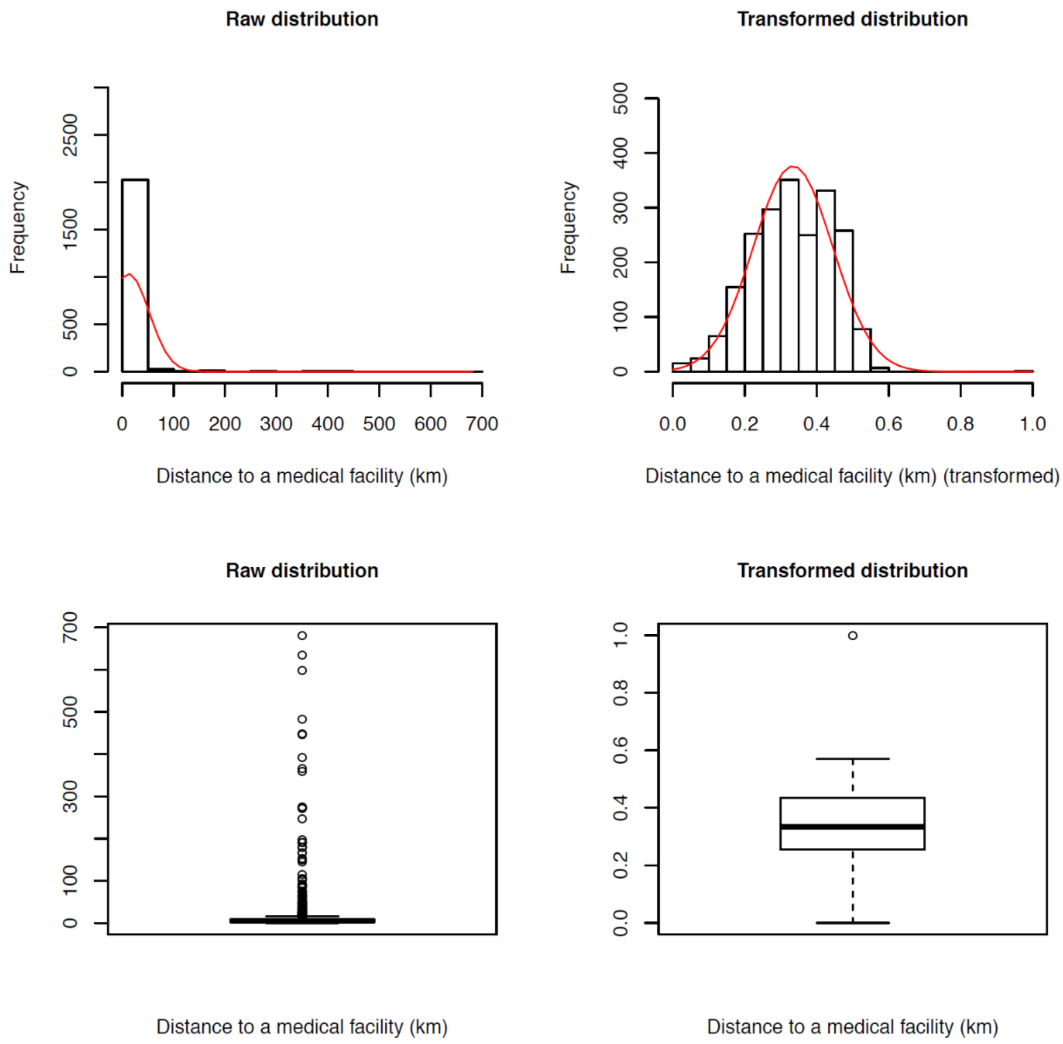
Unreversed

Skewness:
No transform
Pre–transform skewness: –0.4
Post–transform skewness: –0.4

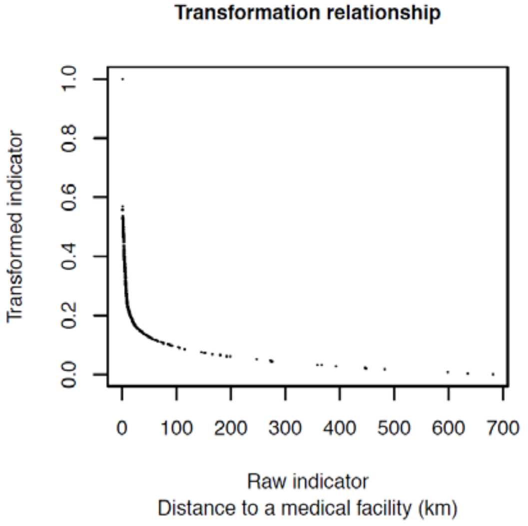
Kurtosis:
No transform
Pre–transform kurtosis: –1.6
Post–transform kurtosis: –1.6

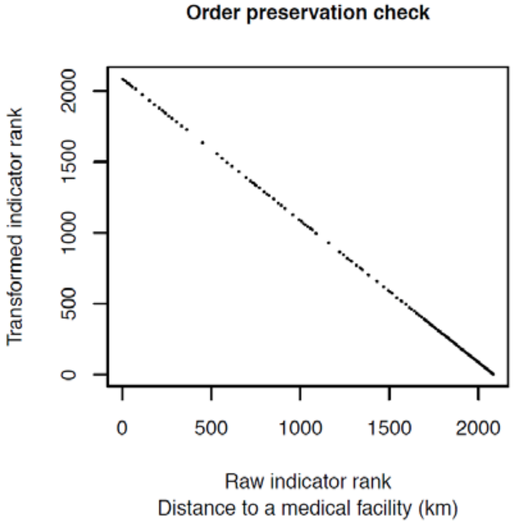
Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

Appendix 5E (cont.)



Appendix 5E (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.07
Pre–transform skewness: 10.4
Post–transform skewness: −0.2

Kurtosis:
Coefficient: 0.35
Pre–transform kurtosis: 128.2
Post–transform kurtosis: 0.0

Outliers:
Pre–transform outlier count: 28
Post–transform outlier count: 1

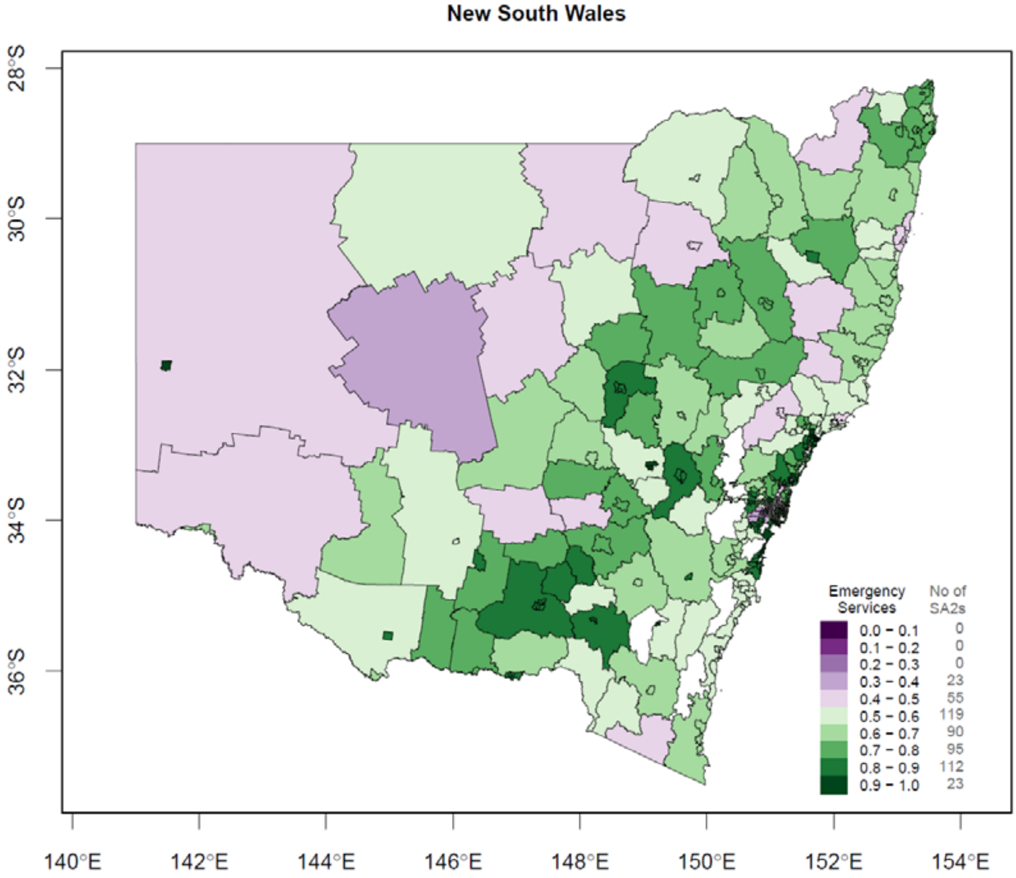
OUTLIER DETAILS

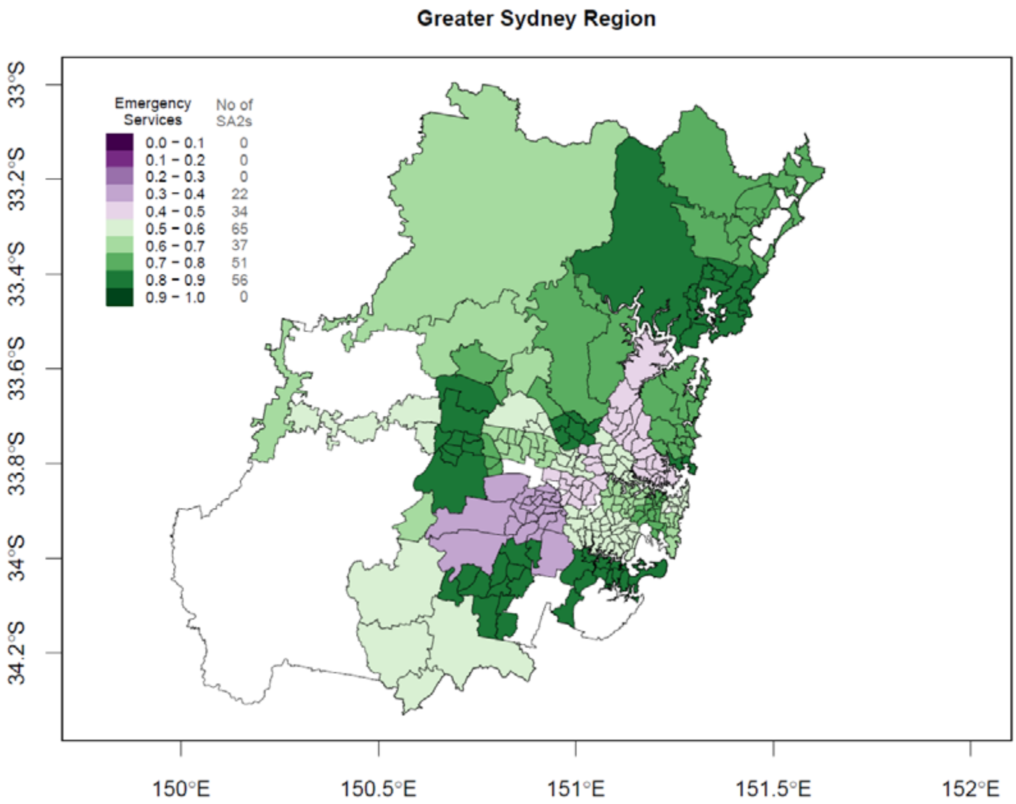
SA2	Value
Nhulunbuy	0.40

APPENDIX 5F – MAPS: EMERGENCY SERVICES SUB-INDEX BY STATE/TERRITORY AND METROPOLITAN AREAS

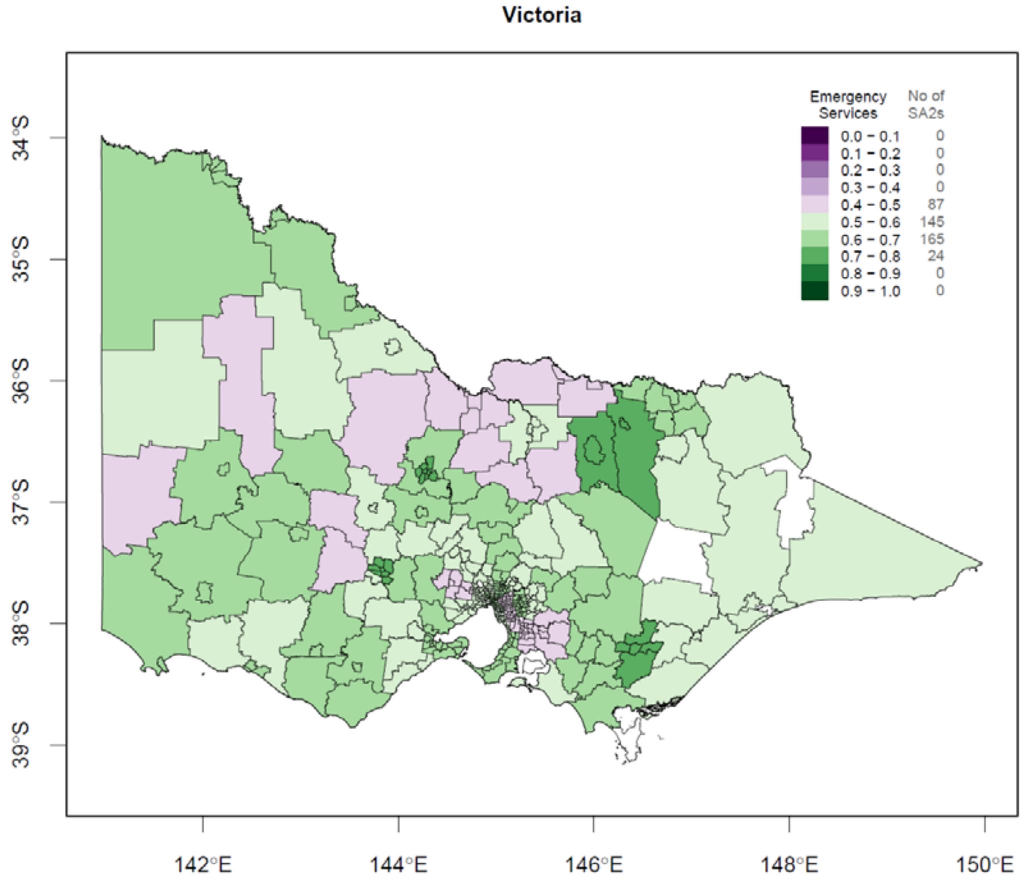
Appendix 5F maps the emergency services sub-index at the resolution of individual States and Territories, and major metropolitan areas.

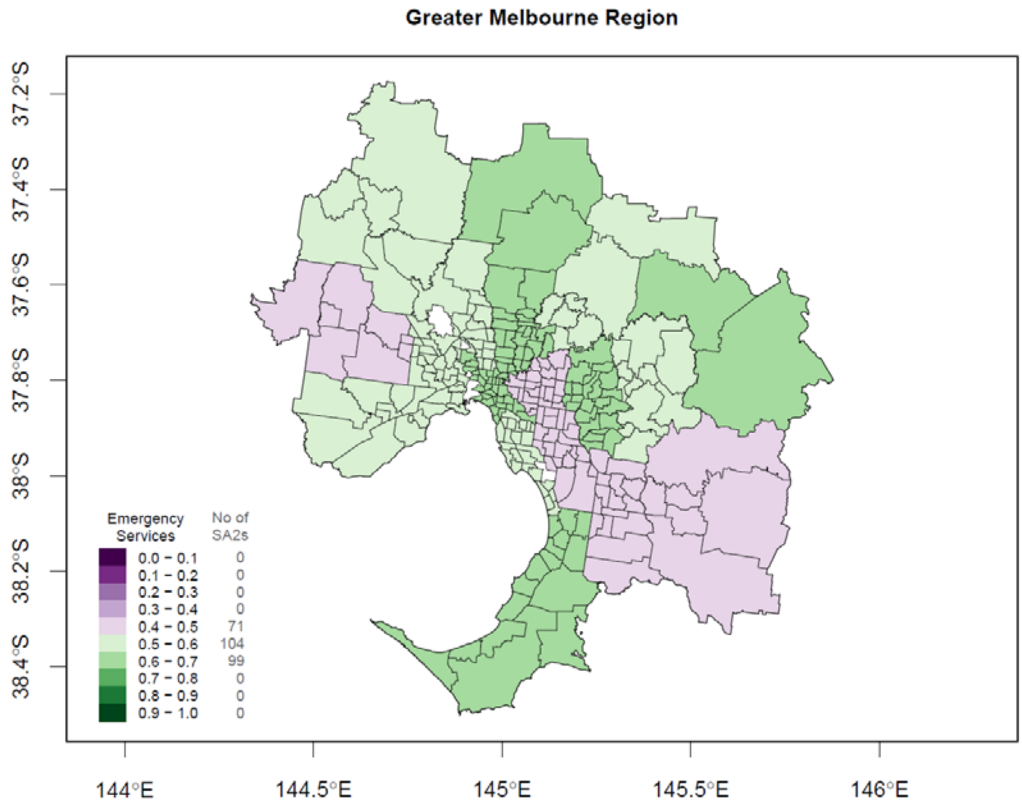
Appendix 5F


New South Wales
28°S
30°S
32°S
34°S
36°S
140°E
142°E
144°E
146°E
148°E
150°E
152°E
154°E
Emergency Services
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 0
0.2 – 0.3 0
0.3 – 0.4 23
0.4 – 0.5 55
0.5 – 0.6 119
0.6 – 0.7 90
0.7 – 0.8 95
0.8 – 0.9 112
0.9 – 1.0 23

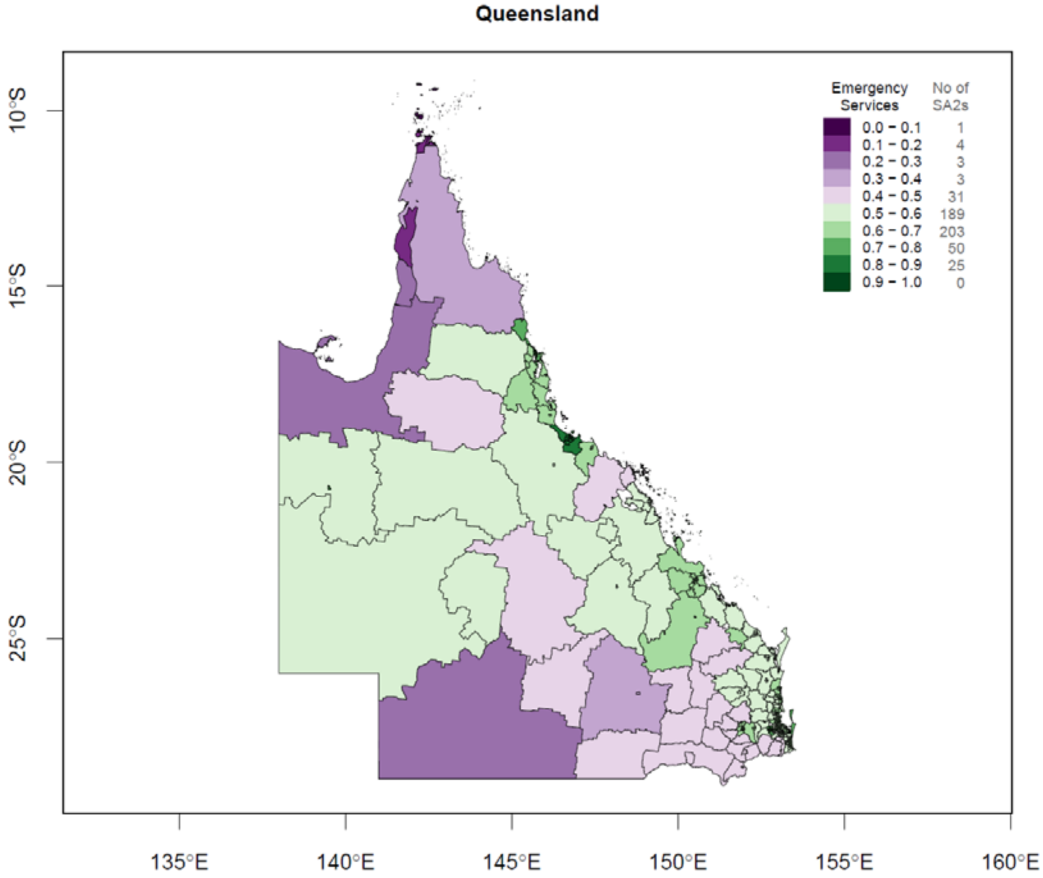

Greater Sydney Region
33°S
33.2°S
33.4°S
33.6°S
33.8°S
34°S
34.2°S
150°E
150.5°E
151°E
151.5°E
152°E
Emergency Services
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 0
0.2 – 0.3 0
0.3 – 0.4 22
0.4 – 0.5 34
0.5 – 0.6 65
0.6 – 0.7 37
0.7 – 0.8 51
0.8 – 0.9 56
0.9 – 1.0 0

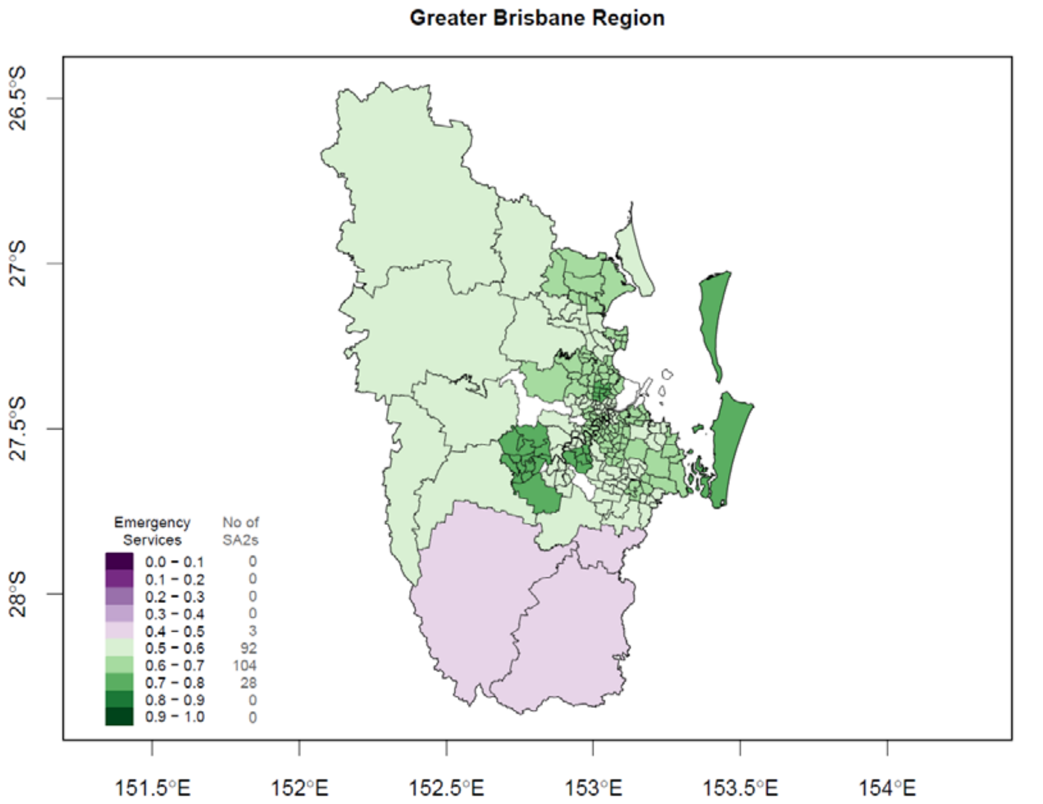
Appendix 5F (cont.)



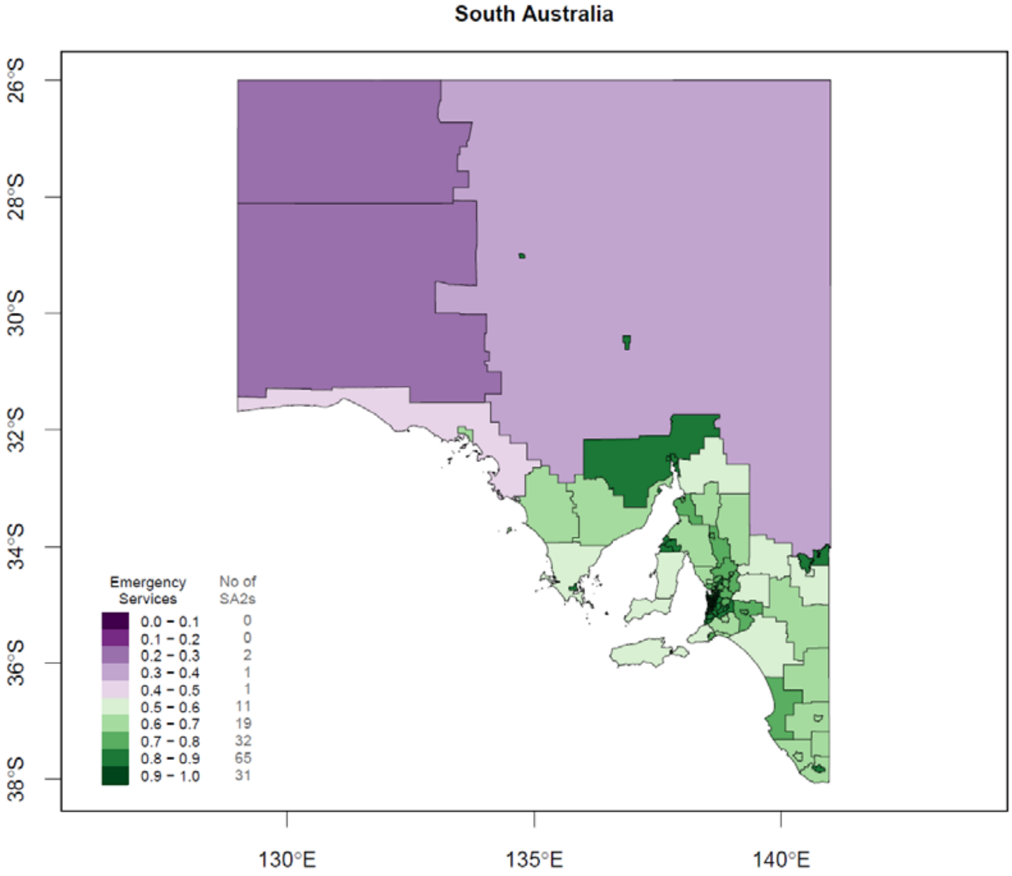


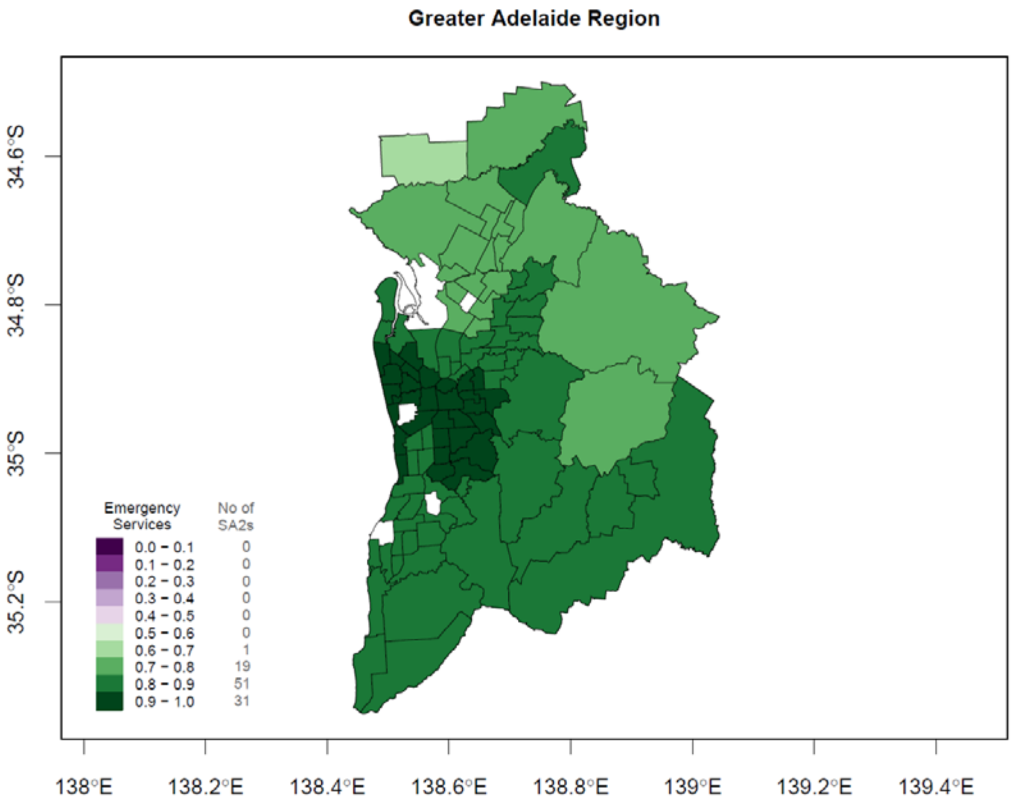
Appendix 5F (cont.)



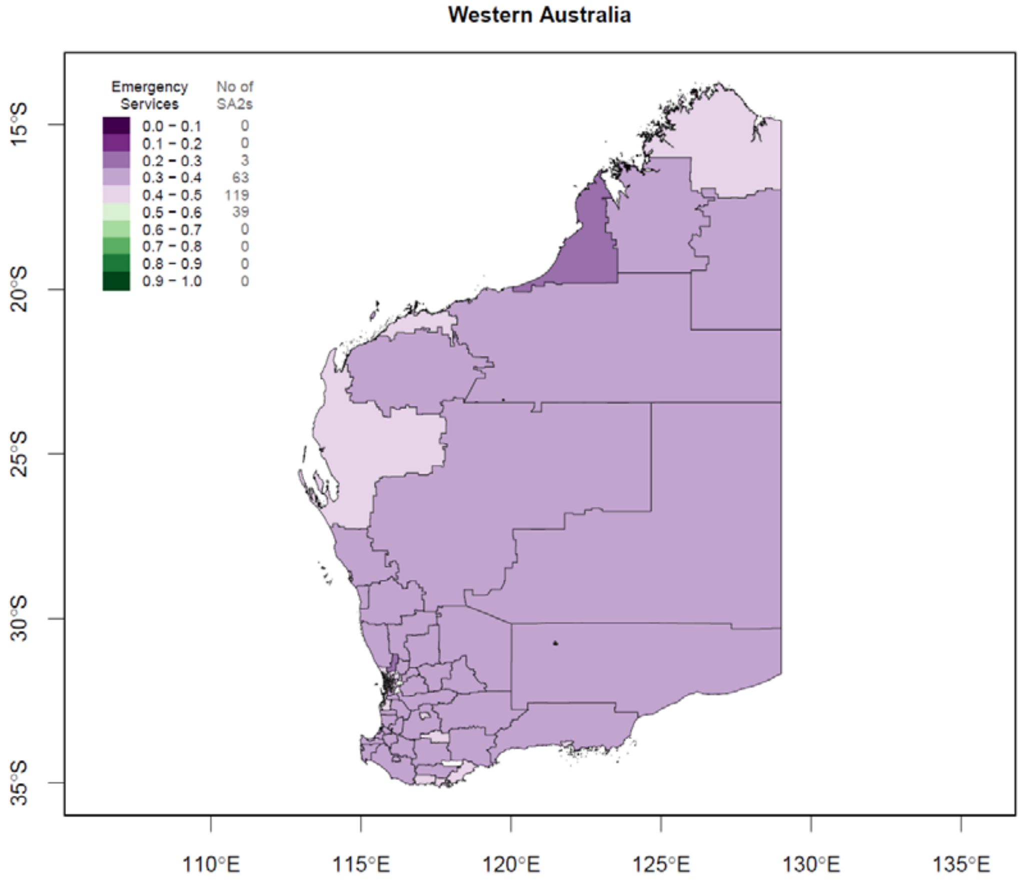


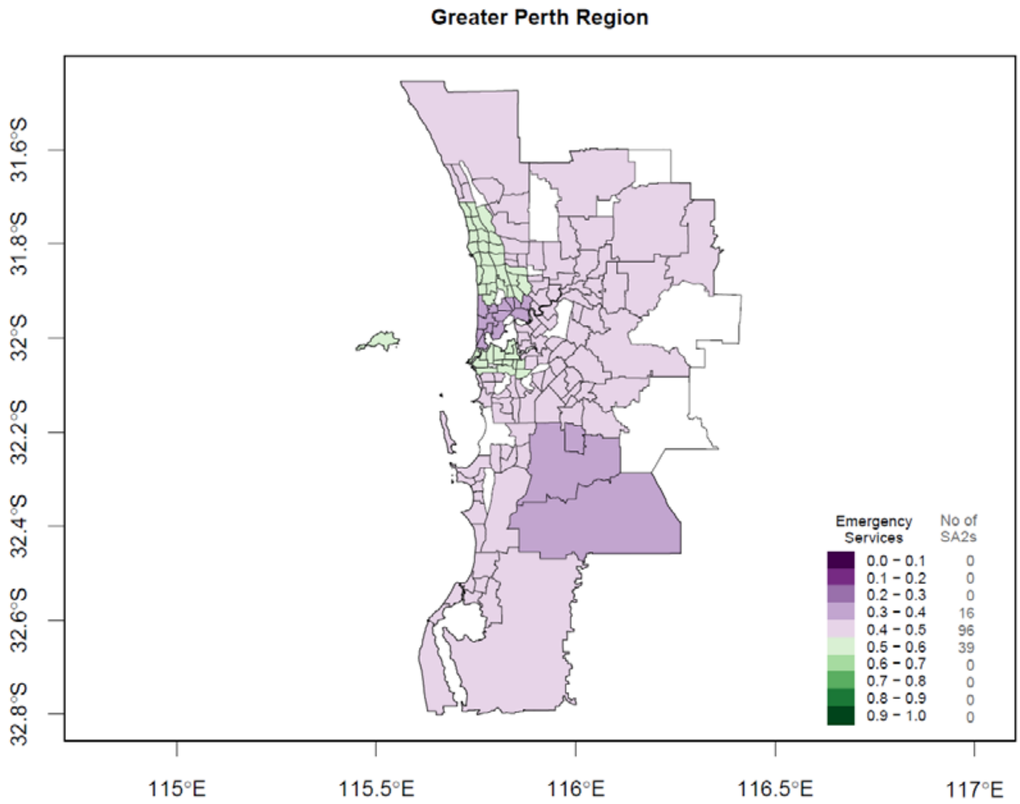
Appendix 5F (cont.)



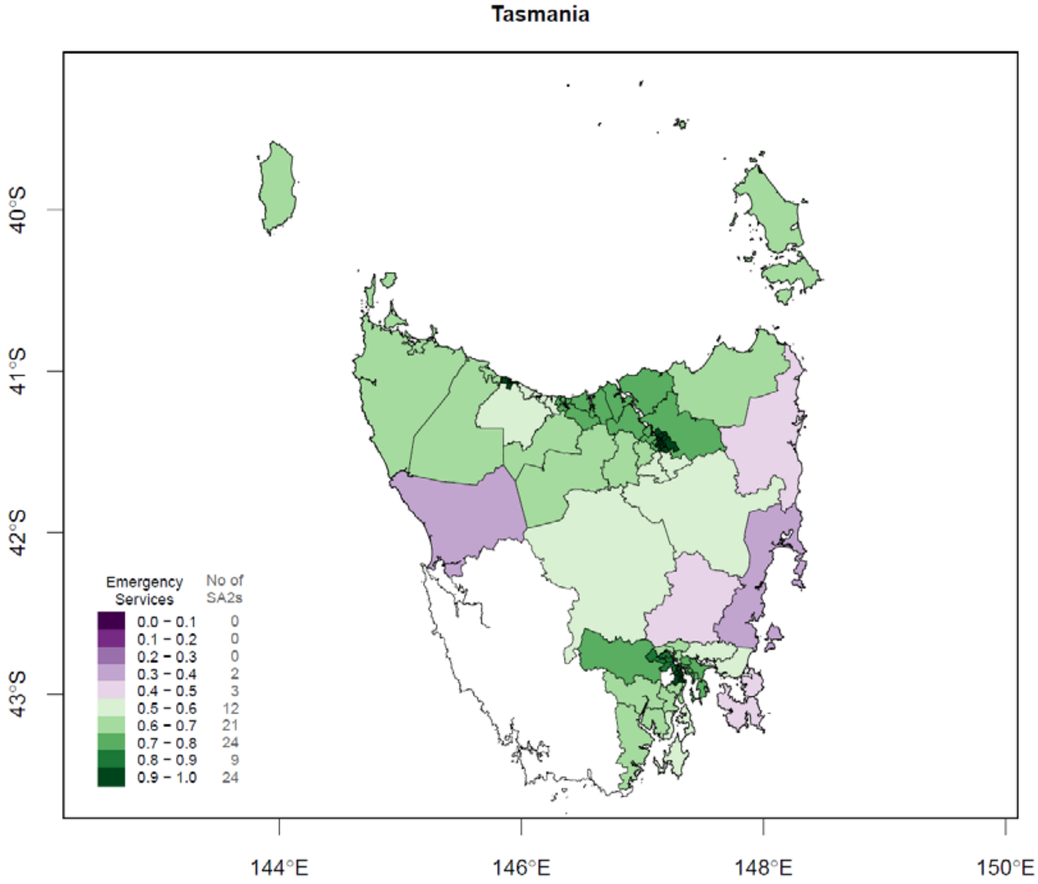


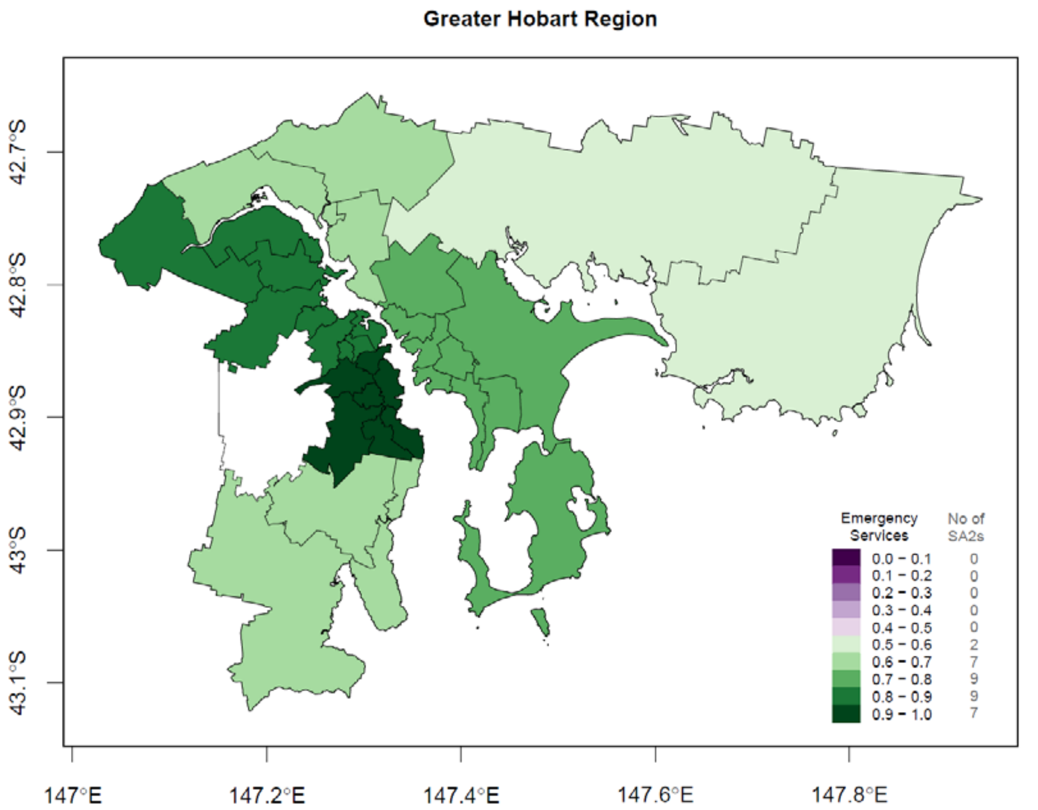
Appendix 5F (cont.)



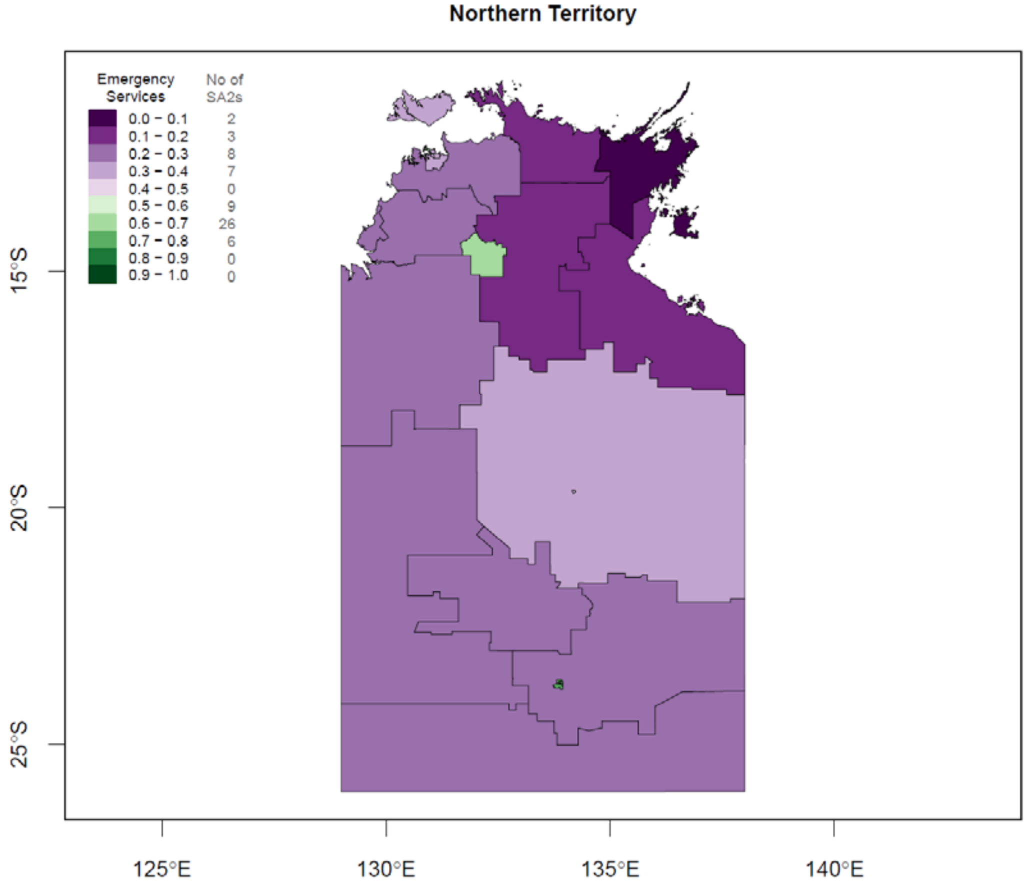


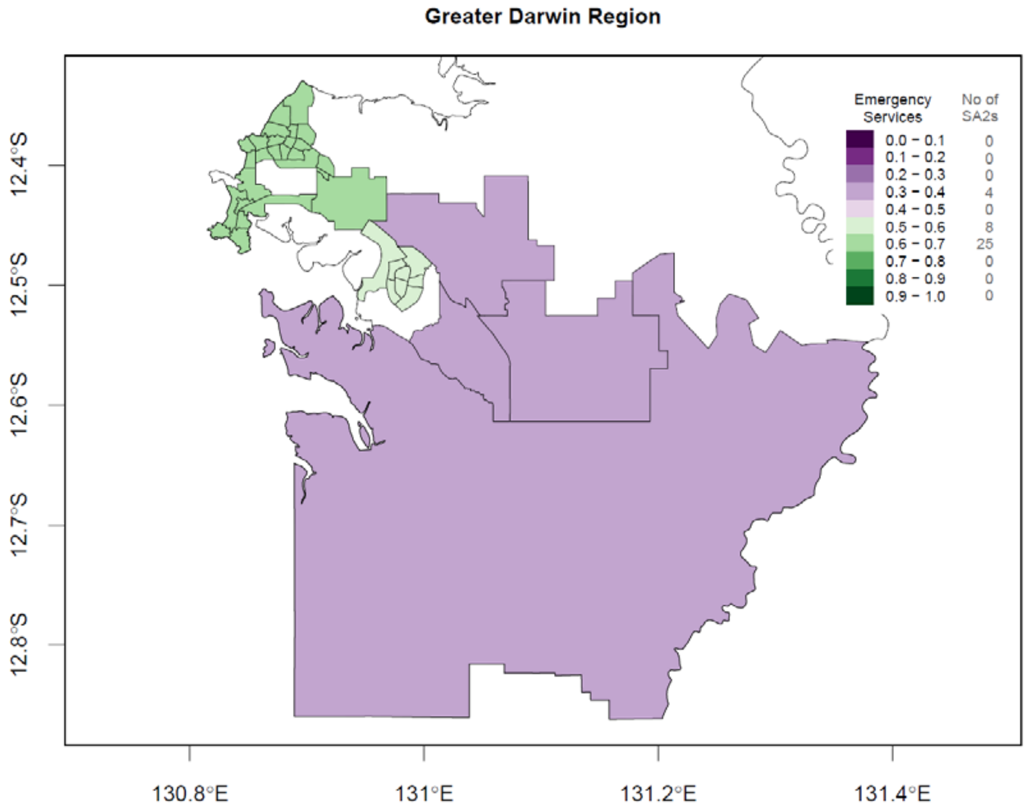
Appendix 5F (cont.)



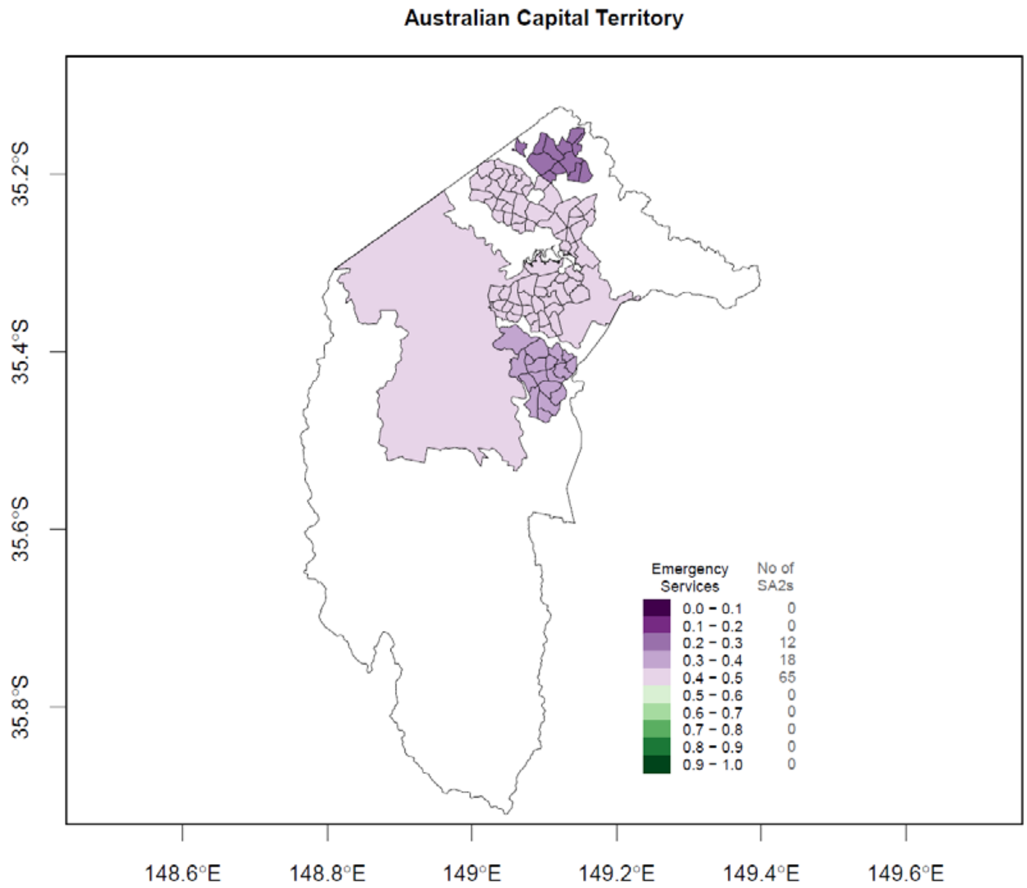


Appendix 5F (cont.)





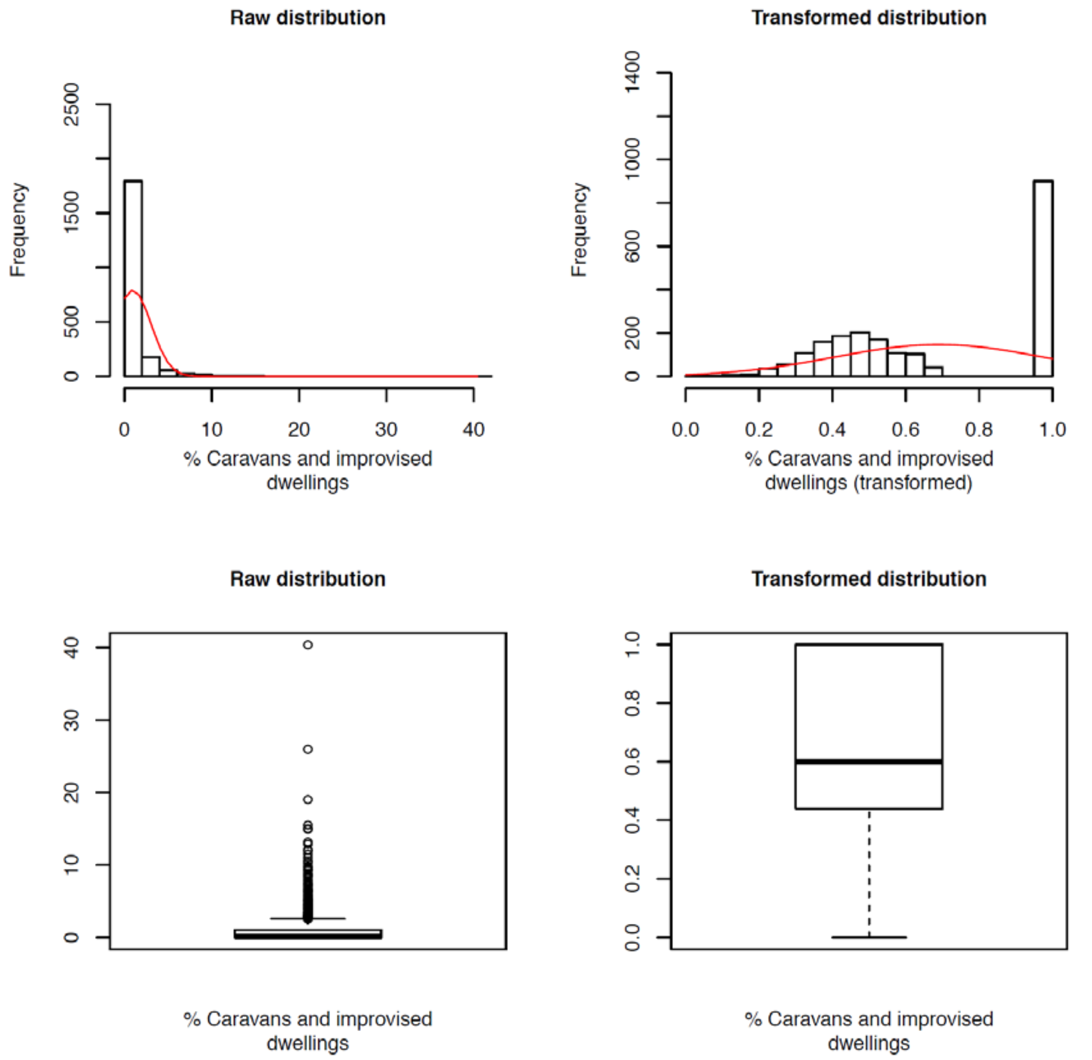
Appendix 5F (cont.)



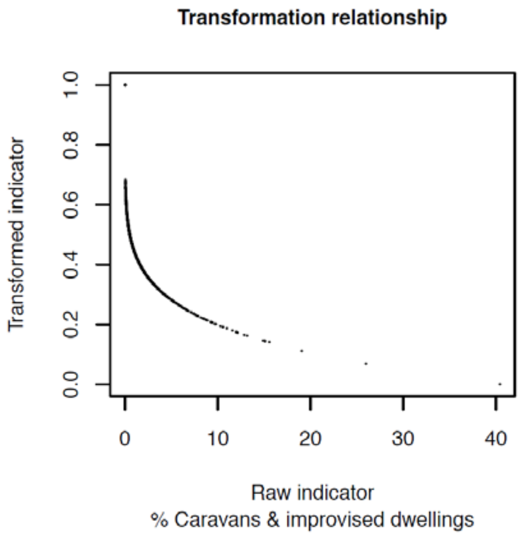
APPENDIX 5G – PLANNING AND THE BUILT ENVIRONMENT TRANSFORMATION DETAILS

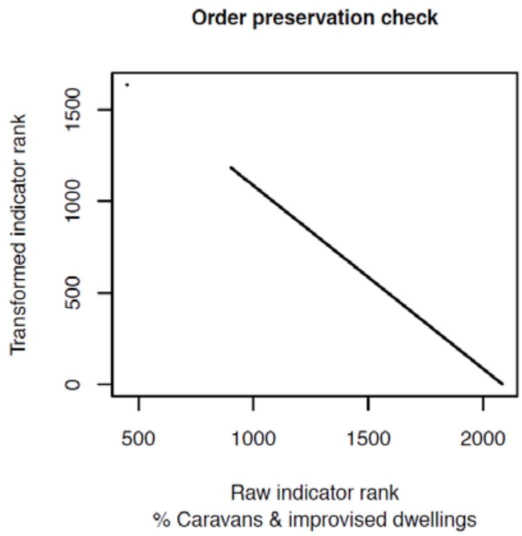
Appendix 5G shows the raw and transformed indicators used to compute the planning and the built environment sub-index.

Appendix 5G


Raw distribution
Frequency
0
500
1500
2500
0
10
20
30
40
% Caravans and improvised dwellings
Transformed distribution
Frequency
0
200
600
1000
1400
0.0
0.2
0.4
0.6
0.8
1.0
% Caravans and improvised dwellings (transformed)
Raw distribution
0
10
20
30
40
% Caravans and improvised dwellings
Transformed distribution
0.0
0.2
0.4
0.6
0.8
1.0
% Caravans and improvised dwellings

Appendix 5G (cont.)





TRANSFORMATION DETAILS

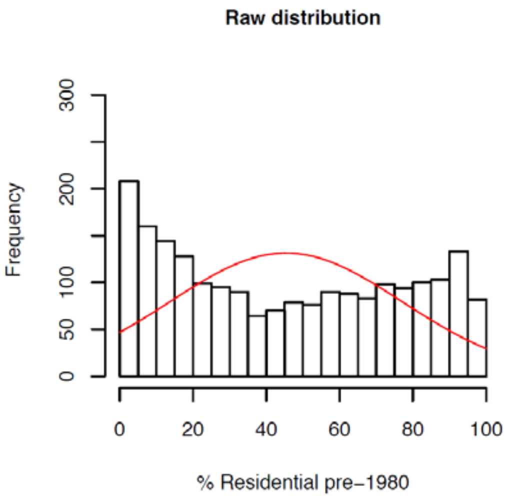
Reversed

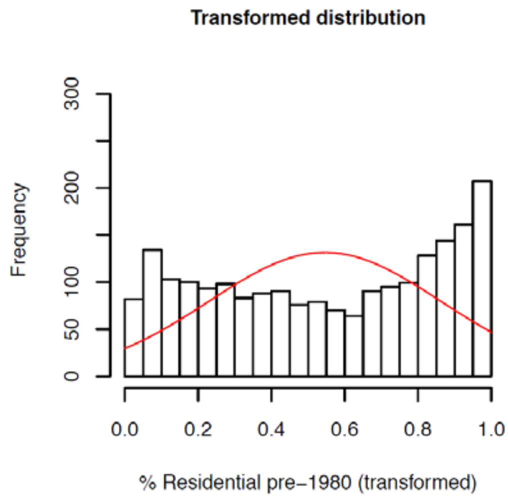
Skewness:
Power transform, exponent: 0.16
Pre−transform skewness: 6.5
Post−transform skewness: 0.0

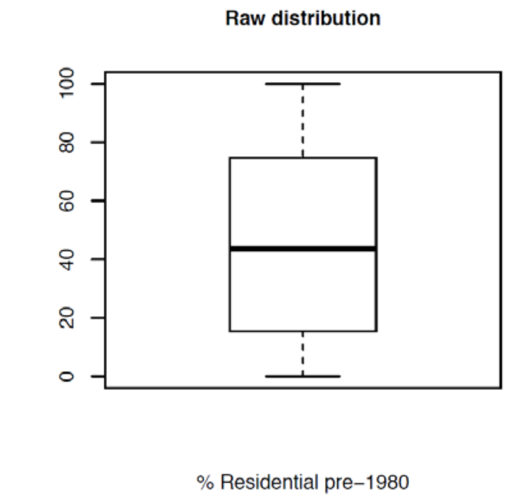
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 80.0
Post−transform kurtosis: −1.7

Outliers:
Pre−transform outlier count: 35
Post−transform outlier count: 0

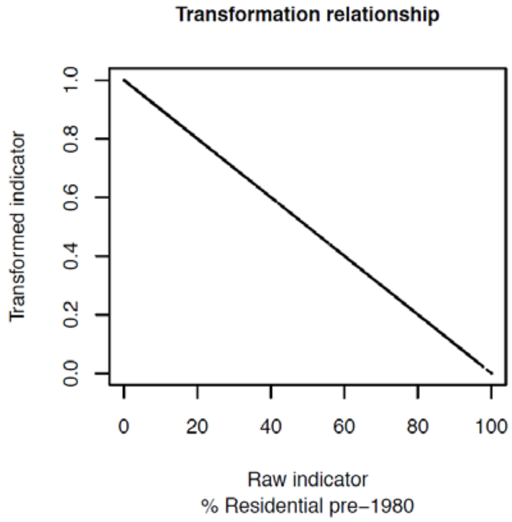
Appendix 5G (cont.)

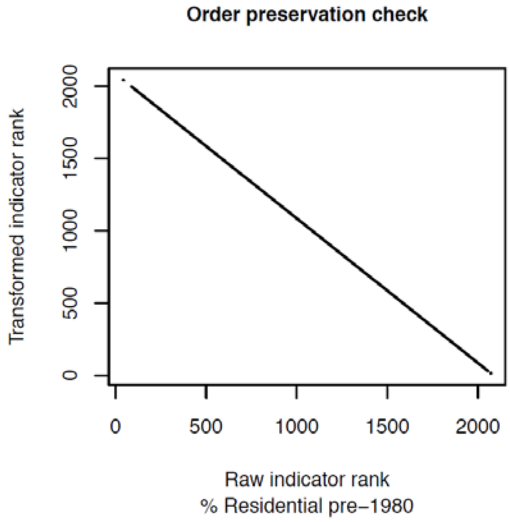






Appendix 5G (cont.)





TRANSFORMATION DETAILS

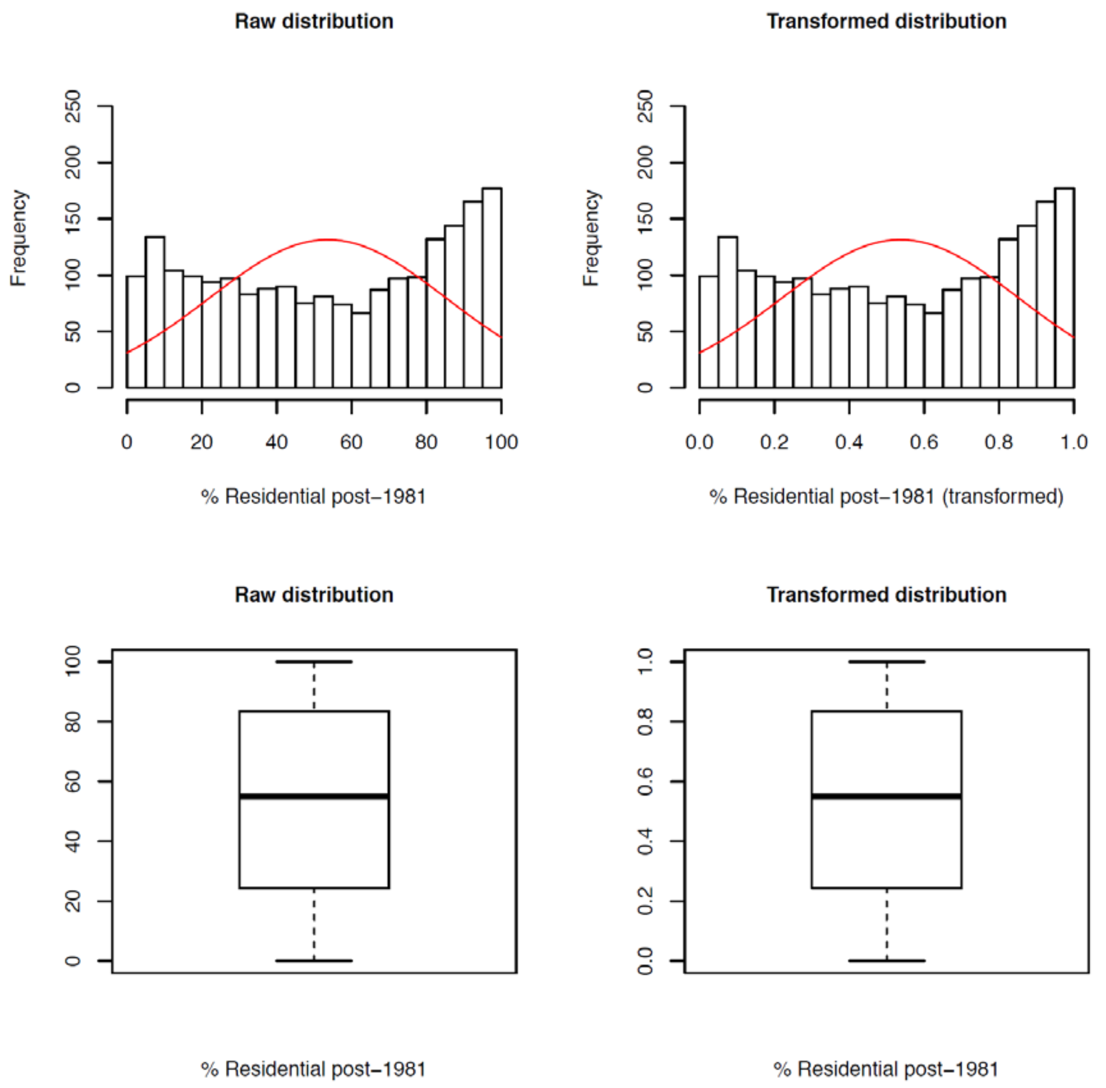
Reversed

Skewness:
No transform
Pre−transform skewness: 0.1
Post−transform skewness: −0.1

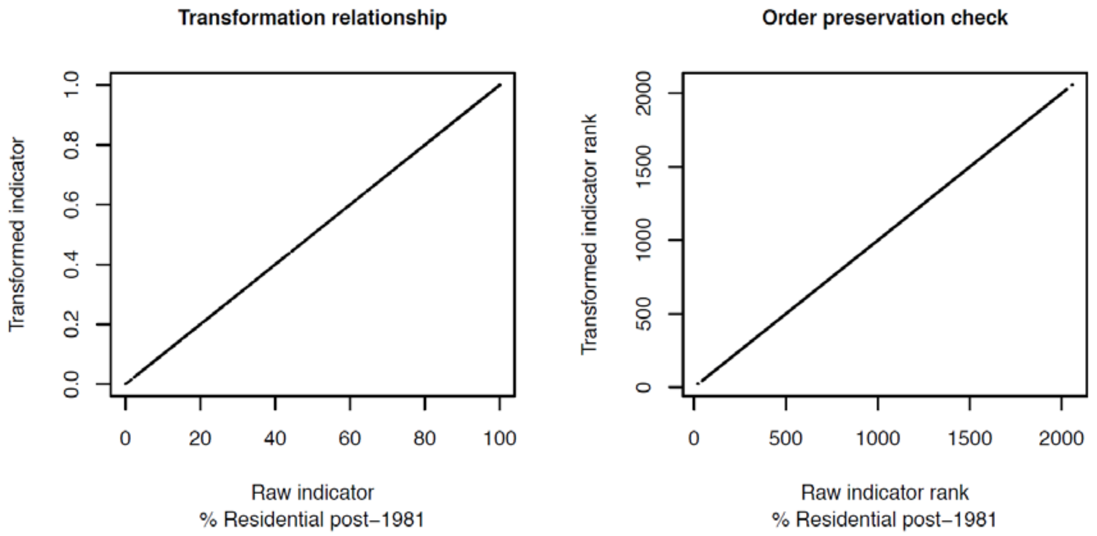
Kurtosis:
No transform
Pre−transform kurtosis: −1.4
Post−transform kurtosis: −1.4

Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

Appendix 5G (cont.)



Appendix 5G (cont.)



TRANSFORMATION DETAILS

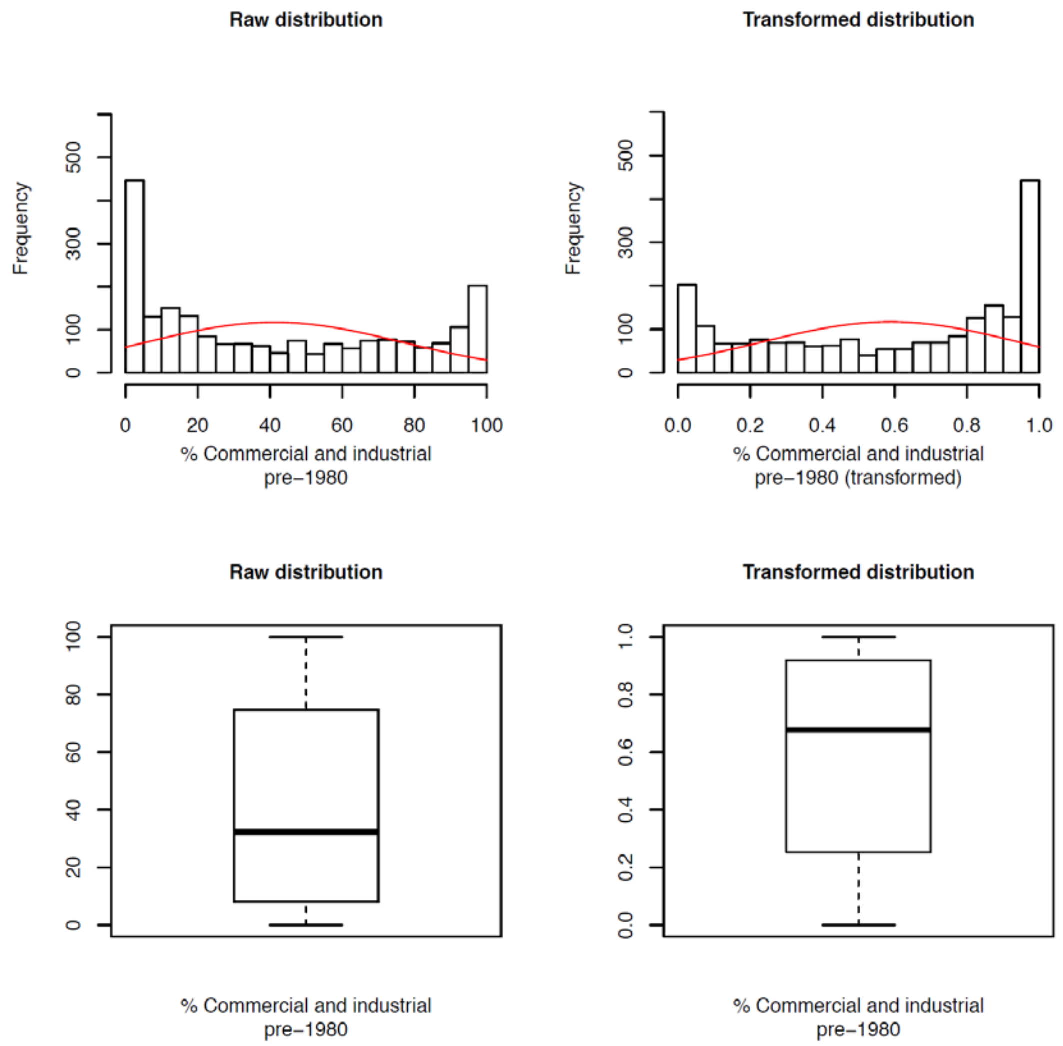
Unreversed

Skewness:
No transform
Pre−transform skewness: −0.1
Post−transform skewness: −0.1

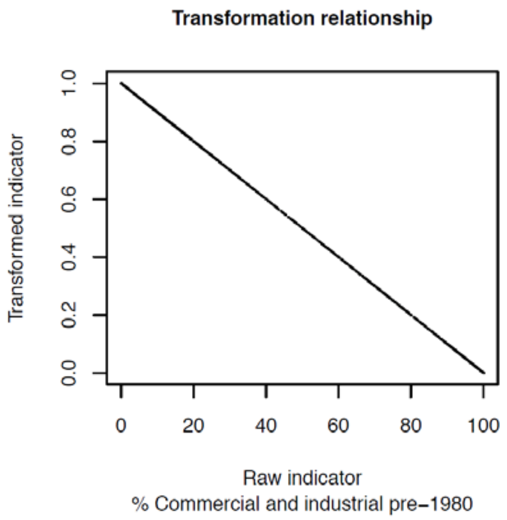
Kurtosis:
No transform
Pre−transform kurtosis: −1.4
Post−transform kurtosis: −1.4

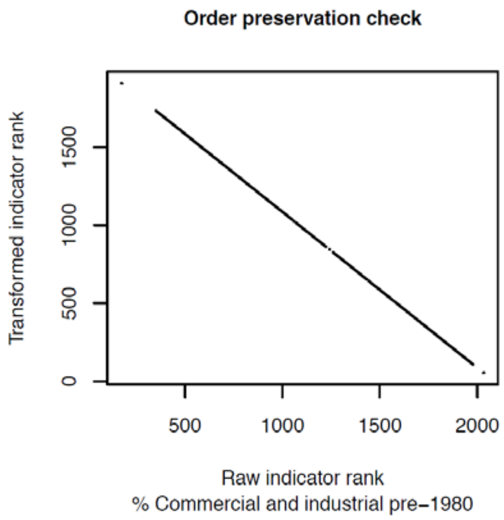
Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

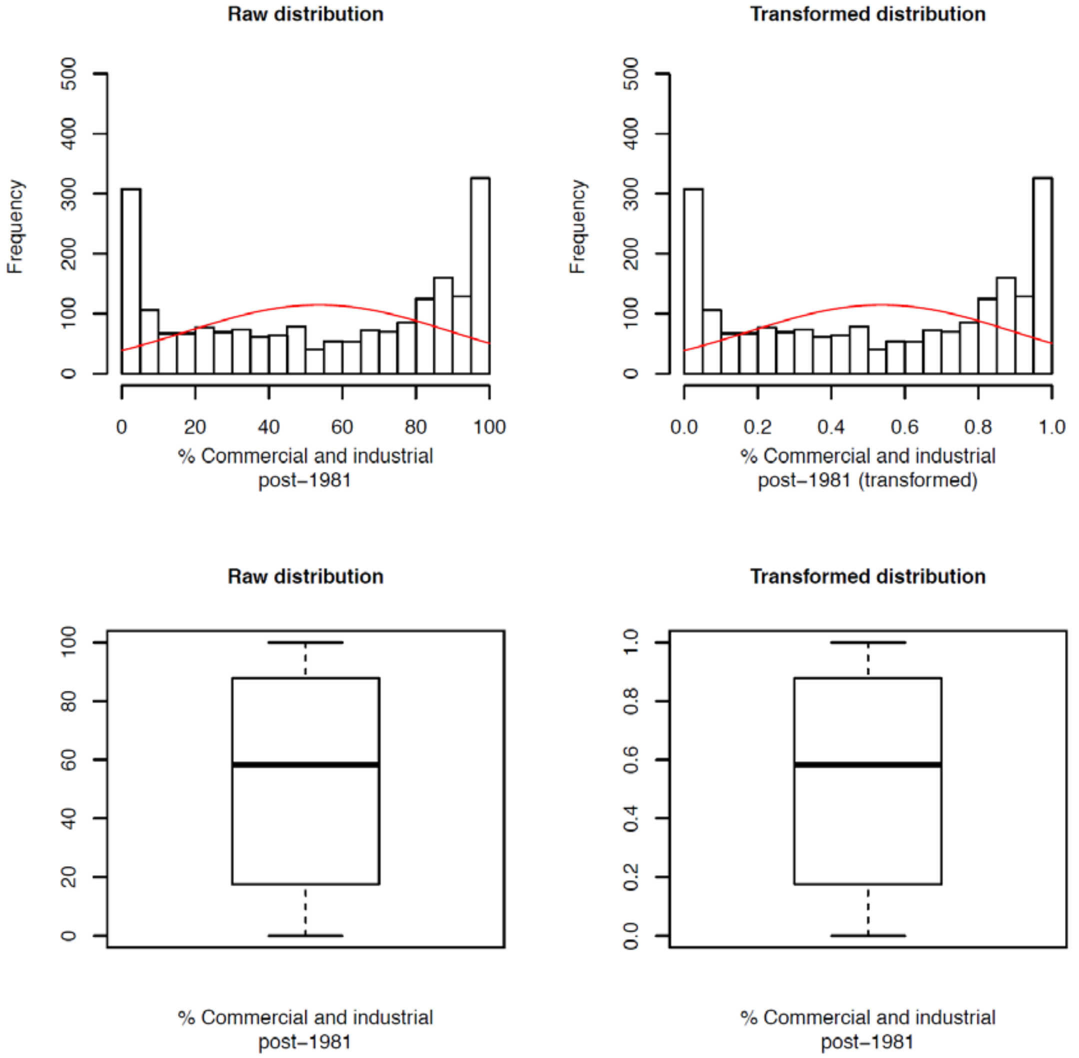
Reversed

Skewness:
No transform
Pre−transform skewness: 0.3
Post−transform skewness: −0.3

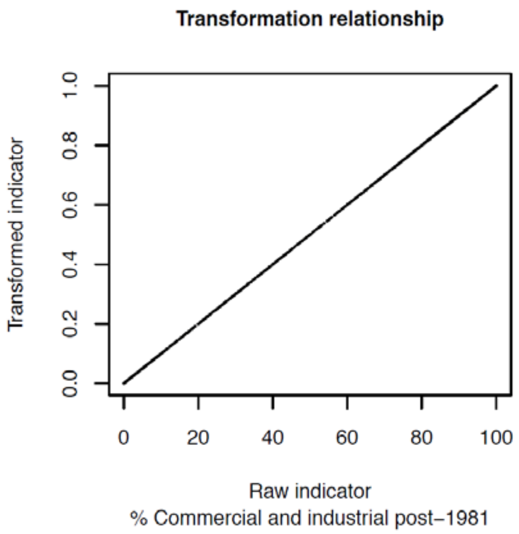
Kurtosis:
No transform
Pre−transform kurtosis: −1.4
Post−transform kurtosis: −1.4

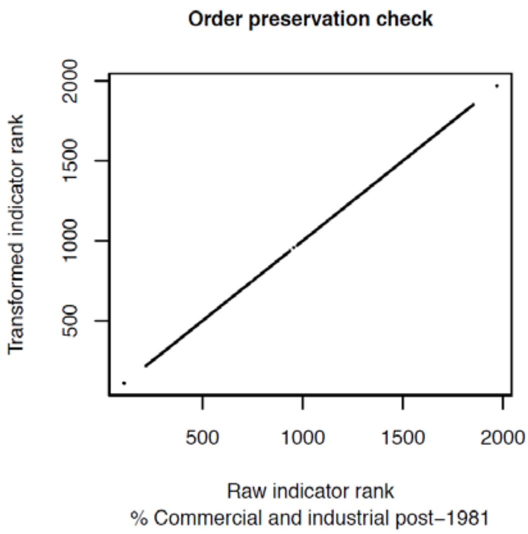
Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

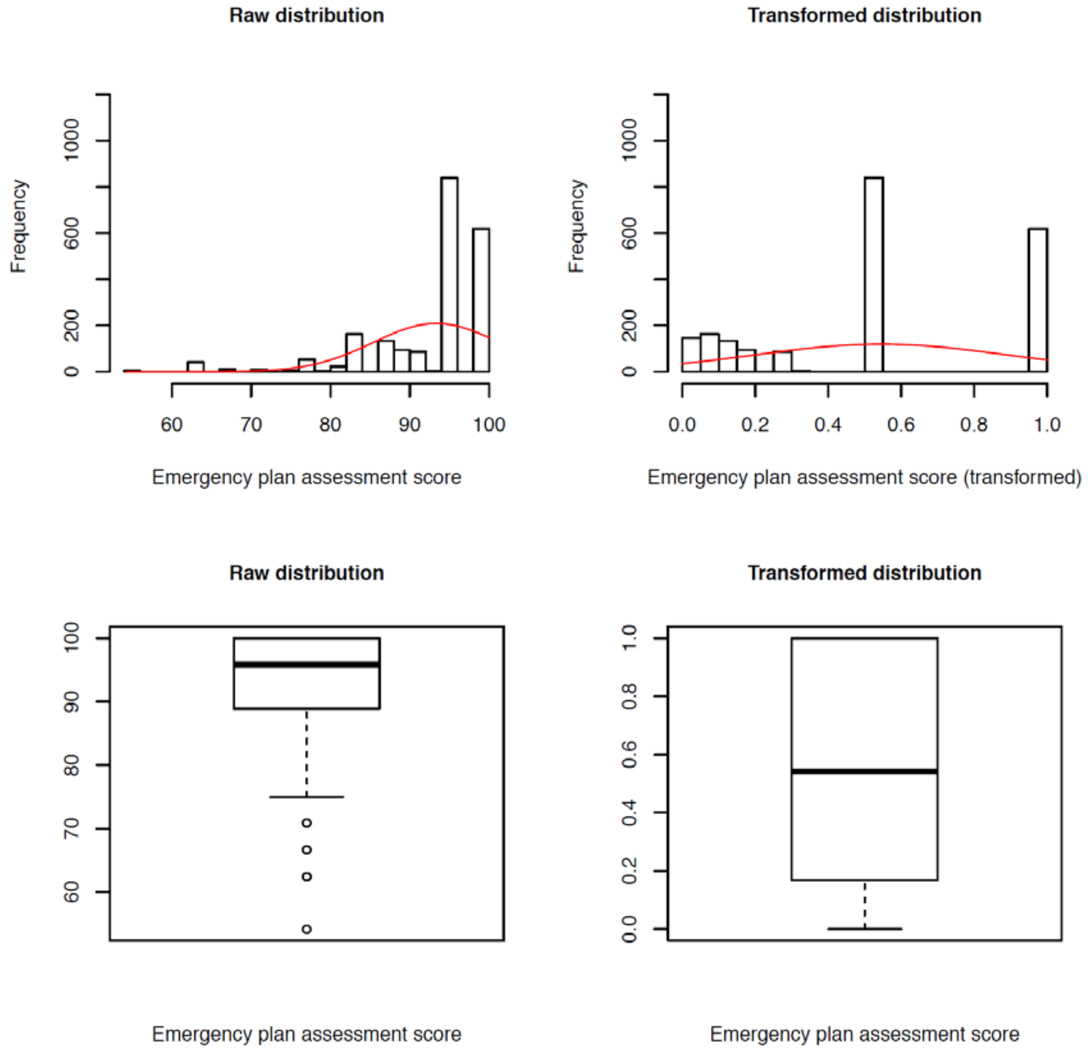
Unreversed

Skewness:
No transform
Pre−transform skewness: −0.2
Post−transform skewness: −0.2

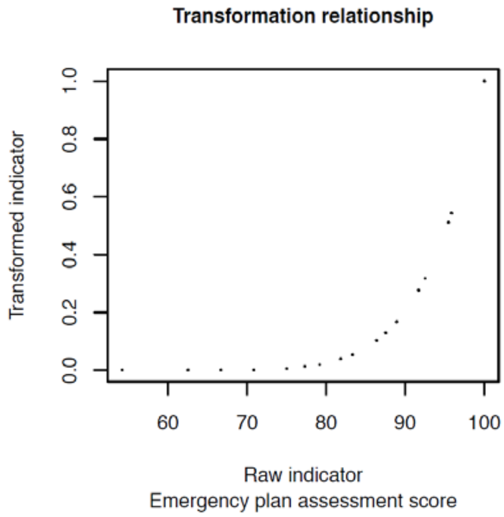
Kurtosis:
No transform
Pre−transform kurtosis: −1.5
Post−transform kurtosis: −1.5

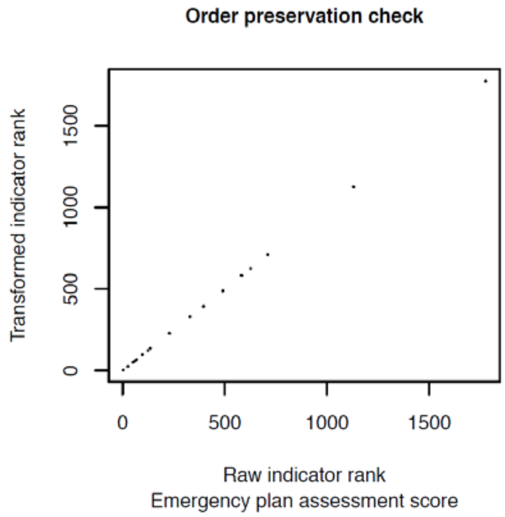
Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

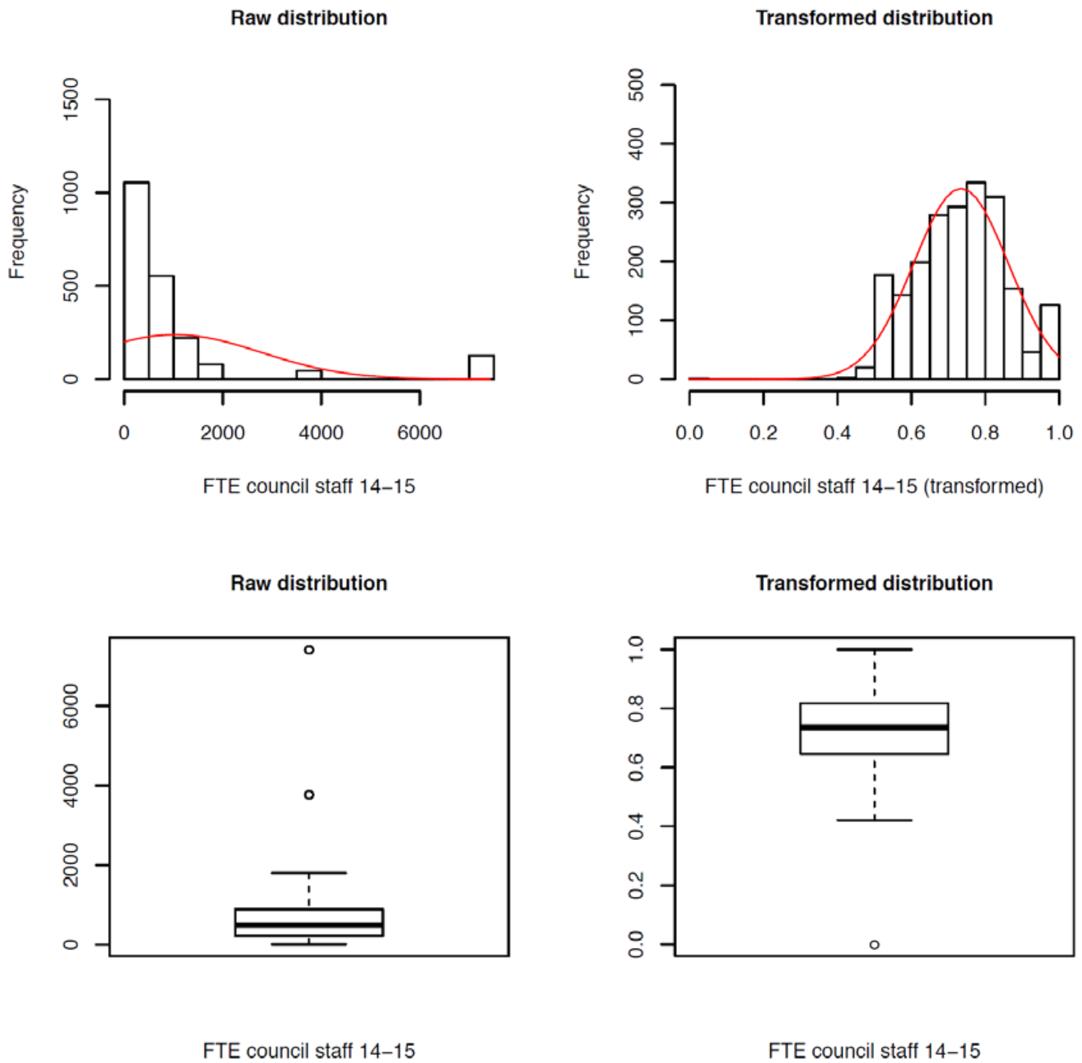
Unreversed

Skewness:
Power transform, exponent: 6.43
Pre−transform skewness: −2.0
Post−transform skewness: 0.0

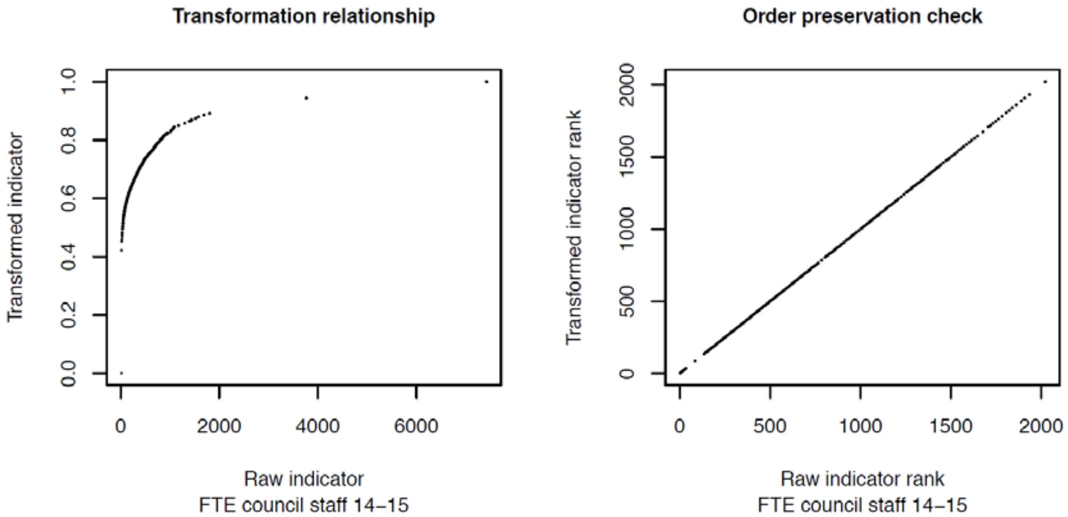
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 4.4
Post−transform kurtosis: −1.2

Outliers:
Pre−transform outlier count: 55
Post−transform outlier count: 0

Appendix 5G (cont.)



Appendix 5G (cont.)



TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.09
Pre−transform skewness: 3.0
Post−transform skewness: 0.0

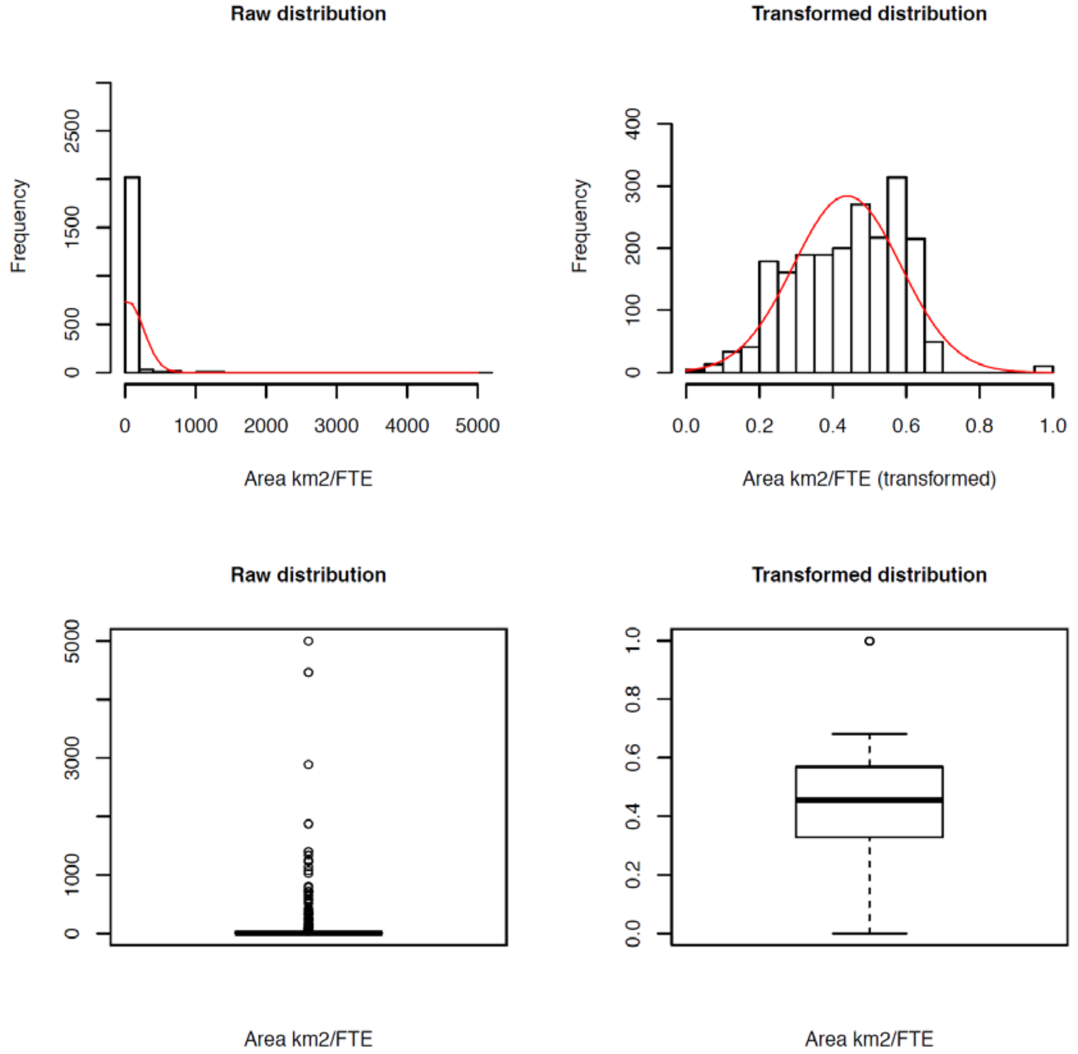
Kurtosis:
Coefficient: 0.21
Pre−transform kurtosis: 8.2
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 126
Post−transform outlier count: 1

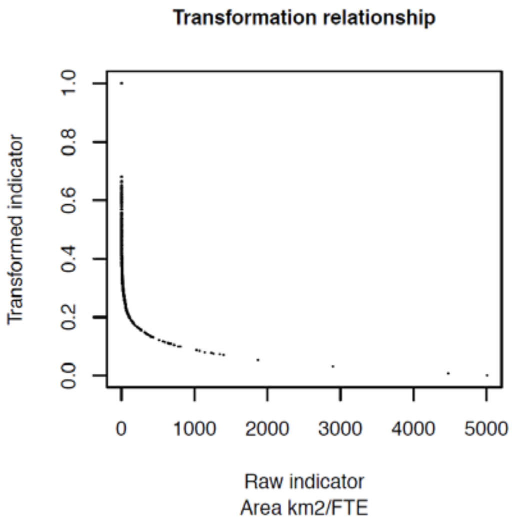
OUTLIER DETAILS

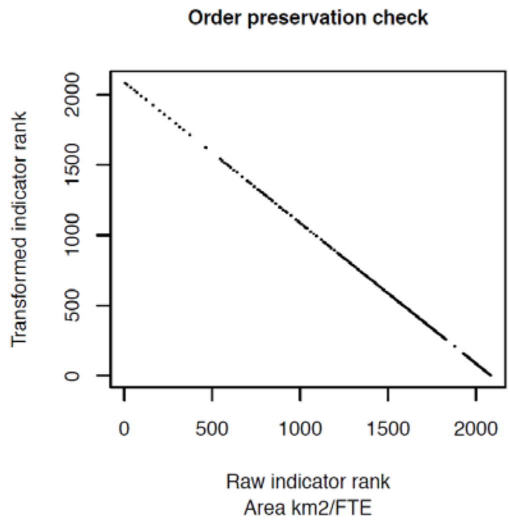
SA2	Value
Weipa	9.00

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.07
Pre−transform skewness: 15.1
Post−transform skewness: −0.1

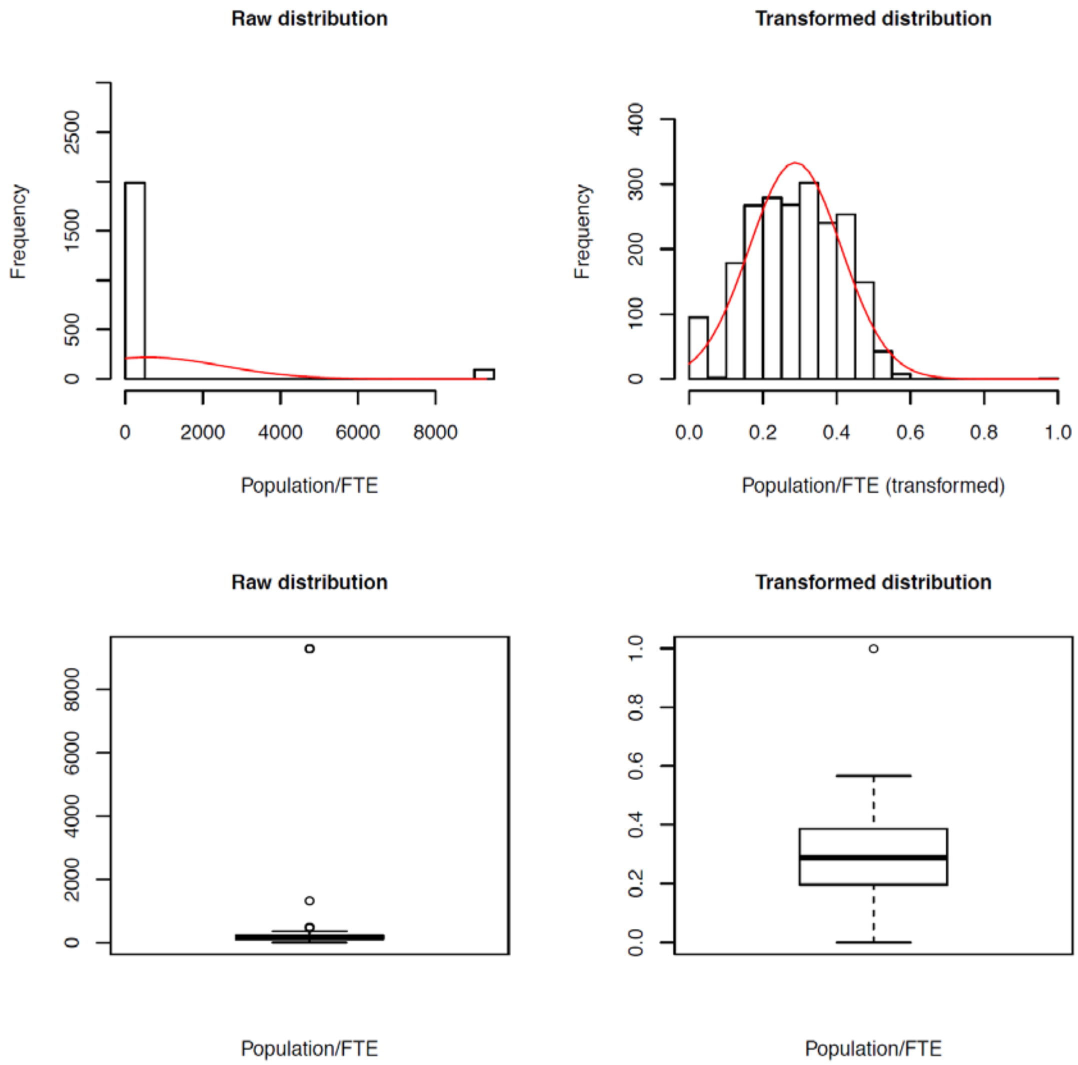
Kurtosis:
Coefficient: 0.24
Pre−transform kurtosis: 281.6
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 18
Post−transform outlier count: 10

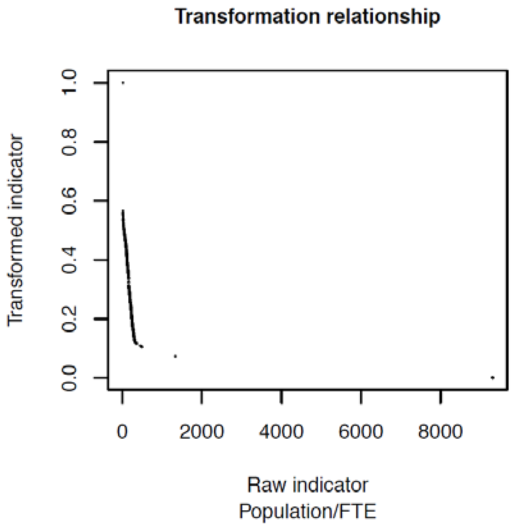
OUTLIER DETAILS

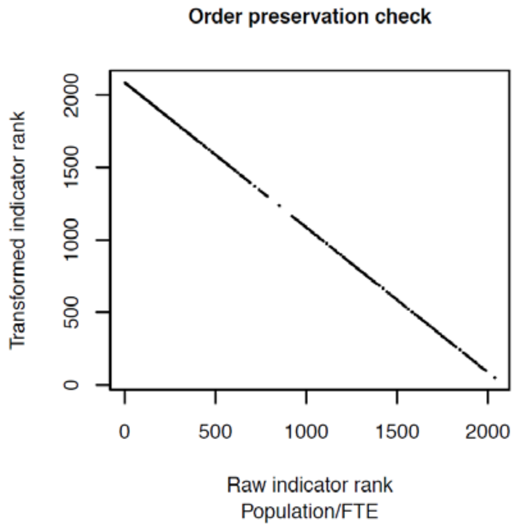
SA2	Value
Darlinghurst	0.01
Erskineville − Alexandria	0.01
Glebe − Forest Lodge	0.01
Newtown − Camperdown − Darlington	0.01
Potts Point − Woolloomooloo	0.01
Pyrmont − Ultimo	0.01
Redfern − Chippendale	0.01
Surry Hills	0.01
Sydney − Haymarket − The Rocks	0.01
Waterloo − Beaconsfield	0.01

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.05
Pre−transform skewness: 4.3
Post−transform skewness: −0.2

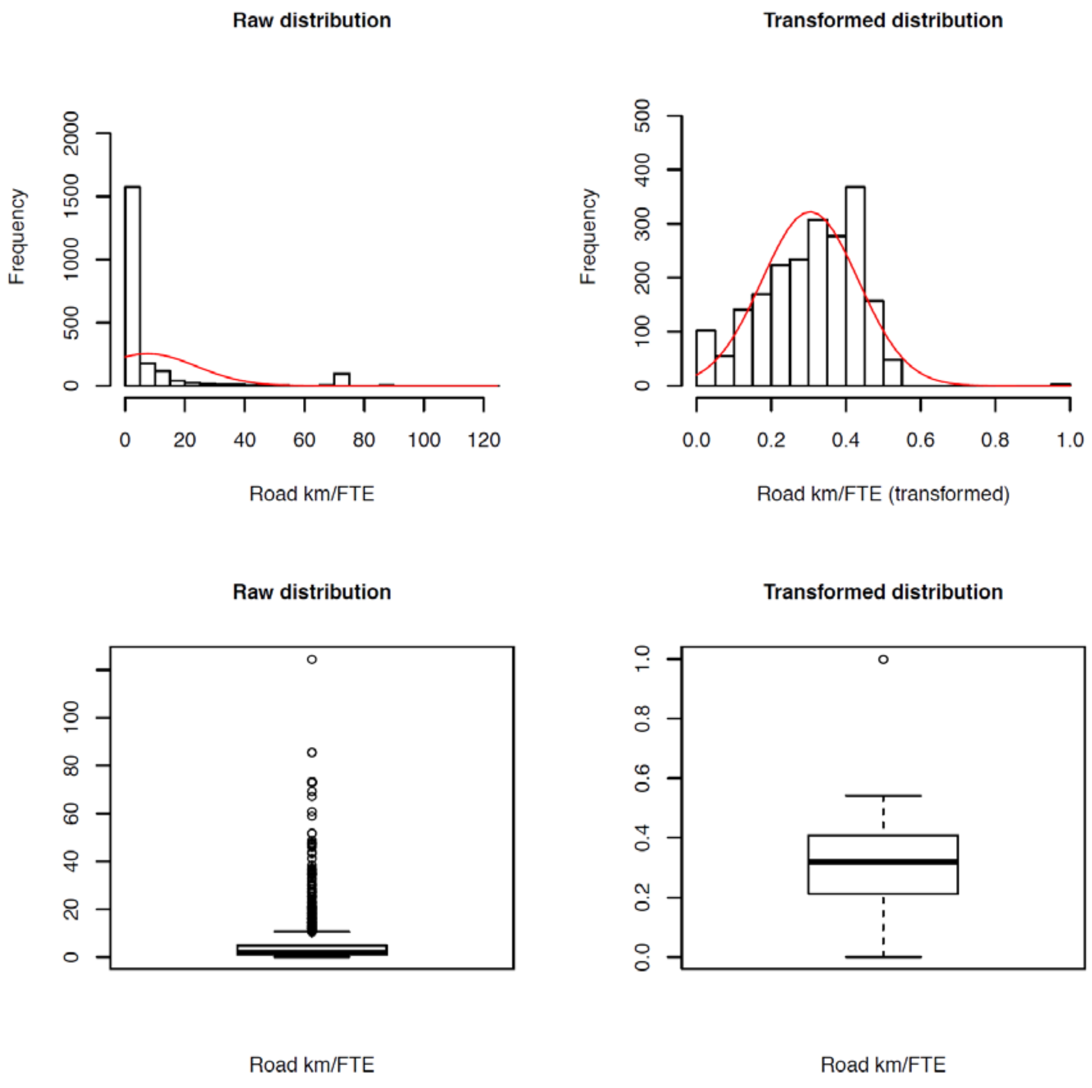
Kurtosis:
Coefficient: 0.50
Pre−transform kurtosis: 16.9
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 95
Post−transform outlier count: 1

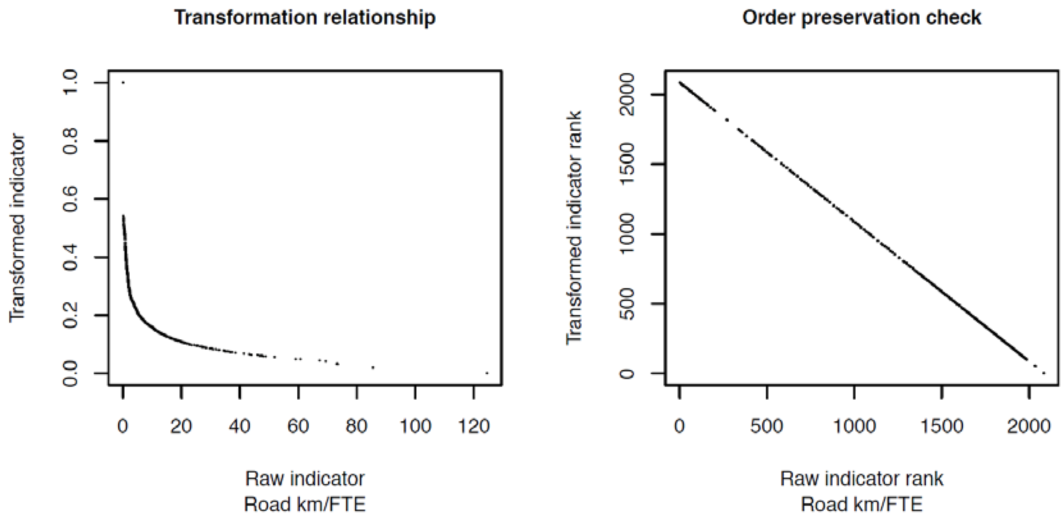
OUTLIER DETAILS

SA2	Value
Forestier – Tasman	9.94

Appendix 5G (cont.)



Appendix 5G (cont.)



TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.07
Pre−transform skewness: 3.4
Post−transform skewness: −0.3

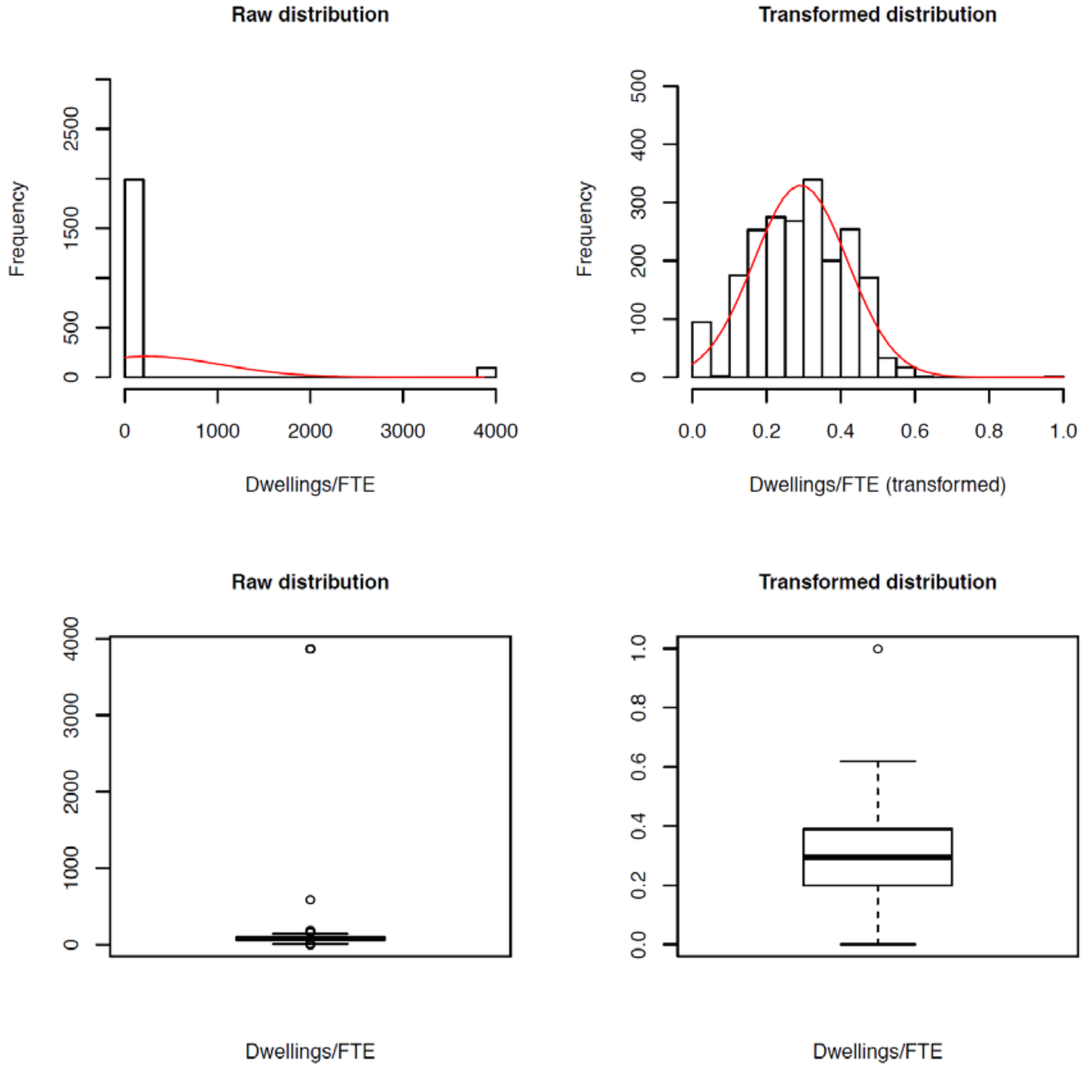
Kurtosis:
Coefficient: 0.37
Pre−transform kurtosis: 11.2
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 100
Post−transform outlier count: 2

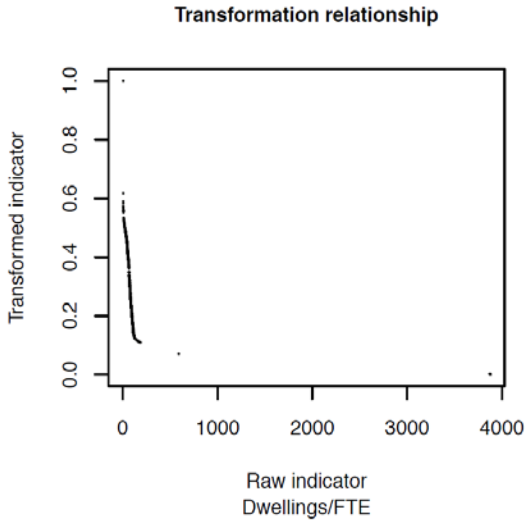
OUTLIER DETAILS

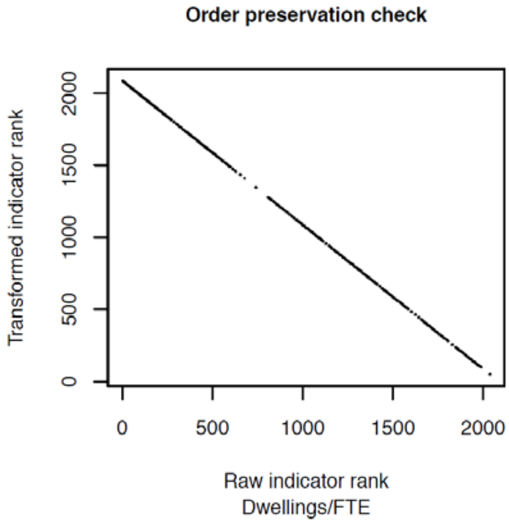
SA2	Value
Mukinbudin	0.00
York – Beverley	0.00

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.05
Pre−transform skewness: 4.3
Post−transform skewness: −0.2

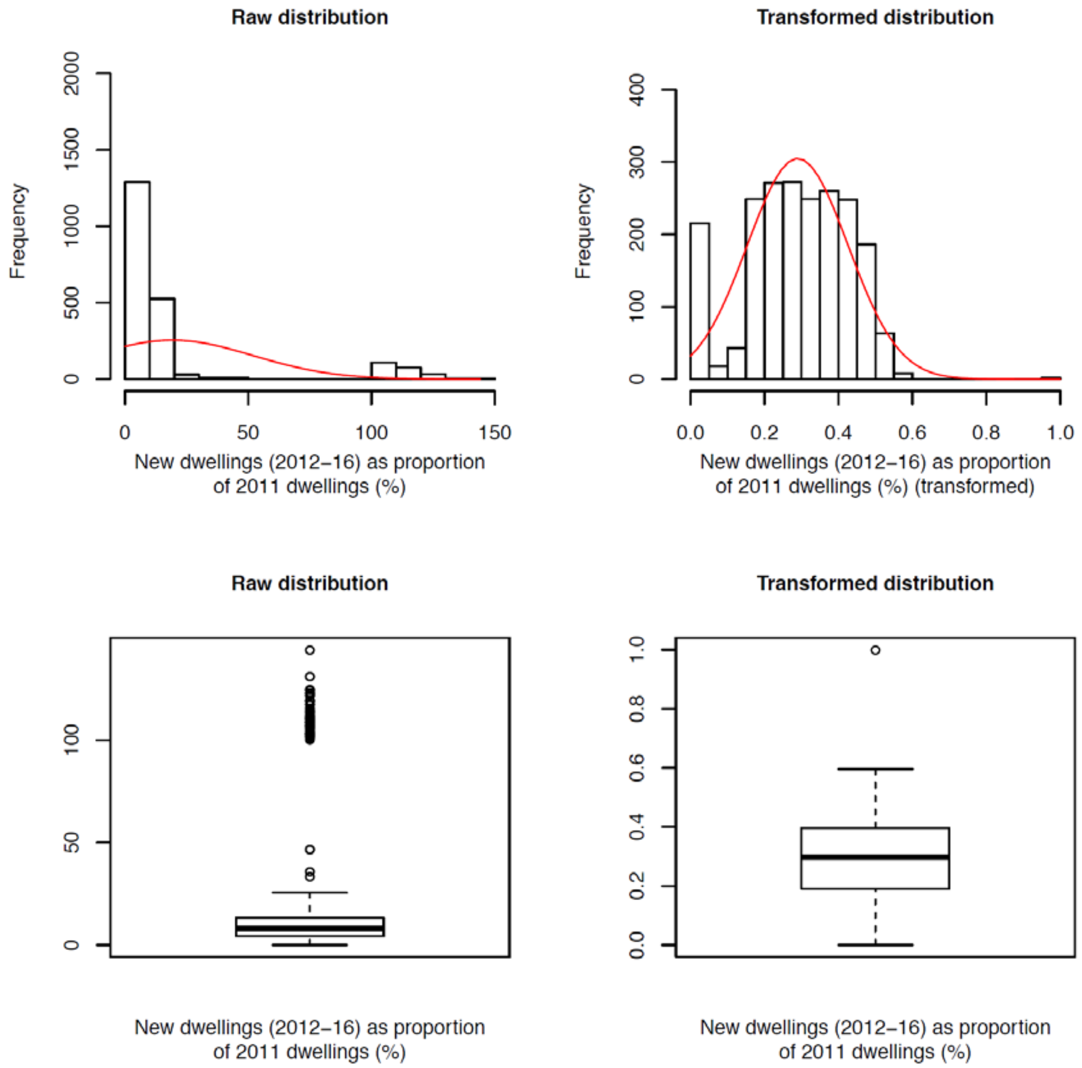
Kurtosis:
Coefficient: 0.53
Pre−transform kurtosis: 16.9
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 95
Post−transform outlier count: 1

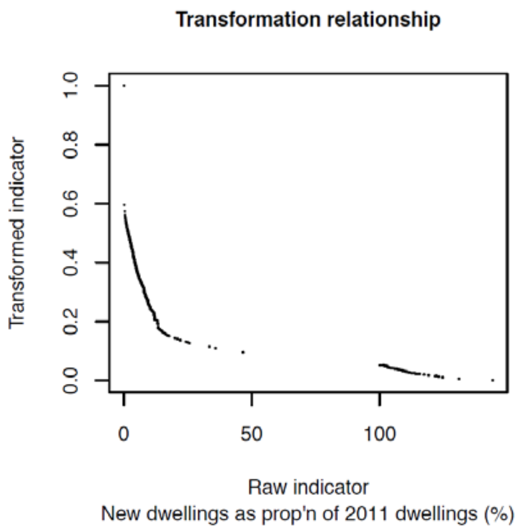
OUTLIER DETAILS

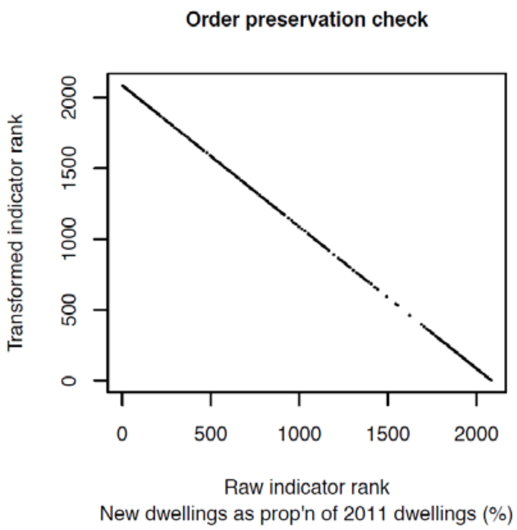
SA2	Value
Palm Island	2.55

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.08
Pre–transform skewness: 2.5
Post–transform skewness: –0.2

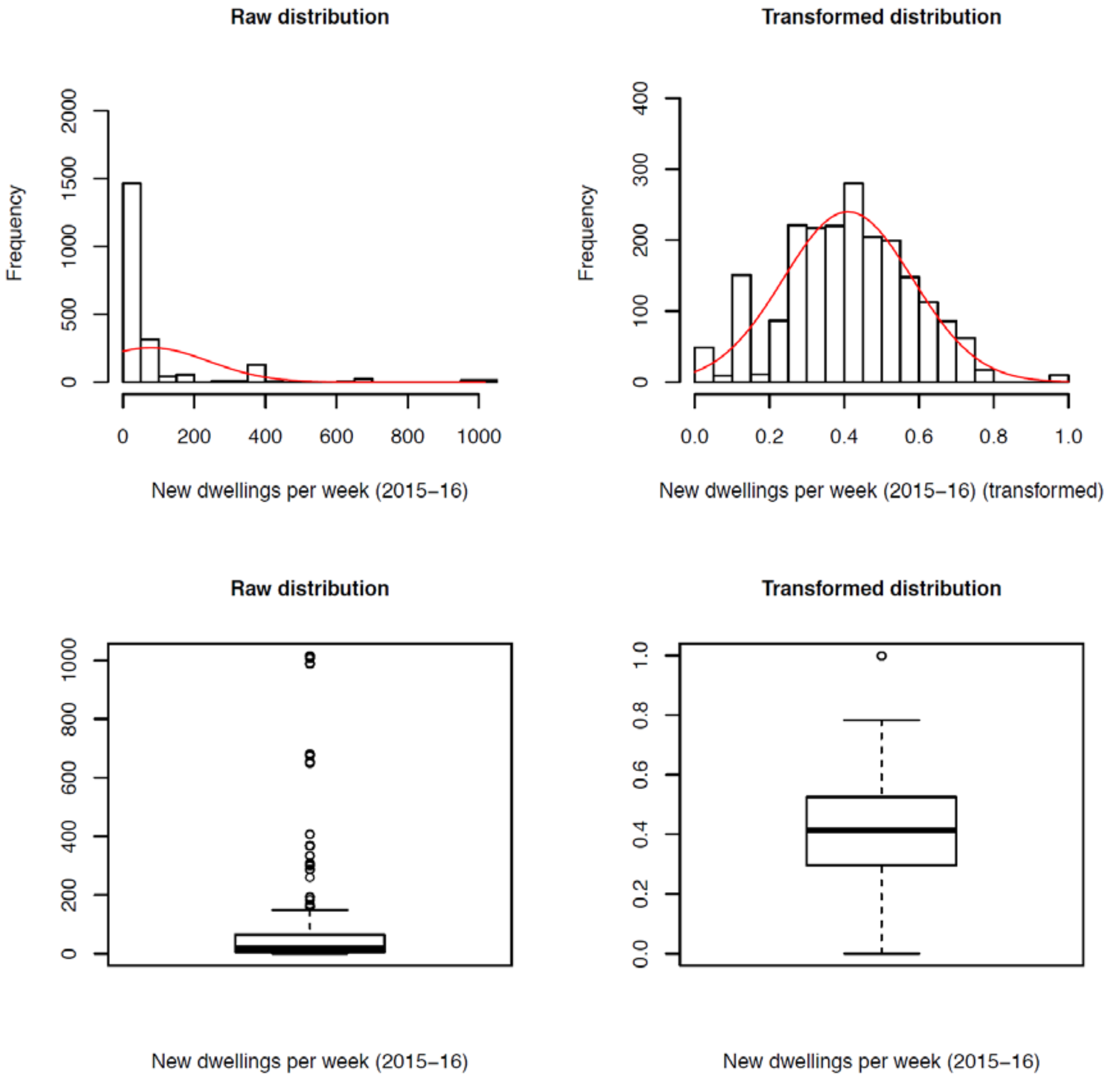
Kurtosis:
Coefficient: 0.42
Pre–transform kurtosis: 4.3
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 8
Post–transform outlier count: 2

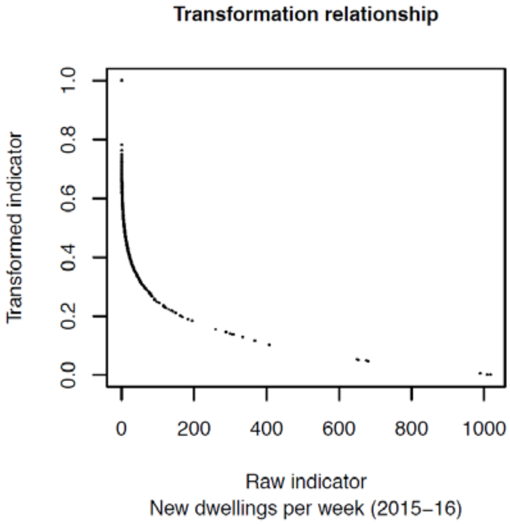
OUTLIER DETAILS

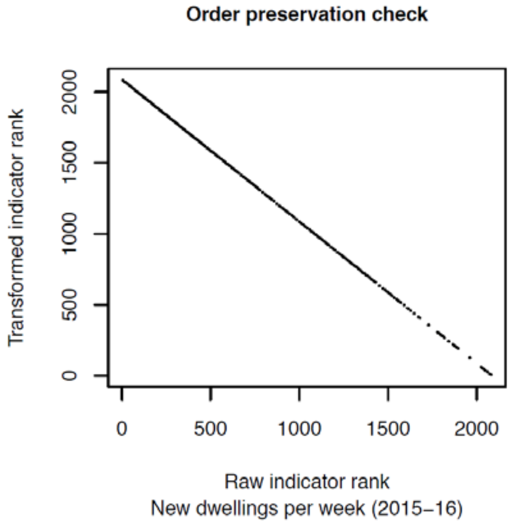
SA2	Value
Yarrabah	0.00
Tiwi Islands	0.00

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.13
Pre−transform skewness: 3.7
Post−transform skewness: −0.0

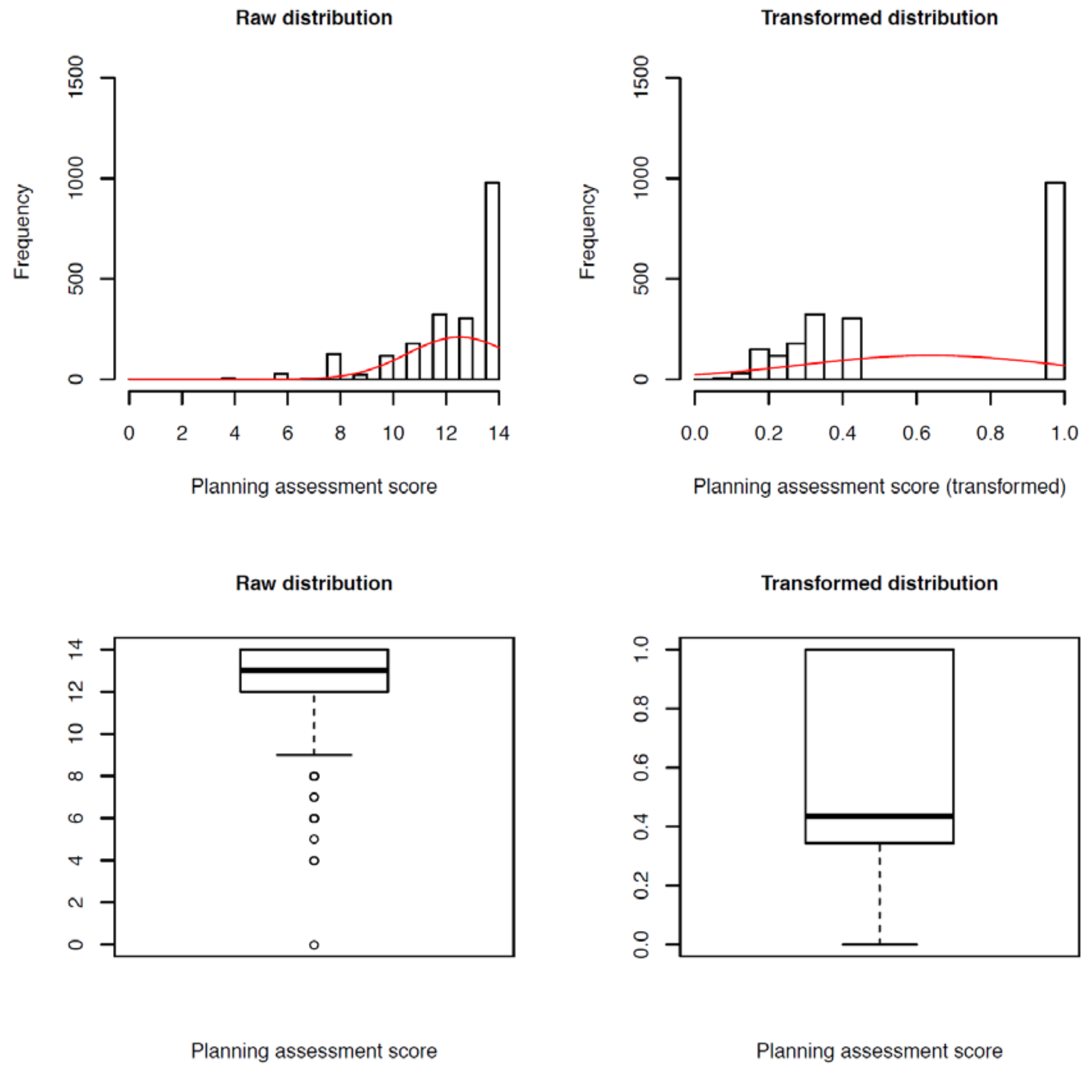
Kurtosis:
Coefficient: 0.13
Pre−transform kurtosis: 15.8
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 58
Post−transform outlier count: 10

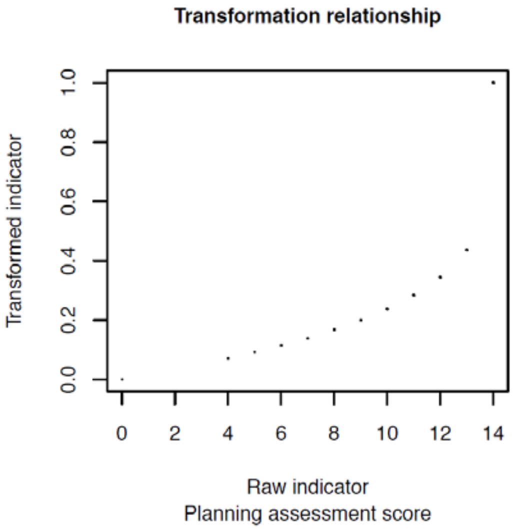
OUTLIER DETAILS

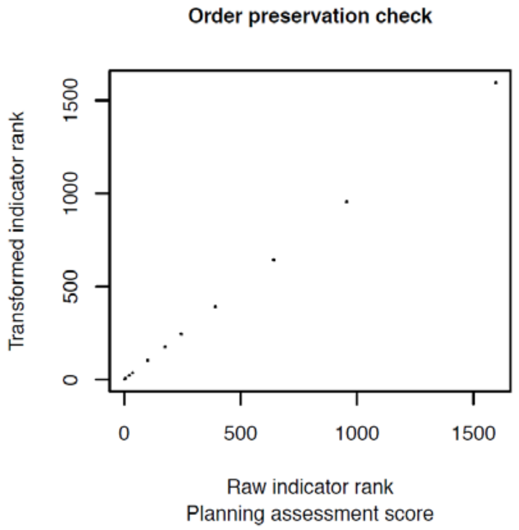
SA2	Value
Yarrabah	0.00
Aurukun	0.00
Mount Isa Region	0.00
Far Central West	0.00
Far South West	0.00
Palm Island	0.00
Leinster – Leonora	0.00
Mukinbudin	0.00
West Coast (Tas.)	0.00
Tiwi Islands	0.00

Appendix 5G (cont.)



Appendix 5G (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.22
Pre−transform skewness: −1.6
Post−transform skewness: 0.0

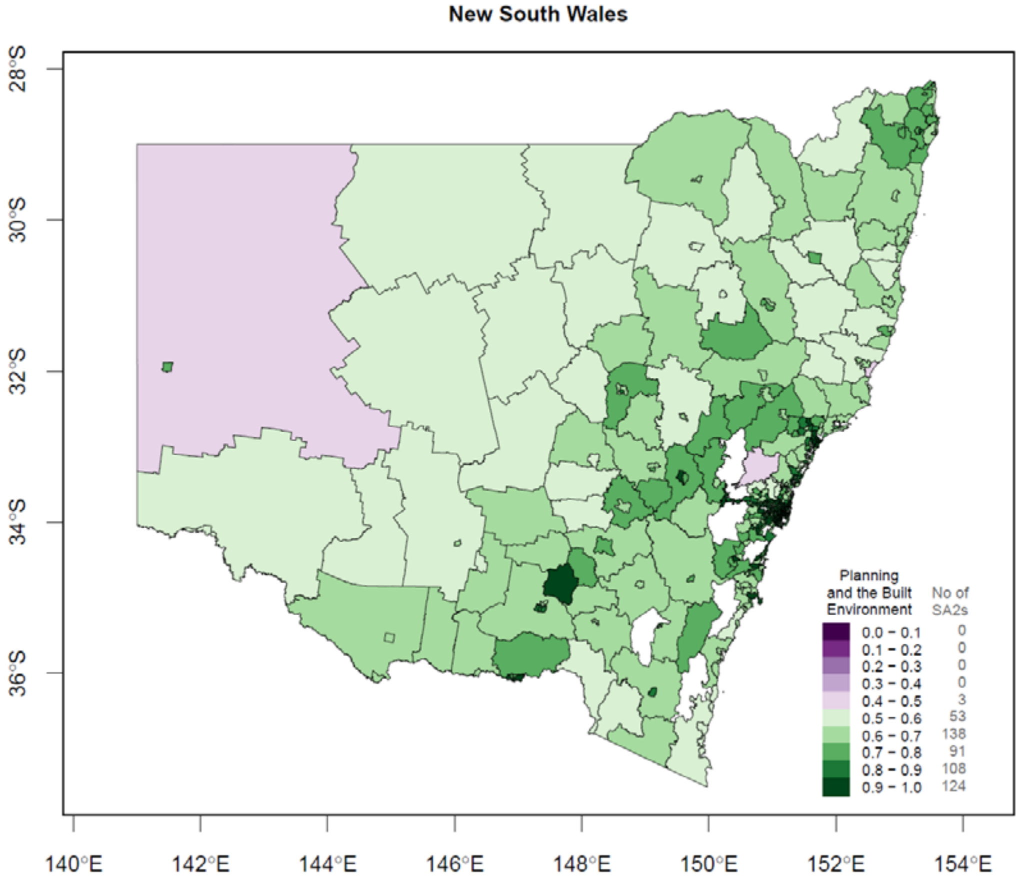
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 2.4
Post−transform kurtosis: −1.8

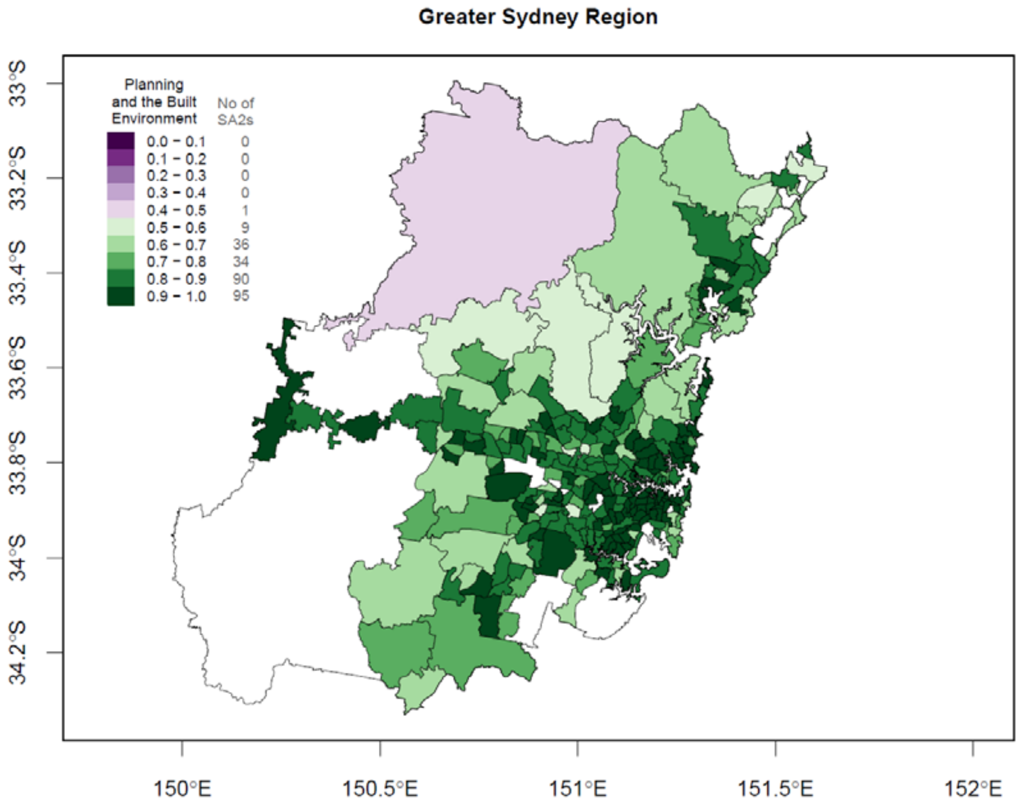
Outliers:
Pre−transform outlier count: 34
Post−transform outlier count: 0

APPENDIX 5H – MAPS: PLANNING AND THE BUILT ENVIRONMENT SUB-INDEX BY STATE/TERRITORY AND METROPOLITAN AREAS

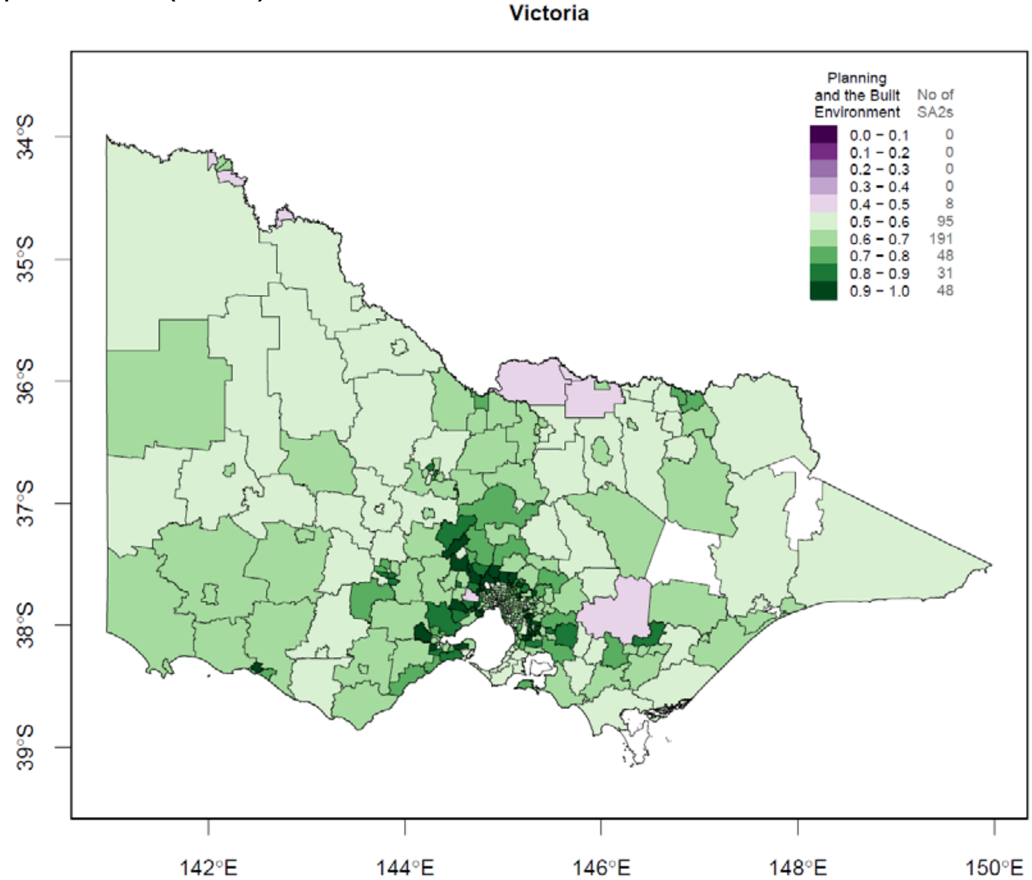
Appendix 5H maps the planning and the built environment sub-index at the resolution of individual States and Territories, and major metropolitan areas.

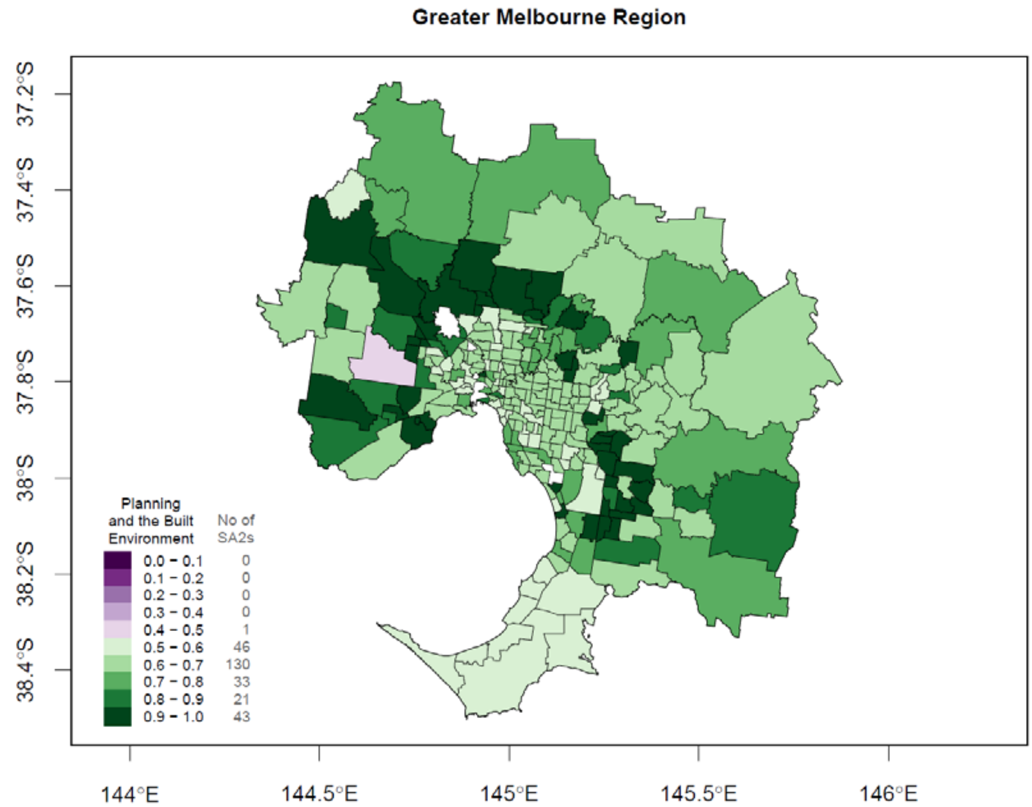
Appendix 5H


New South Wales
28°S
30°S
32°S
34°S
36°S
140°E
142°E
144°E
146°E
148°E
150°E
152°E
154°E
Planning and the Built Environment
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 0
0.2 – 0.3 0
0.3 – 0.4 0
0.4 – 0.5 3
0.5 – 0.6 53
0.6 – 0.7 138
0.7 – 0.8 91
0.8 – 0.9 108
0.9 – 1.0 124

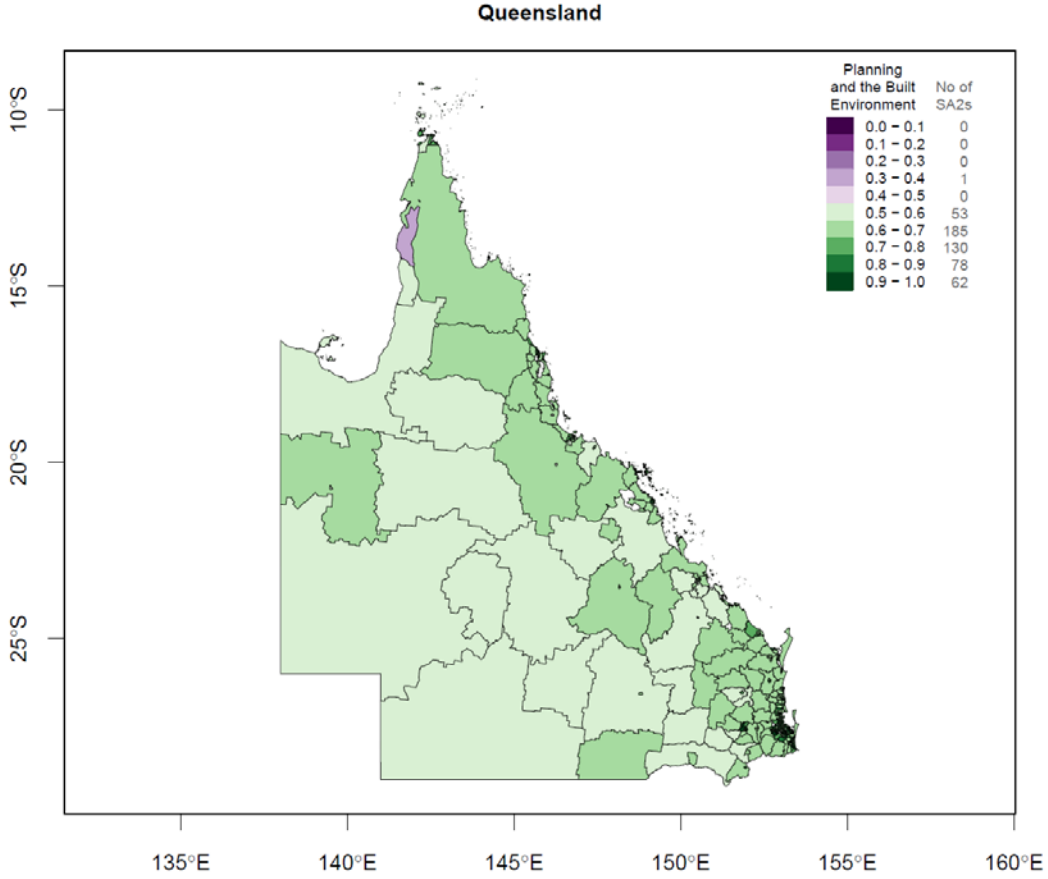

Greater Sydney Region
33°S
33.2°S
33.4°S
33.6°S
33.8°S
34°S
34.2°S
150°E
150.5°E
151°E
151.5°E
152°E
Planning and the Built Environment
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 0
0.2 – 0.3 0
0.3 – 0.4 0
0.4 – 0.5 1
0.5 – 0.6 9
0.6 – 0.7 36
0.7 – 0.8 34
0.8 – 0.9 90
0.9 – 1.0 95

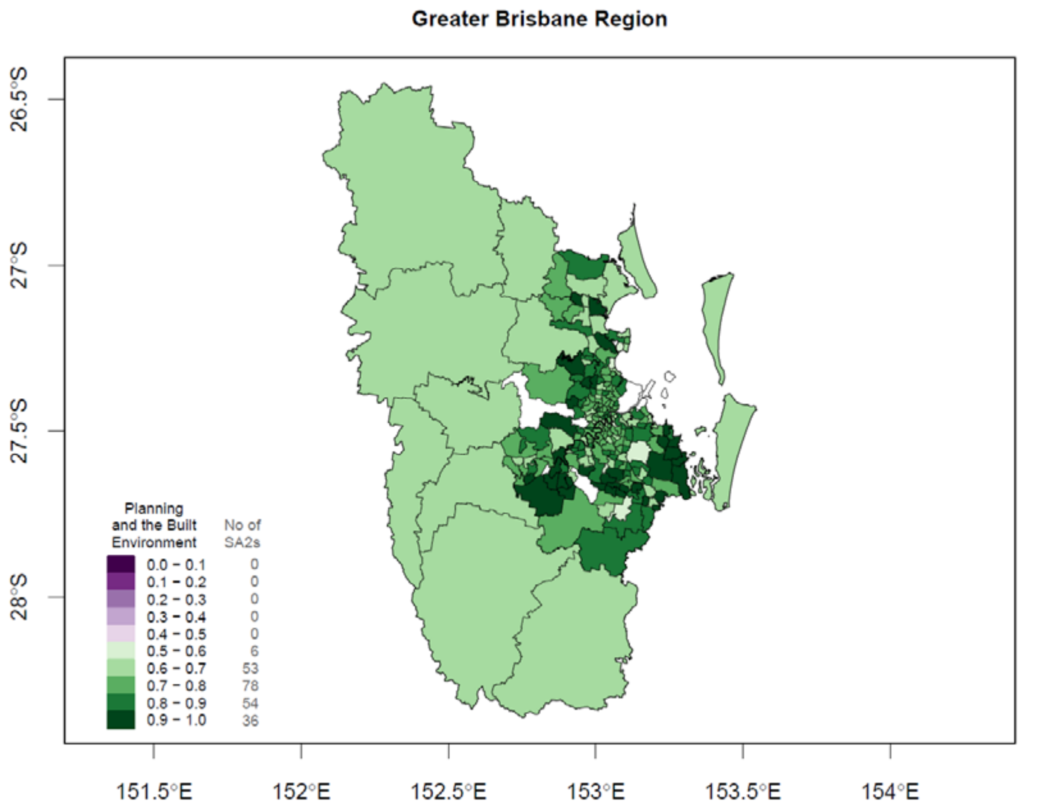
Appendix 5H (cont.)



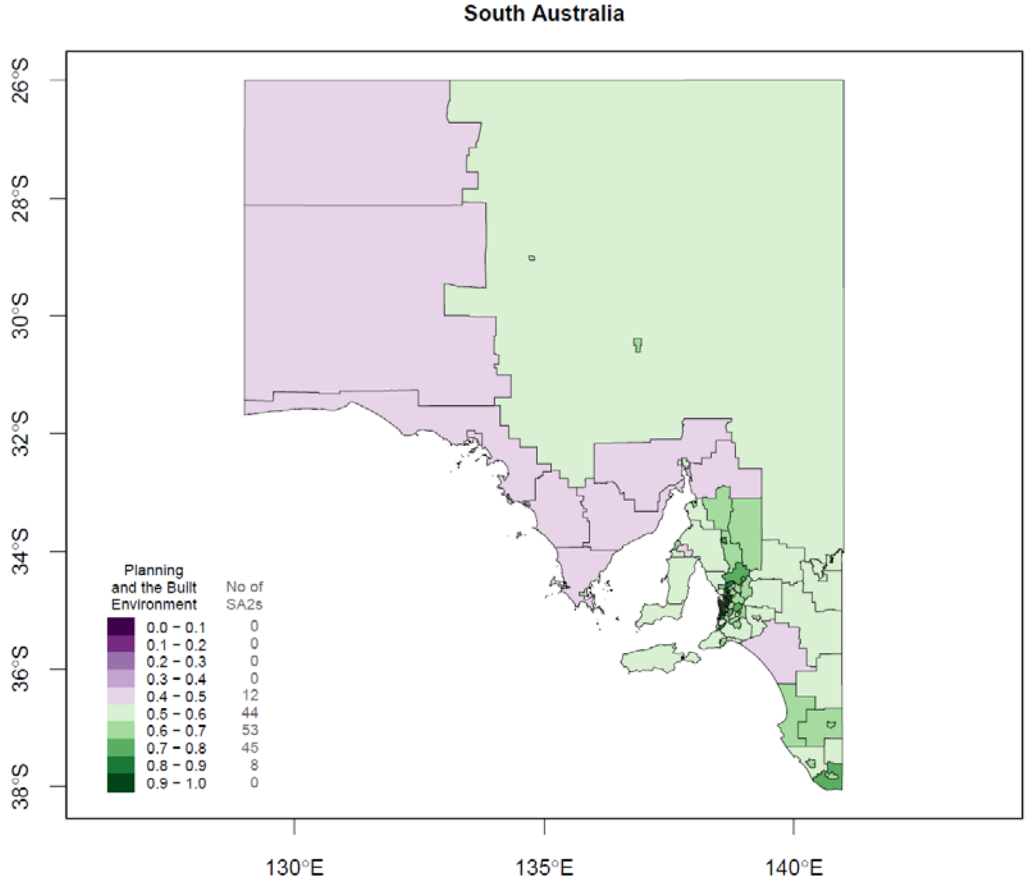


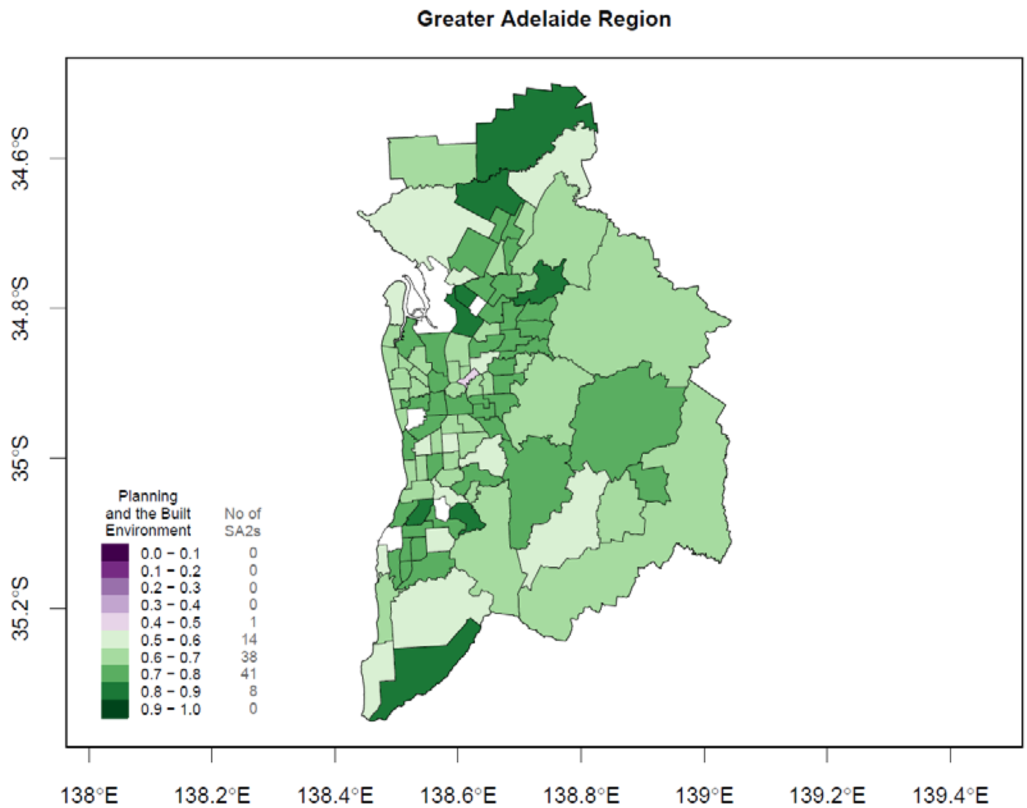
Appendix 5H (cont.)



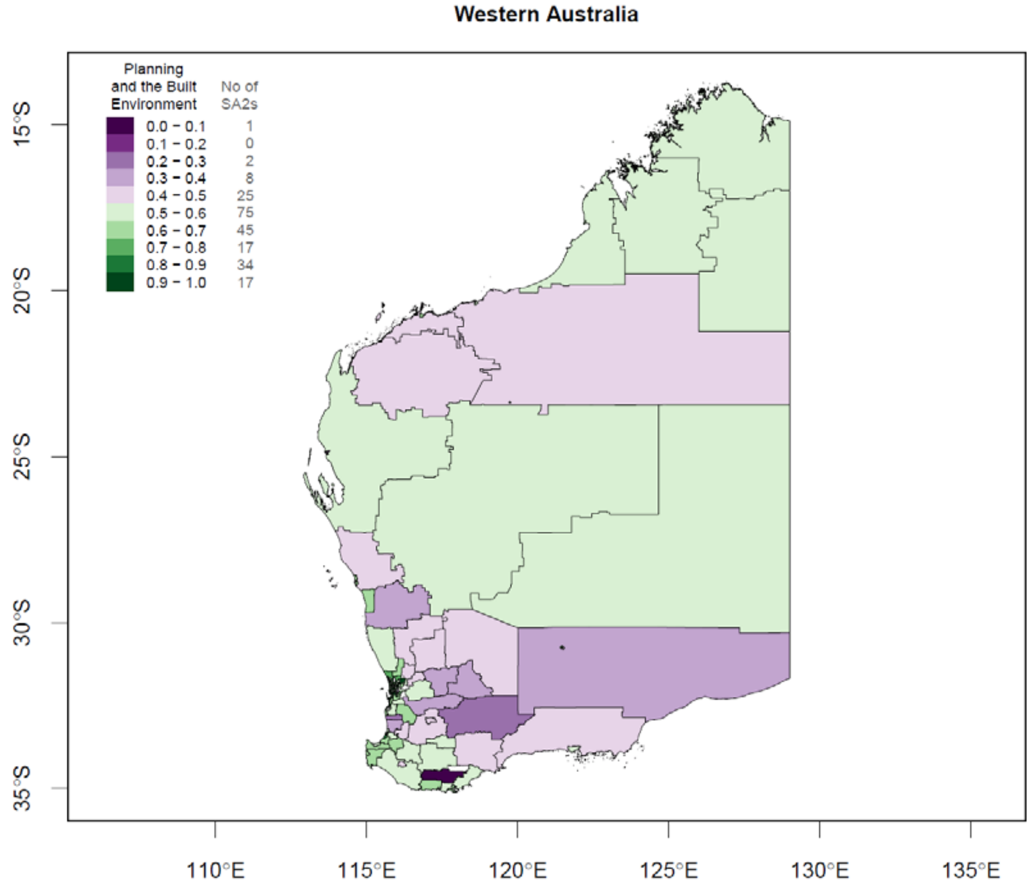


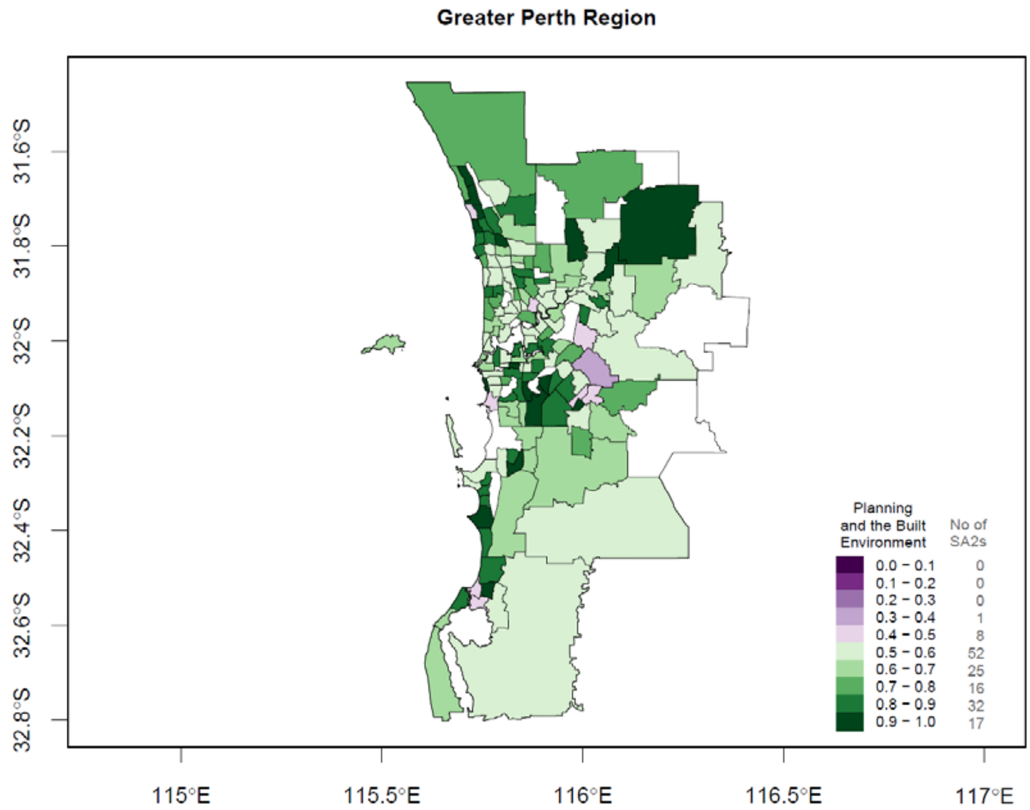
Appendix 5H (cont.)



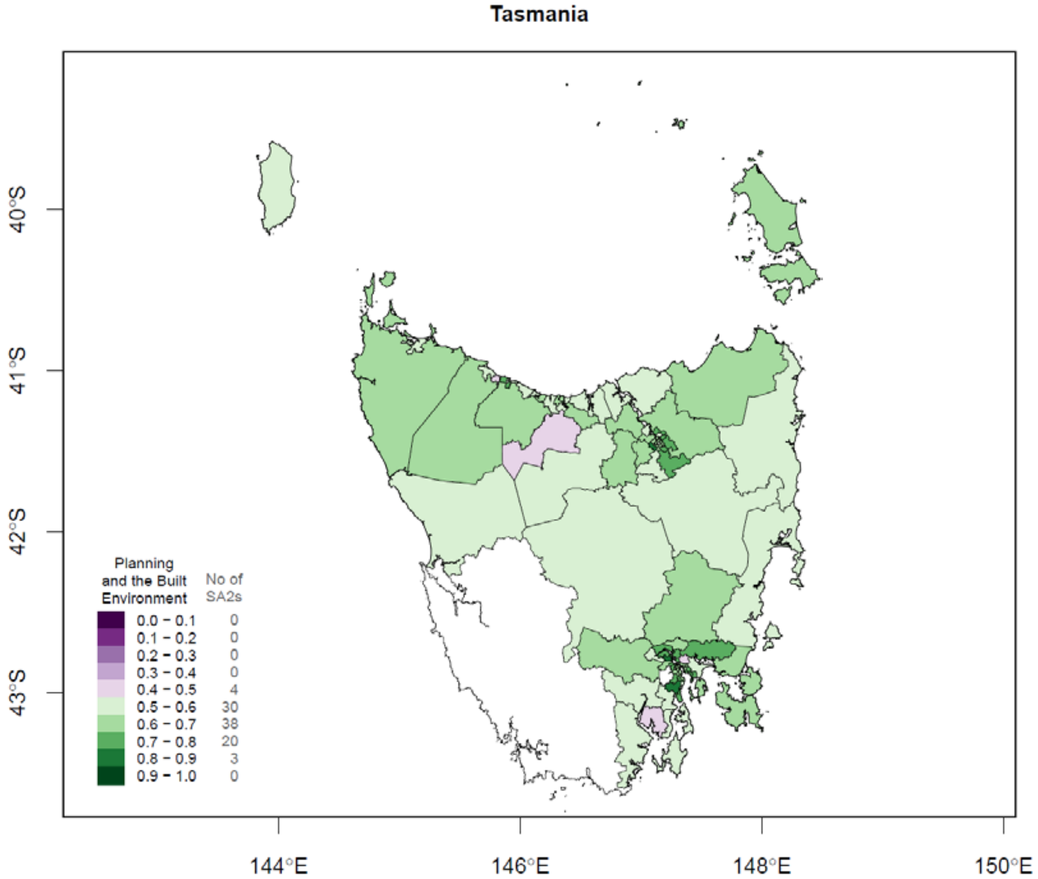


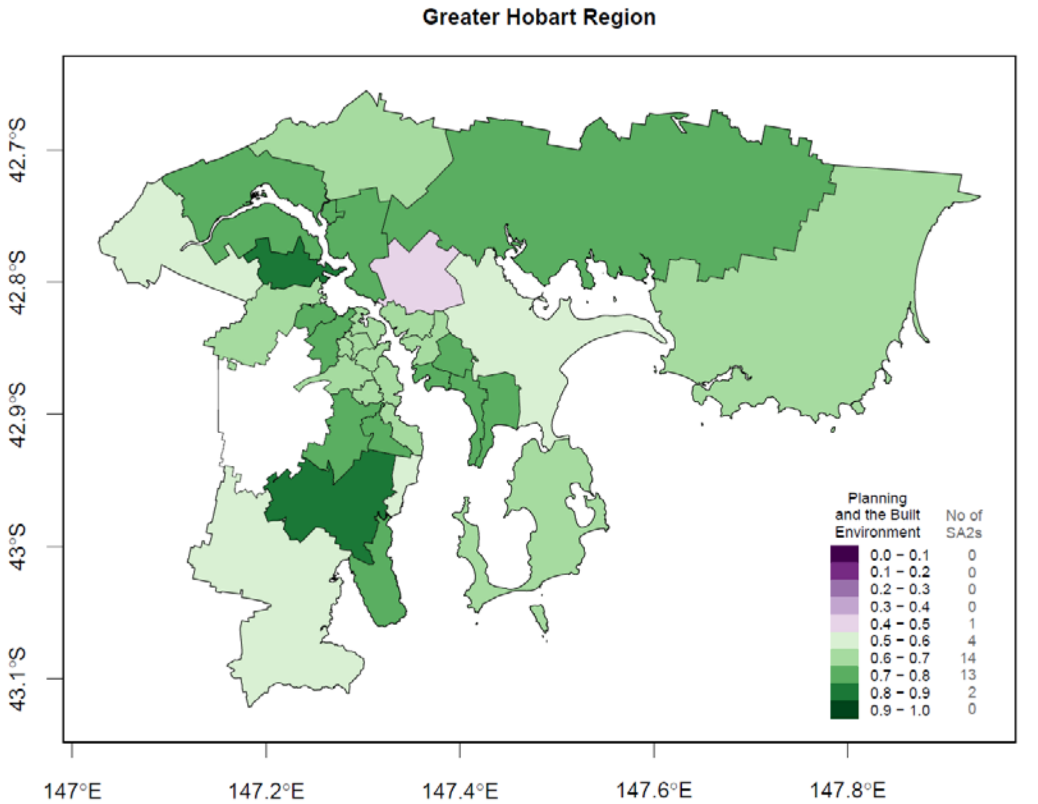
Appendix 5H (cont.)



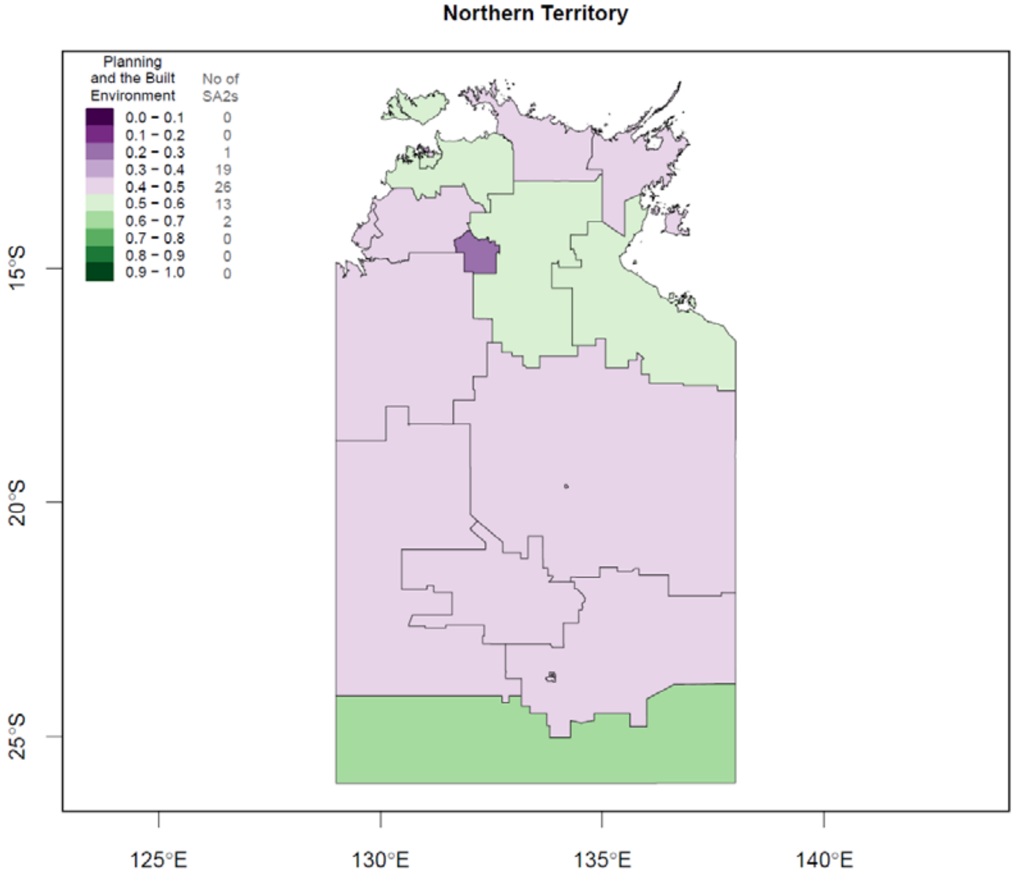


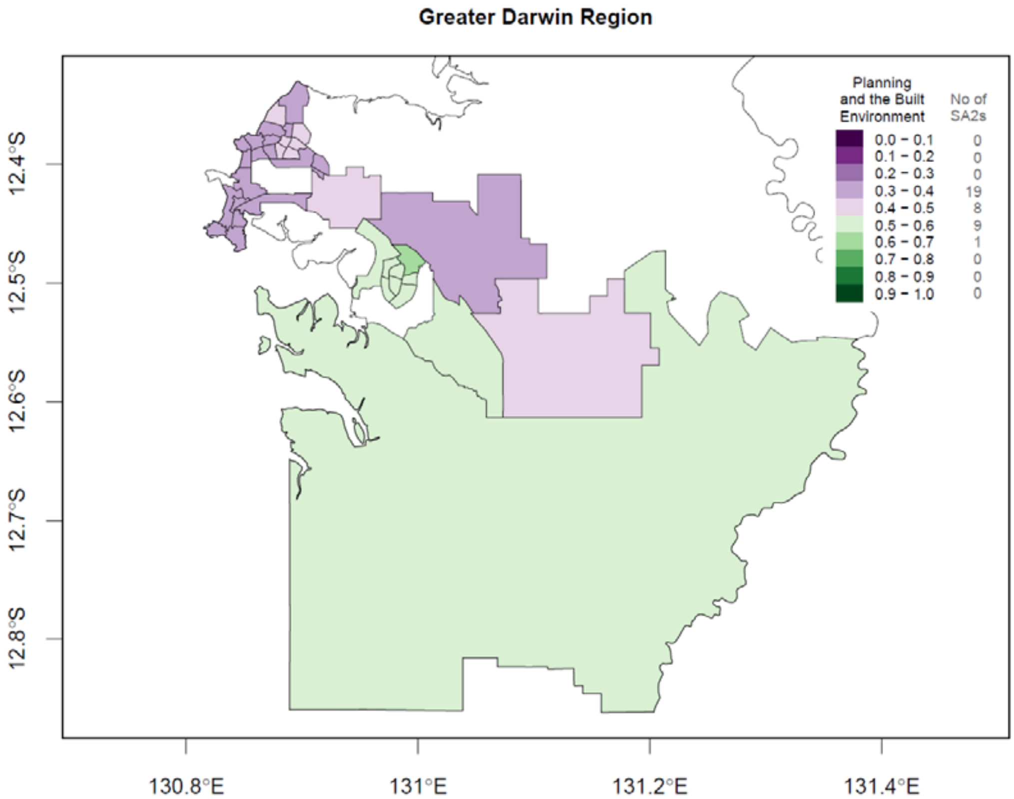
Appendix 5H (cont.)



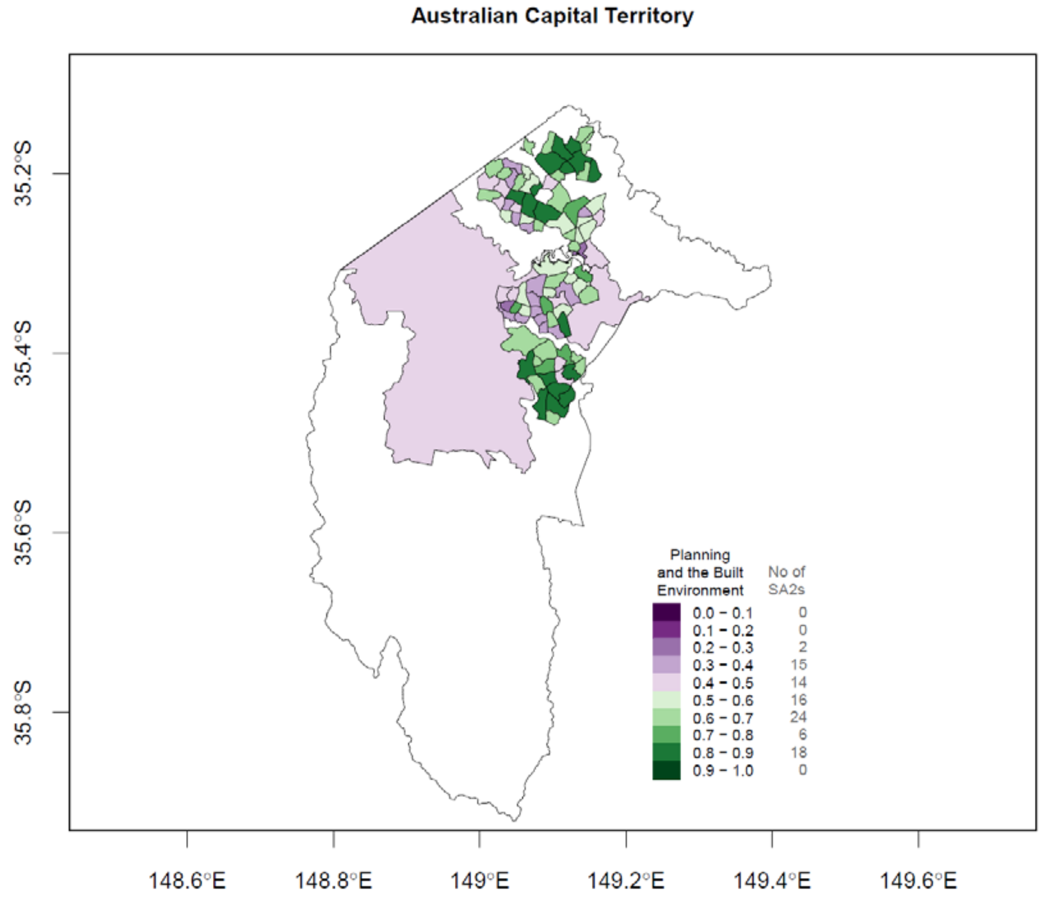


Appendix 5H (cont.)





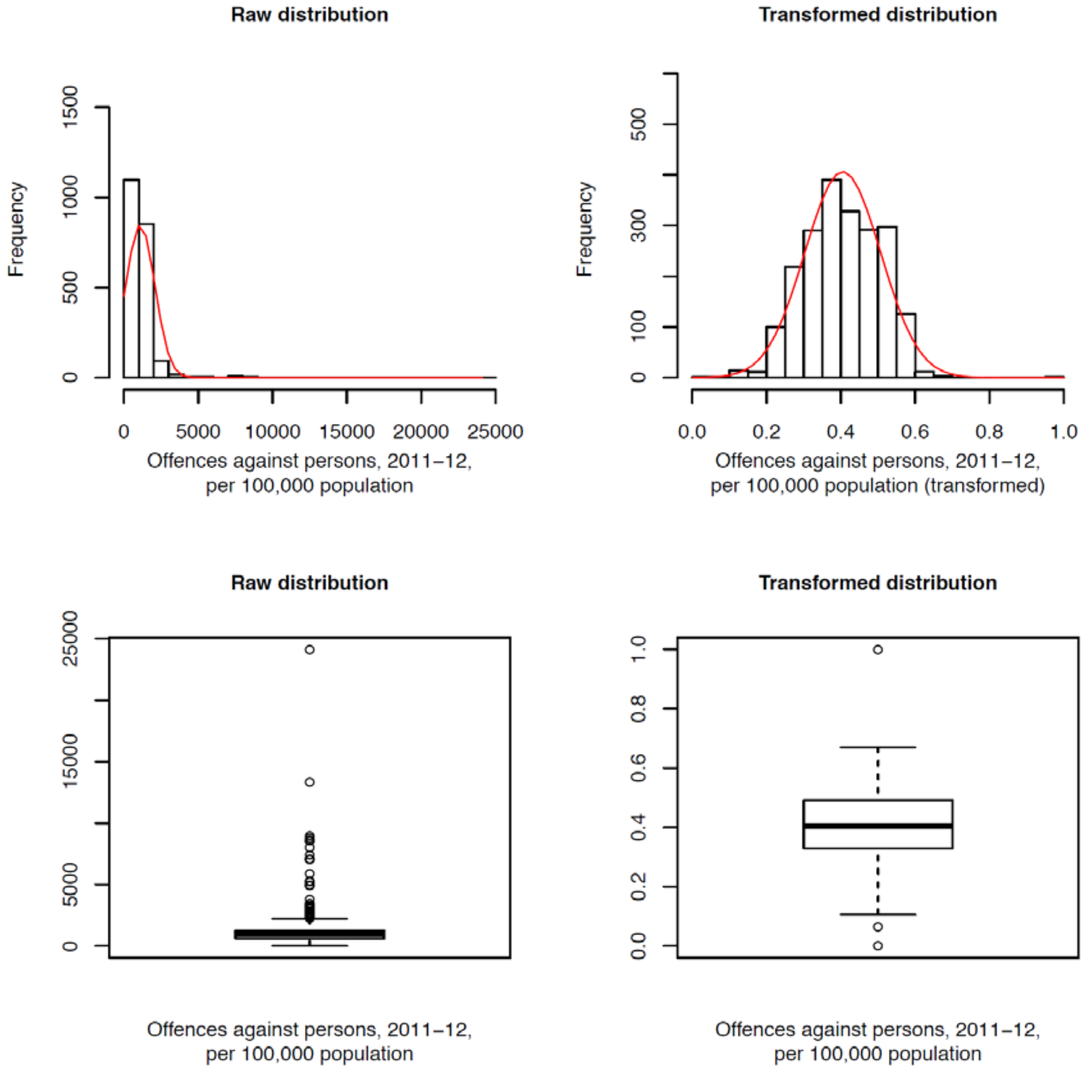
Appendix 5H (cont.)



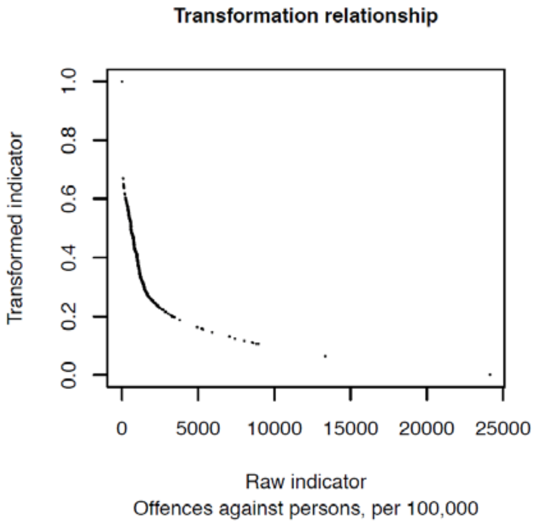
APPENDIX 5I – COMMUNITY CAPITAL TRANSFORMATION DETAILS

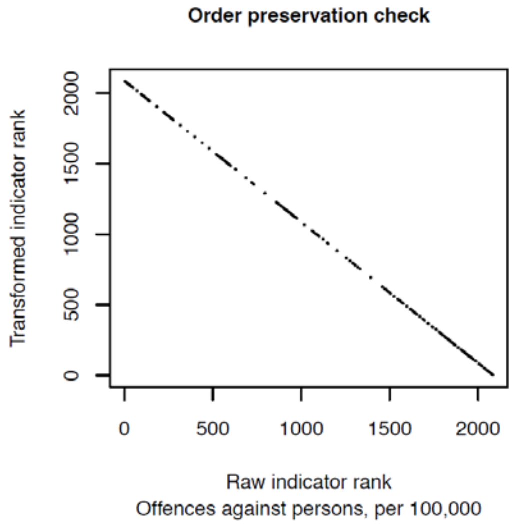
Appendix 5I shows the raw and transformed indicators used to compute the community capital sub-index.

Appendix 5I


Raw distribution
Frequency
0
500
1000
1500
0
5000
10000
15000
20000
25000
Offences against persons, 2011–12, per 100,000 population
Transformed distribution
Frequency
0
100
300
500
0.0
0.2
0.4
0.6
0.8
1.0
Offences against persons, 2011–12, per 100,000 population (transformed)
Raw distribution
0
5000
15000
25000
Offences against persons, 2011–12, per 100,000 population
Transformed distribution
0.0
0.2
0.4
0.6
0.8
1.0
Offences against persons, 2011–12, per 100,000 population

Appendix 5I (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.15
Pre−transform skewness: 9.7
Post−transform skewness: −0.1

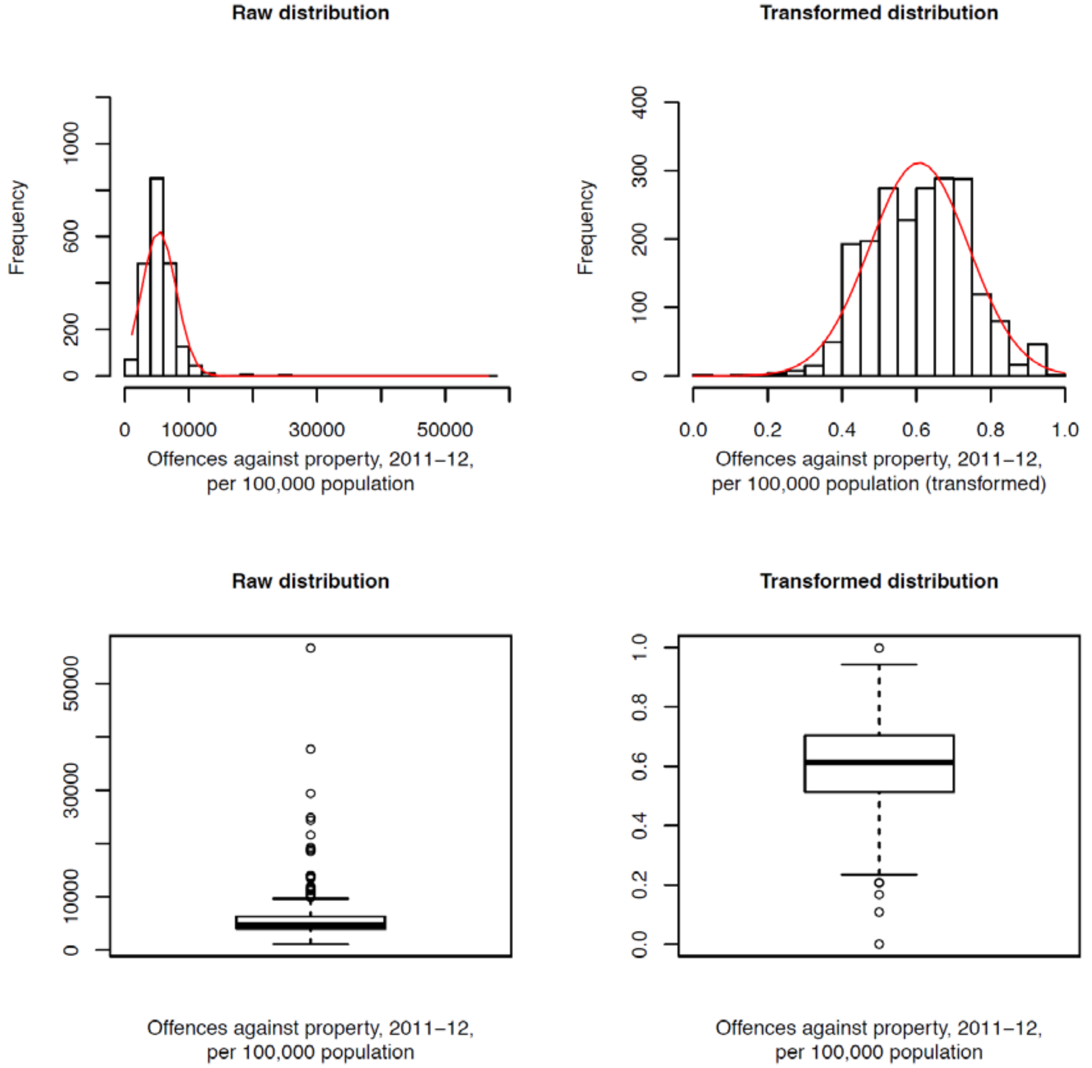
Kurtosis:
Coefficient: 0.28
Pre−transform kurtosis: 172.0
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 24
Post−transform outlier count: 3

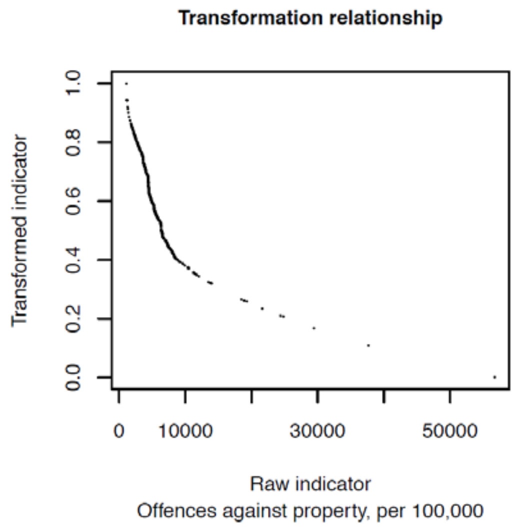
OUTLIER DETAILS

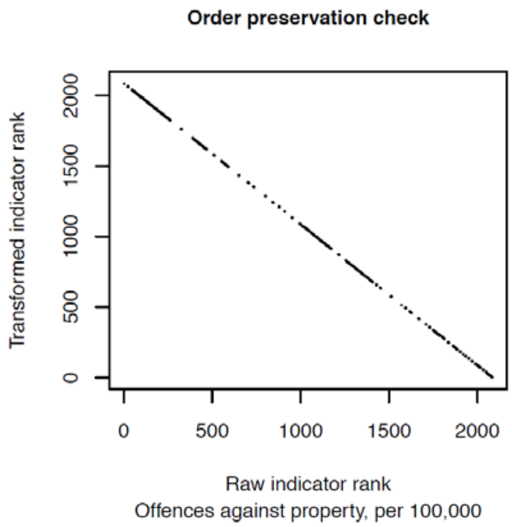
SA2	Value
ACT – South West	0.00
Tennant Creek	13325.90
Civic	24131.00

Appendix 5I (cont.)



Appendix 5I (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.39
Pre−transform skewness: 6.1
Post−transform skewness: 0.0

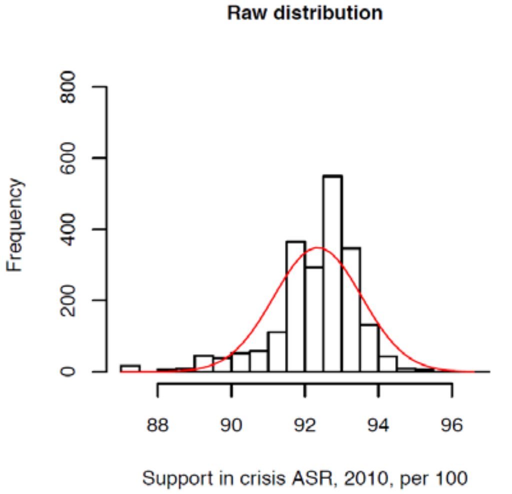
Kurtosis:
Coefficient: 0.38
Pre−transform kurtosis: 85.5
Post−transform kurtosis: −0.0

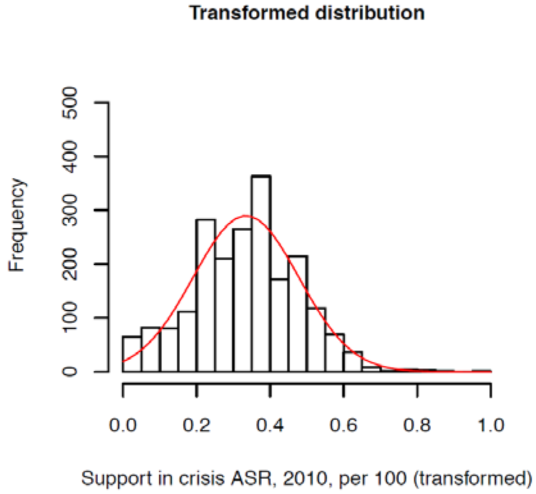
Outliers:
Pre−transform outlier count: 15
Post−transform outlier count: 3

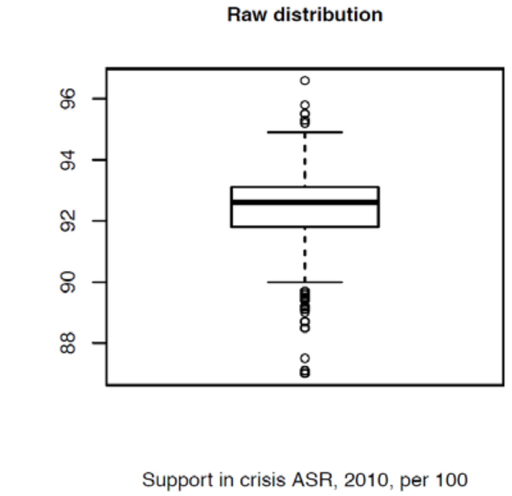
OUTLIER DETAILS

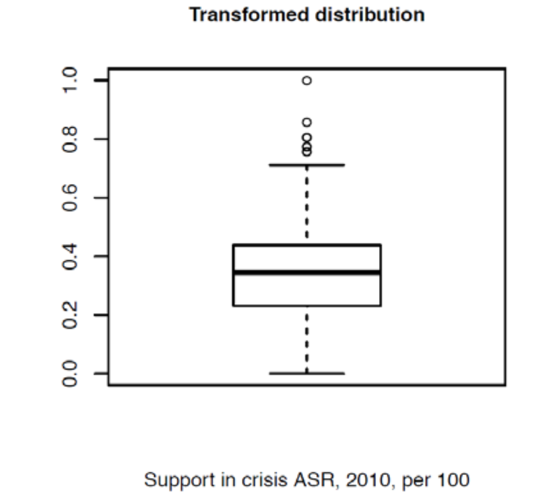
SA2	Value
Phillip	29423.00
Greenway	37663.00
Civic	56708.00

Appendix 5I (cont.)

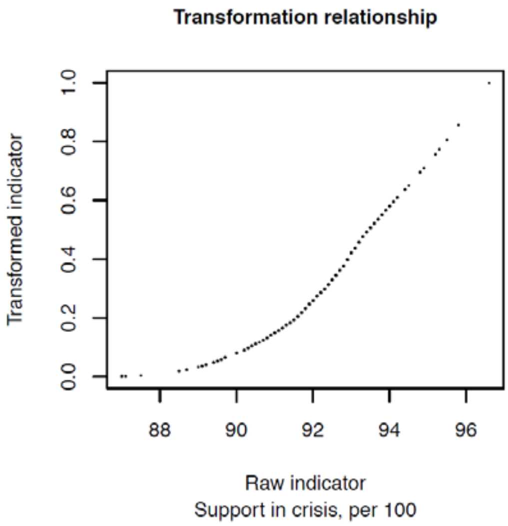


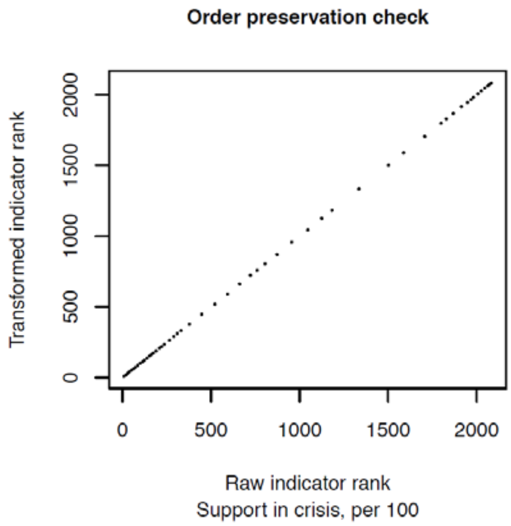






Appendix 5I (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 2.13
Pre–transform skewness: –1.3
Post–transform skewness: –0.0

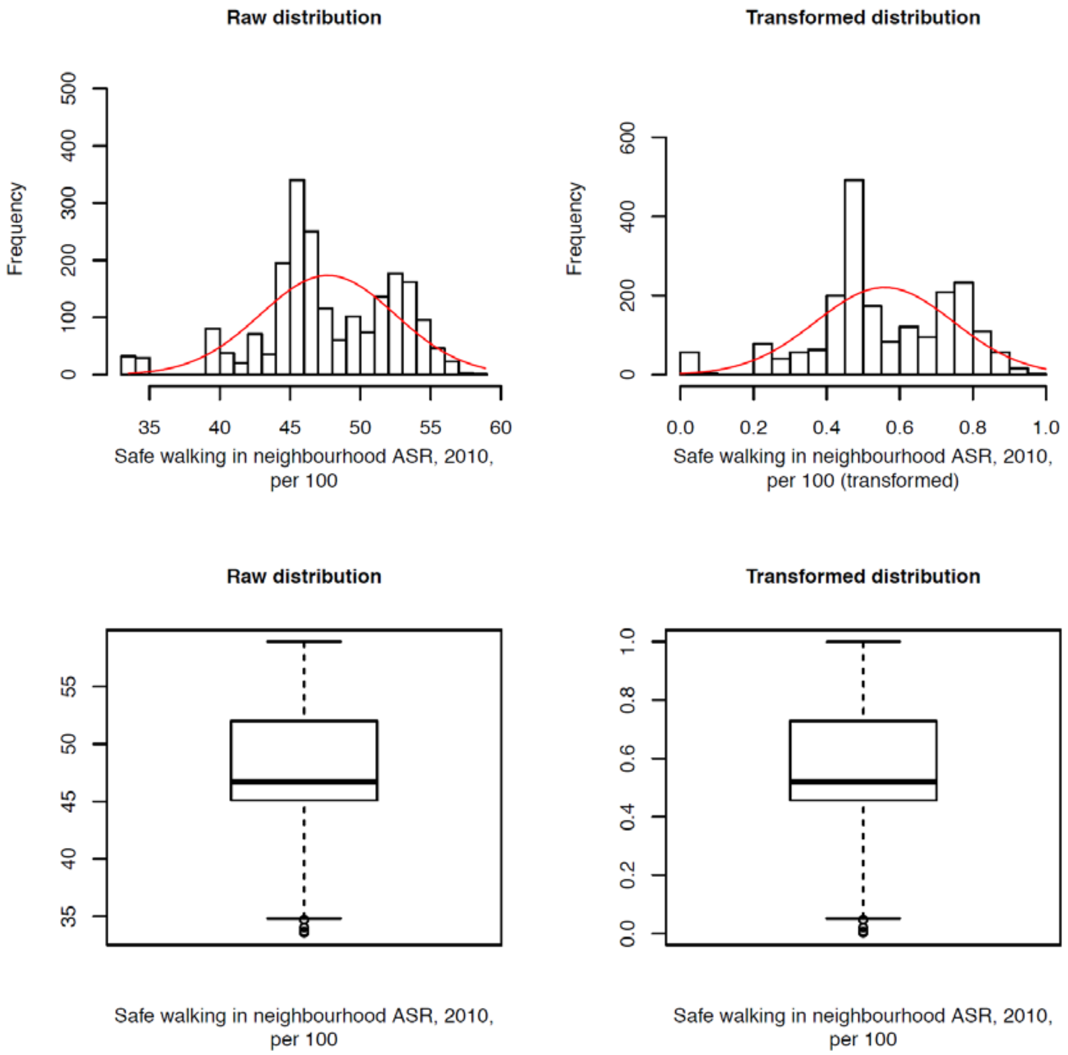
Kurtosis:
Coefficient: 0.18
Pre–transform kurtosis: 3.3
Post–transform kurtosis: 0.0

Outliers:
Pre–transform outlier count: 18
Post–transform outlier count: 5

OUTLIER DETAILS

SA2	Value
City Beach	95.50
Floreat	95.50
Wembley – West Leederville – Glendalough	95.50
Queenscliff	95.80
Claremont (WA)	96.60

Appendix 5I (cont.)



Appendix 5I (cont.)

TRANSFORMATION DETAILS

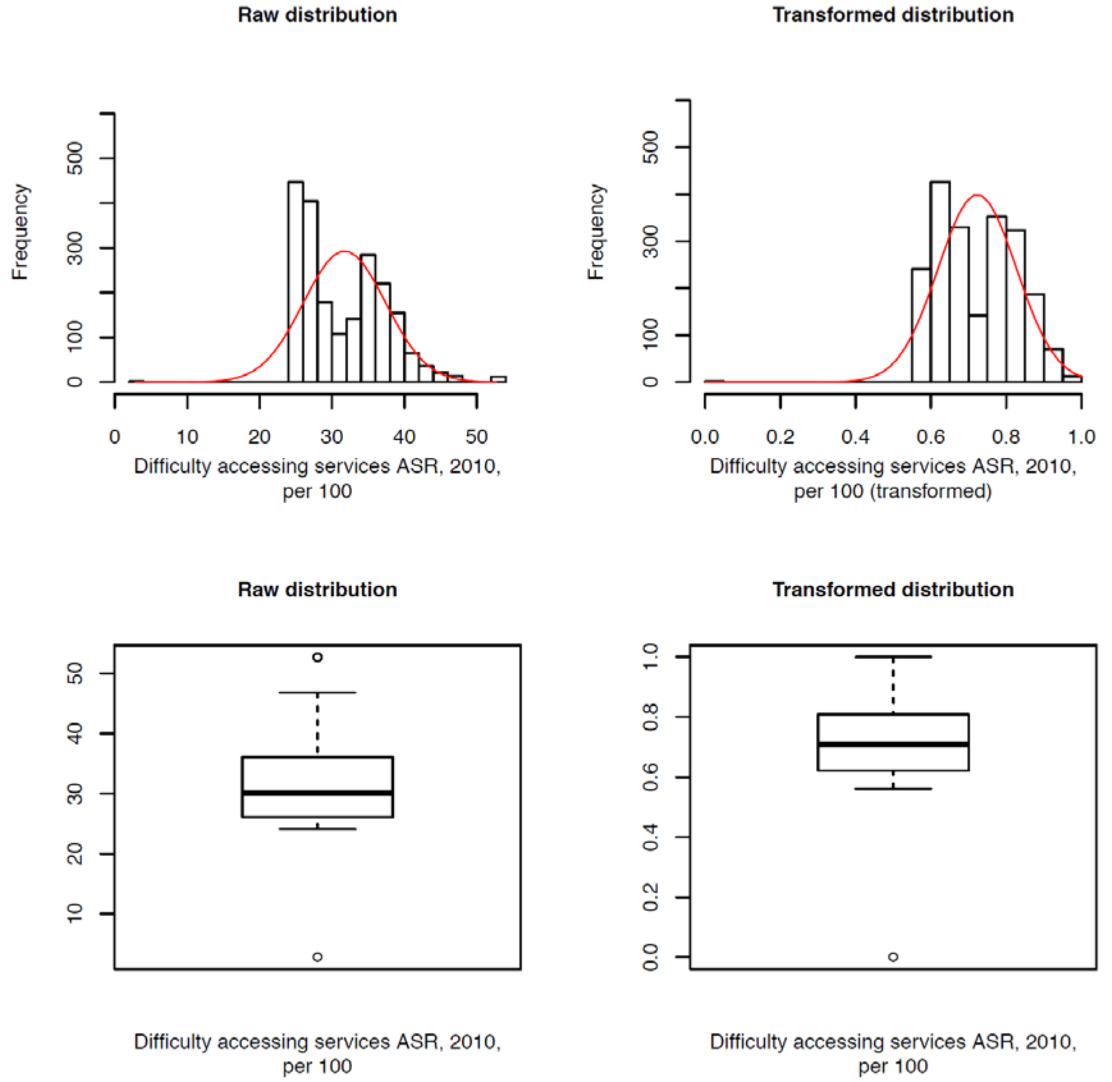
Unreversed

Skewness:
No transform
Pre–transform skewness: –0.4
Post–transform skewness: –0.4

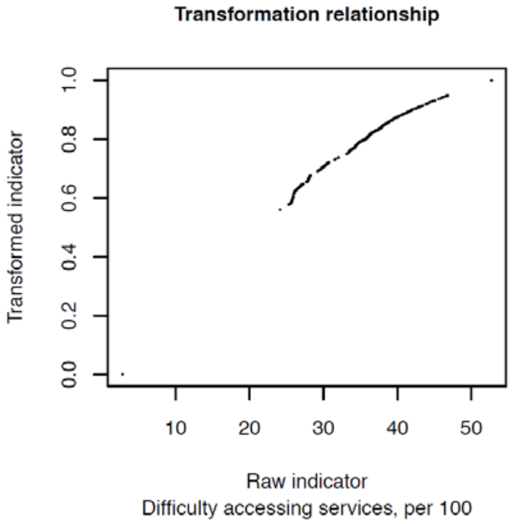
Kurtosis:
No transform
Pre–transform kurtosis: 0.2
Post–transform kurtosis: 0.2

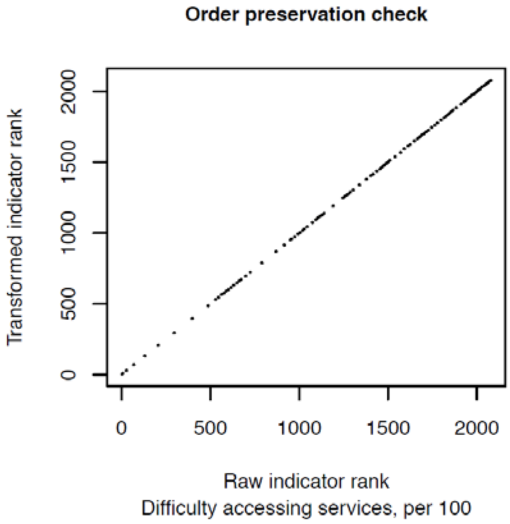
Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

Appendix 5l (cont.)



Appendix 5I (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.49
Pre–transform skewness: 0.7
Post–transform skewness: 0.2

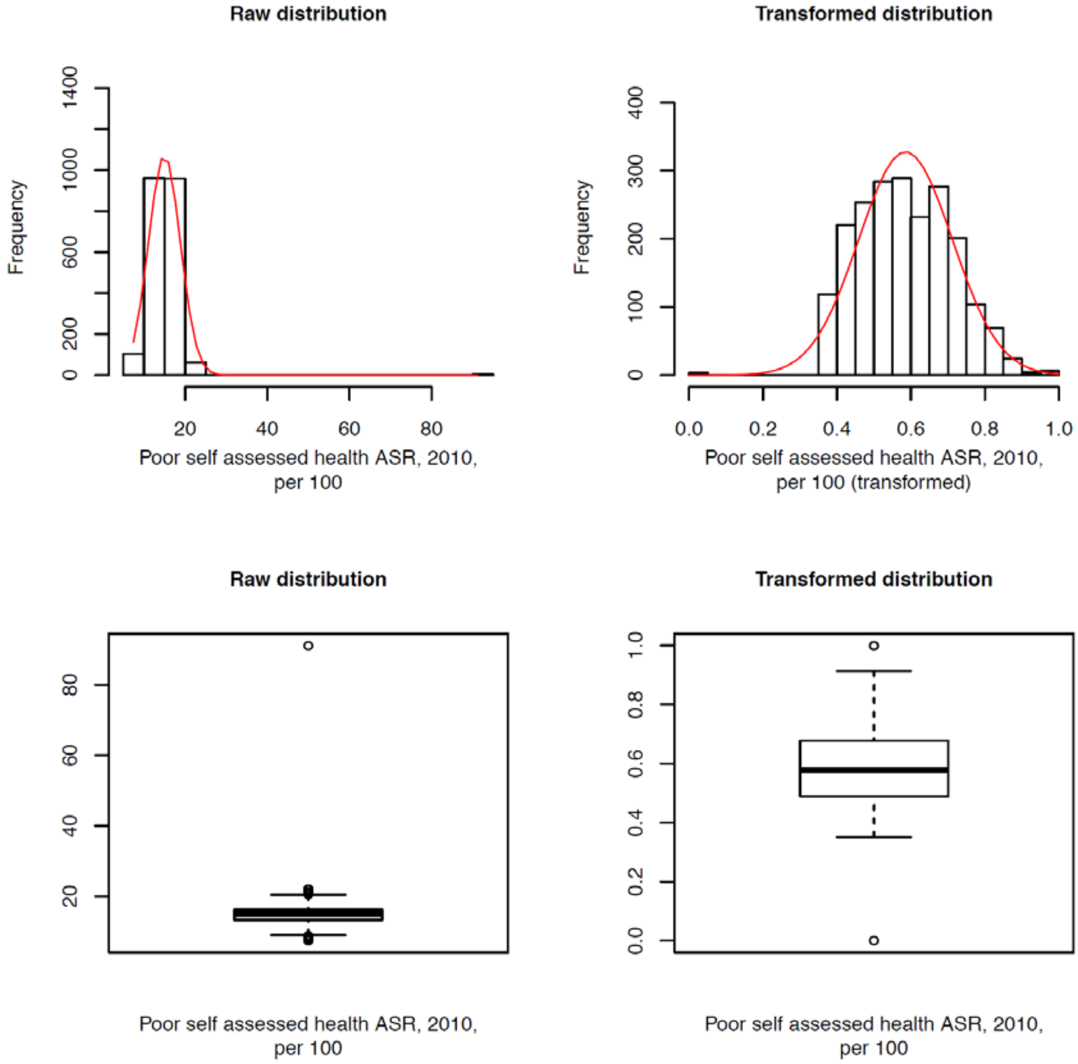
Kurtosis:
Coefficient: 0.17
Pre–transform kurtosis: 0.2
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 13
Post–transform outlier count: 1

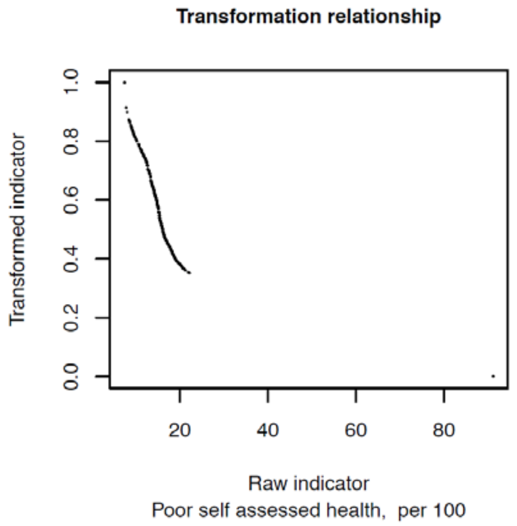
OUTLIER DETAILS

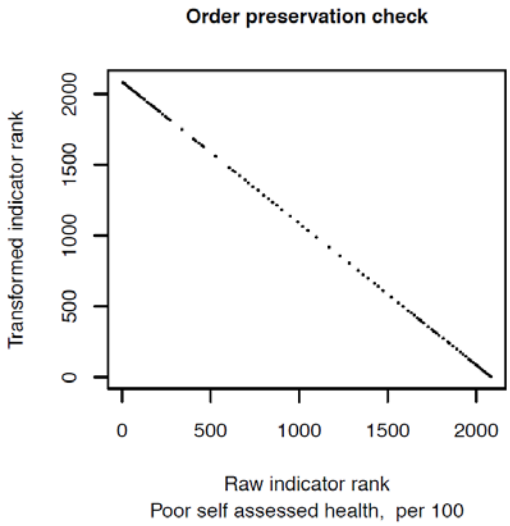
SA2	Value
Karana Downs	2.80

Appendix 5I (cont.)



Appendix 5I (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.39
Pre−transform skewness: 10.9
Post−transform skewness: 0.1

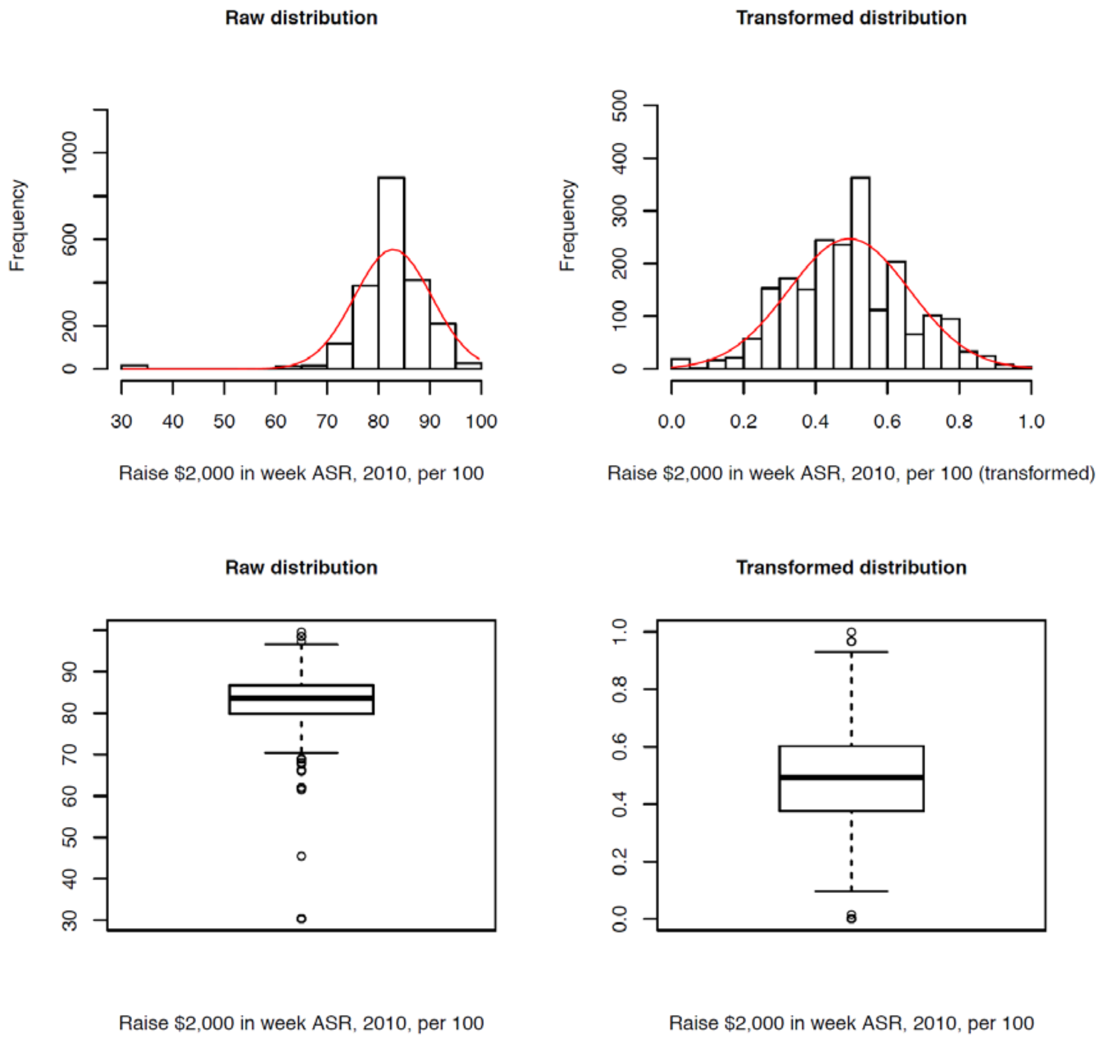
Kurtosis:
Coefficient: 0.41
Pre−transform kurtosis: 212.8
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 3
Post−transform outlier count: 3

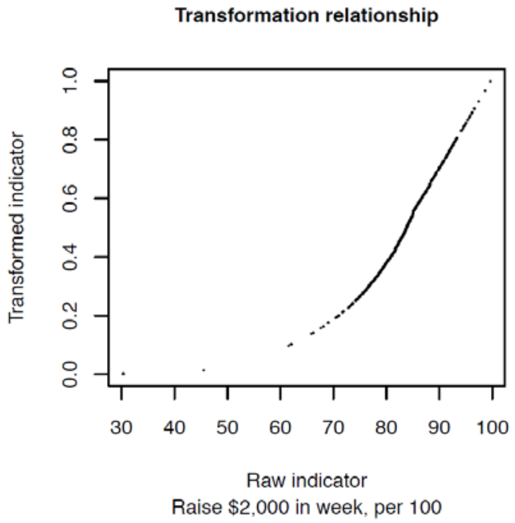
OUTLIER DETAILS

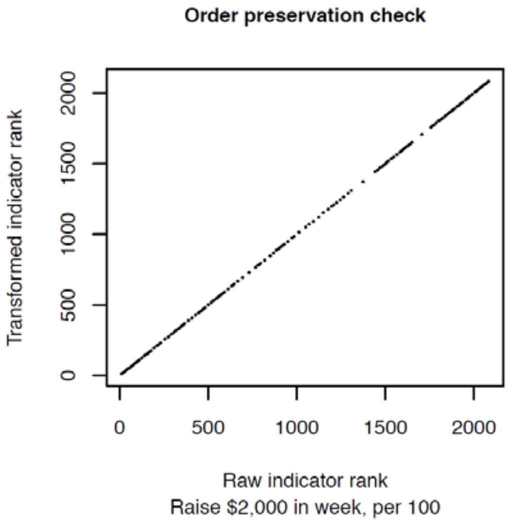
SA2	Value
Kadina	91.10
Moonta	91.10
Wallaroo	91.10

Appendix 5I (cont.)



Appendix 5I (cont.)





TRANSFORMATION DETAILS

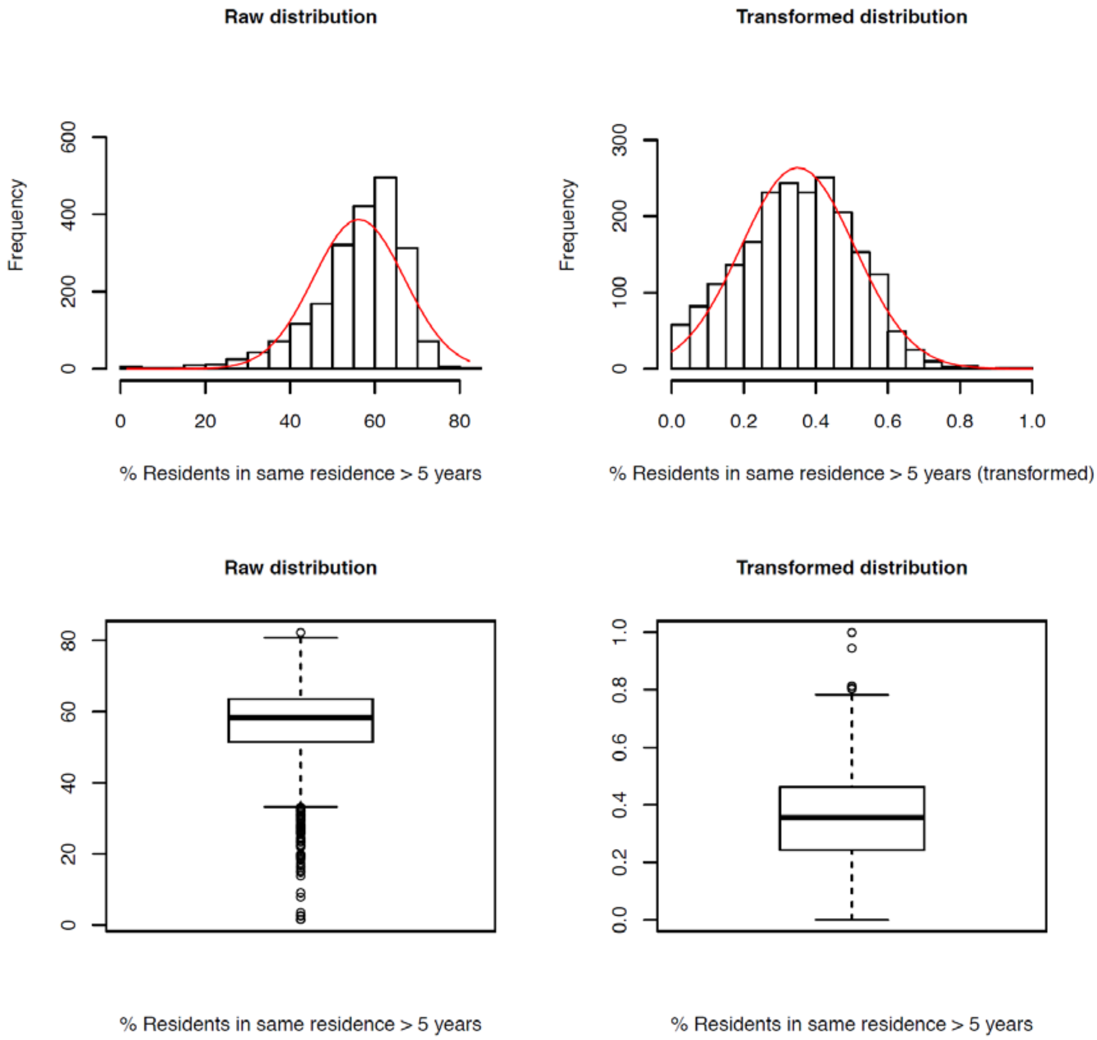
Unreversed

Skewness:
Power transform, exponent: 2.71
Pre–transform skewness: −3.1
Post–transform skewness: 0.0

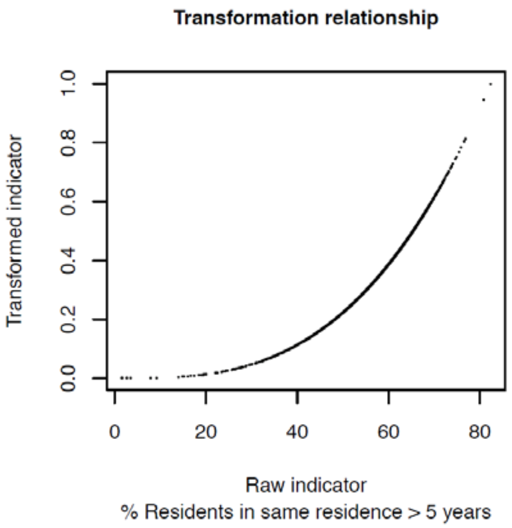
Kurtosis:
Coefficient: 0.20
Pre–transform kurtosis: 19.3
Post–transform kurtosis: 0.0

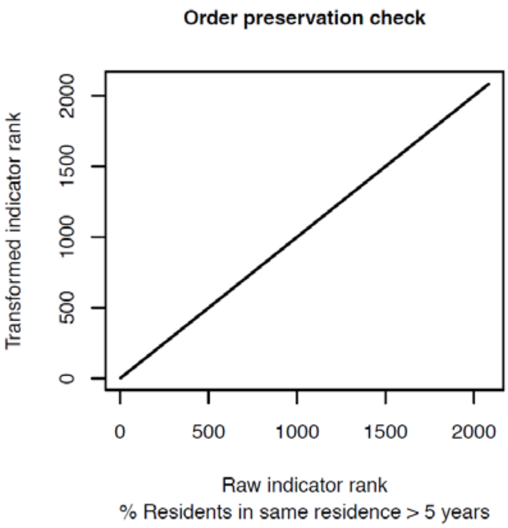
Outliers:
Pre–transform outlier count: 19
Post–transform outlier count: 0

Appendix 5I (cont.)



Appendix 5I (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 2.94
Pre−transform skewness: −1.3
Post−transform skewness: 0.0

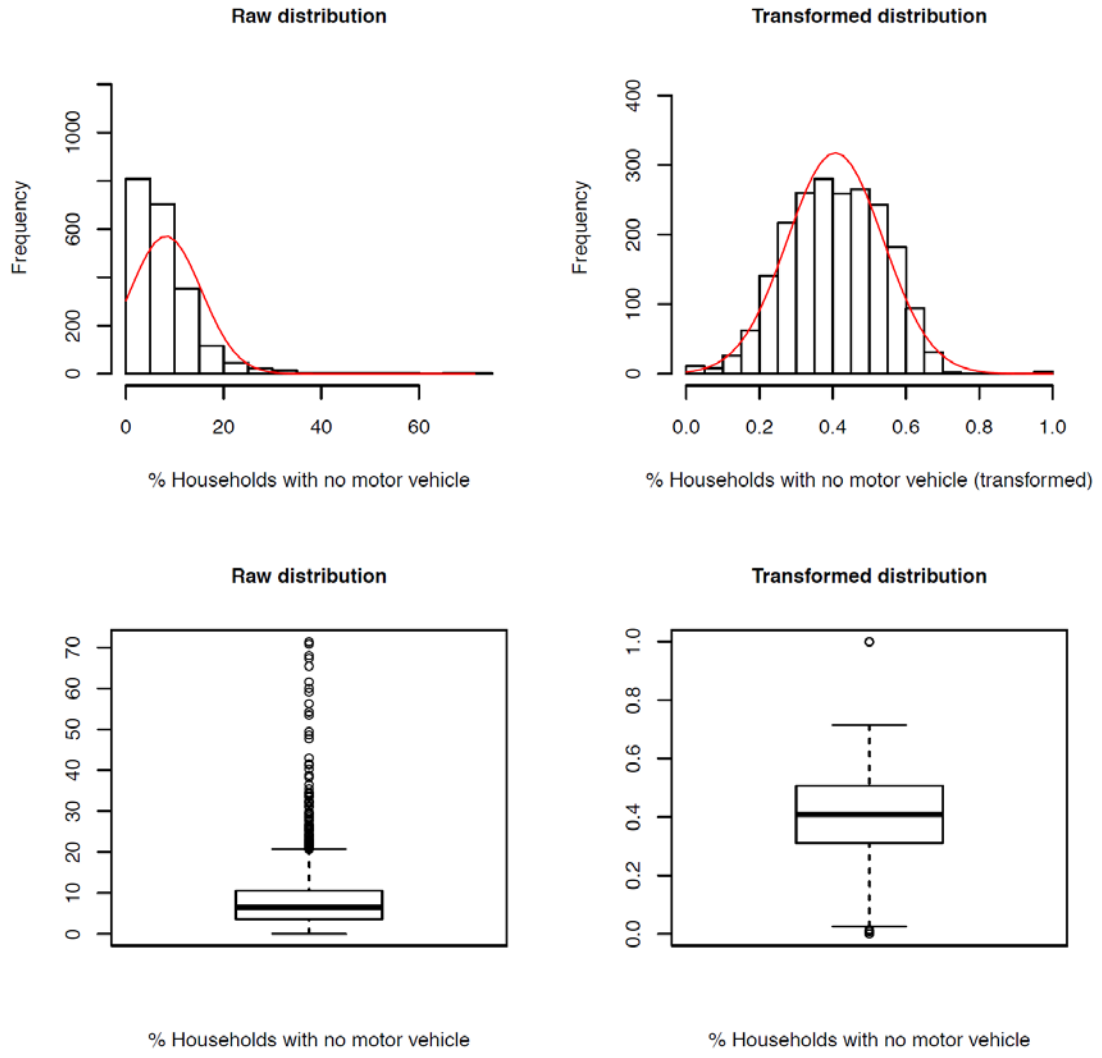
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 2.7
Post−transform kurtosis: −0.3

Outliers:
Pre−transform outlier count: 21
Post−transform outlier count: 2

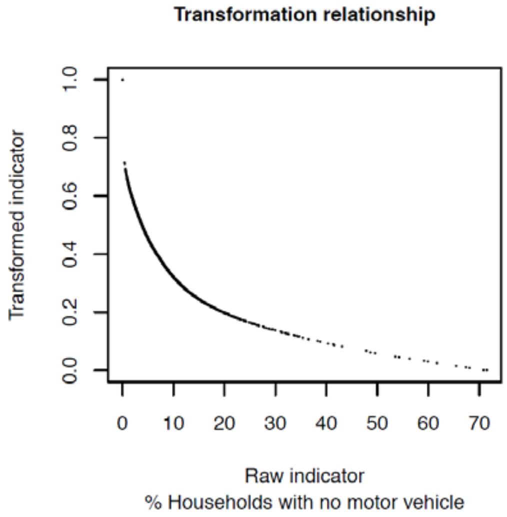
OUTLIER DETAILS

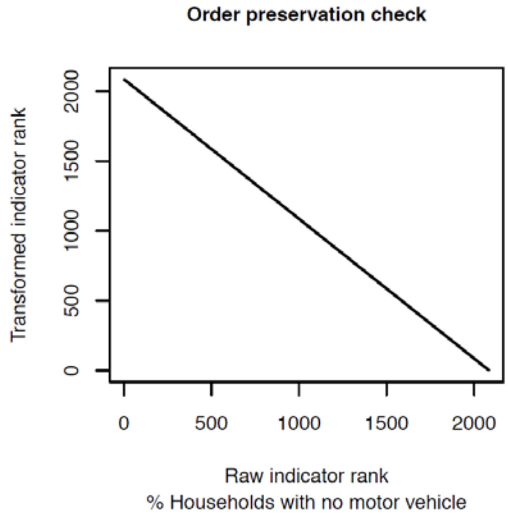
SA2	Value
Palm Island	80.79
Yarrabah	82.31

Appendix 5I (cont.)



Appendix 5I (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.20
Pre−transform skewness: 3.4
Post−transform skewness: −0.0

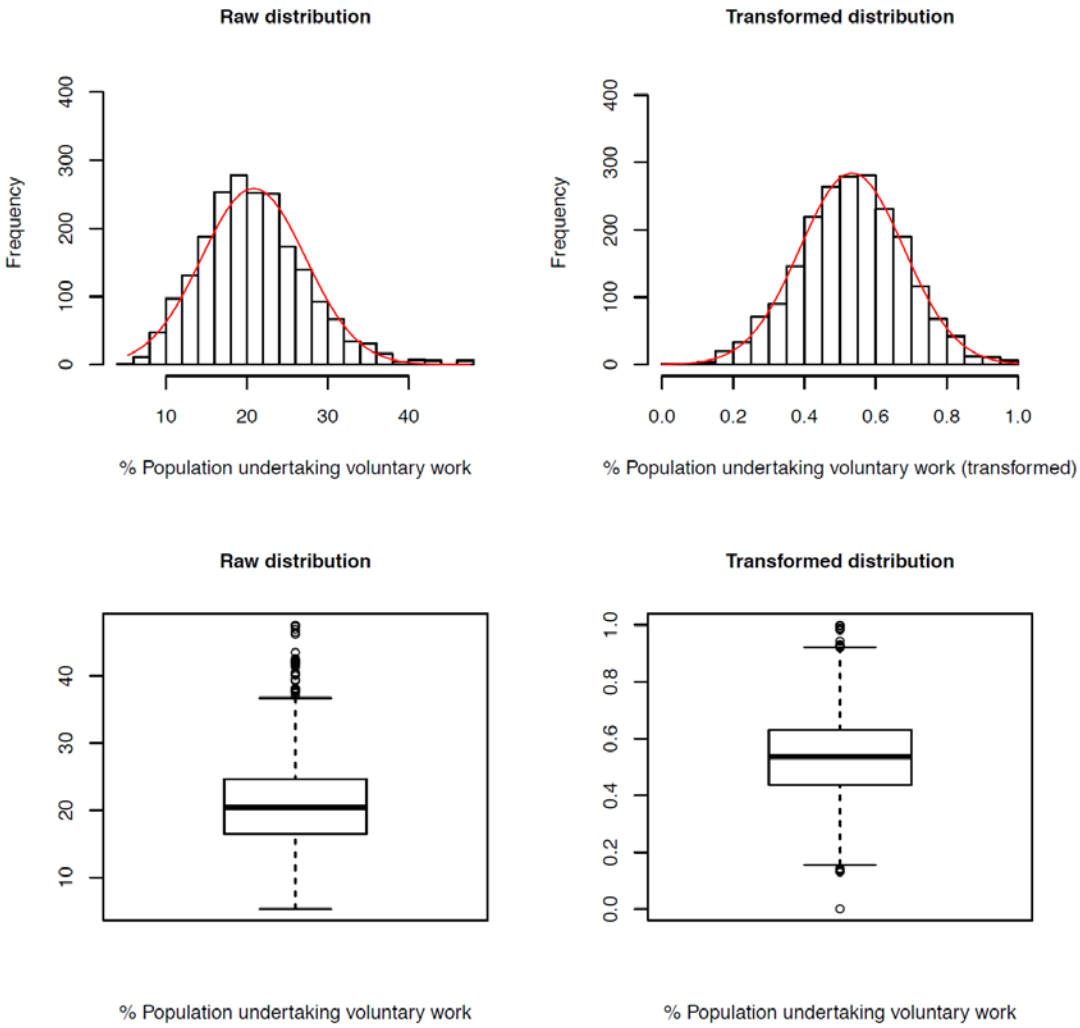
Kurtosis:
Coefficient: 0.21
Pre−transform kurtosis: 19.3
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 31
Post−transform outlier count: 3

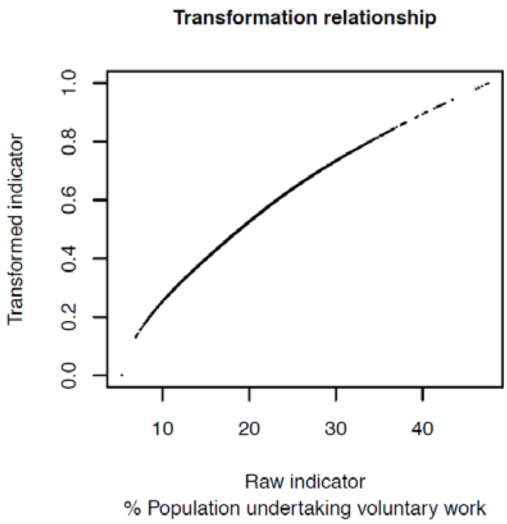
OUTLIER DETAILS

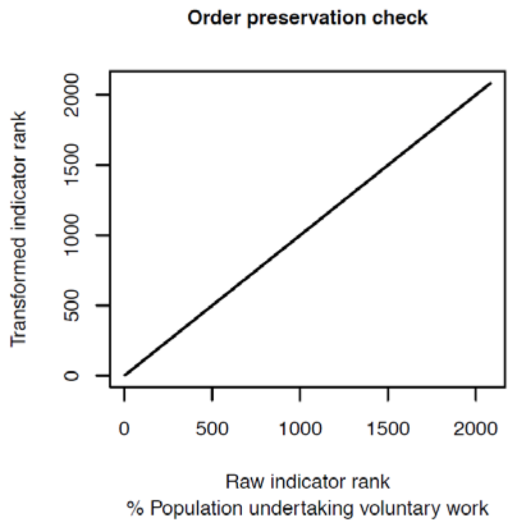
SA2	Value
North Coogee	0.00
Casuarina – Wellard (East)	0.00
ACT – South West	0.00

Appendix 5I (cont.)



Appendix 5I (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.60
Pre–transform skewness: 0.6
Post–transform skewness: –0.0

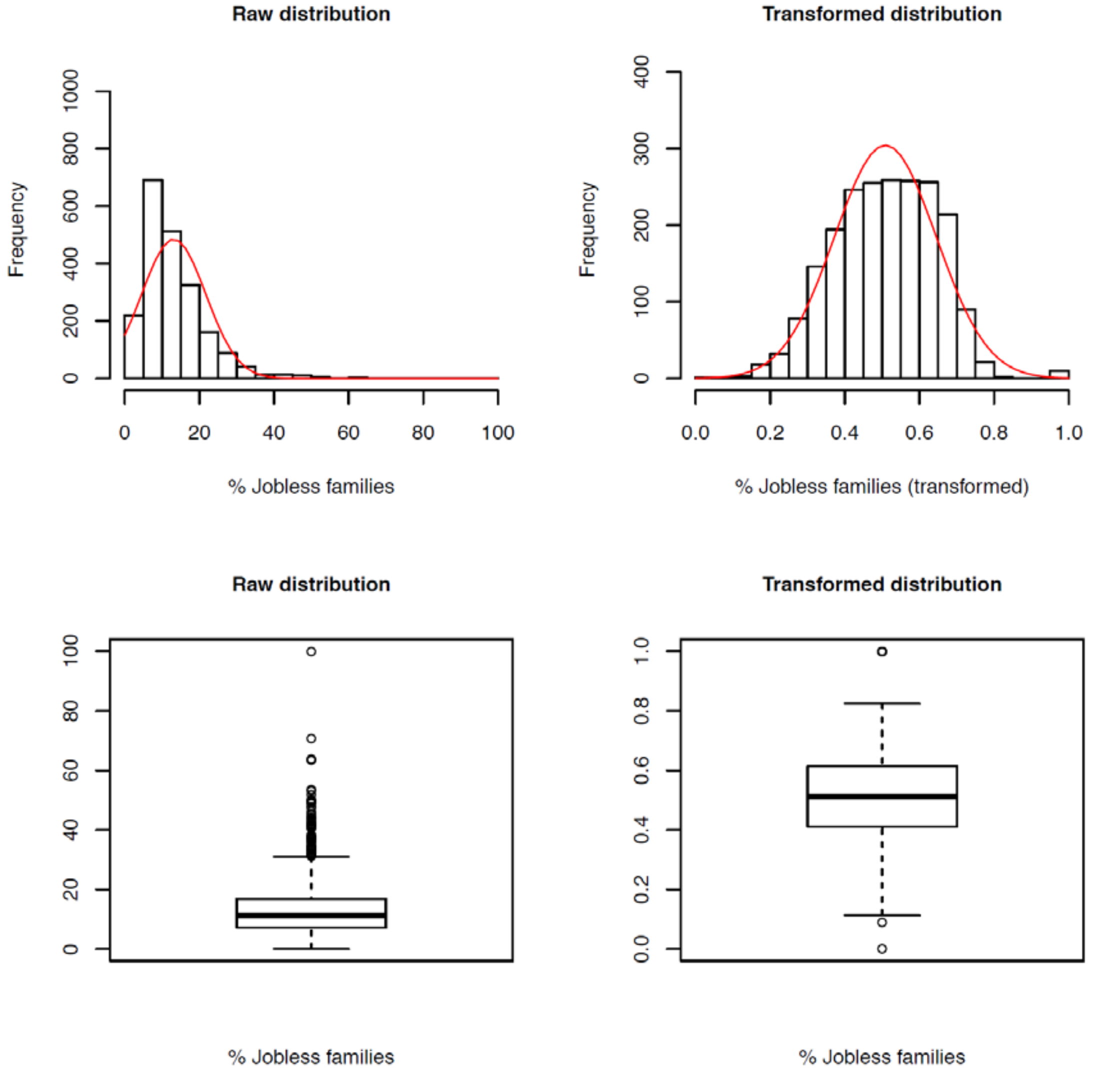
Kurtosis:
Coefficient: 0.06
Pre–transform kurtosis: 0.7
Post–transform kurtosis: –0.0

Outliers:
Pre–transform outlier count: 12
Post–transform outlier count: 1

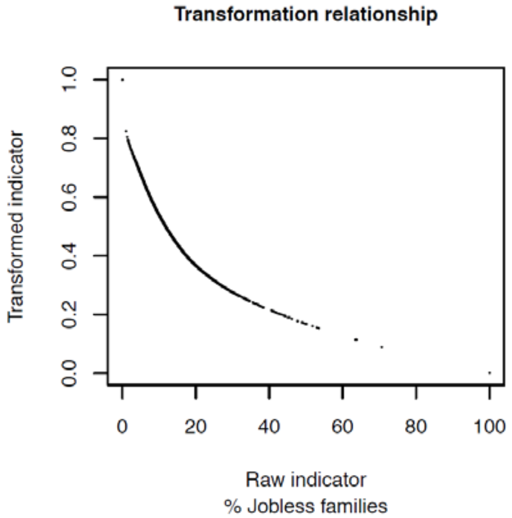
OUTLIER DETAILS

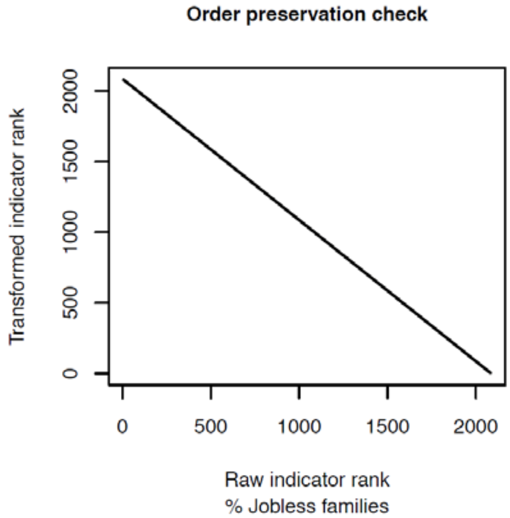
SA2	Value
Thamarrurr	5.29

Appendix 5I (cont.)



Appendix 5I (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.33
Pre−transform skewness: 2.1
Post−transform skewness: −0.1

Kurtosis:
Coefficient: 0.22
Pre−transform kurtosis: 9.4
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 28
Post−transform outlier count: 11

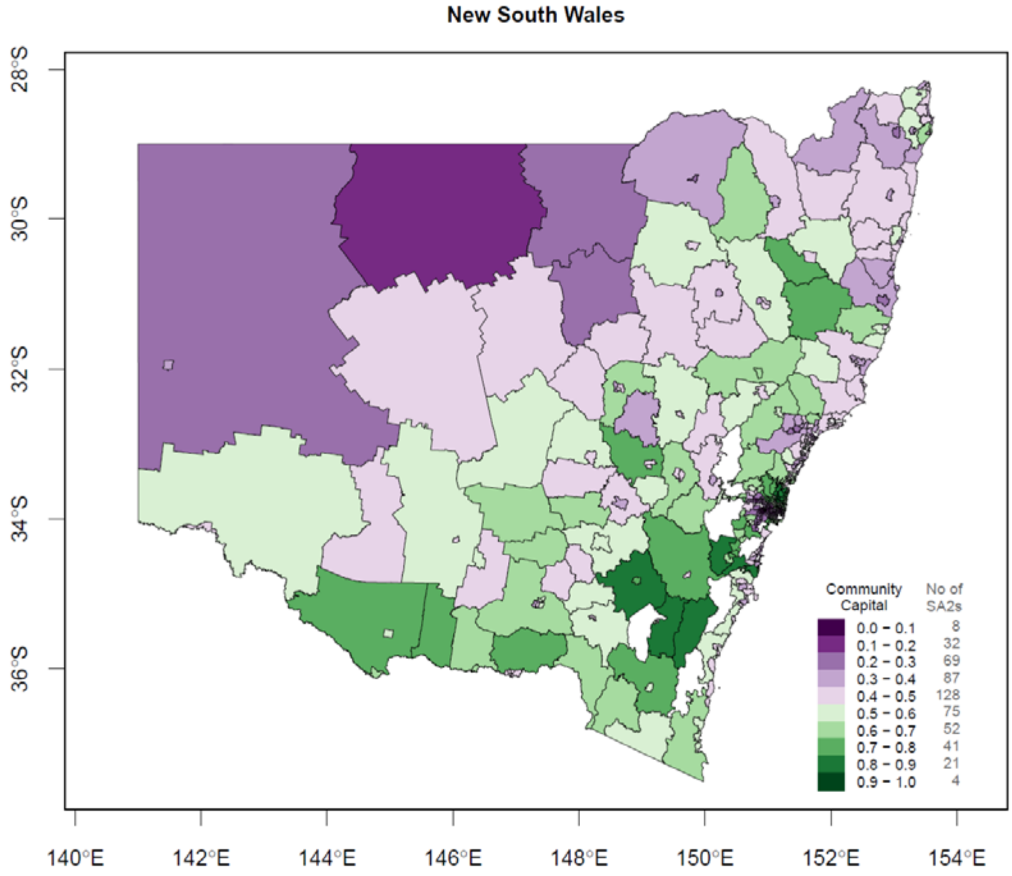
OUTLIER DETAILS

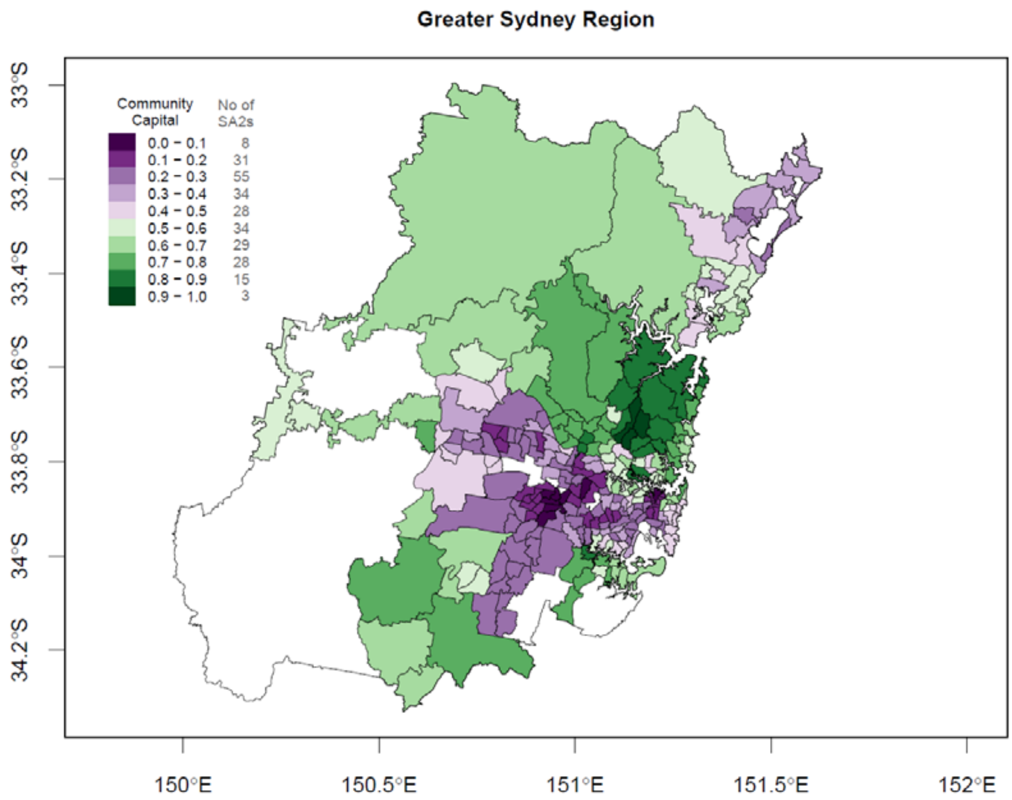
SA2	Value
Mackay Harbour	0.00
North Coogee	0.00
Larrakeyah	0.00
Lyons (NT)	0.00
Crace	0.00
Hall	0.00
Civic	0.00
Macarthur	0.00
Chapman	0.00
O'Malley	0.00
Western	100.00

APPENDIX 5J – MAPS: COMMUNITY CAPITAL SUB-INDEX BY STATE/TERRITORY AND METROPOLITAN AREAS

Appendix 5J maps the community capital sub-index at the resolution of individual States and Territories, and major metropolitan areas.

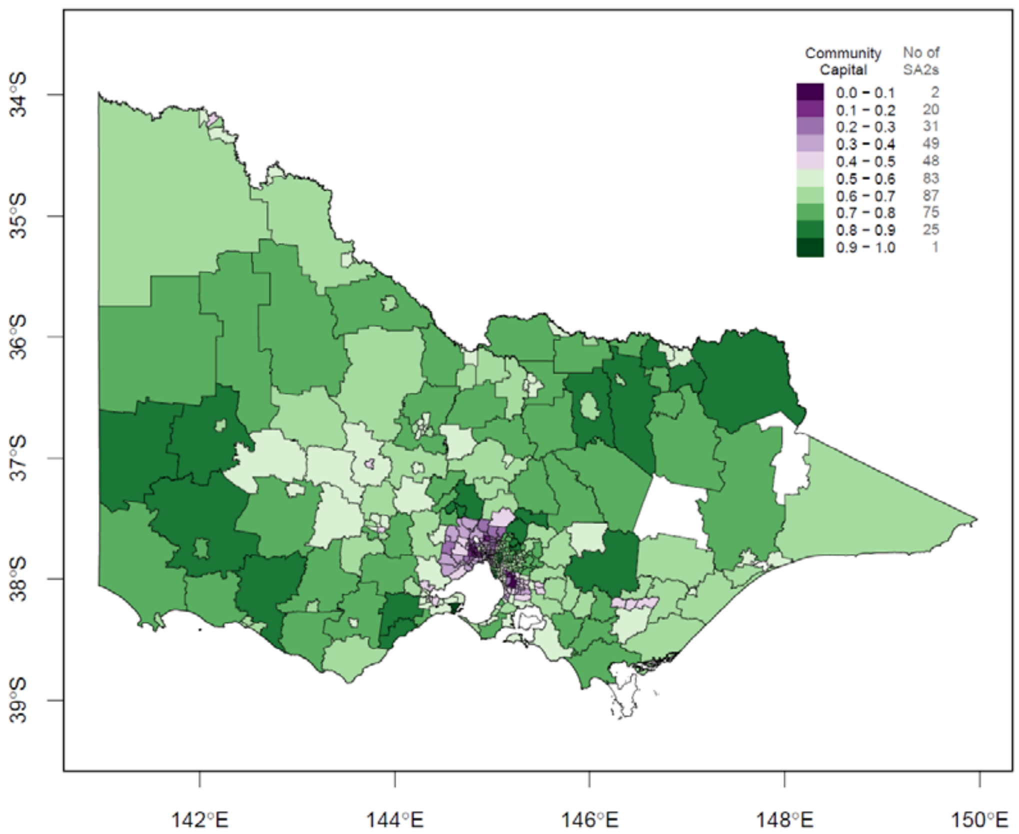
Appendix 5J


New South Wales
28°S
30°S
32°S
34°S
36°S
140°E
142°E
144°E
146°E
148°E
150°E
152°E
154°E
Community Capital
No of SA2s
0.0 – 0.1 8
0.1 – 0.2 32
0.2 – 0.3 69
0.3 – 0.4 87
0.4 – 0.5 128
0.5 – 0.6 75
0.6 – 0.7 52
0.7 – 0.8 41
0.8 – 0.9 21
0.9 – 1.0 4

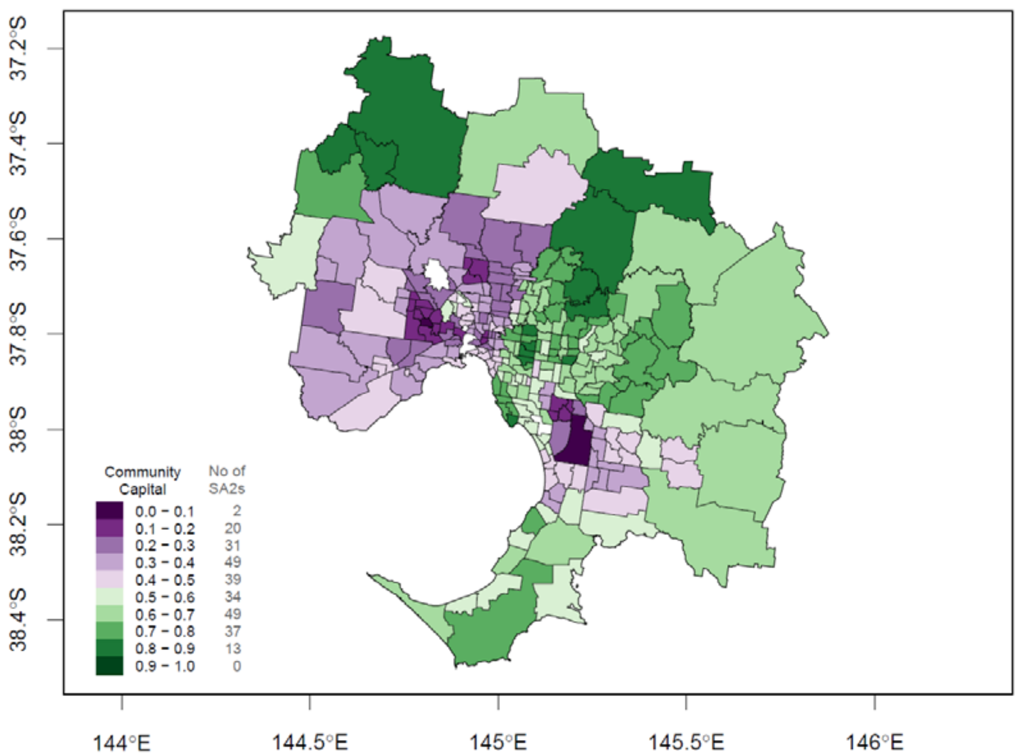

Greater Sydney Region
33°S
33.2°S
33.4°S
33.6°S
33.8°S
34°S
34.2°S
150°E
150.5°E
151°E
151.5°E
152°E
Community Capital
No of SA2s
0.0 – 0.1 8
0.1 – 0.2 31
0.2 – 0.3 55
0.3 – 0.4 34
0.4 – 0.5 28
0.5 – 0.6 34
0.6 – 0.7 29
0.7 – 0.8 28
0.8 – 0.9 15
0.9 – 1.0 3

Appendix 5J (cont.)

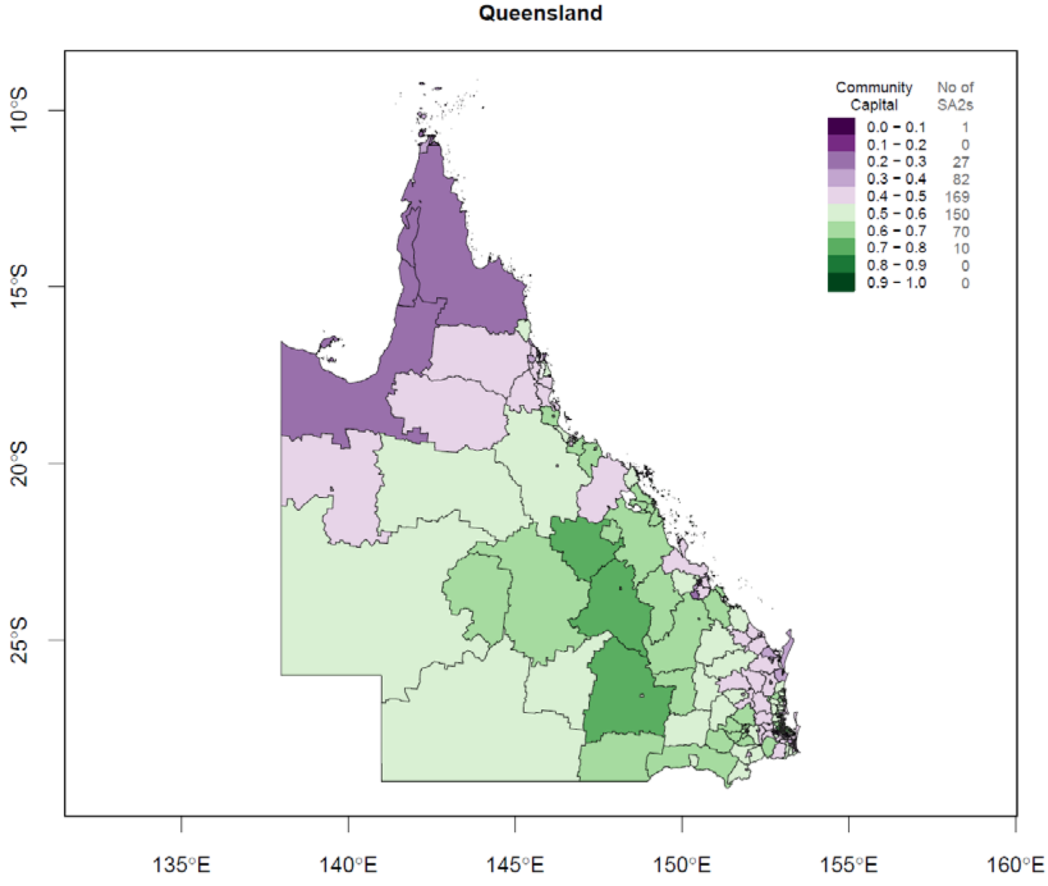
Victoria

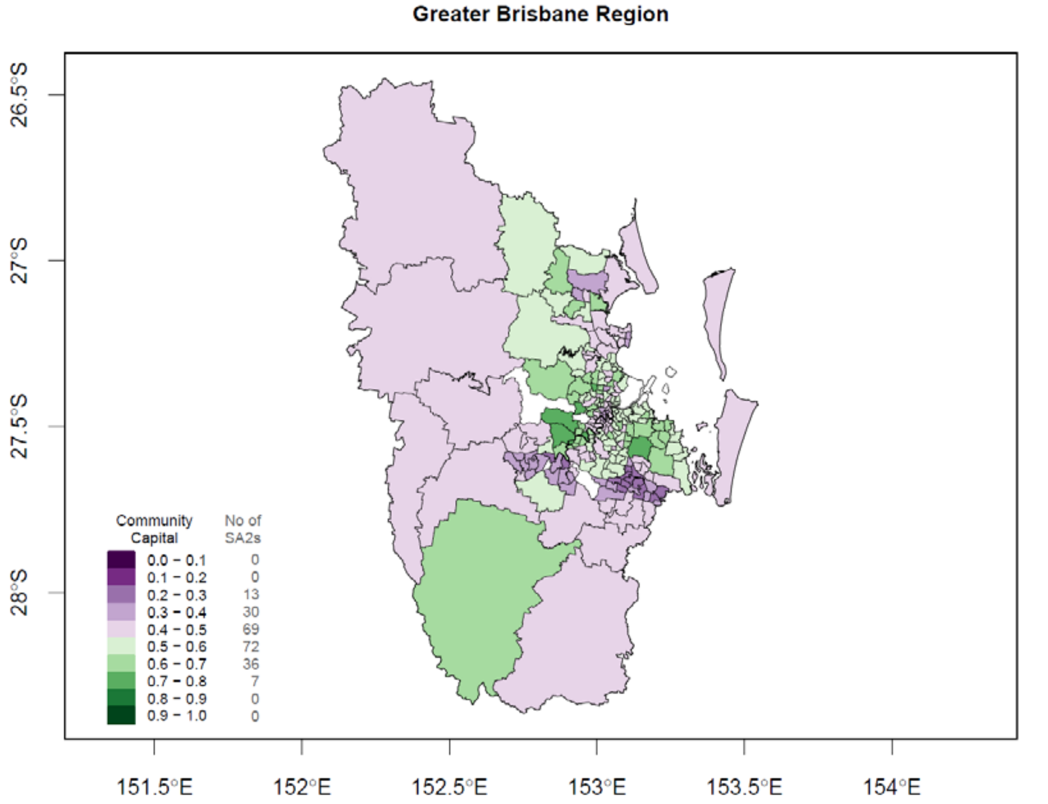


Greater Melbourne Region



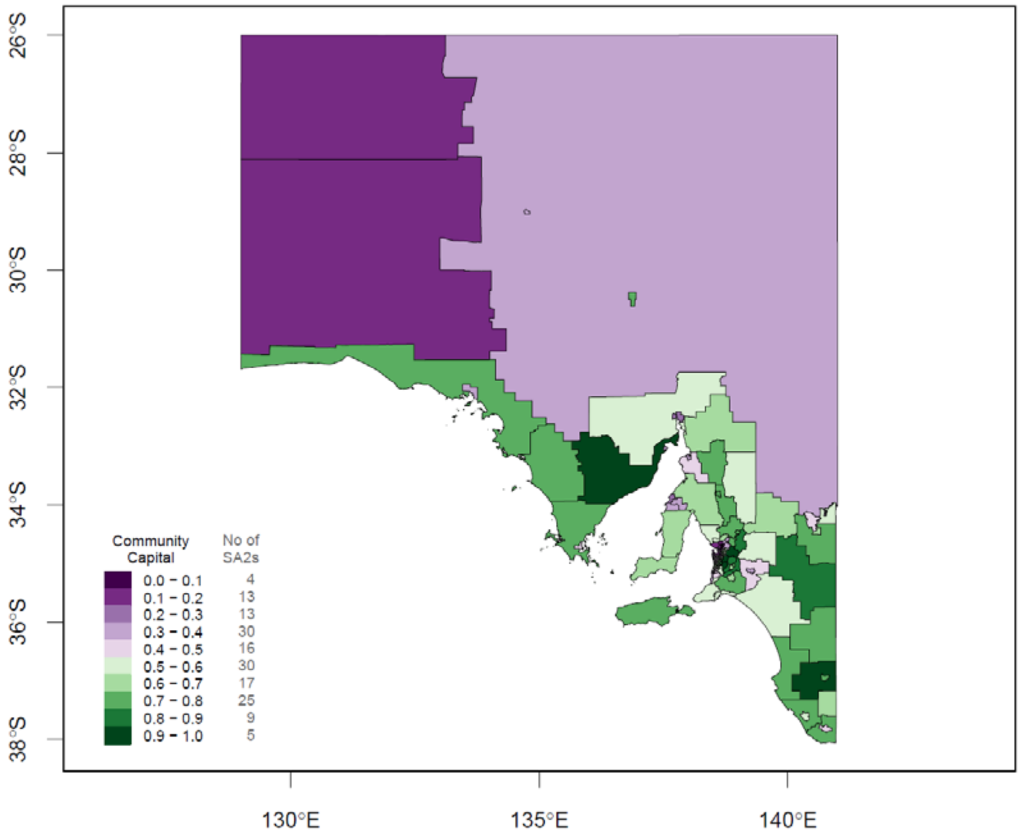
Appendix 5J (cont.)



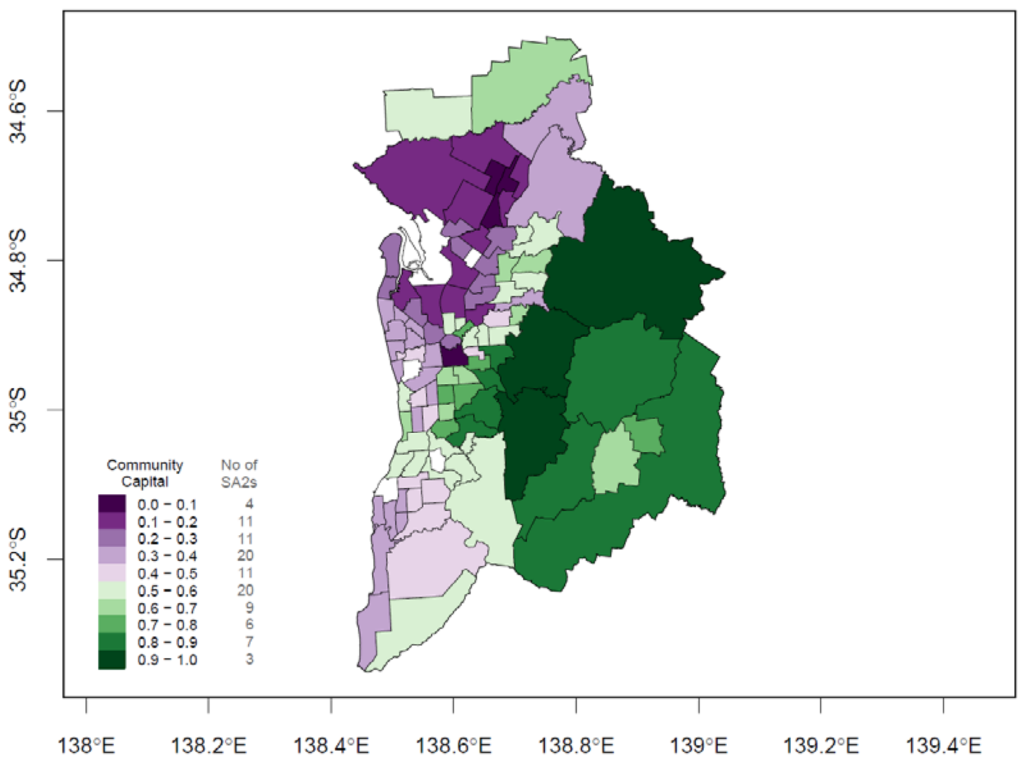


Appendix 5J (cont.)

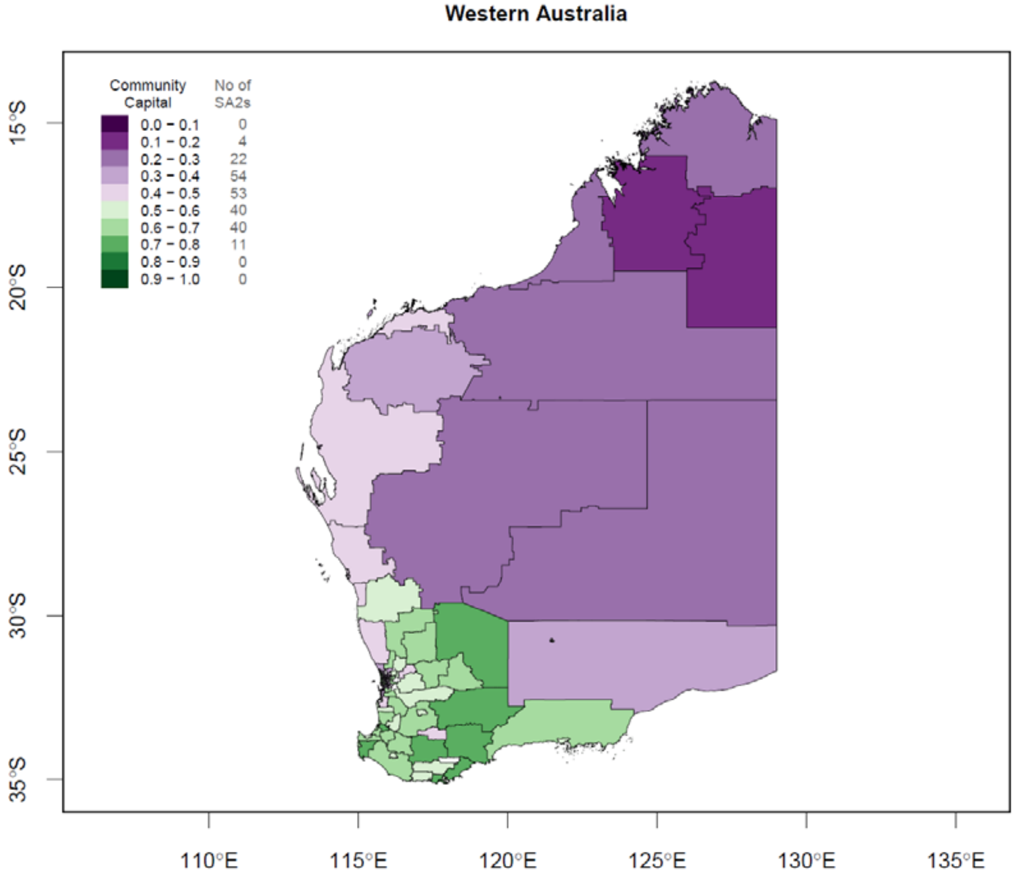
South Australia

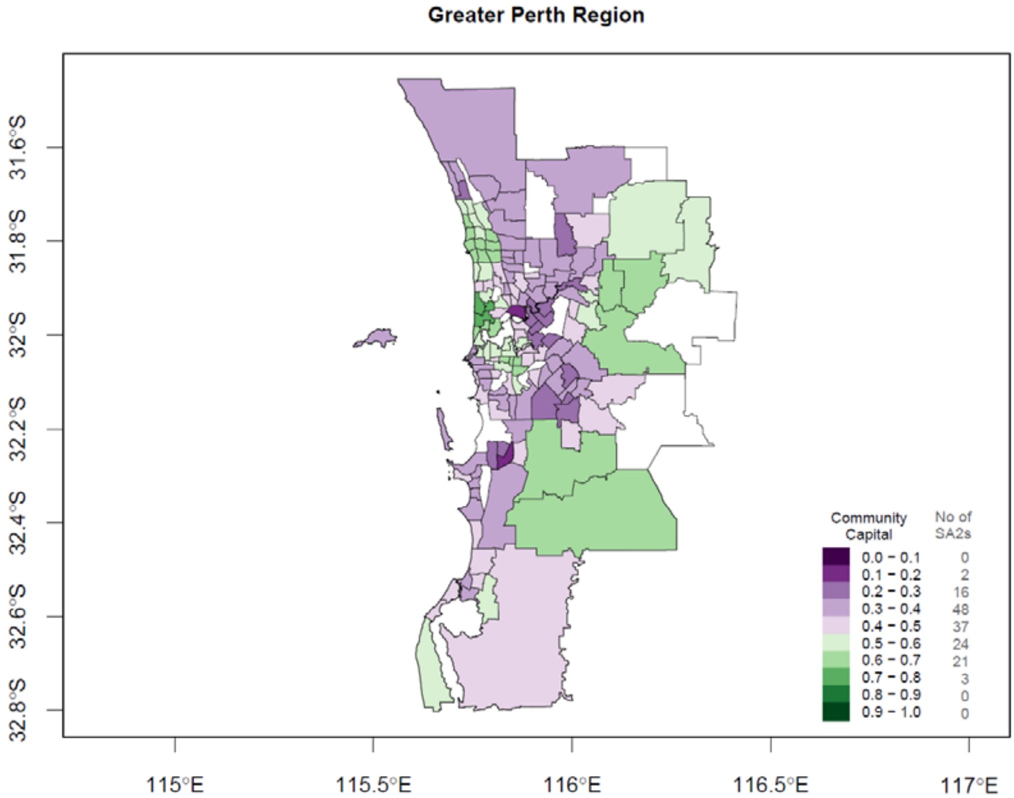


Greater Adelaide Region

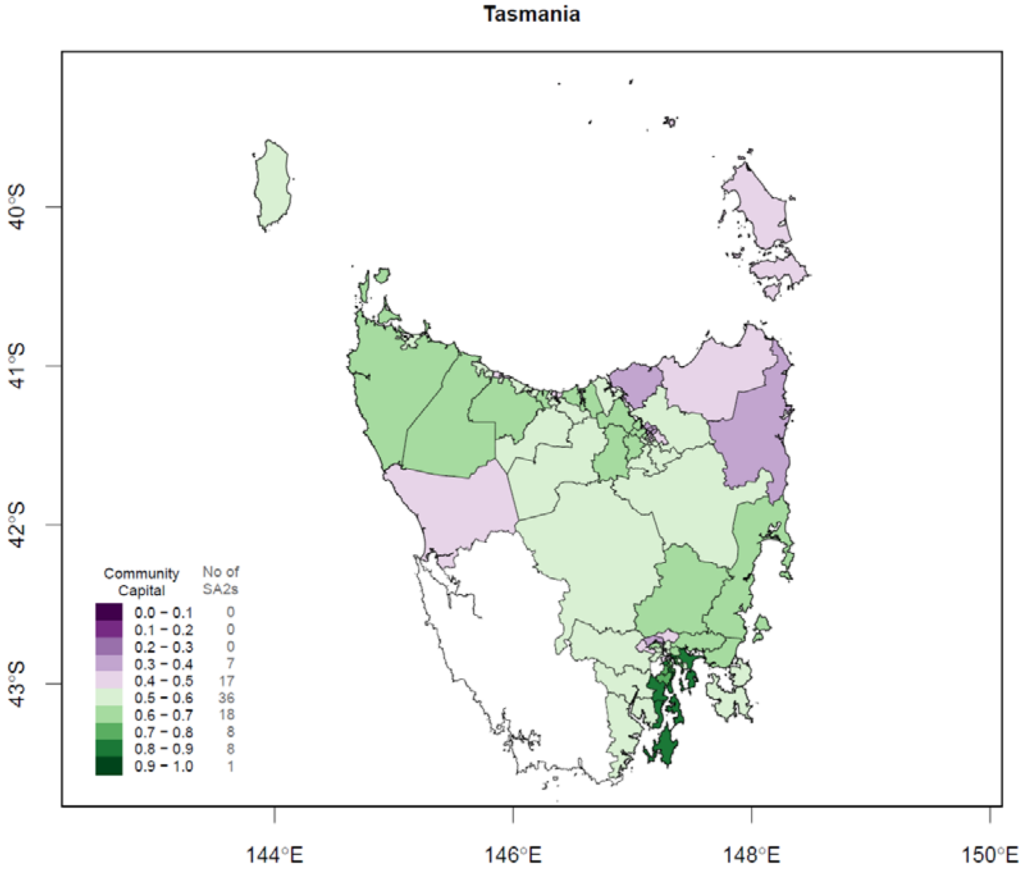


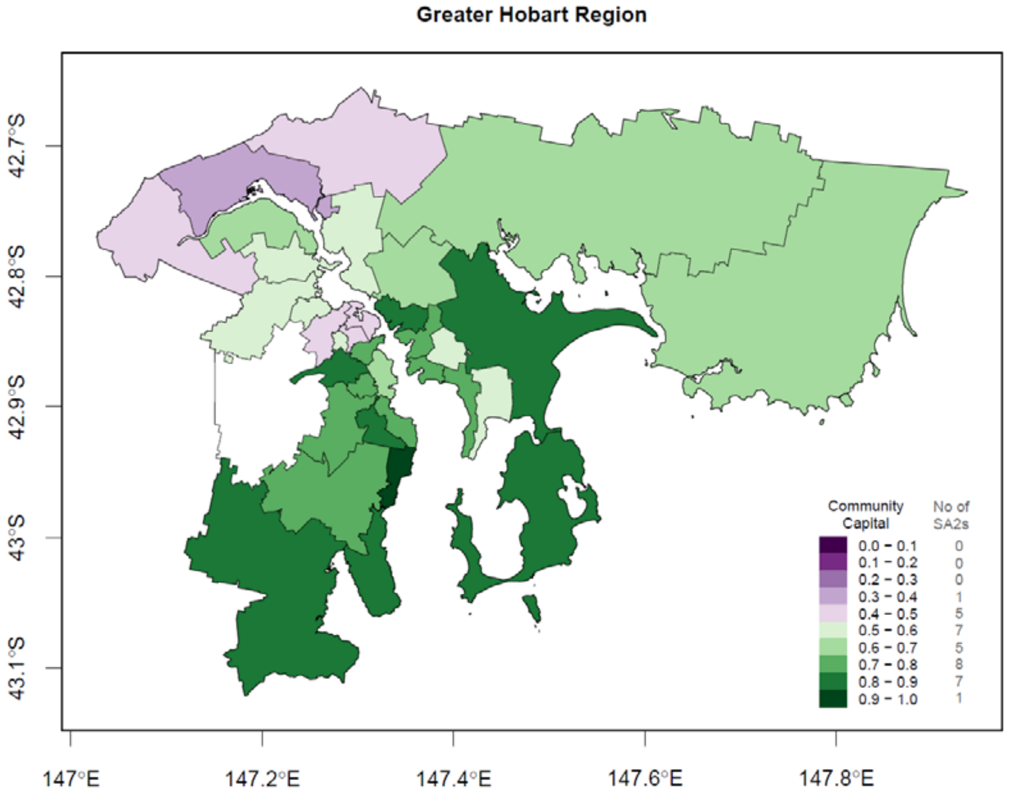
Appendix 5J (cont.)





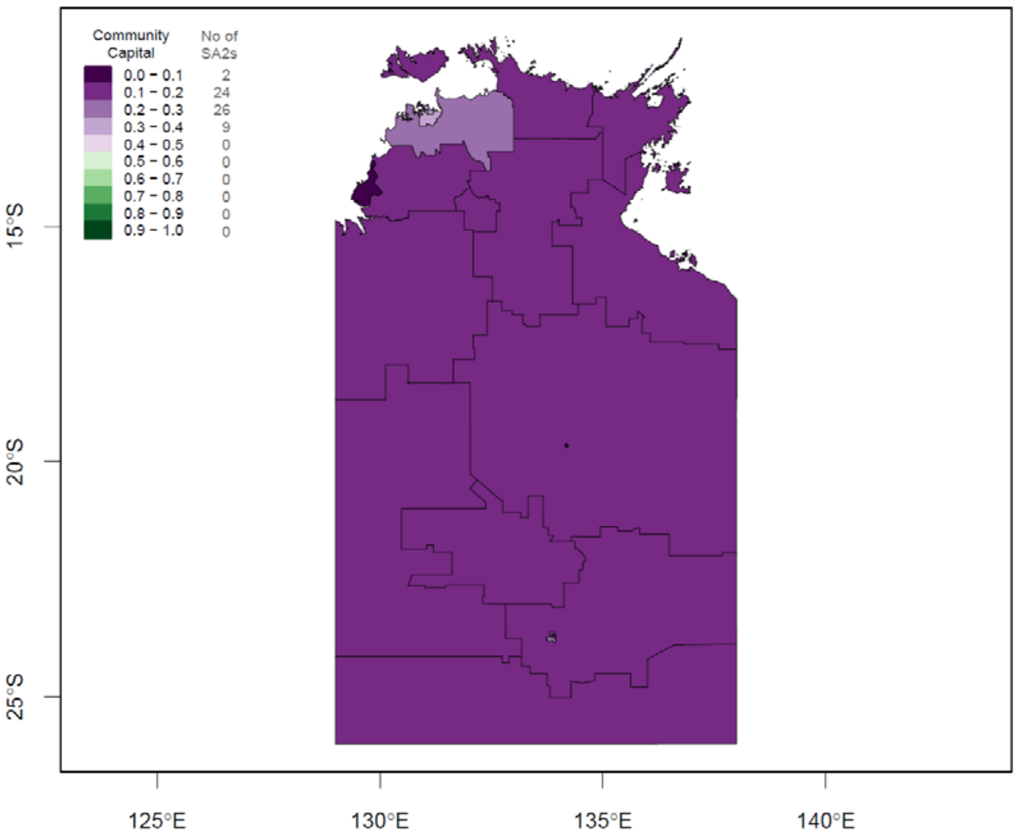
Appendix 5J (cont.)



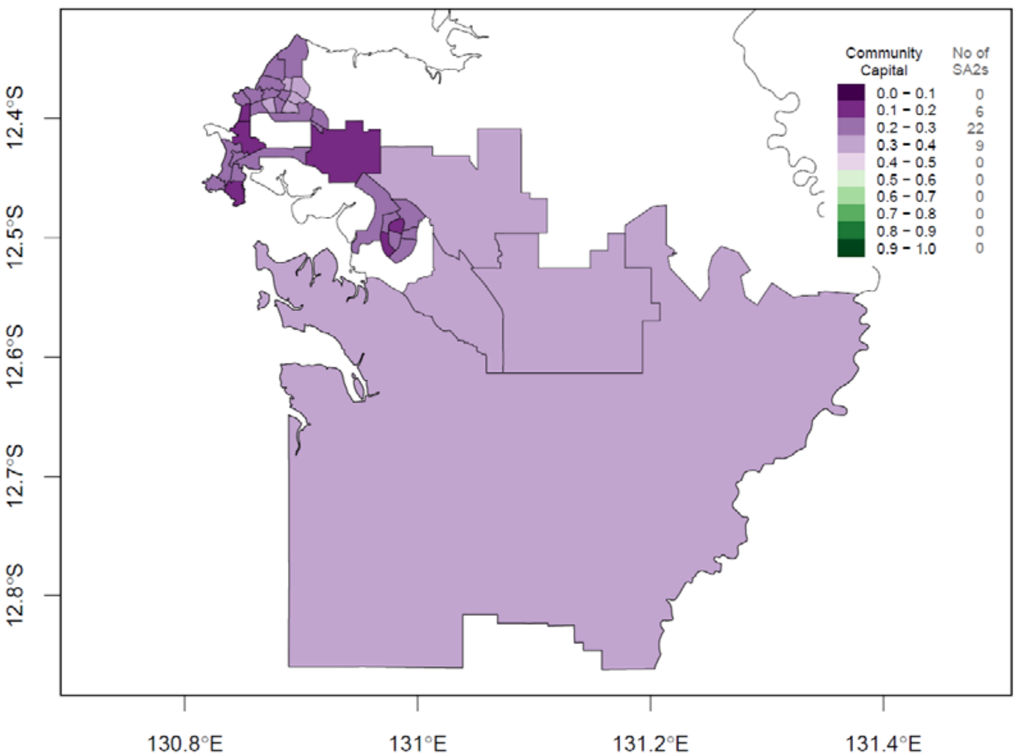


Appendix 5J (cont.)

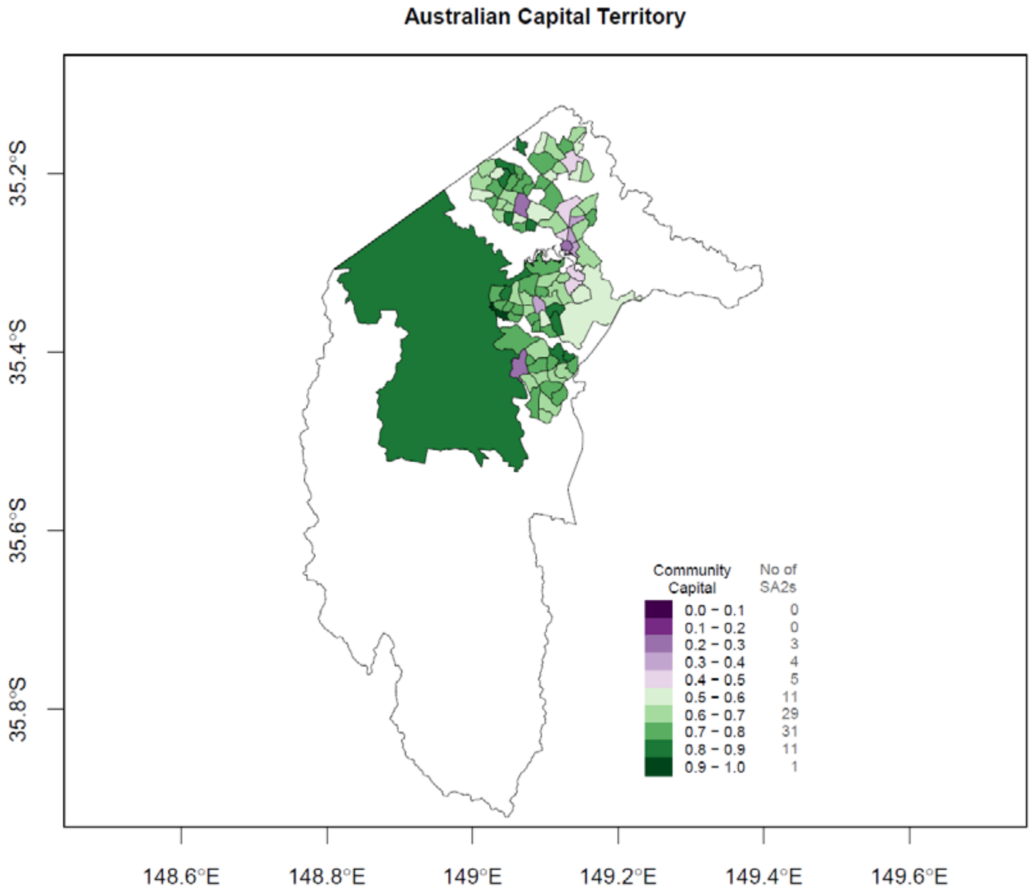
Northern Territory



Greater Darwin Region



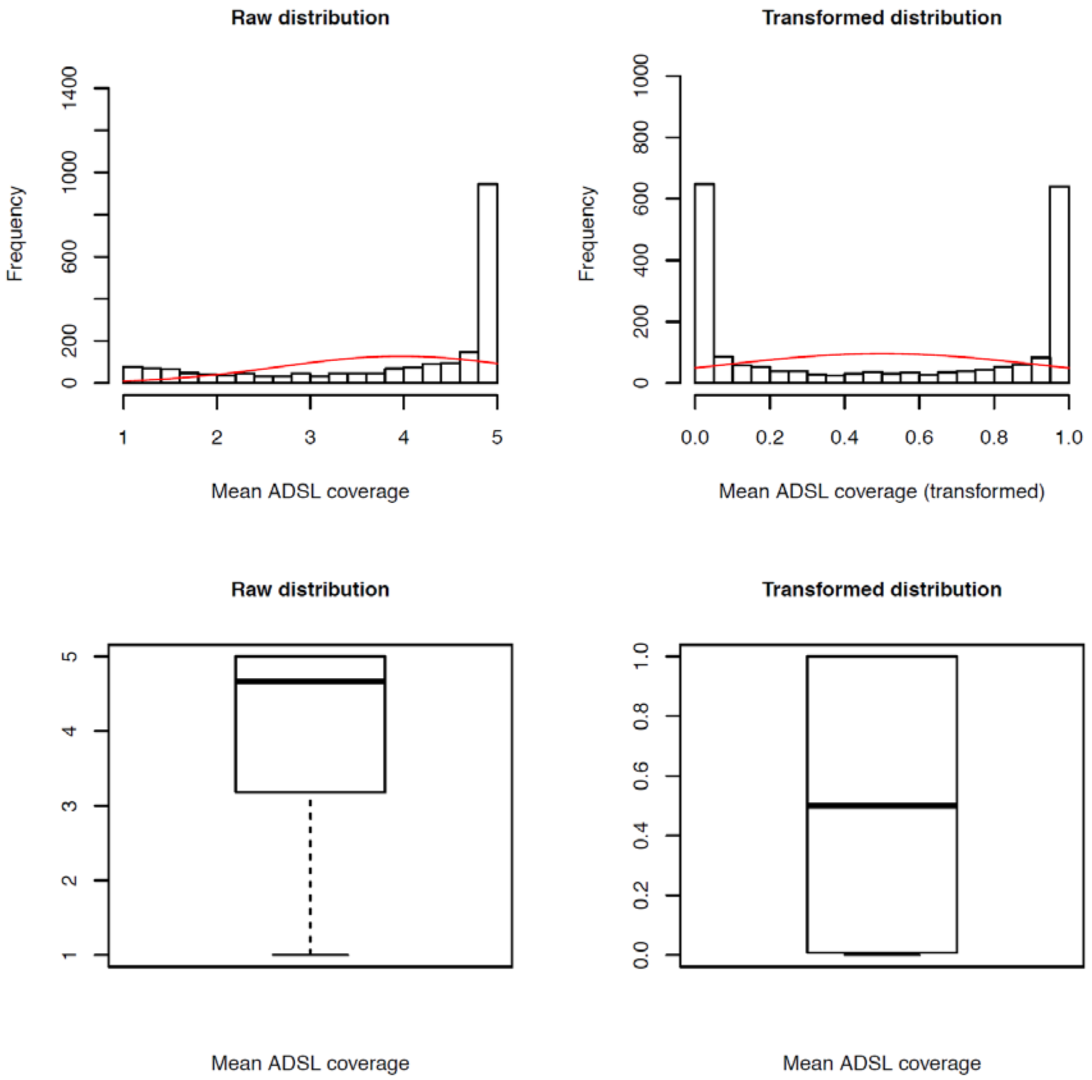
Appendix 5J (cont.)



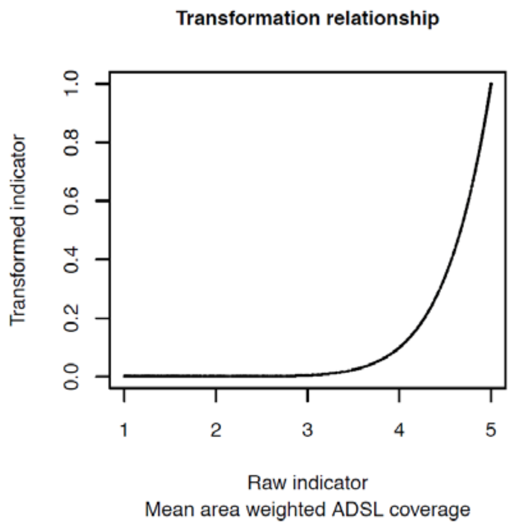
APPENDIX 5K – INFORMATION ACCESS TRANSFORMATION DETAILS

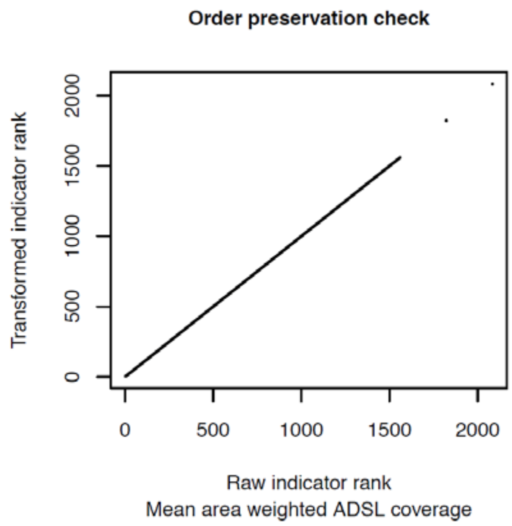
Appendix 5K shows the raw and transformed indicators used to compute the information access sub-index.

Appendix 5K


Raw distribution
Transformed distribution
Frequency
0
200
600
1000
1400
1
2
3
4
5
Mean ADSL coverage
0
200
400
600
800
1000
0.0
0.2
0.4
0.6
0.8
1.0
Mean ADSL coverage (transformed)
Raw distribution
Transformed distribution
Mean ADSL coverage
Mean ADSL coverage

Appendix 5K (cont.)





TRANSFORMATION DETAILS

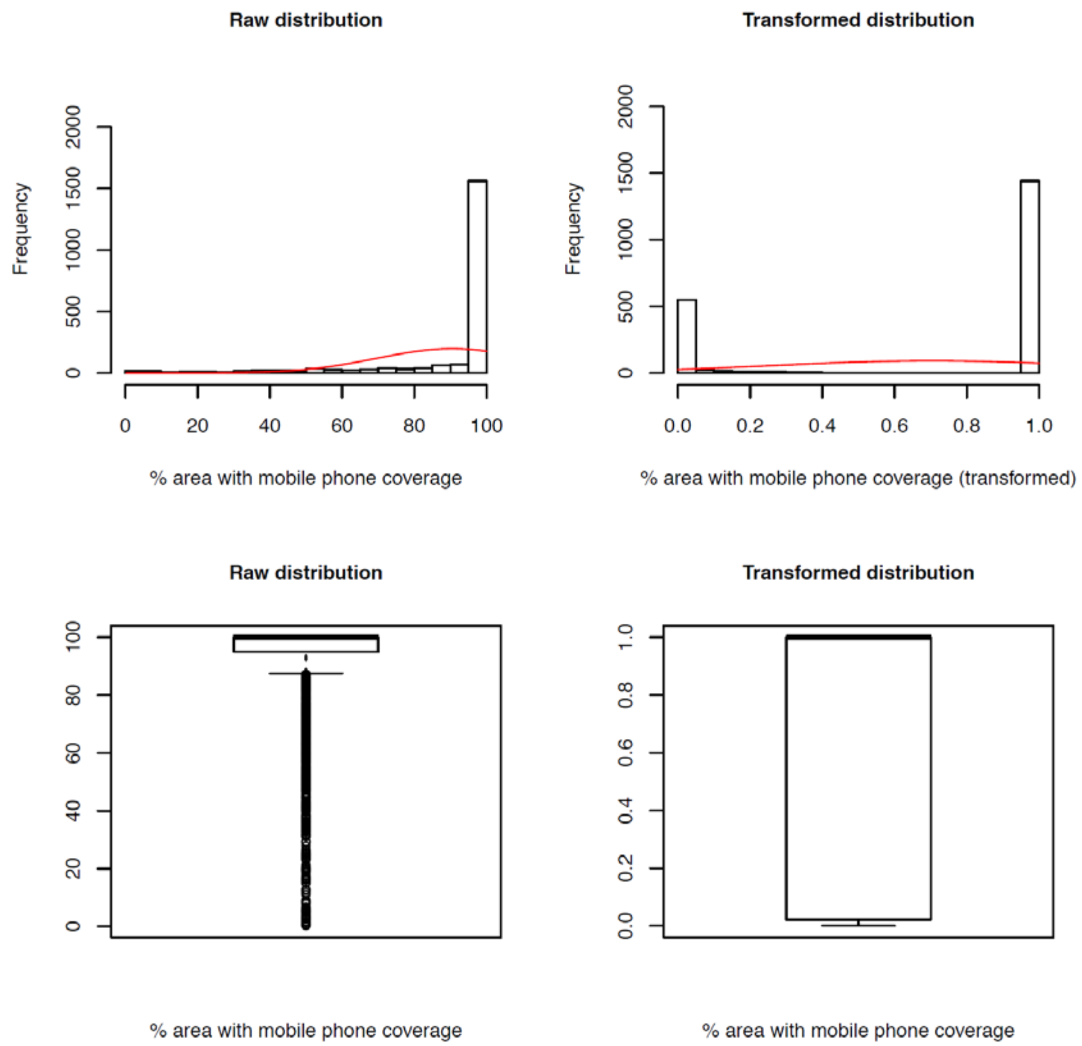
Unreversed

Skewness:
Power transform, exponent: 8.02
Pre−transform skewness: −1.1
Post−transform skewness: 0.0

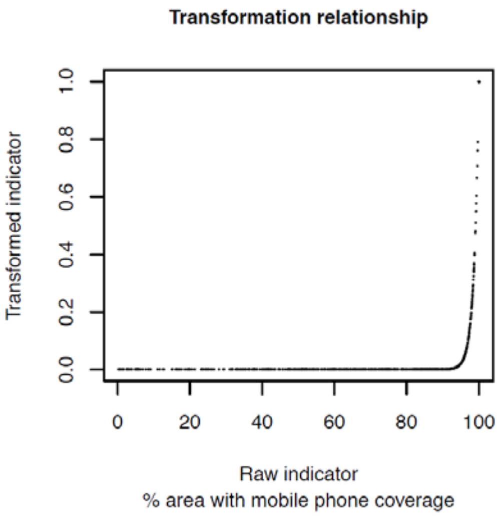
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: −0.4
Post−transform kurtosis: −1.8

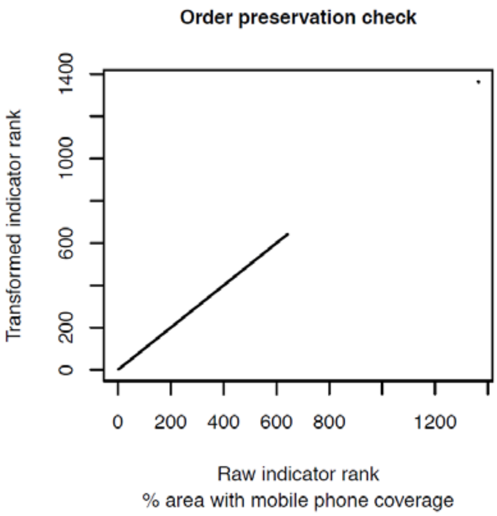
Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

Appendix 5K (cont.)



Appendix 5K (cont.)





TRANSFORMATION DETAILS

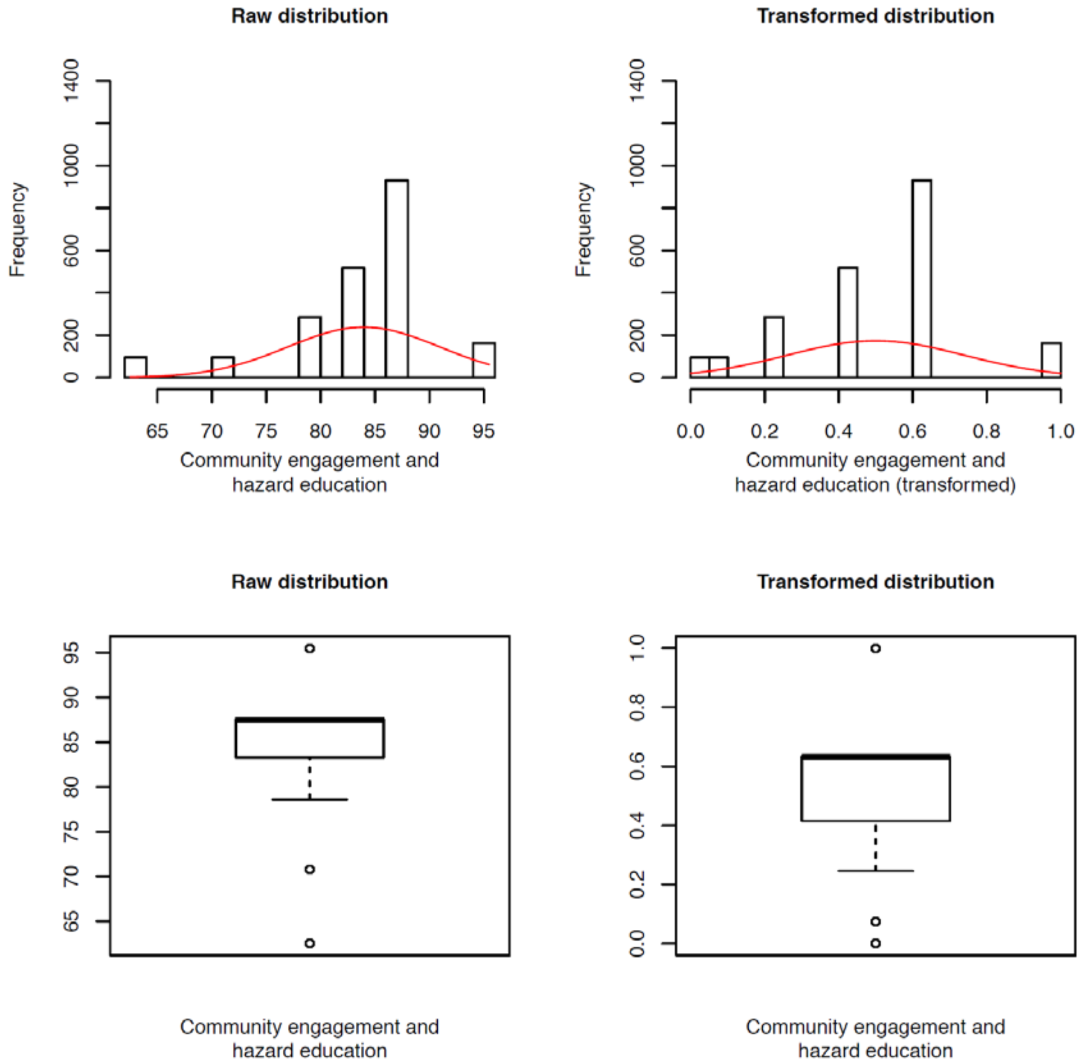
Unreversed

Skewness:
Power transform, exponent: 75.00
Pre–transform skewness: –2.5
Post–transform skewness: –0.9

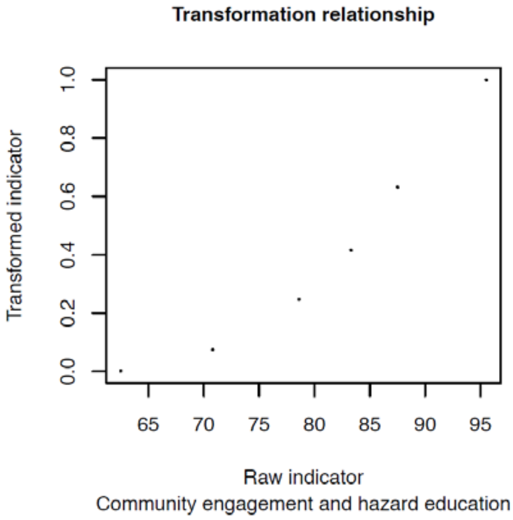
Kurtosis:
Coefficient: 0.00
Pre–transform kurtosis: 5.7
Post–transform kurtosis: –1.2

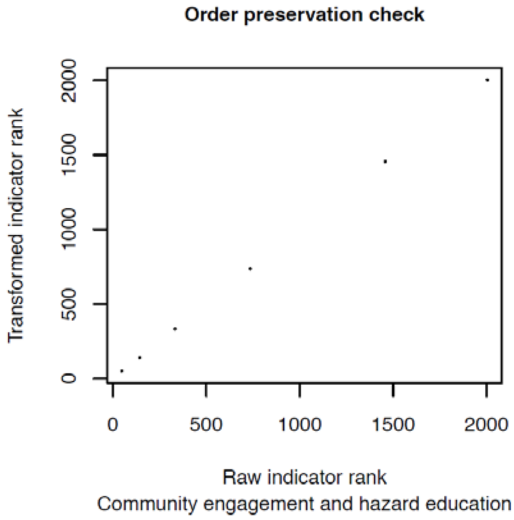
Outliers:
Pre–transform outlier count: 53
Post–transform outlier count: 0

Appendix 5K (cont.)



Appendix 5K (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 1.80
Pre−transform skewness: −1.3
Post−transform skewness: −0.1

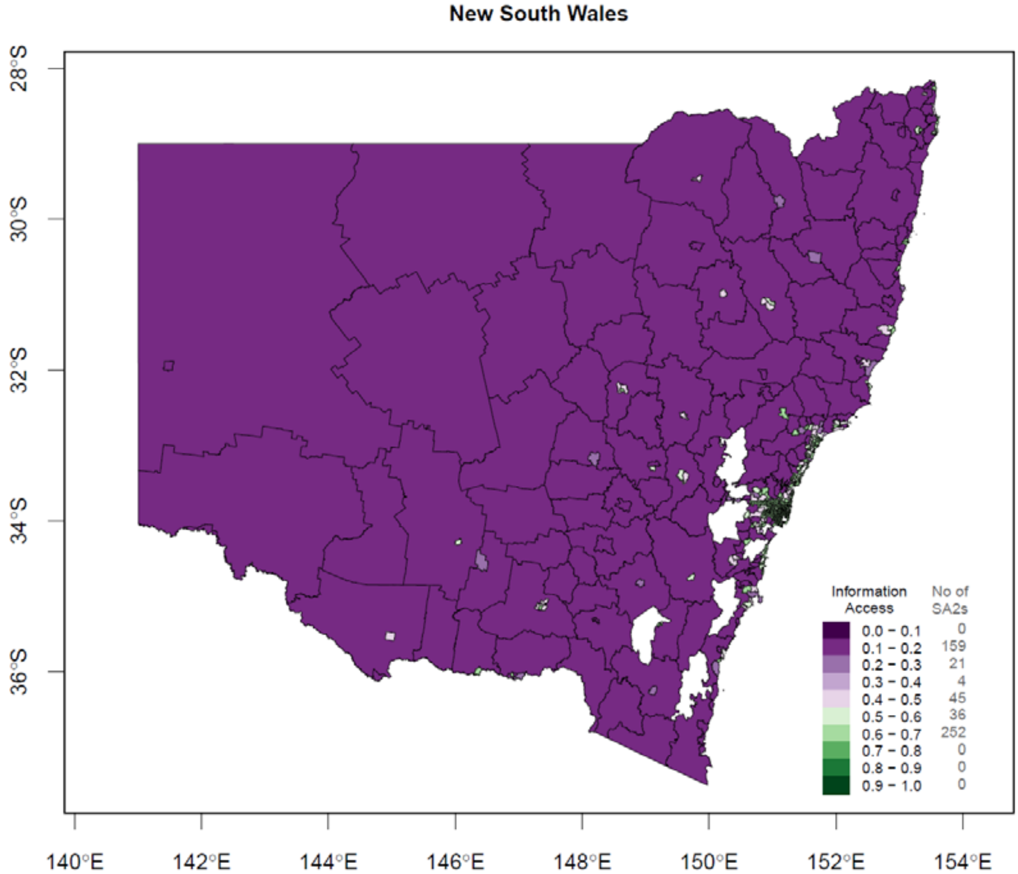
Kurtosis:
Coefficient: 0.29
Pre−transform kurtosis: 2.3
Post−transform kurtosis: 0.0

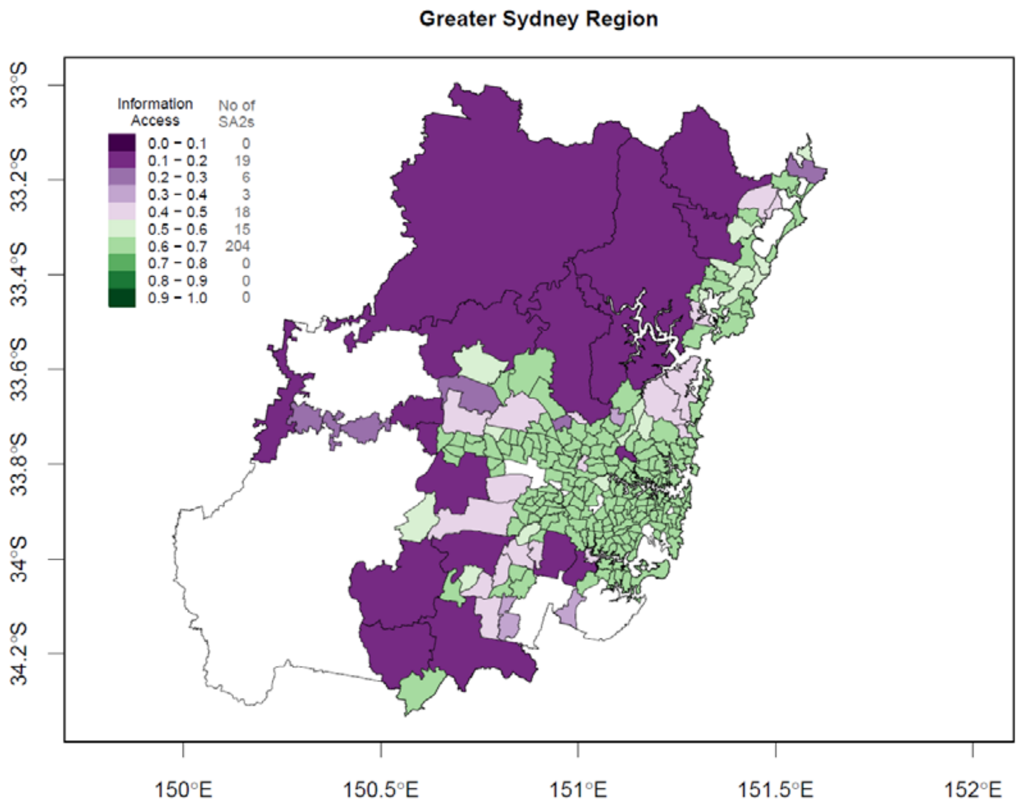
Outliers:
Pre−transform outlier count: 0
Post−transform outlier count: 0

APPENDIX 5L – MAPS: INFORMATION ACCESS INDEX BY STATE/TERRITORY AND METROPOLITAN AREAS

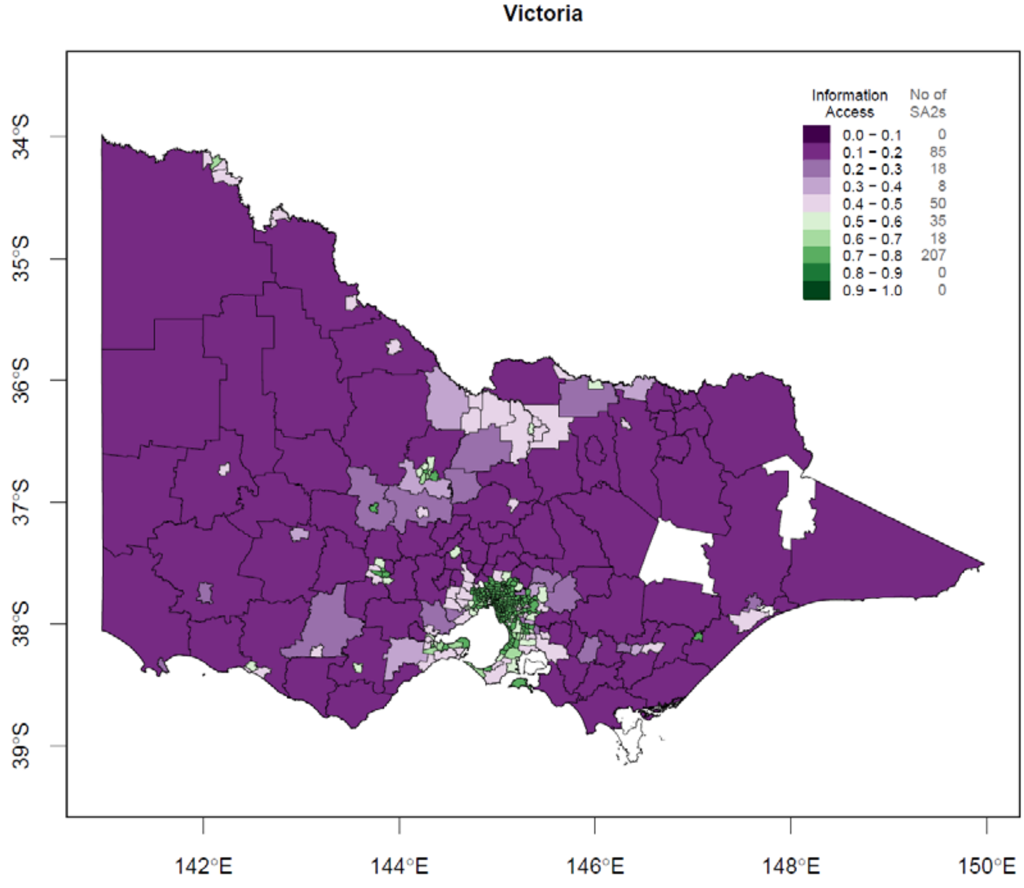
Appendix 5L maps the information access index at the resolution of individual States and Territories, and major metropolitan areas.

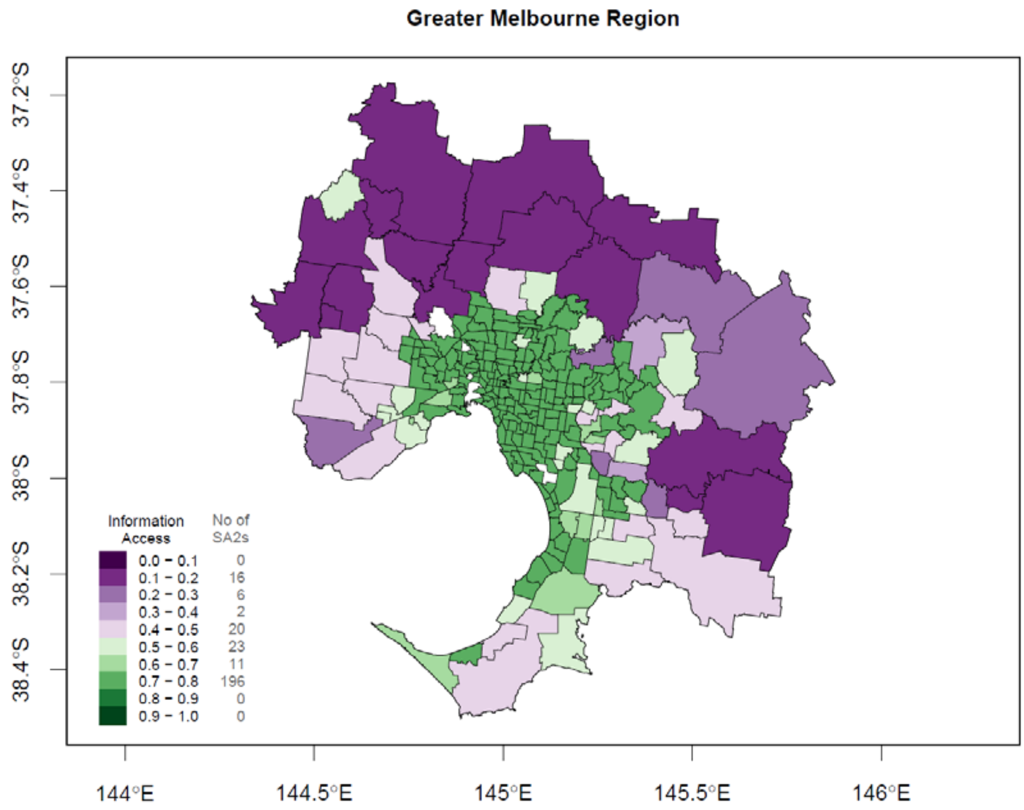
Appendix 5L


New South Wales
Information Access
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 159
0.2 – 0.3 21
0.3 – 0.4 4
0.4 – 0.5 45
0.5 – 0.6 36
0.6 – 0.7 252
0.7 – 0.8 0
0.8 – 0.9 0
0.9 – 1.0 0
28°S
30°S
32°S
34°S
36°S
140°E
142°E
144°E
146°E
148°E
150°E
152°E
154°E

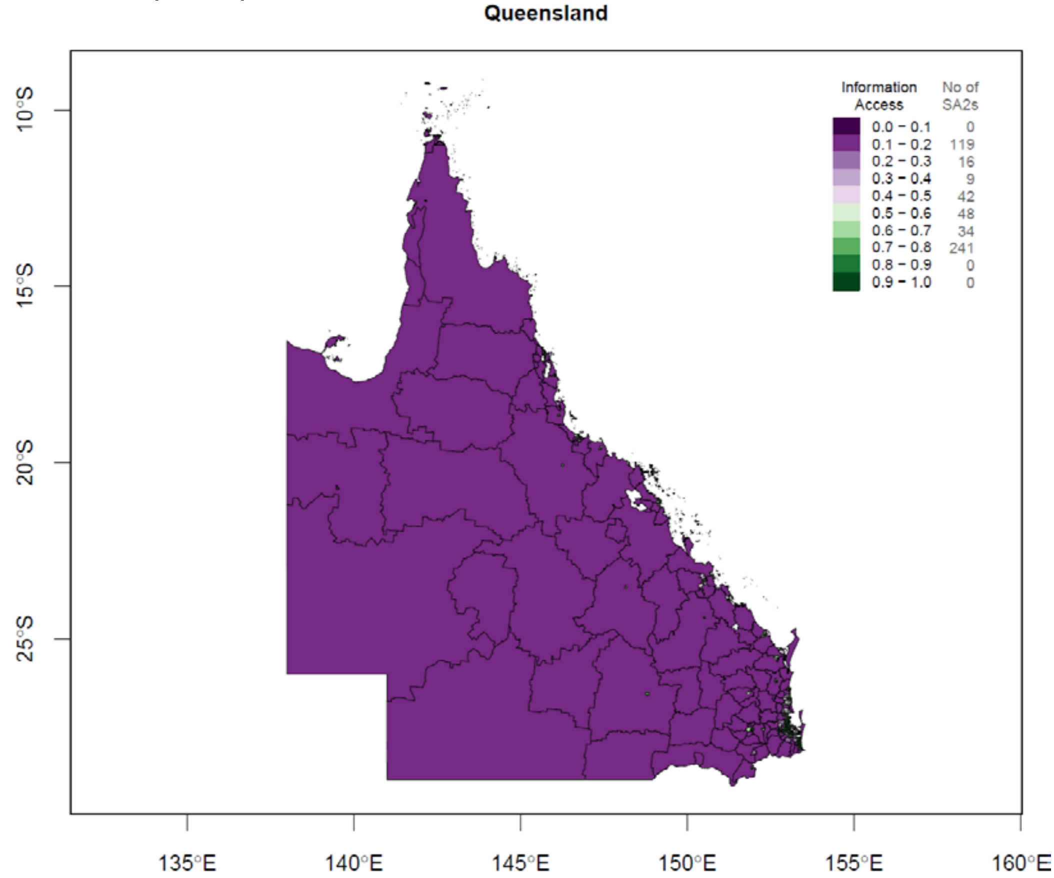

Greater Sydney Region
Information Access
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 19
0.2 – 0.3 6
0.3 – 0.4 3
0.4 – 0.5 18
0.5 – 0.6 15
0.6 – 0.7 204
0.7 – 0.8 0
0.8 – 0.9 0
0.9 – 1.0 0
33°S
33.2°S
33.4°S
33.6°S
33.8°S
34°S
34.2°S
150°E
150.5°E
151°E
151.5°E
152°E

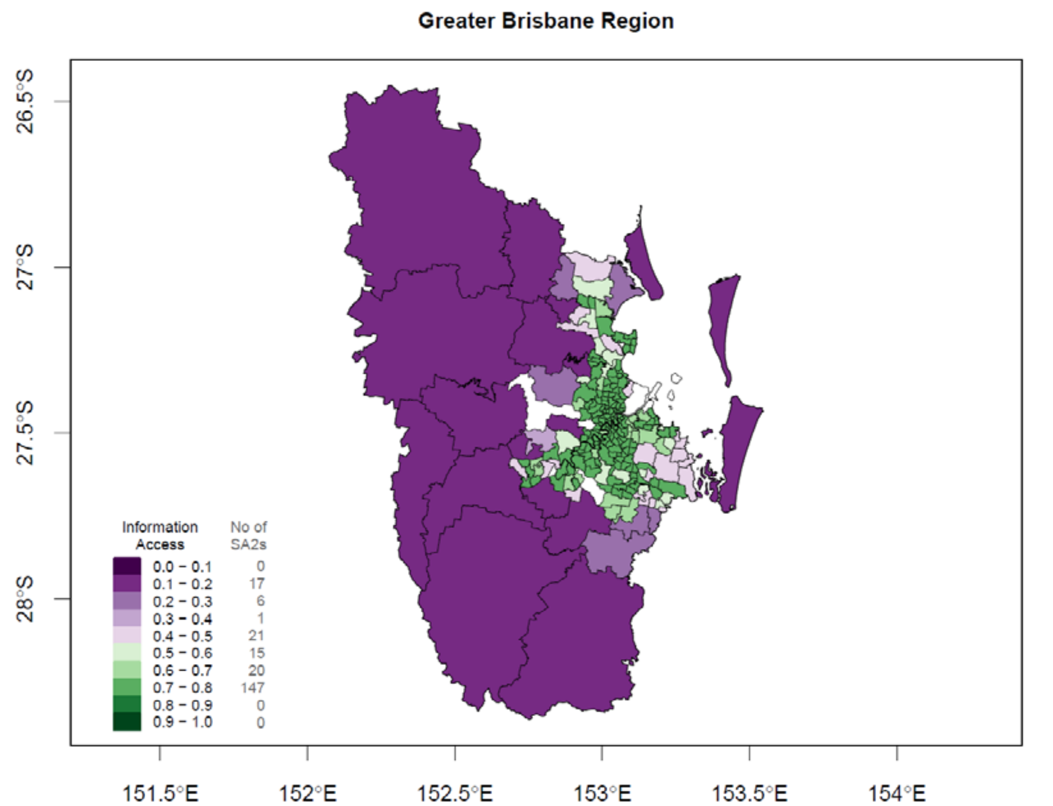
Appendix 5L (cont.)



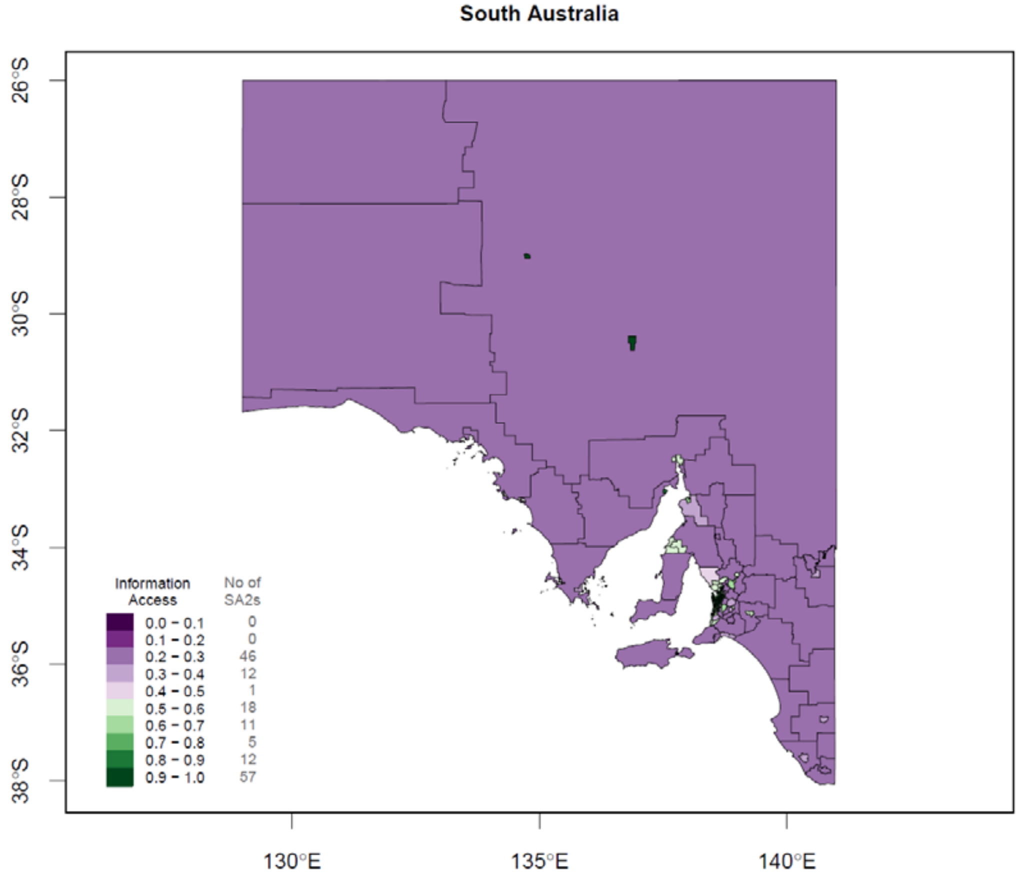


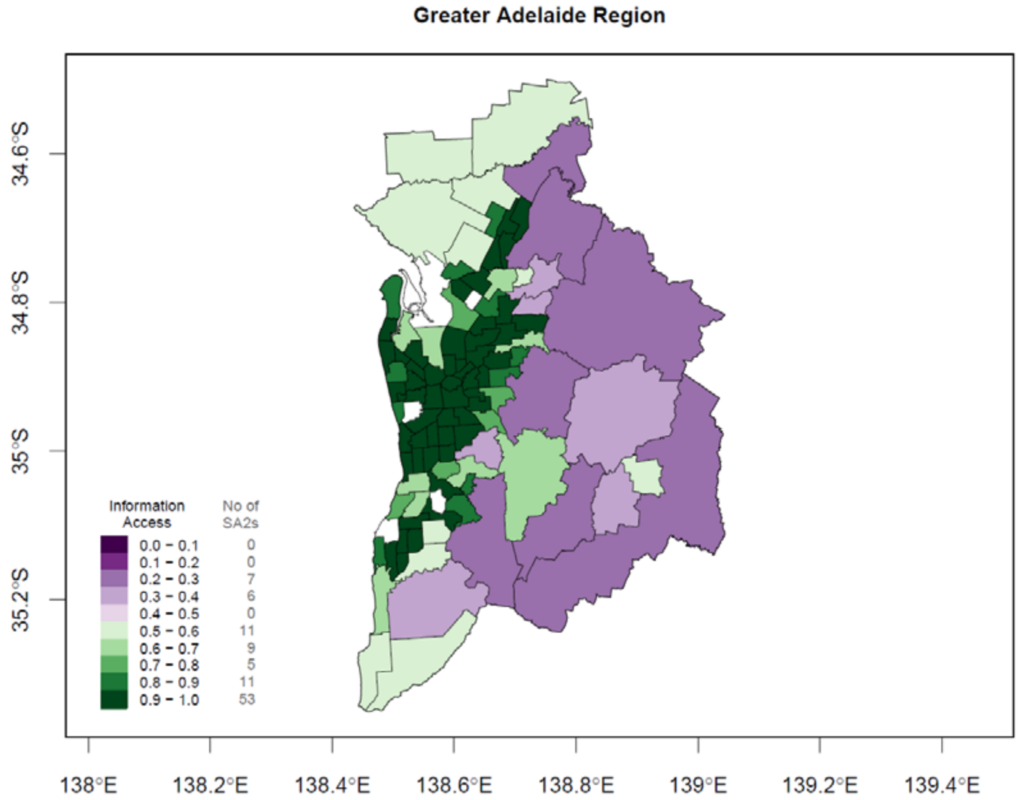
Appendix 5L (cont.)



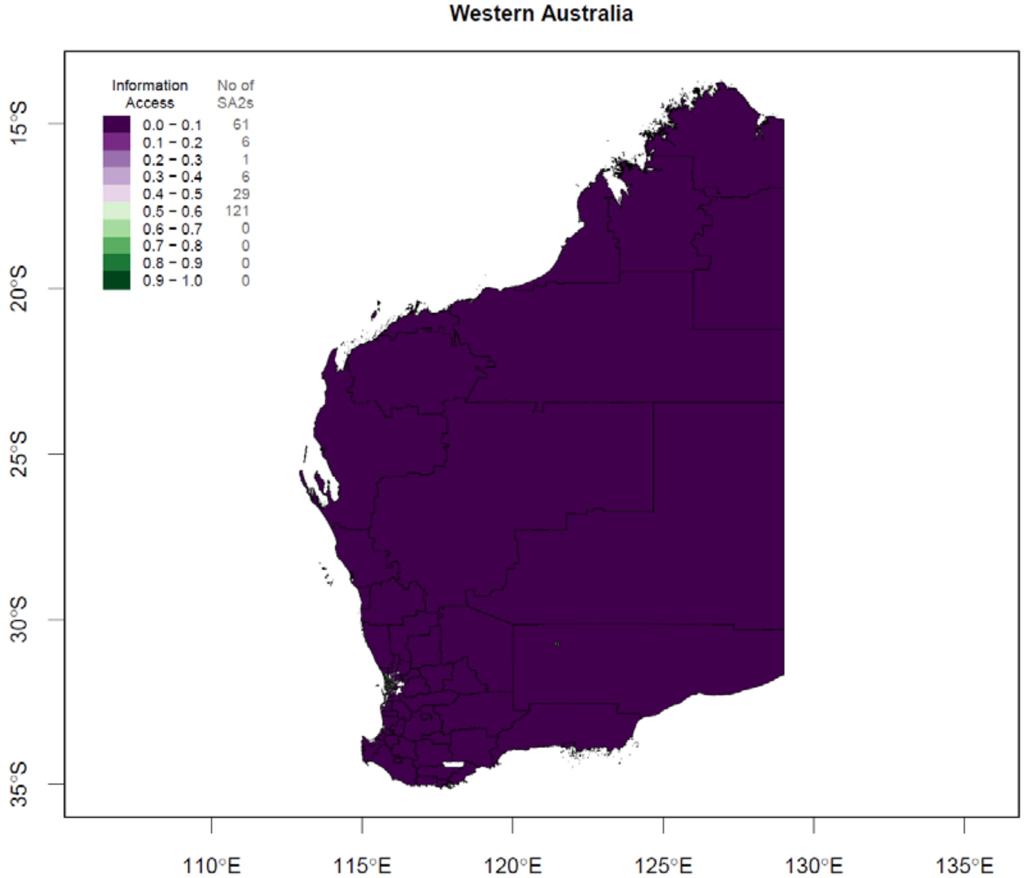


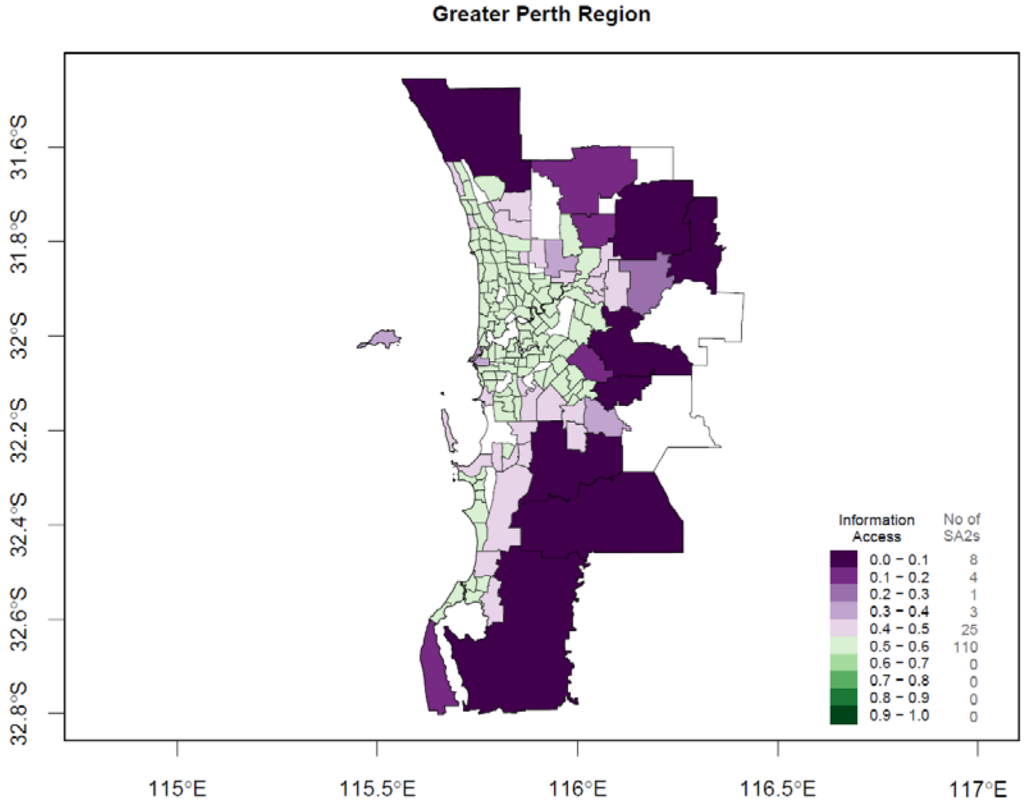
Appendix 5L (cont.)



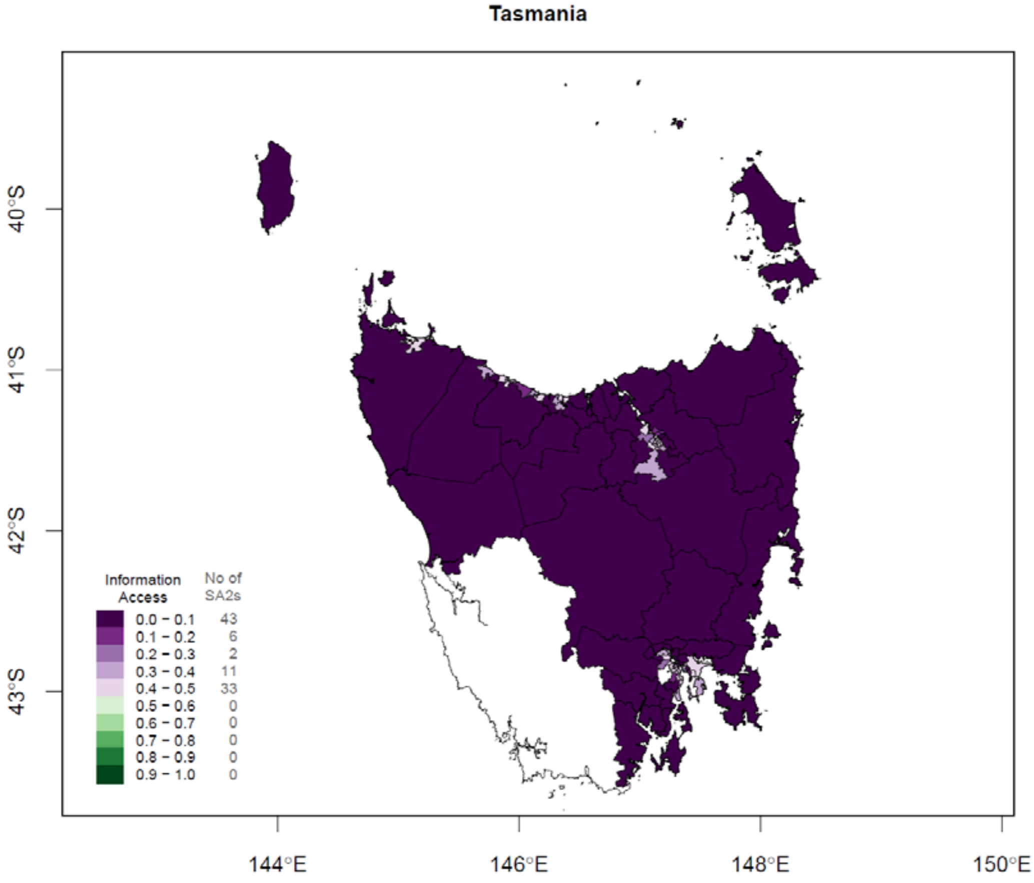


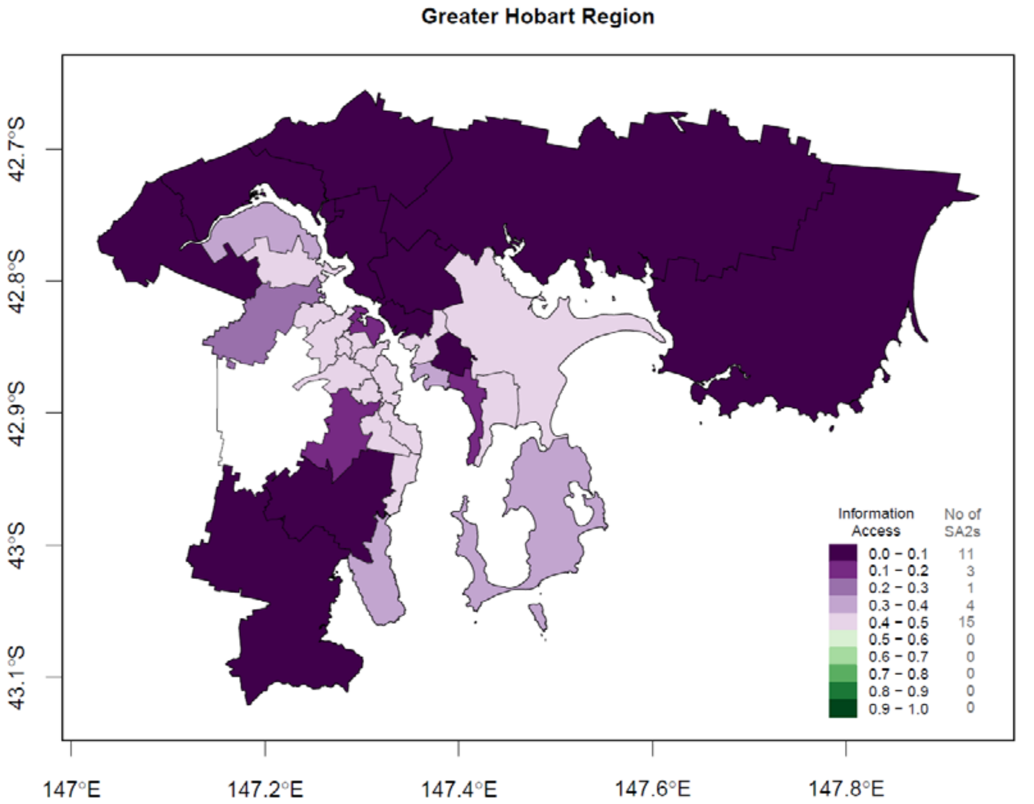
Appendix 5L (cont.)



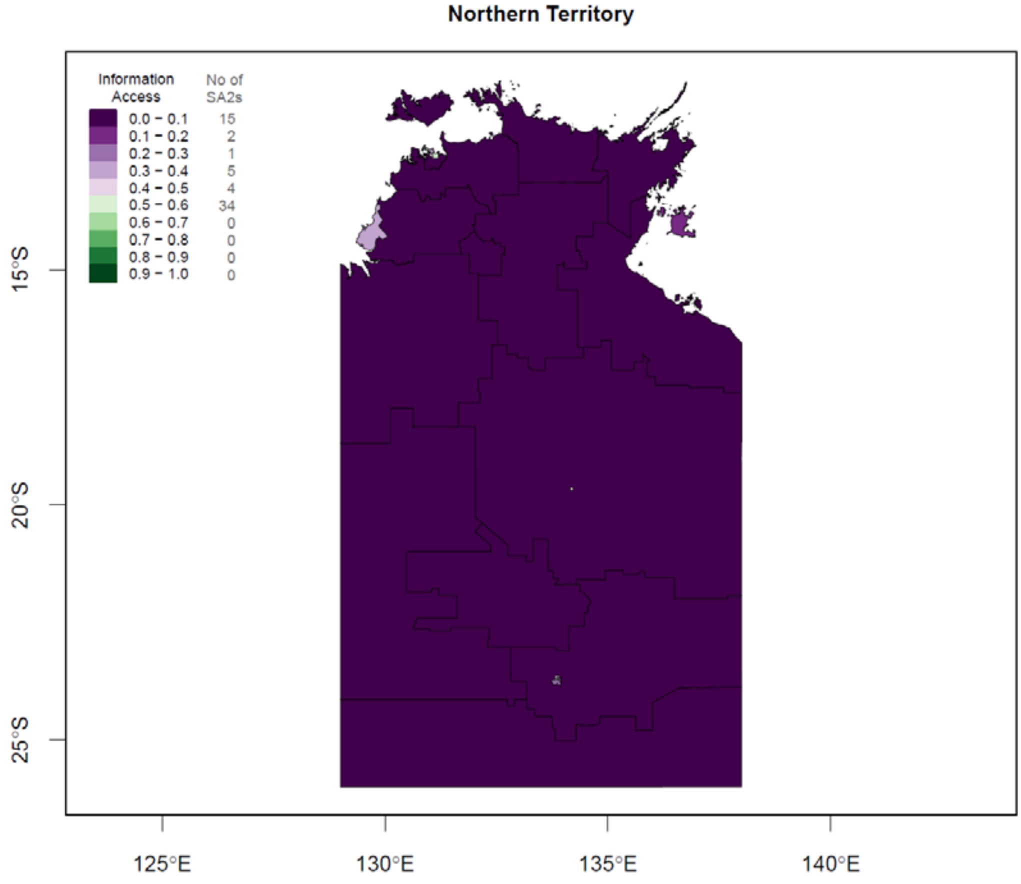


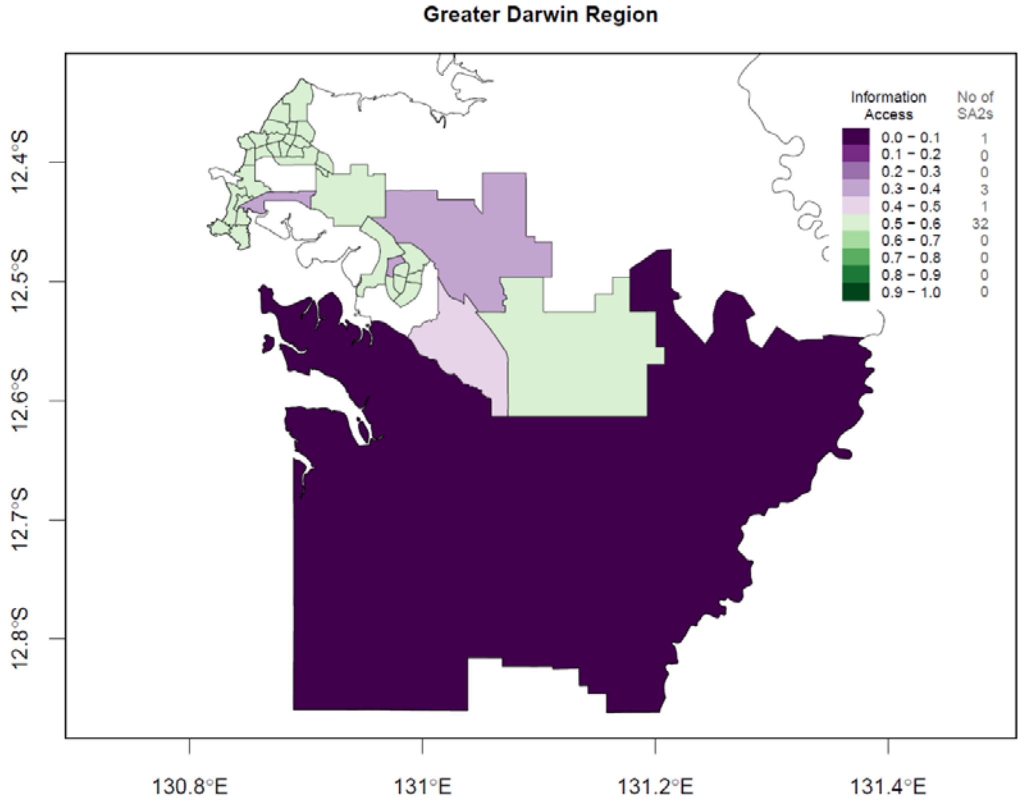
Appendix 5L (cont.)



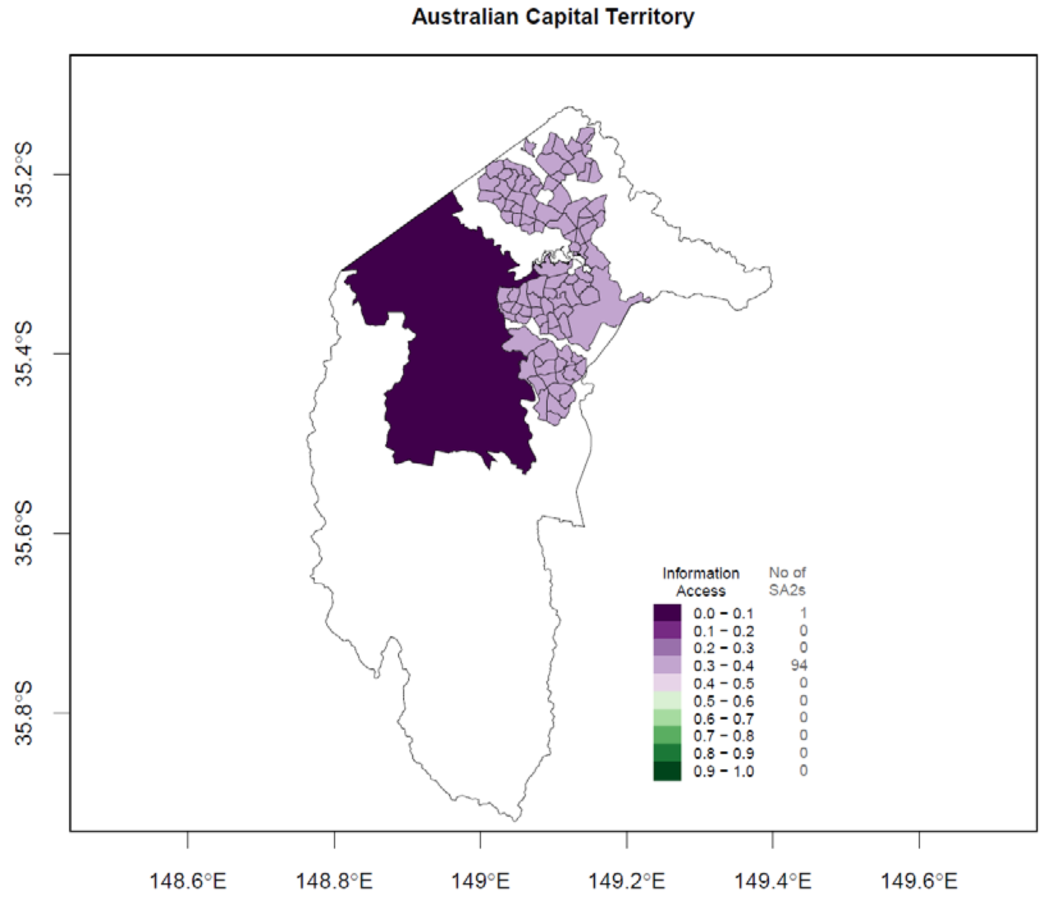


Appendix 5L (cont.)





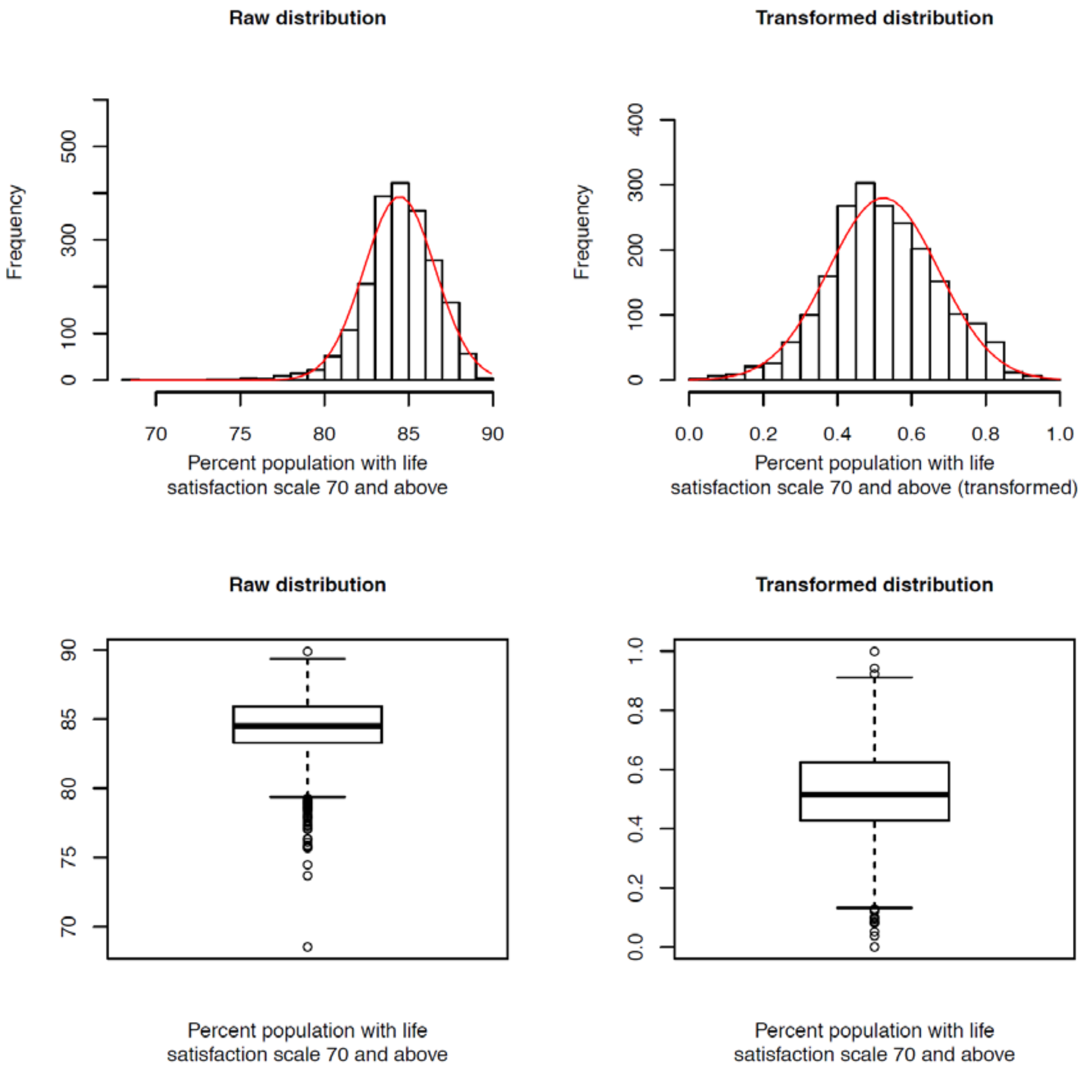
Appendix 5L (cont.)



APPENDIX 5M – SOCIAL AND COMMUNITY ENGAGEMENT TRANSFORMATION DETAILS

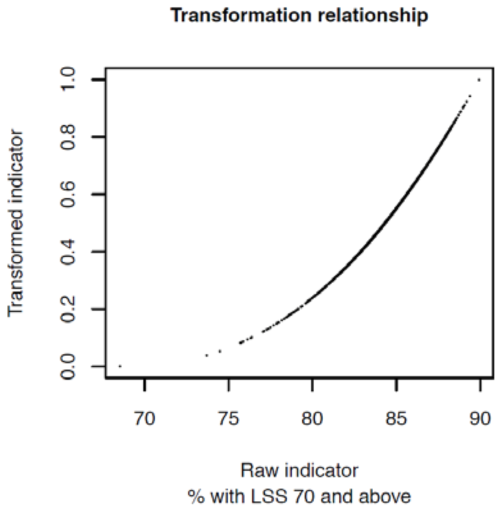
Appendix 5M shows the raw and transformed indicators used to compute the social and community engagement sub-index.

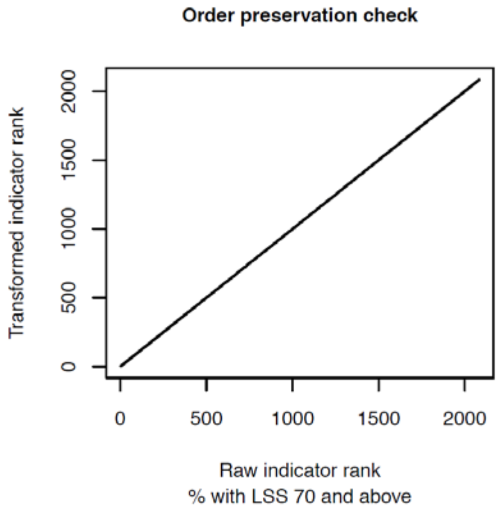
Appendix 5M



Raw distribution
Transformed distribution
Frequency
0
100
300
500
70
75
80
85
90
Percent population with life satisfaction scale 70 and above
Frequency
0
100
200
300
400
0.0
0.2
0.4
0.6
0.8
1.0
Percent population with life satisfaction scale 70 and above (transformed)
Raw distribution
Transformed distribution
Percent population with life satisfaction scale 70 and above
Percent population with life satisfaction scale 70 and above

Appendix 5M (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 2.28
Pre−transform skewness: −0.8
Post−transform skewness: 0.0

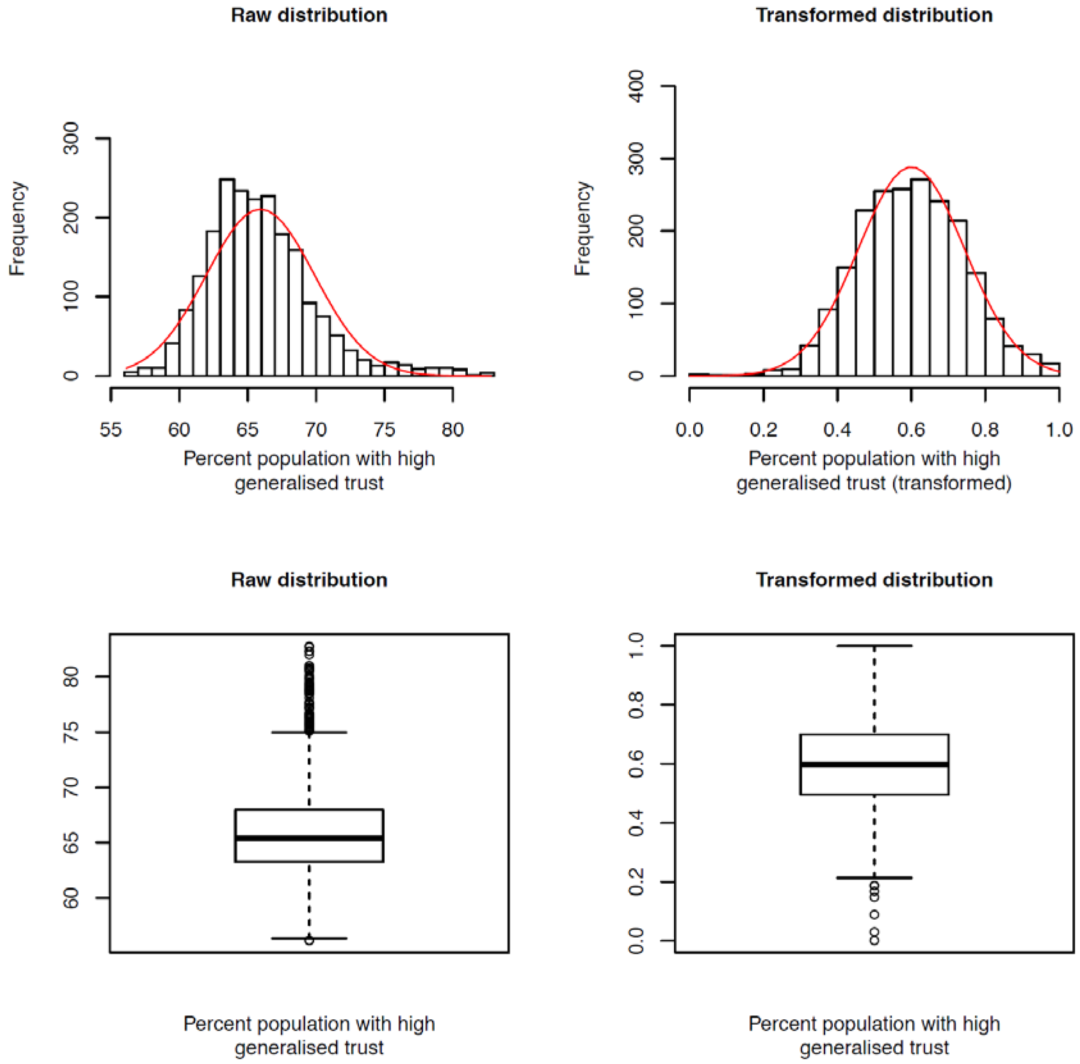
Kurtosis:
Coefficient: 0.01
Pre−transform kurtosis: 2.7
Post−transform kurtosis: −0.0

Outliers:
Pre−transform outlier count: 15
Post−transform outlier count: 1

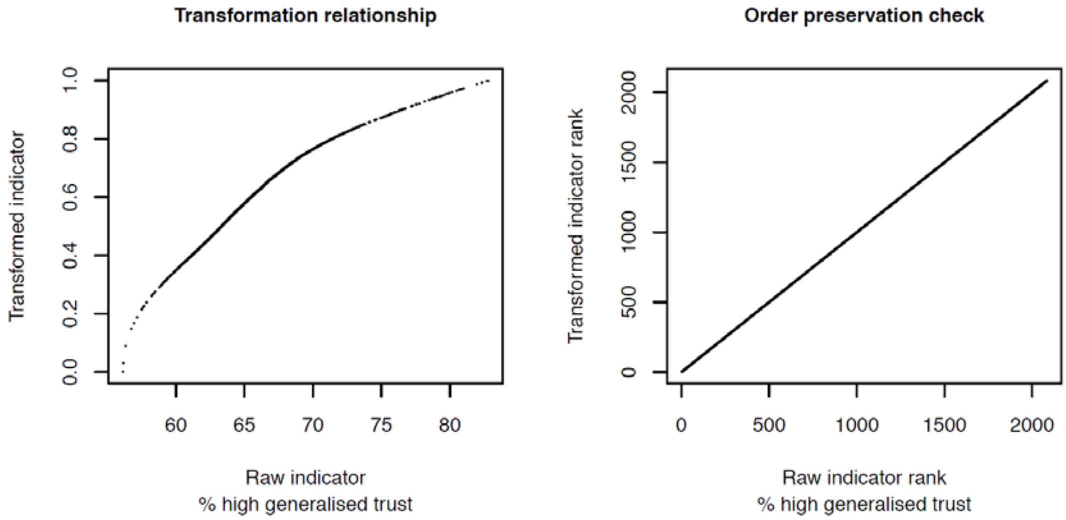
OUTLIER DETAILS

SA2	Value
Palm Island	68.53

Appendix 5M (cont.)



Appendix 5M (cont.)



TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.46
Pre−transform skewness: 1.0
Post−transform skewness: 0.0

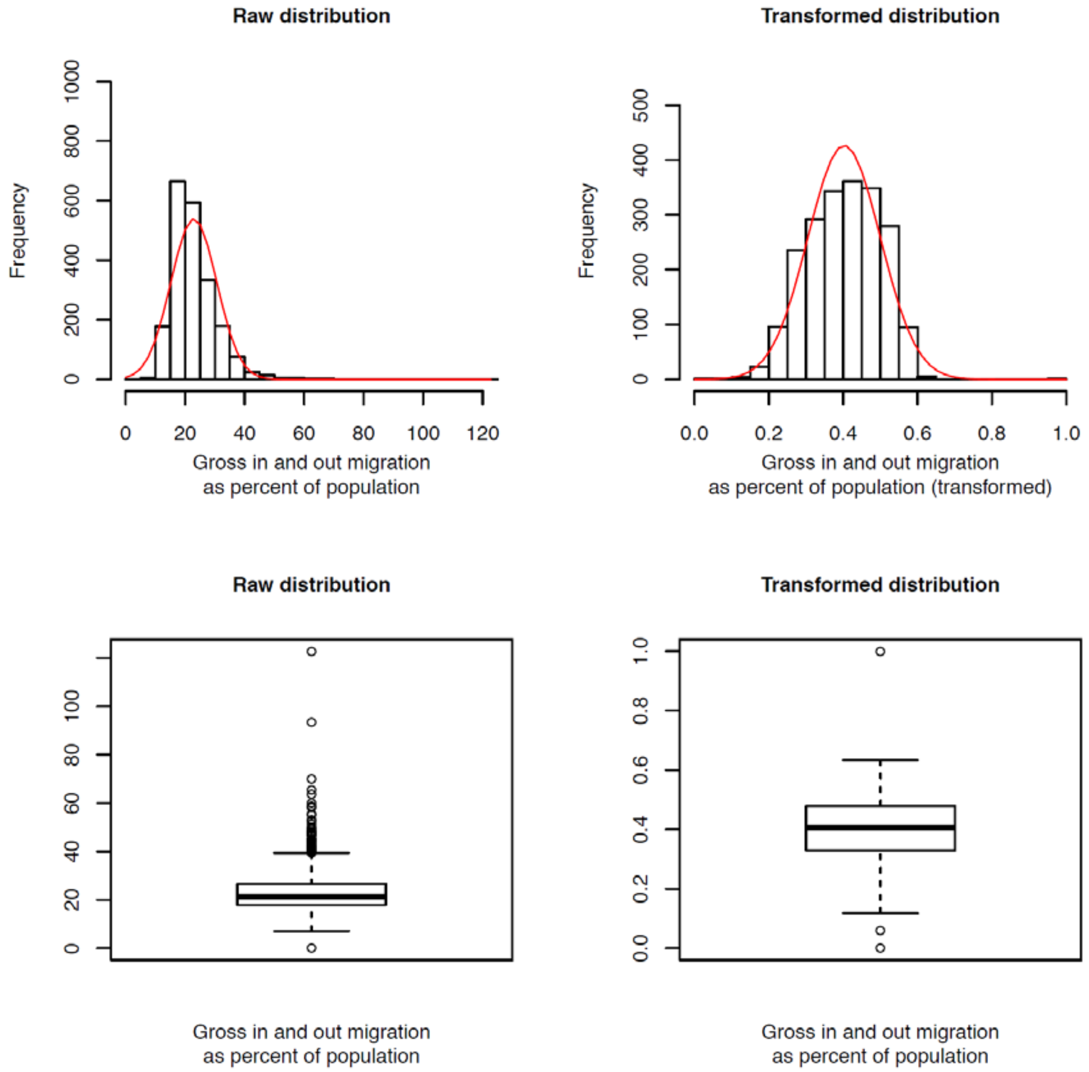
Kurtosis:
Coefficient: 0.21
Pre−transform kurtosis: 1.8
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 24
Post−transform outlier count: 3

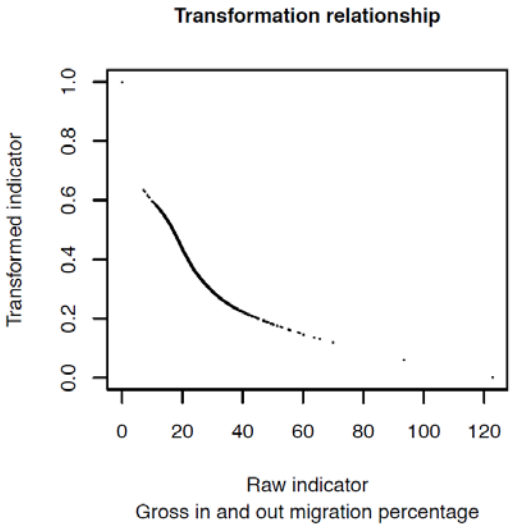
OUTLIER DETAILS

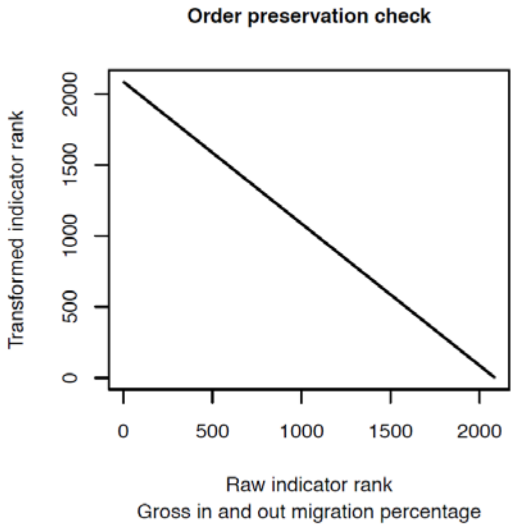
SA2	Value
Newman	56.13
South Hedland	56.15
Ashburton (WA)	56.33

Appendix 5M (cont.)



Appendix 5M (cont.)





TRANSFORMATION DETAILS

Reversed

Skewness:
Power transform, exponent: 0.28
Pre−transform skewness: 2.5
Post−transform skewness: −0.1

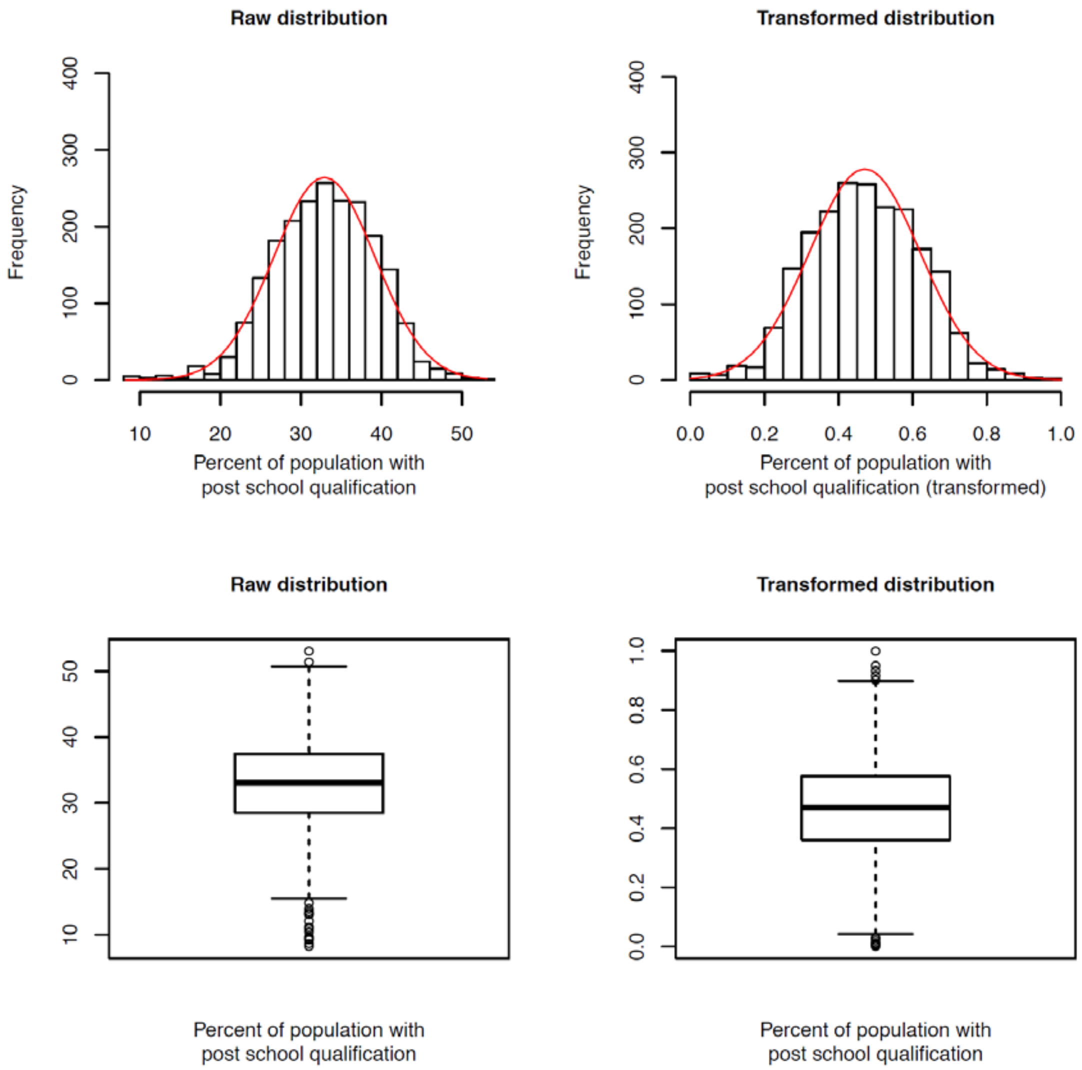
Kurtosis:
Coefficient: 0.24
Pre−transform kurtosis: 19.0
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 18
Post−transform outlier count: 3

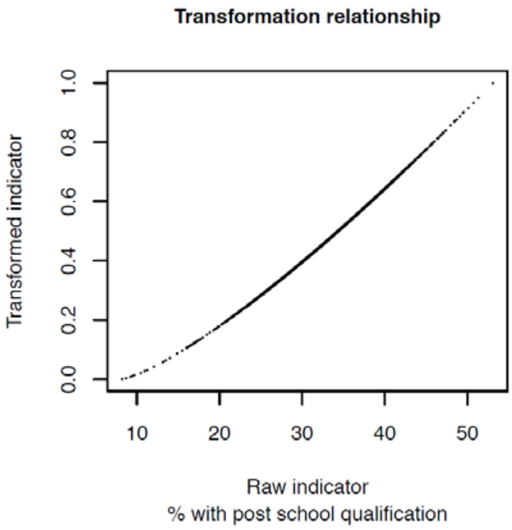
OUTLIER DETAILS

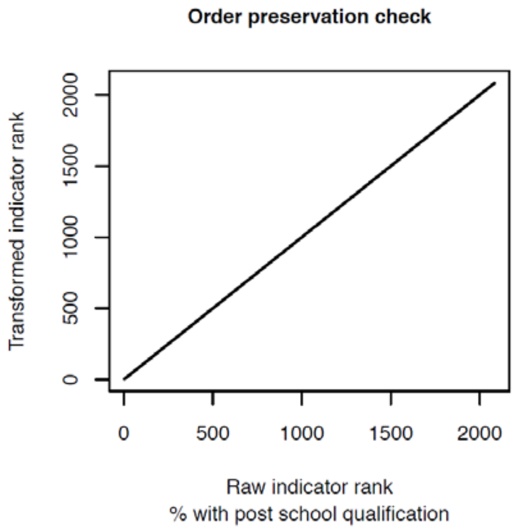
SA2	Value
Western	0.00
Bonner	93.37
Crace	122.78

Appendix 5M (cont.)



Appendix 5M (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 1.28
Pre−transform skewness: −0.3
Post−transform skewness: 0.0

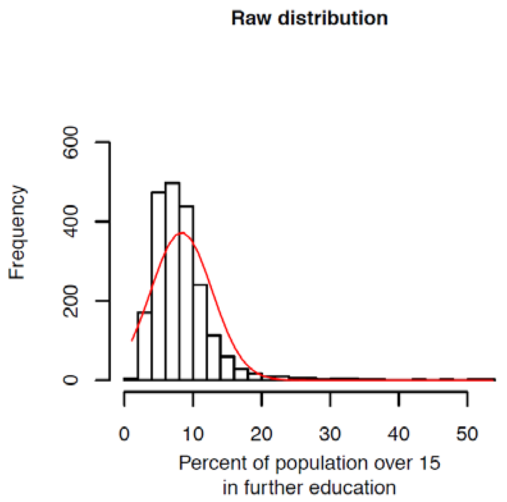
Kurtosis:
Coefficient: 0.00
Pre−transform kurtosis: 0.3
Post−transform kurtosis: −0.1

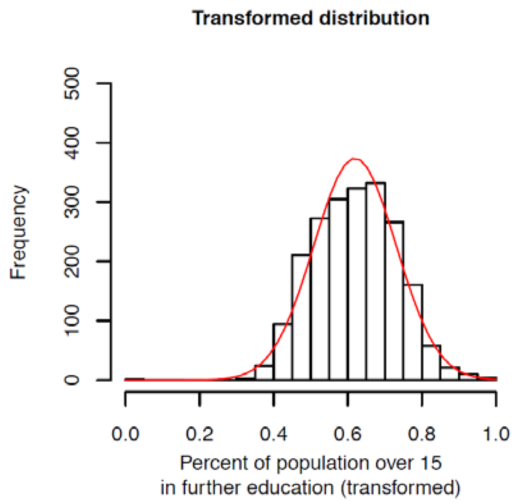
Outliers:
Pre−transform outlier count: 9
Post−transform outlier count: 1

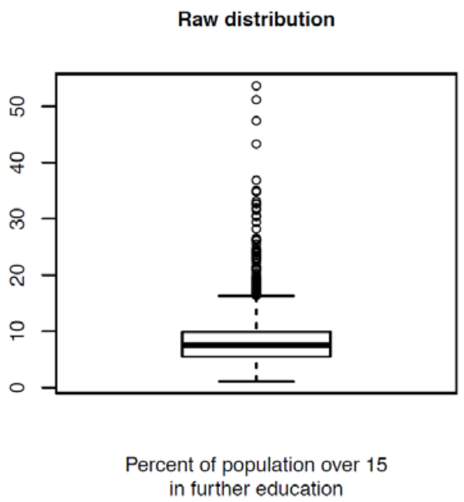
OUTLIER DETAILS

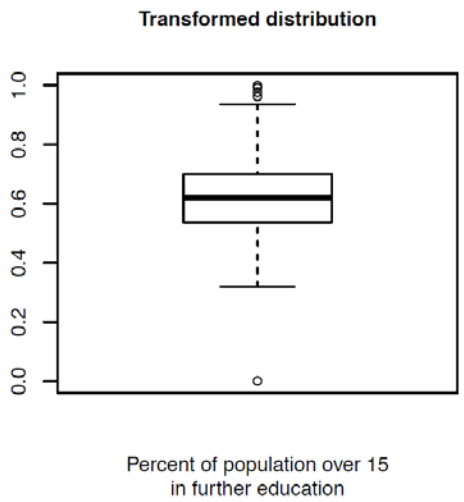
SA2	Value
Phillip	53.07

Appendix 5M (cont.)

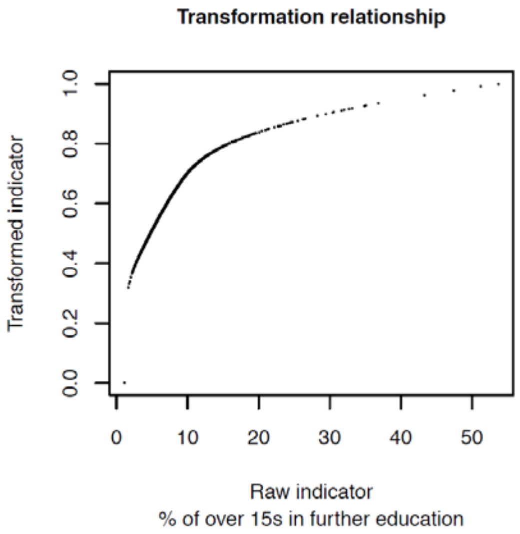


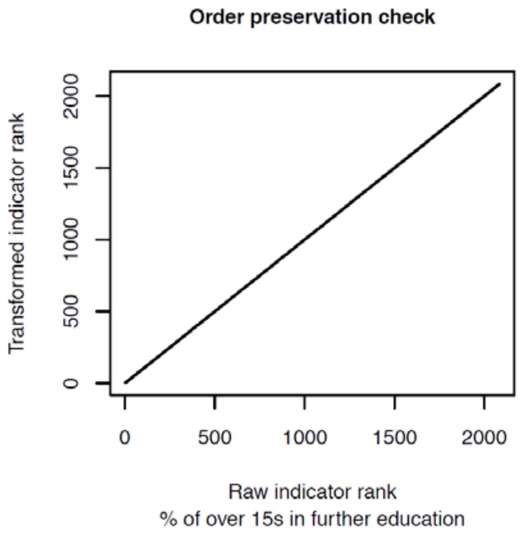






Appendix 5M (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.21
Pre–transform skewness: 3.1
Post–transform skewness: 0.0

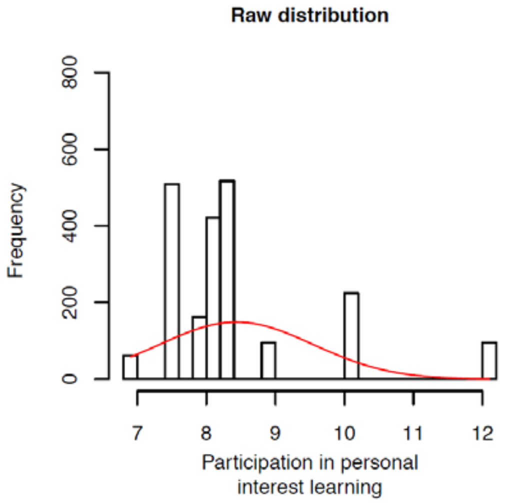
Kurtosis:
Coefficient: 0.22
Pre–transform kurtosis: 18.7
Post–transform kurtosis: 0.0

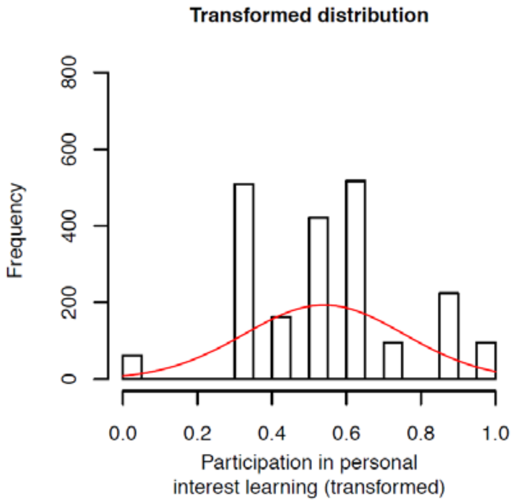
Outliers:
Pre–transform outlier count: 31
Post–transform outlier count: 3

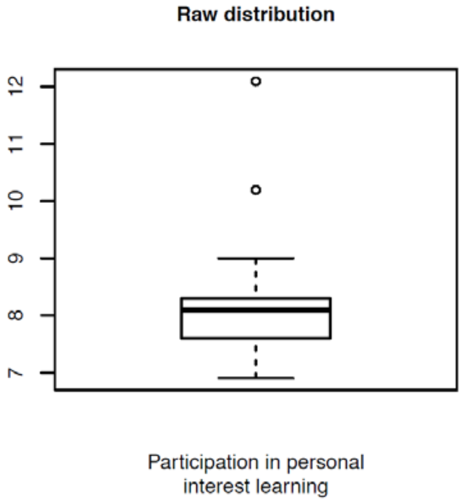
OUTLIER DETAILS

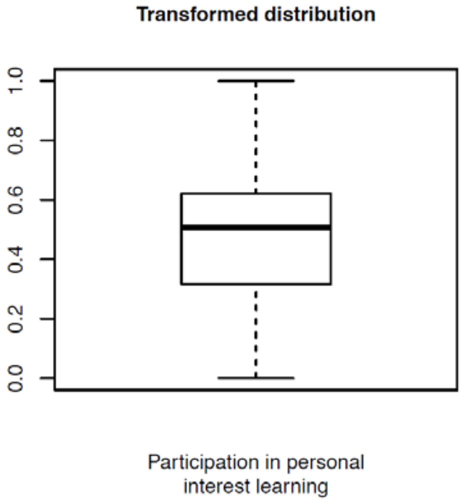
SA2	Value
Aurukun	1.10
Civic	51.21
St Lucia	53.70

Appendix 5M (cont.)

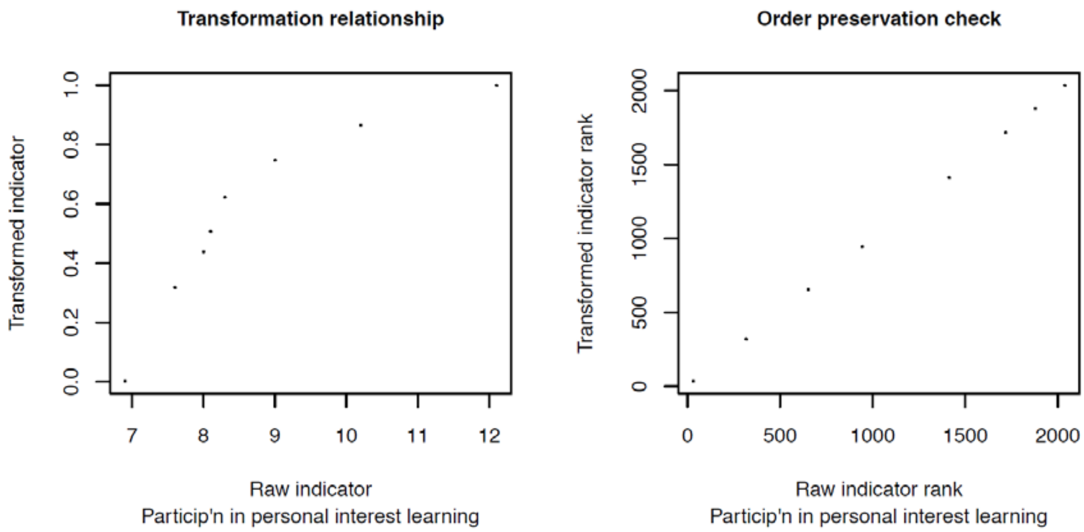








Appendix 5M (cont.)



TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.42
Pre–transform skewness: 1.9
Post–transform skewness: 0.1

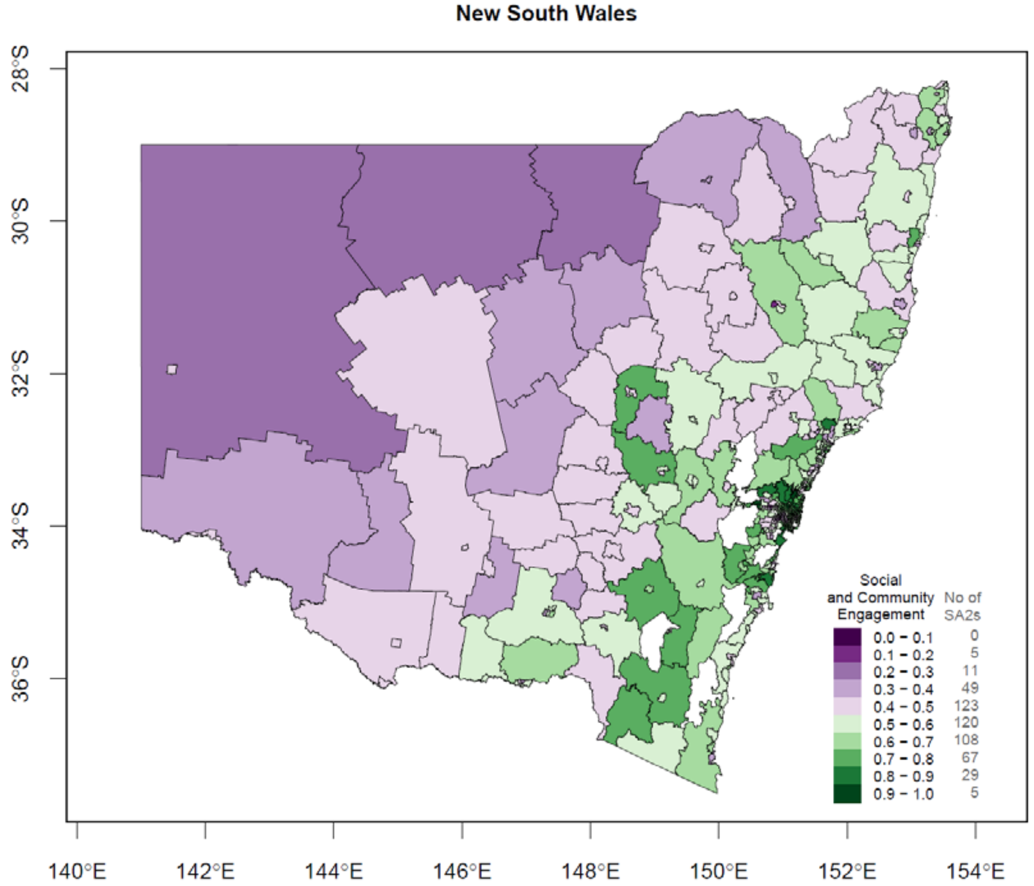
Kurtosis:
Coefficient: 0.66
Pre–transform kurtosis: 3.2
Post–transform kurtosis: –0.0

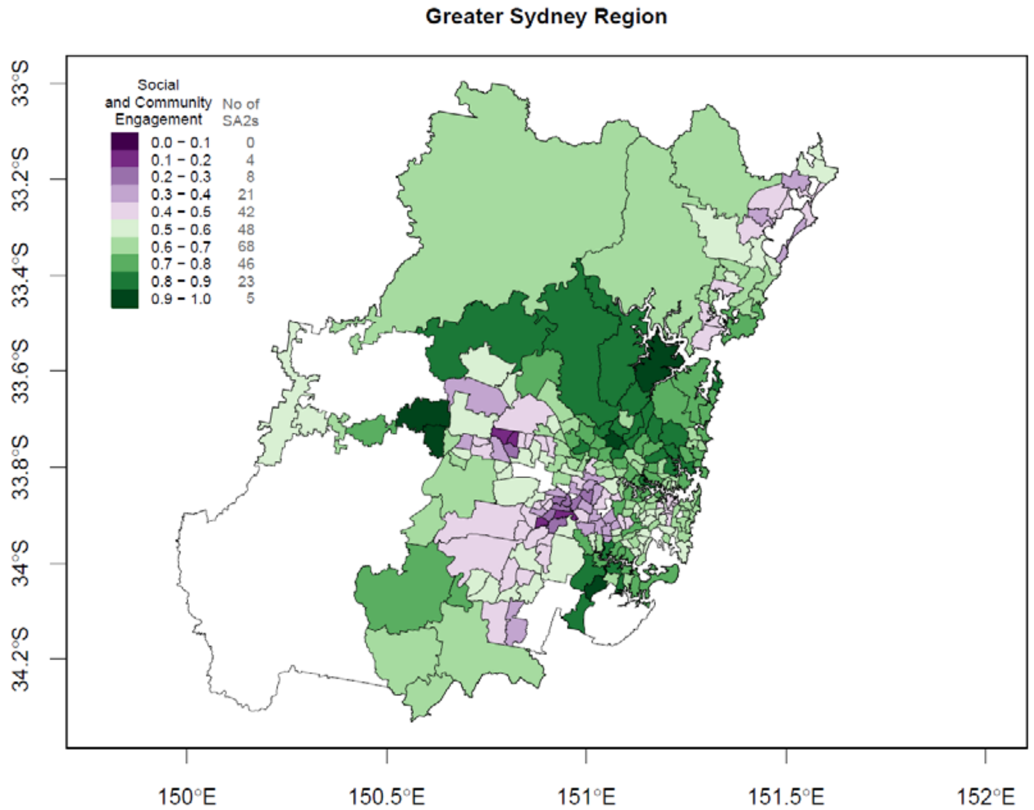
Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

APPENDIX 5N – MAPS: SOCIAL AND COMMUNITY ENGAGEMENT SUB-INDEX BY STATE/TERRITORY AND METROPOLITAN AREAS

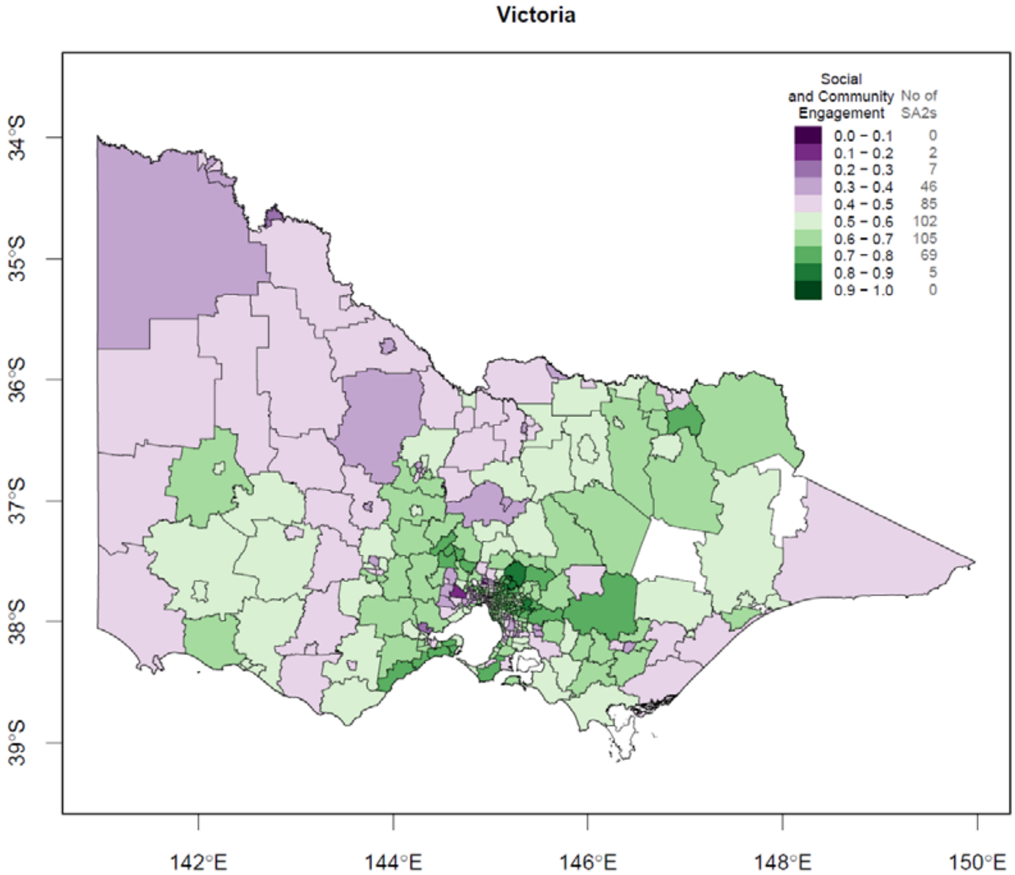
Appendix 5N maps the social and community engagement sub-index at the resolution of individual States and Territories, and major metropolitan areas.

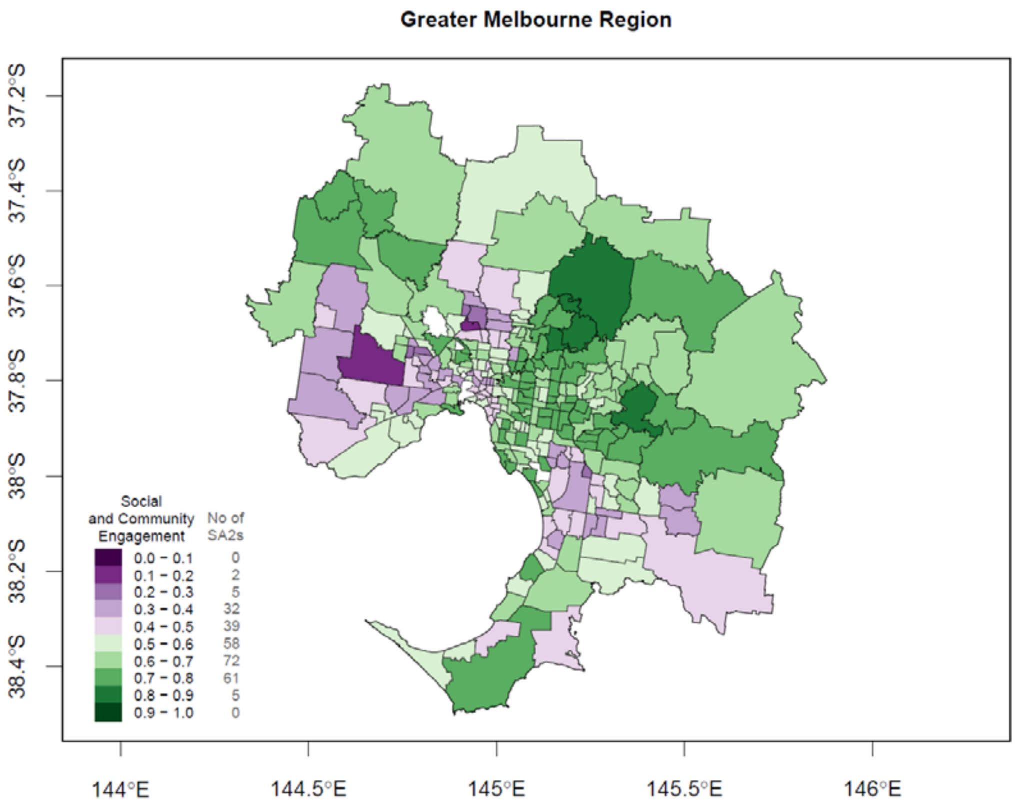
Appendix 5N


New South Wales
Social and Community Engagement
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 5
0.2 – 0.3 11
0.3 – 0.4 49
0.4 – 0.5 123
0.5 – 0.6 120
0.6 – 0.7 108
0.7 – 0.8 67
0.8 – 0.9 29
0.9 – 1.0 5
28°S
30°S
32°S
34°S
36°S
140°E
142°E
144°E
146°E
148°E
150°E
152°E
154°E

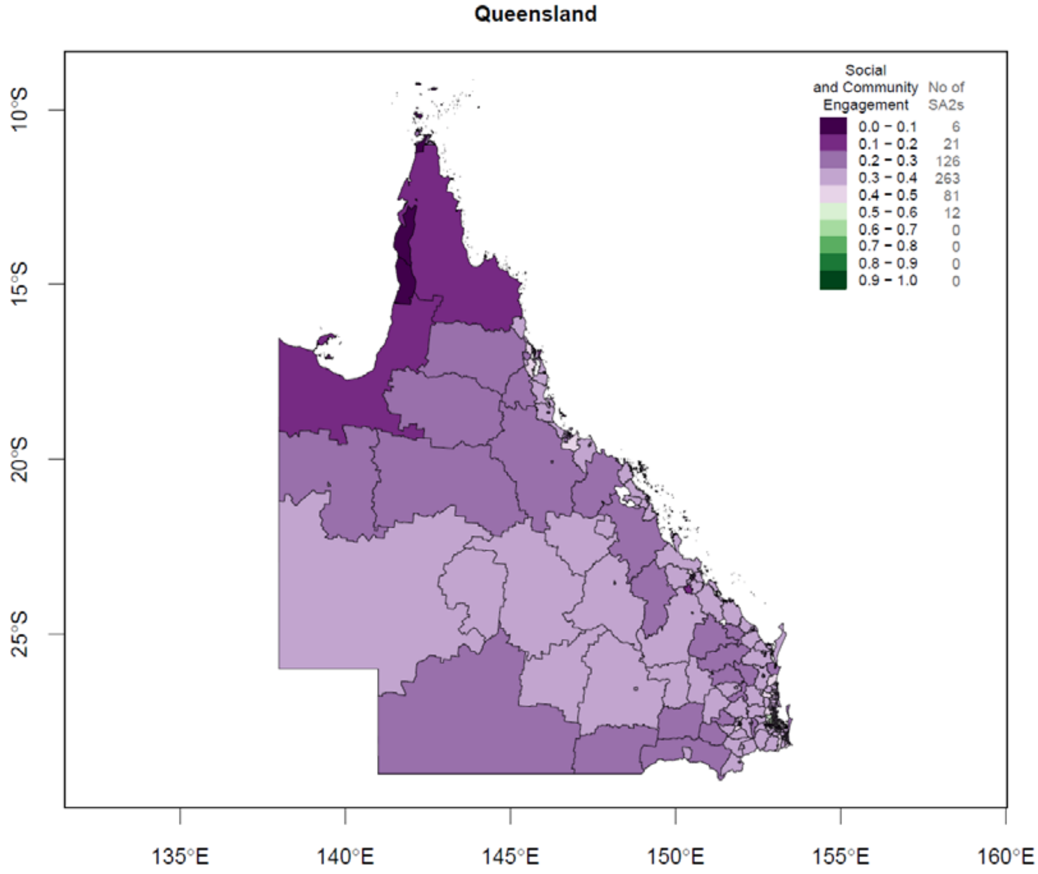

Greater Sydney Region
Social and Community Engagement
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 4
0.2 – 0.3 8
0.3 – 0.4 21
0.4 – 0.5 42
0.5 – 0.6 48
0.6 – 0.7 68
0.7 – 0.8 46
0.8 – 0.9 23
0.9 – 1.0 5
33°S
33.2°S
33.4°S
33.6°S
33.8°S
34°S
34.2°S
150°E
150.5°E
151°E
151.5°E
152°E

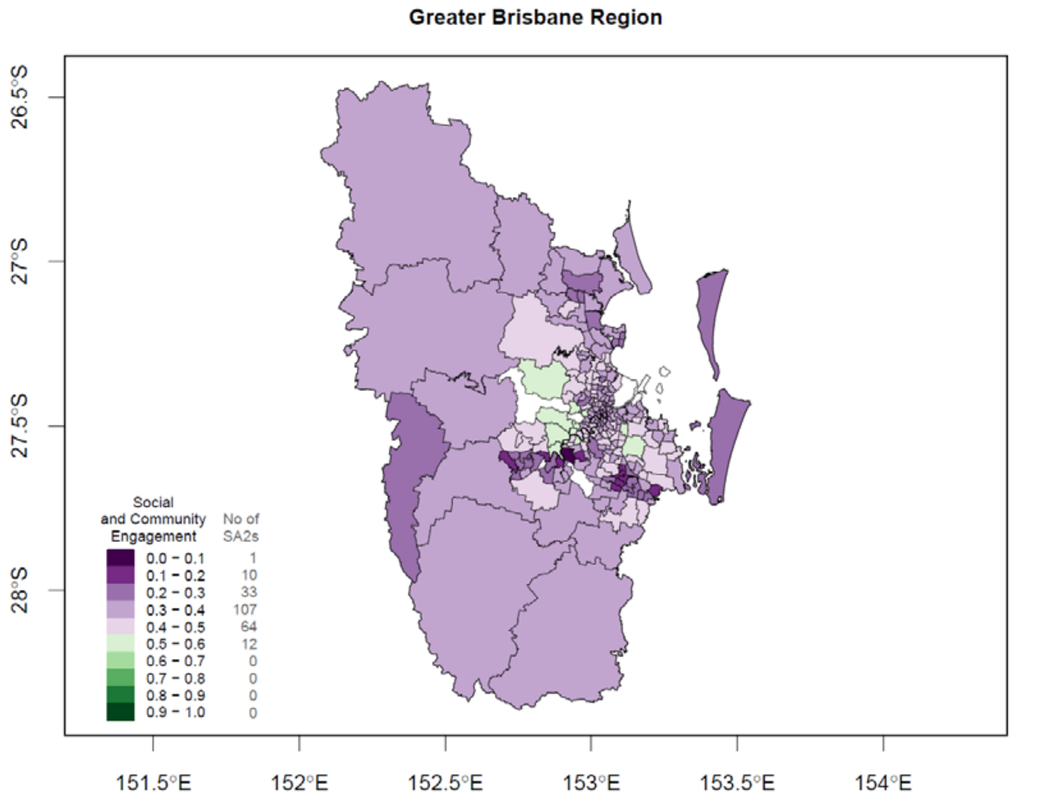
Appendix 5N (cont.)



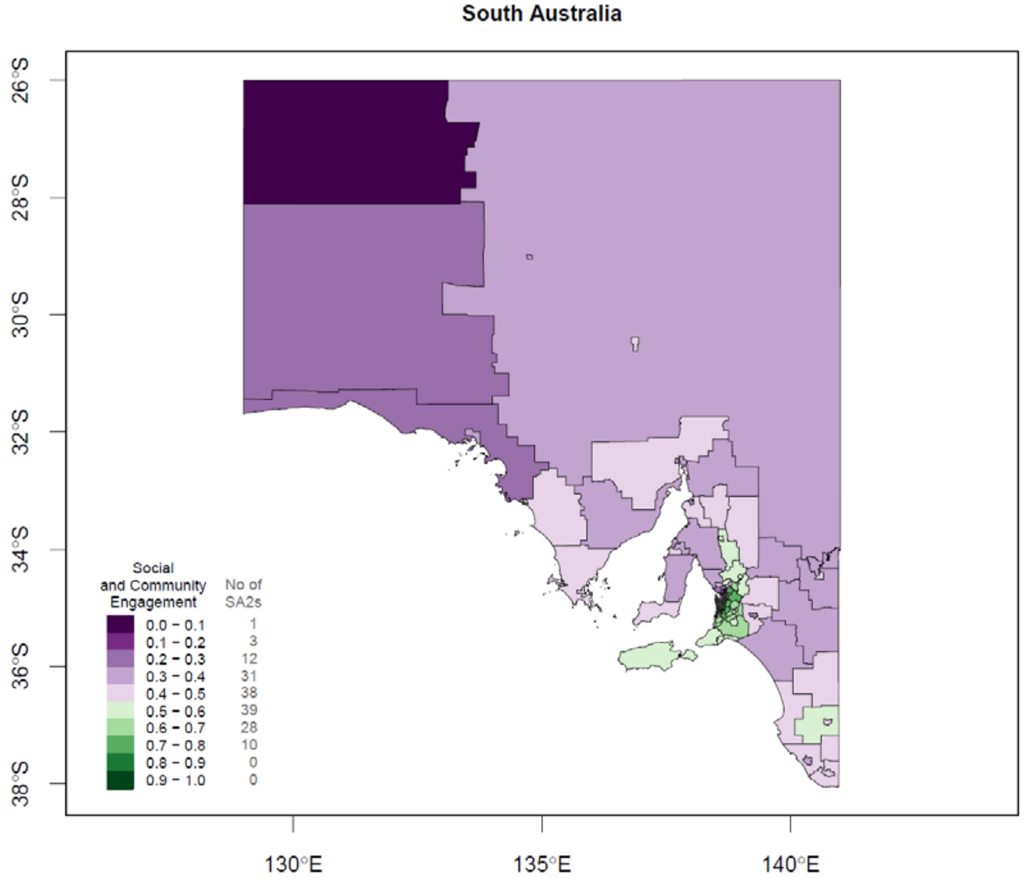


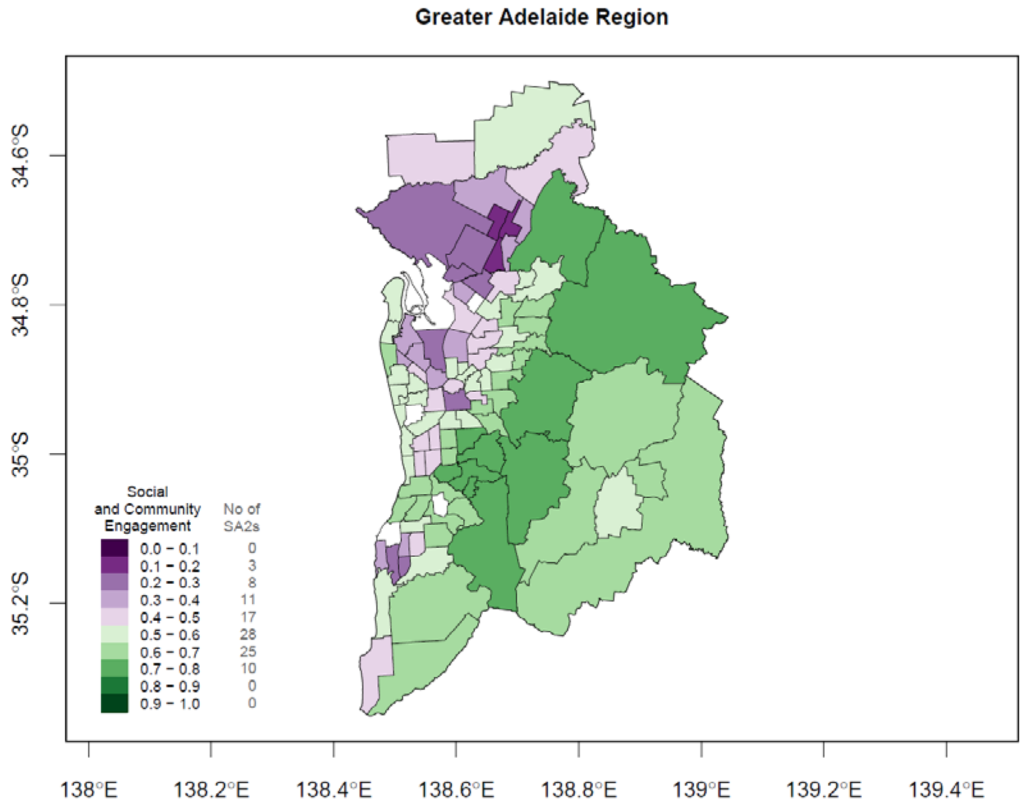
Appendix 5N (cont.)



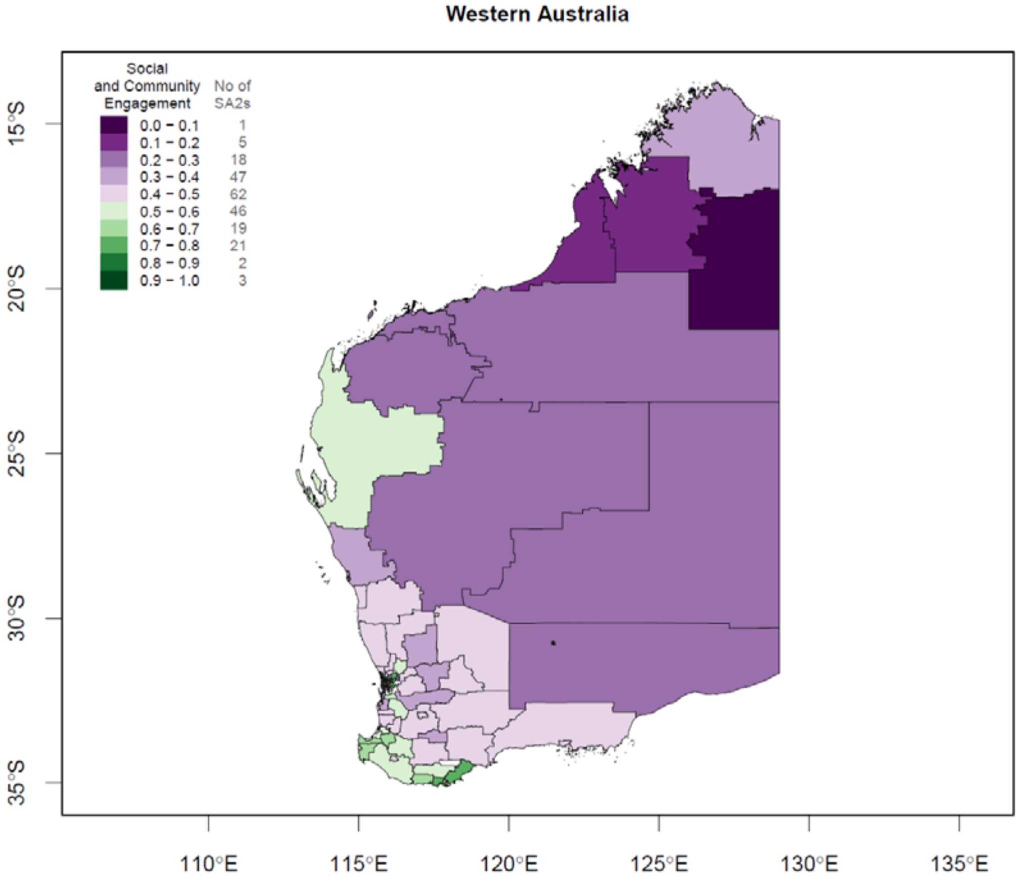


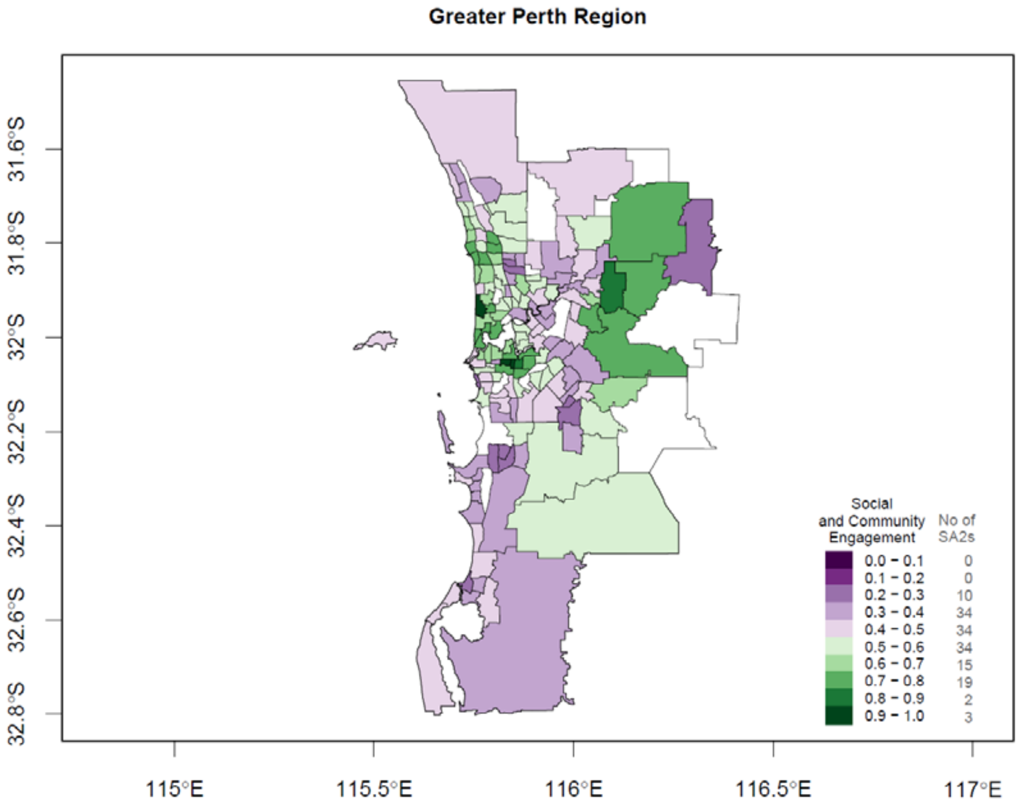
Appendix 5N (cont.)





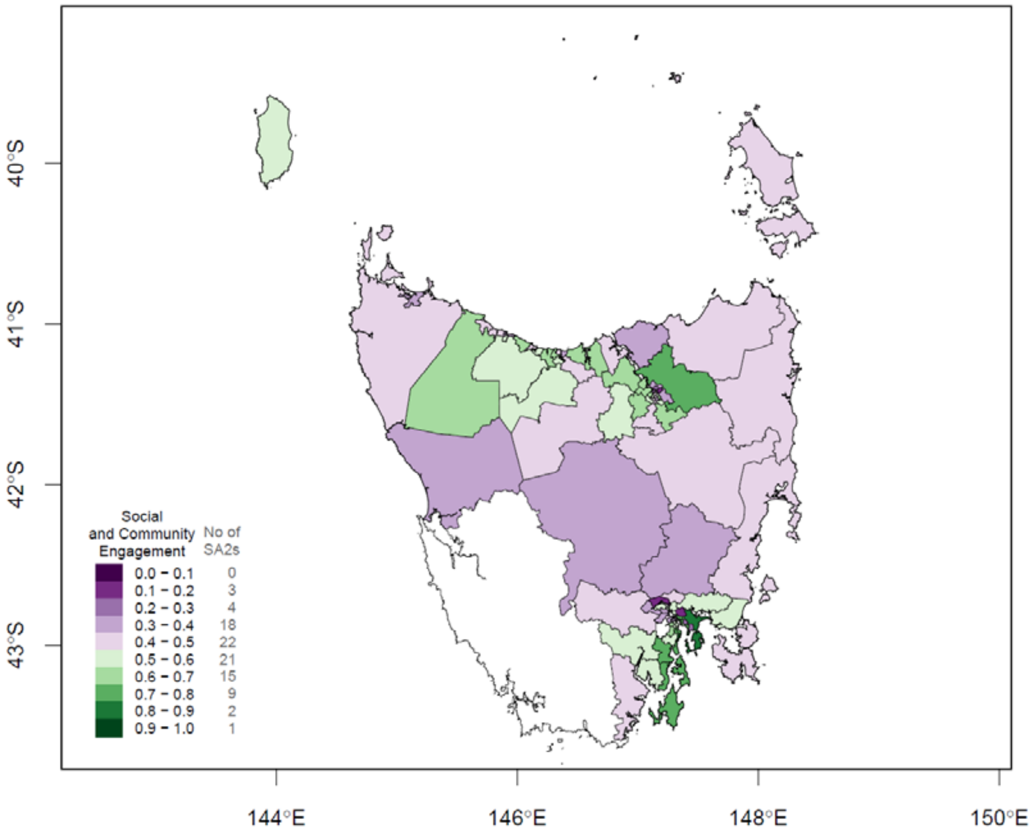
Appendix 5N (cont.)



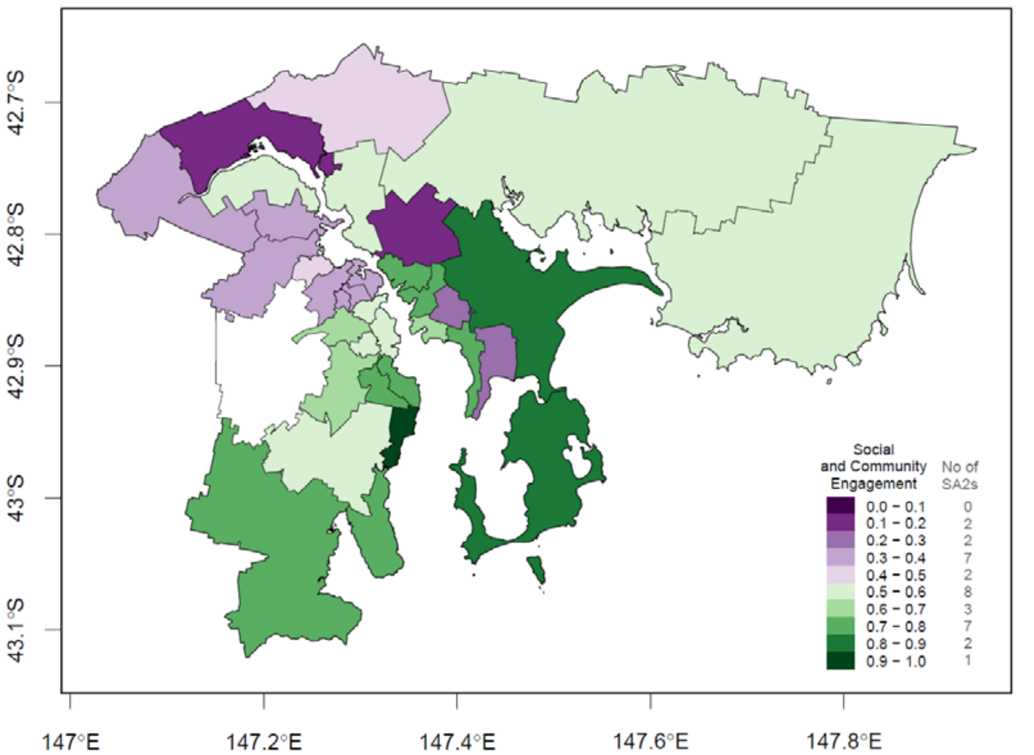


Appendix 5N (cont.)

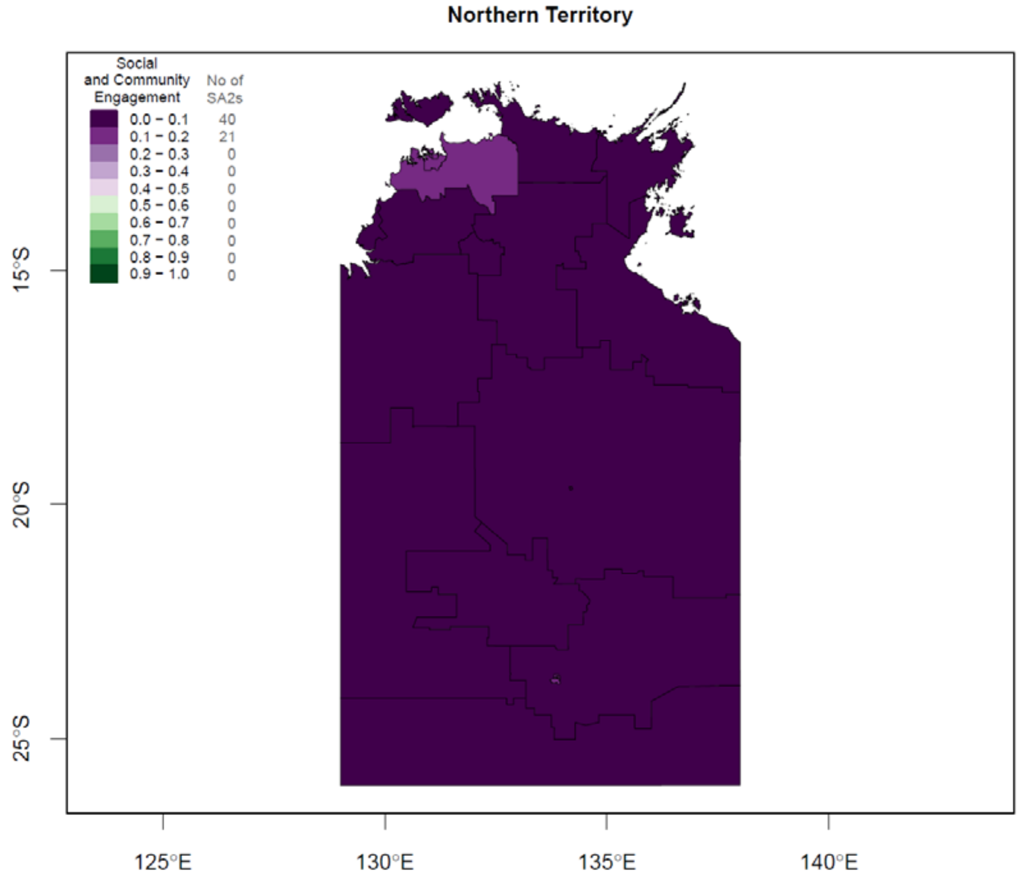
Tasmania

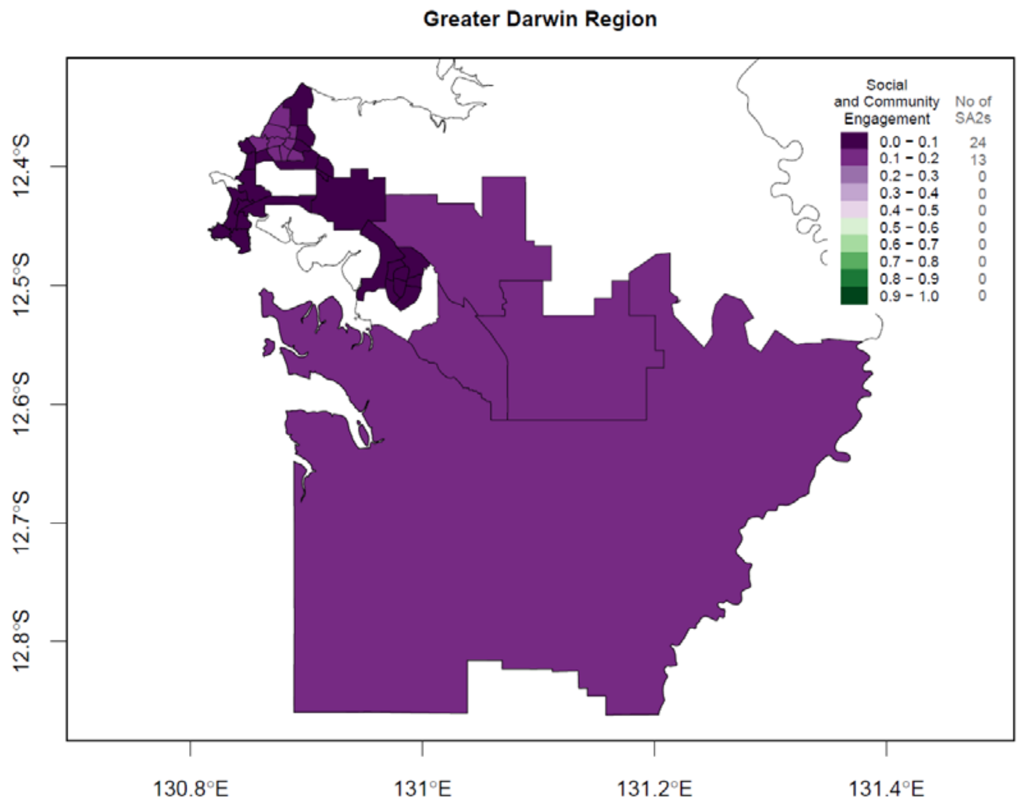


Greater Hobart Region

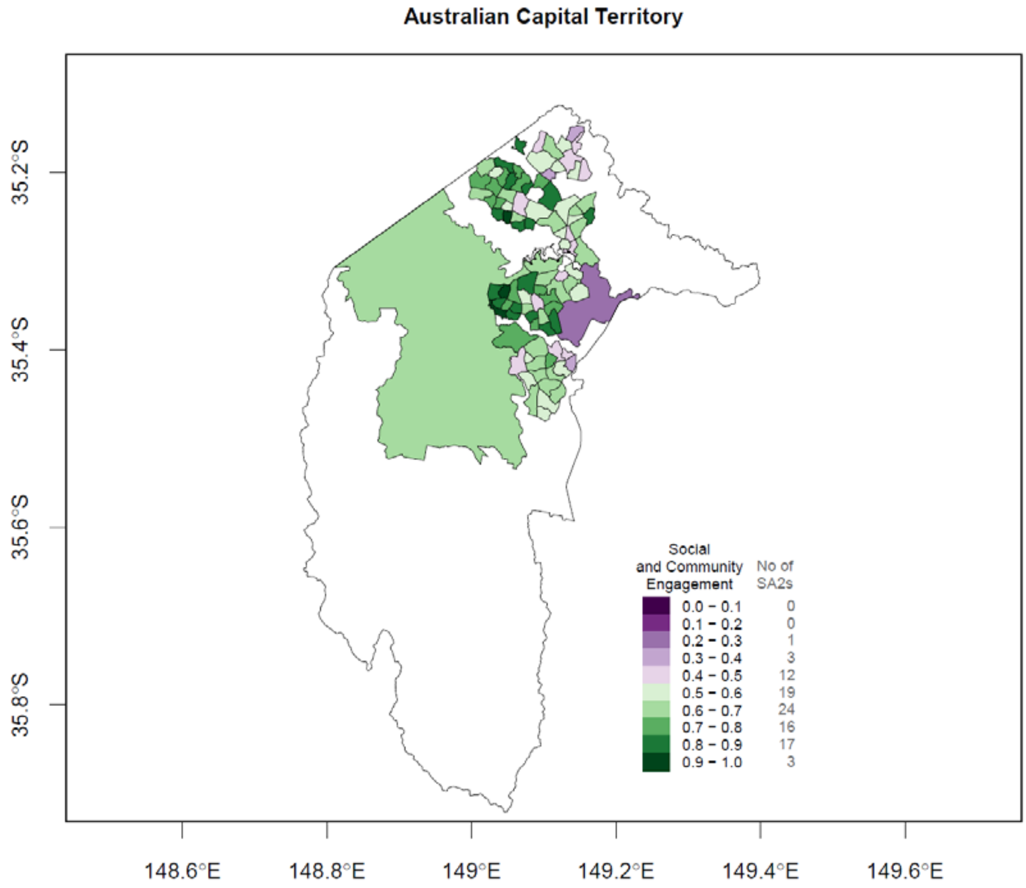


Appendix 5N (cont.)





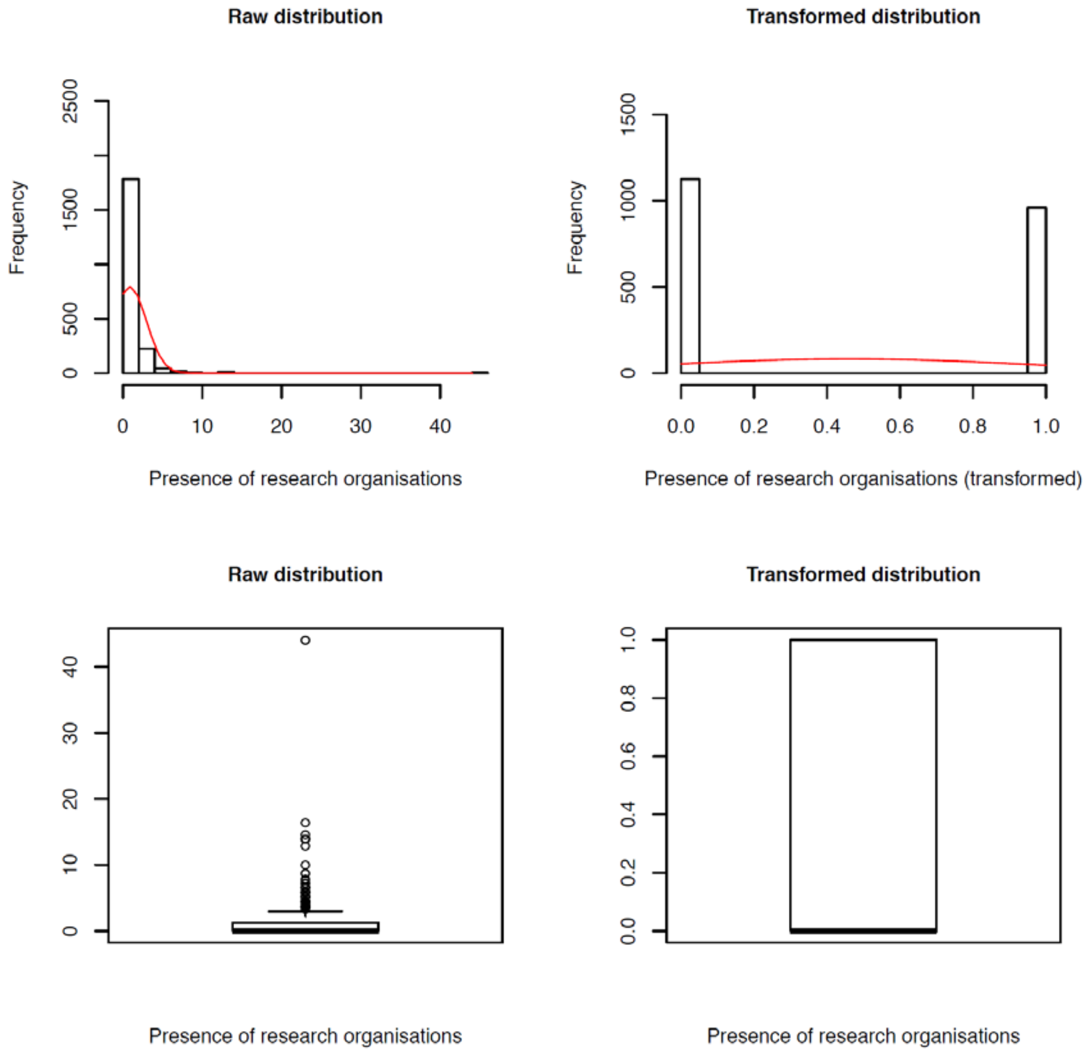
Appendix 5N (cont.)



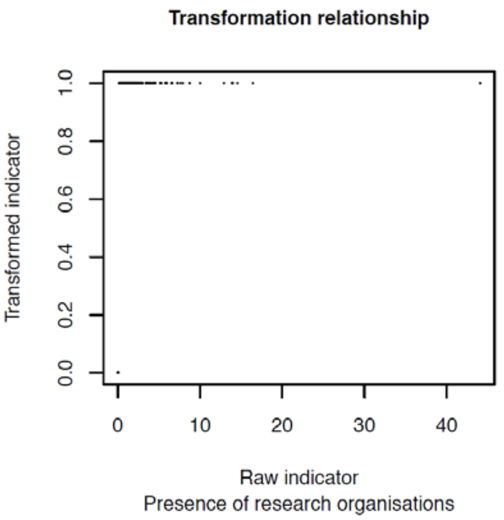
APPENDIX 5O – GOVERNANCE AND LEADERSHIP TRANSFORMATION DETAILS

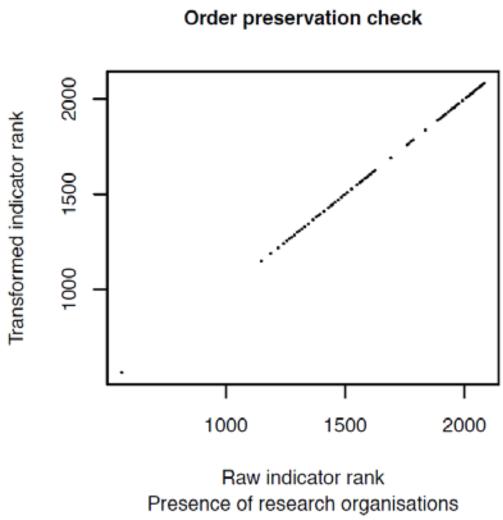
Appendix 5O shows the raw and transformed indicators used to compute the governance and leadership sub-index.

Appendix 5O


Raw distribution
Transformed distribution
Frequency
0
500
1500
2500
0
10
20
30
40
Presence of research organisations
Frequency
0
500
1000
1500
0.0
0.2
0.4
0.6
0.8
1.0
Presence of research organisations (transformed)
Raw distribution
Transformed distribution
0
10
20
30
40
Presence of research organisations
0.0
0.2
0.4
0.6
0.8
1.0
Presence of research organisations

Appendix 5O (cont.)





TRANSFORMATION DETAILS

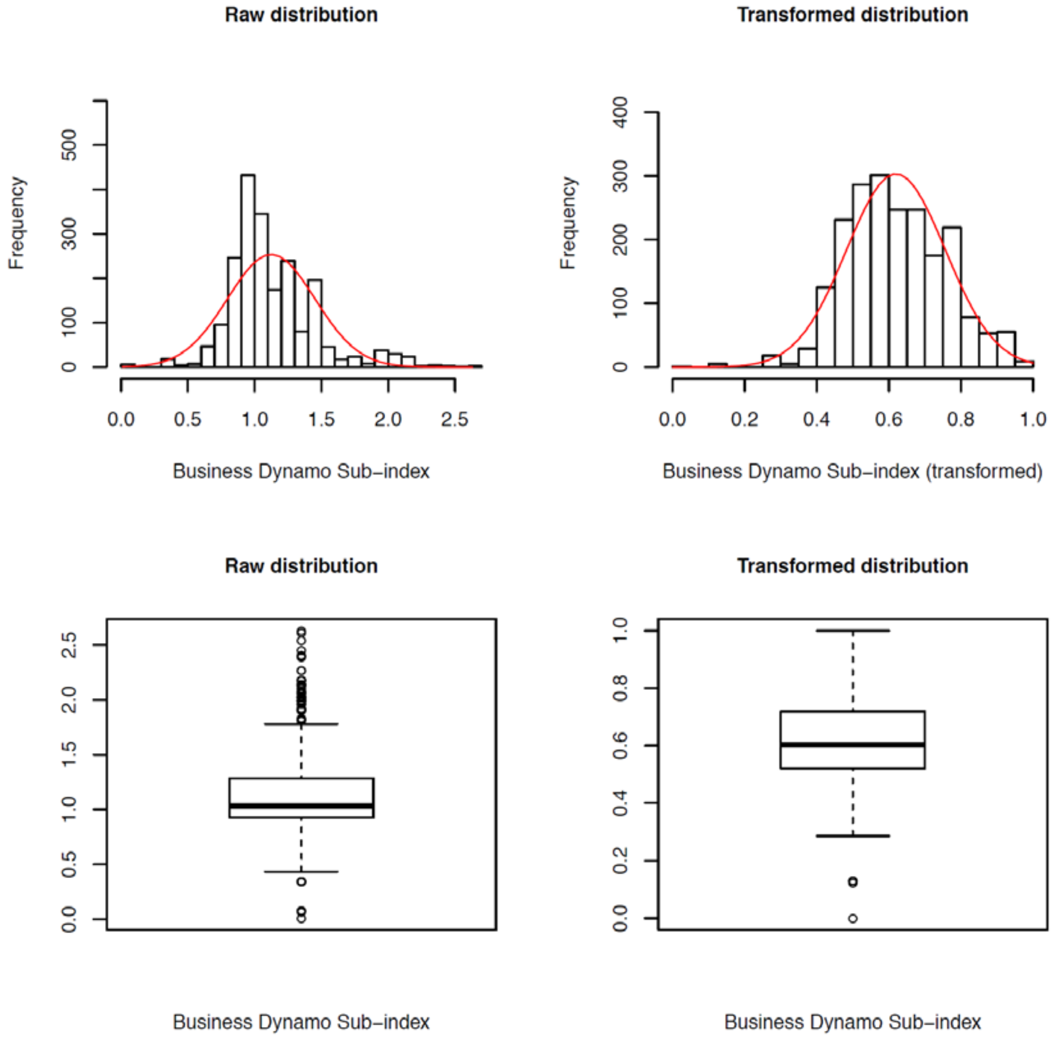
Unreversed

Skewness:
Power transform, exponent: 0.00
Pre–transform skewness: 10.4
Post–transform skewness: 0.2

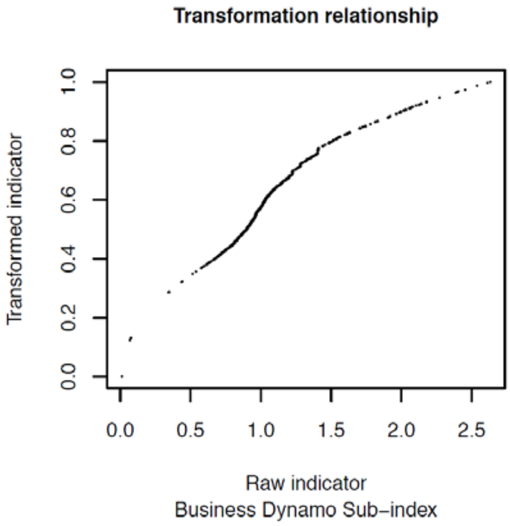
Kurtosis:
Coefficient: 0.00
Pre–transform kurtosis: 183.0
Post–transform kurtosis: –2.0

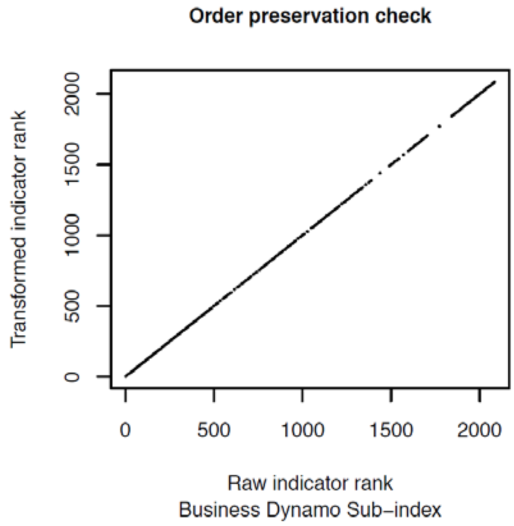
Outliers:
Pre–transform outlier count: 18
Post–transform outlier count: 0

Appendix 5O (cont.)



Appendix 5O (cont.)





TRANSFORMATION DETAILS

Unreversed

Skewness:
Power transform, exponent: 0.48
Pre−transform skewness: 1.1
Post−transform skewness: 0.1

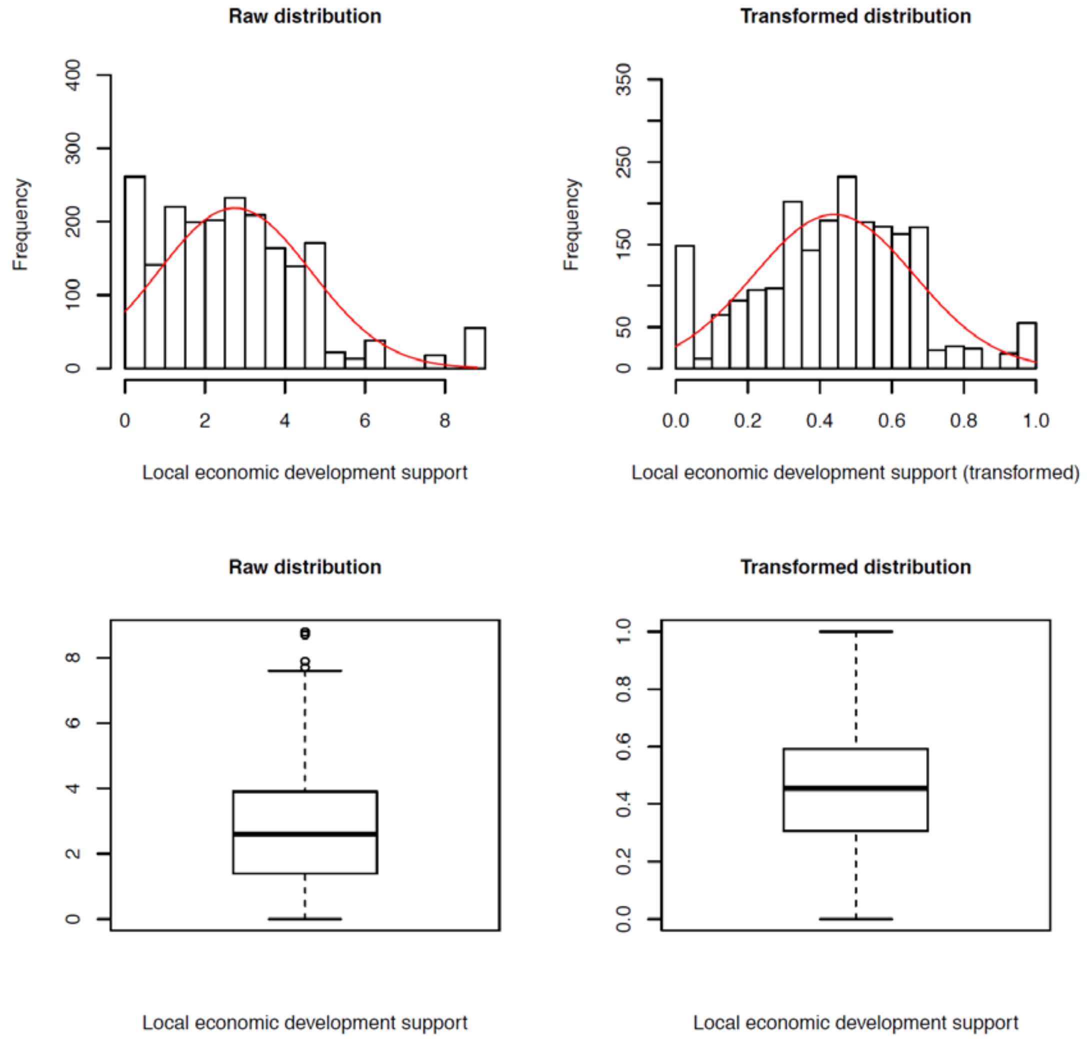
Kurtosis:
Coefficient: 0.32
Pre−transform kurtosis: 2.3
Post−transform kurtosis: 0.0

Outliers:
Pre−transform outlier count: 12
Post−transform outlier count: 6

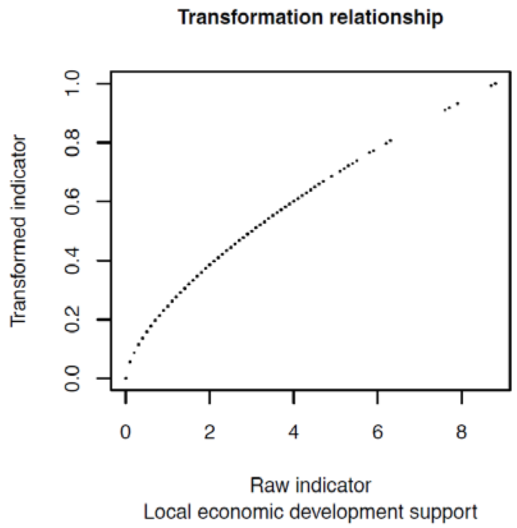
OUTLIER DETAILS

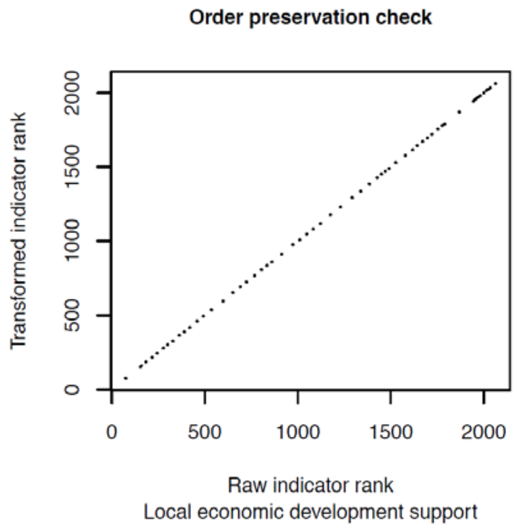
SA2	Value
APY Lands	0.01
Leinster – Leonora	0.07
Outback	0.08
Petermann – Simpson	0.08
Sandover – Plenty	0.08
Tanami	0.08

Appendix 5O (cont.)



Appendix 5O (cont.)





TRANSFORMATION DETAILS

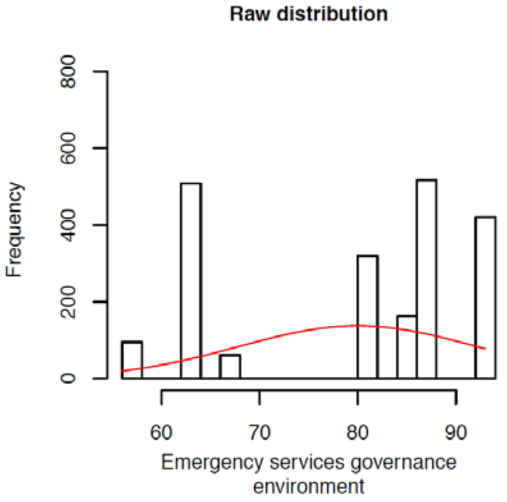
Unreversed

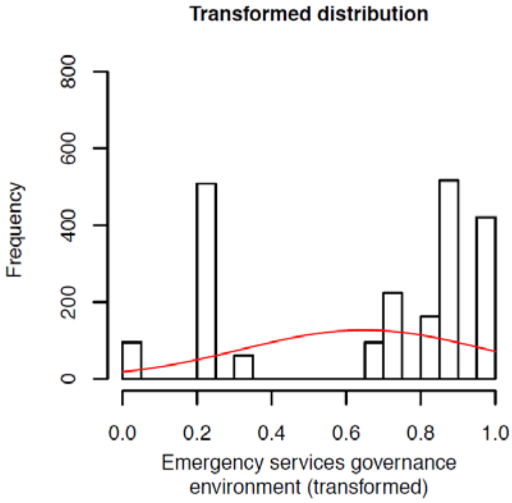
Skewness:
Power transform, exponent: 0.64
Pre–transform skewness: 0.9
Post–transform skewness: –0.0

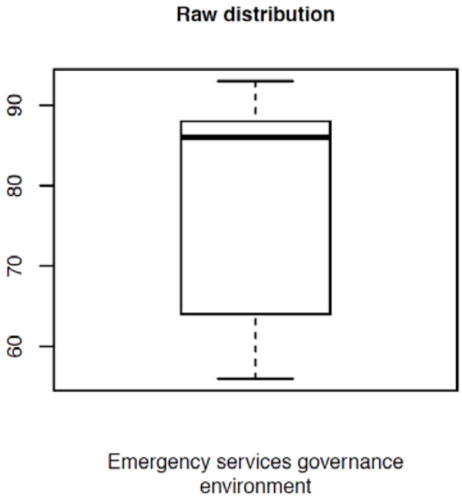
Kurtosis:
Coefficient: 0.00
Pre–transform kurtosis: 1.1
Post–transform kurtosis: –0.0

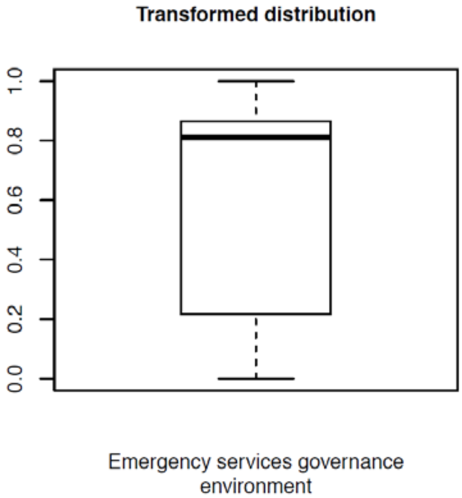
Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

Appendix 5O (cont.)

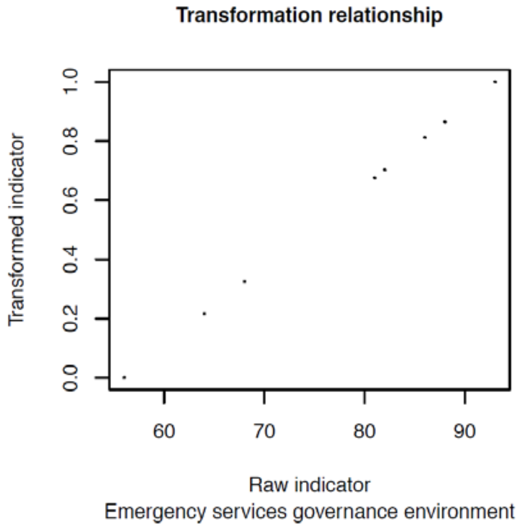


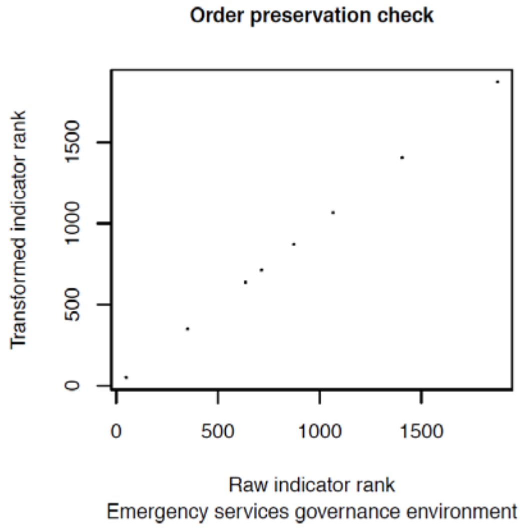






Appendix 5O (cont.)





TRANSFORMATION DETAILS

Unreversed

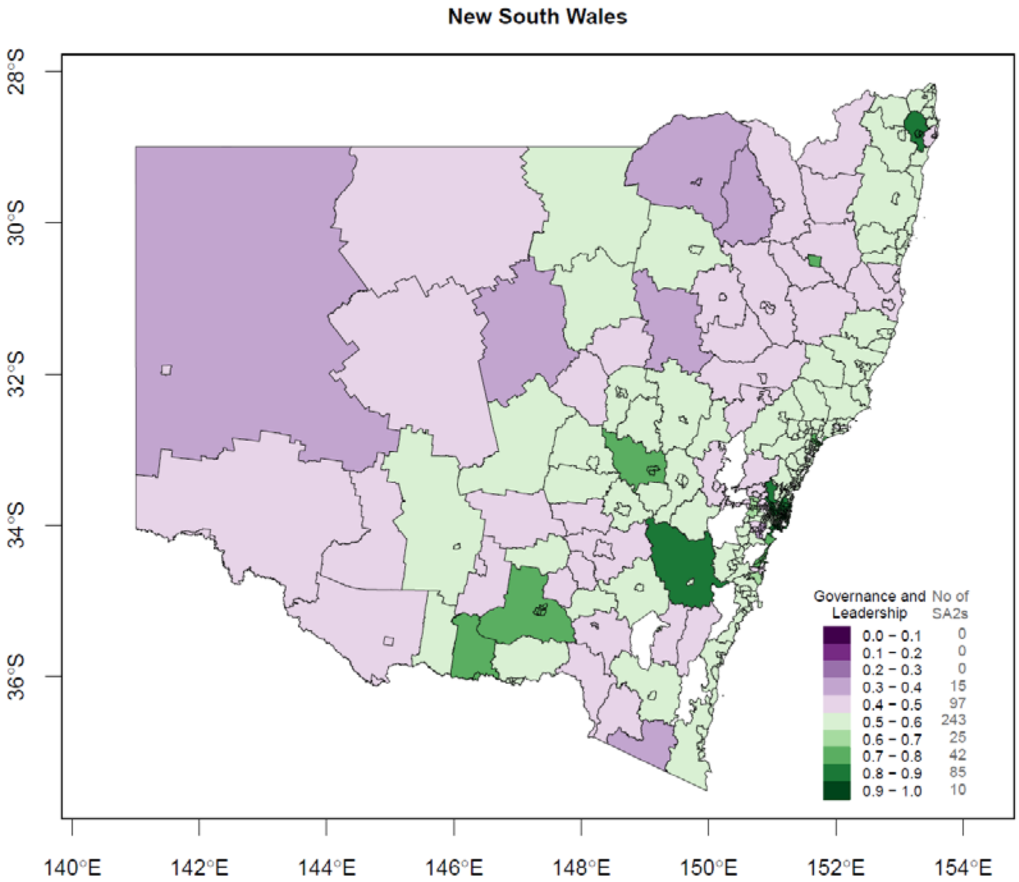
Skewness:
No transform
Pre–transform skewness: –0.6
Post–transform skewness: –0.6

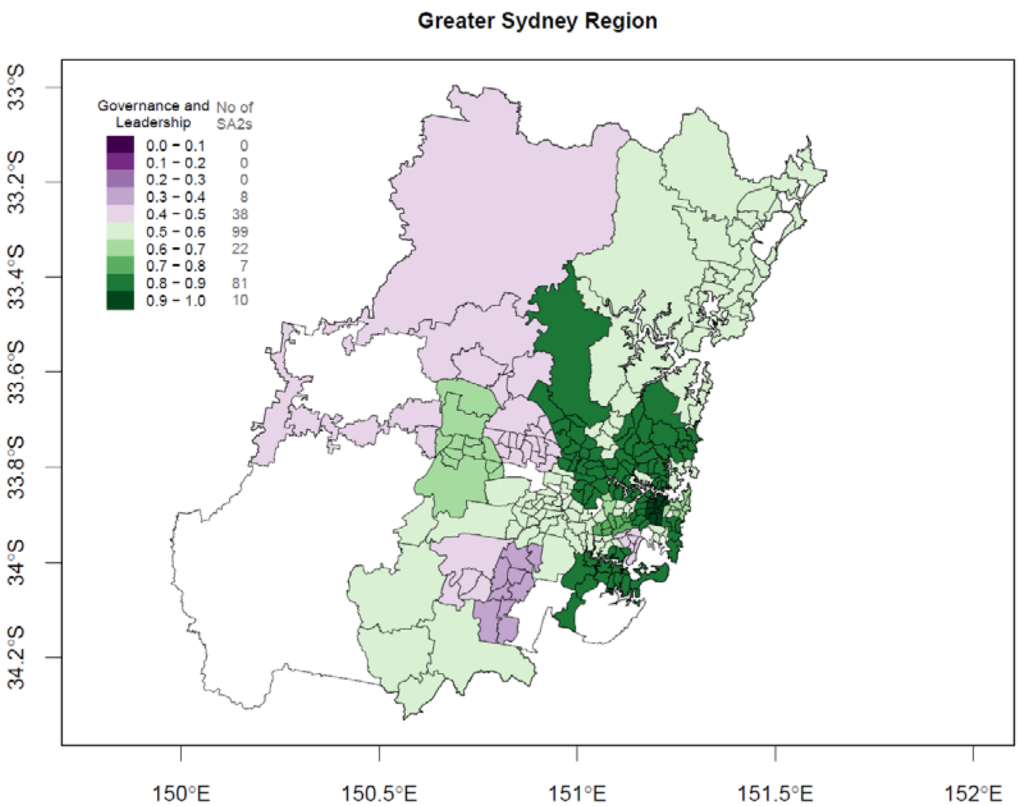
Kurtosis:
No transform
Pre–transform kurtosis: –1.2
Post–transform kurtosis: –1.2

Outliers:
Pre–transform outlier count: 0
Post–transform outlier count: 0

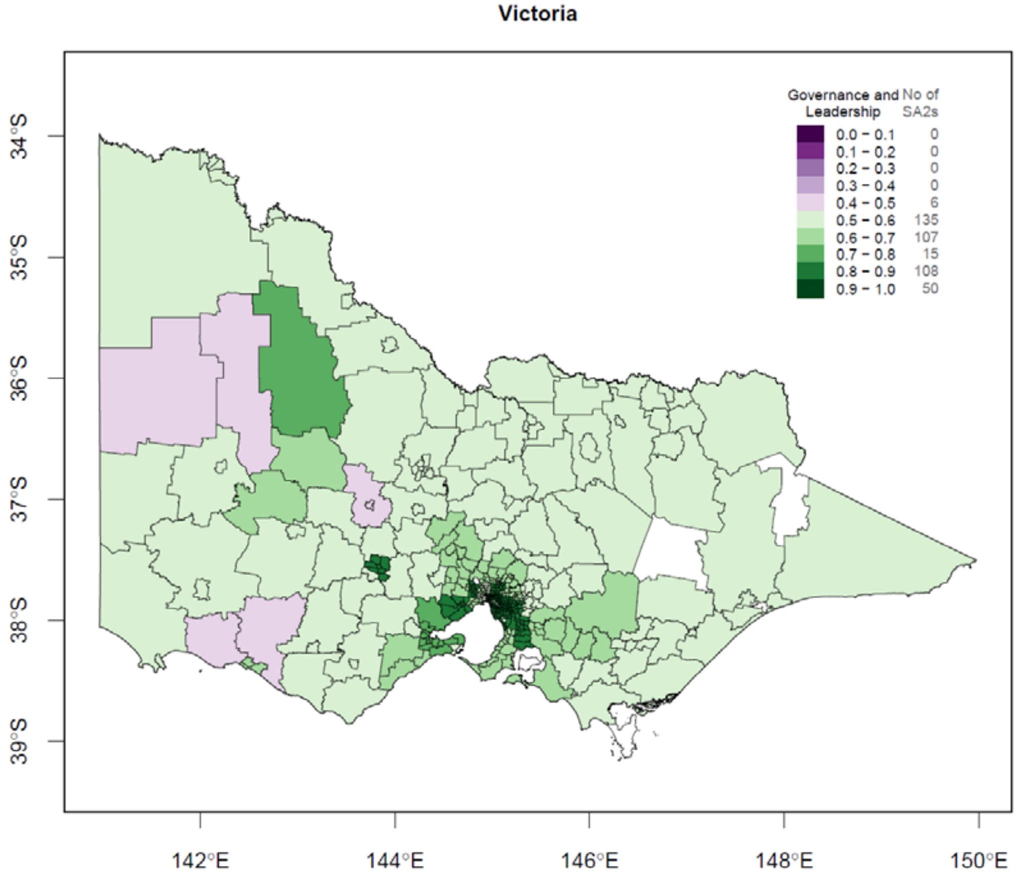
APPENDIX 5P – MAPS: GOVERNANCE AND LEADERSHIP SUB-INDEX BY STATE/TERRITORY AND METROPOLITAN AREAS

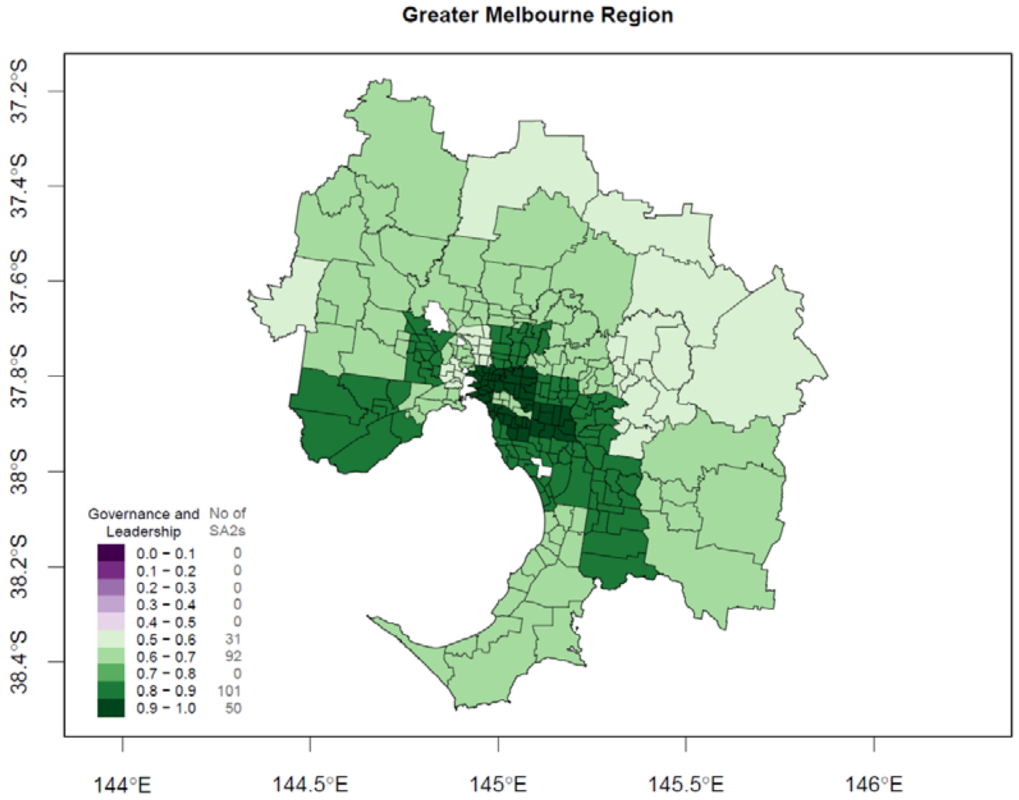
Appendix 5P maps the governance and leadership sub-index at the resolution of individual States and Territories, and major metropolitan areas.


New South Wales
28°S
30°S
32°S
34°S
36°S
140°E
142°E
144°E
146°E
148°E
150°E
152°E
154°E
Governance and Leadership
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 0
0.2 – 0.3 0
0.3 – 0.4 15
0.4 – 0.5 97
0.5 – 0.6 243
0.6 – 0.7 25
0.7 – 0.8 42
0.8 – 0.9 85
0.9 – 1.0 10

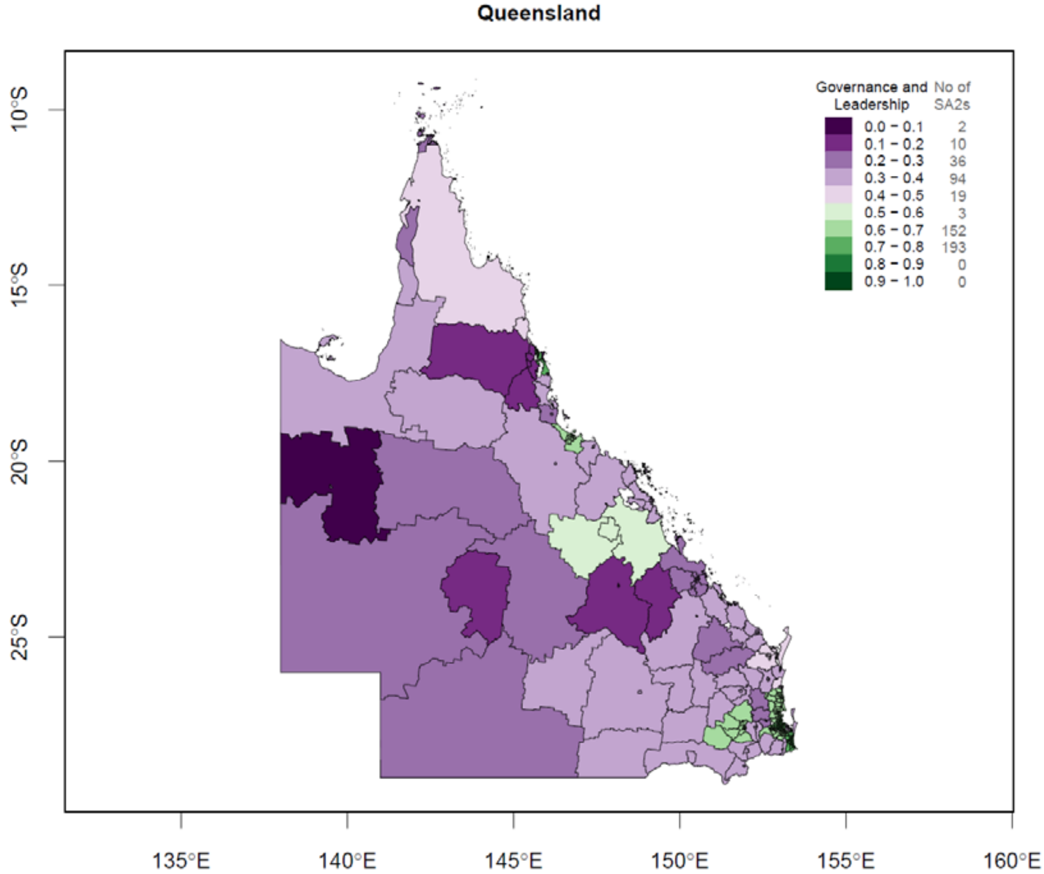

Greater Sydney Region
33°S
33.2°S
33.4°S
33.6°S
33.8°S
34°S
34.2°S
150°E
150.5°E
151°E
151.5°E
152°E
Governance and Leadership
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 0
0.2 – 0.3 0
0.3 – 0.4 8
0.4 – 0.5 38
0.5 – 0.6 99
0.6 – 0.7 22
0.7 – 0.8 7
0.8 – 0.9 81
0.9 – 1.0 10

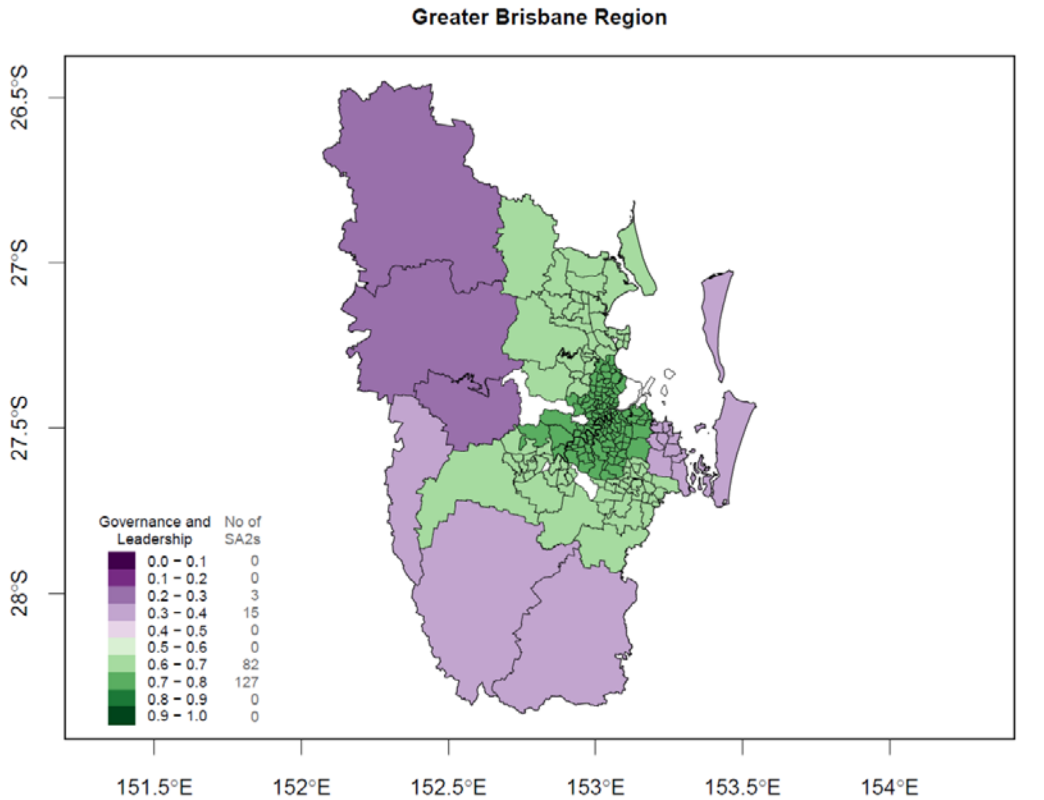
Appendix 5P


Victoria
Governance and Leadership
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 0
0.2 – 0.3 0
0.3 – 0.4 0
0.4 – 0.5 6
0.5 – 0.6 135
0.6 – 0.7 107
0.7 – 0.8 15
0.8 – 0.9 108
0.9 – 1.0 50
34°S
35°S
36°S
37°S
38°S
39°S
142°E
144°E
146°E
148°E
150°E

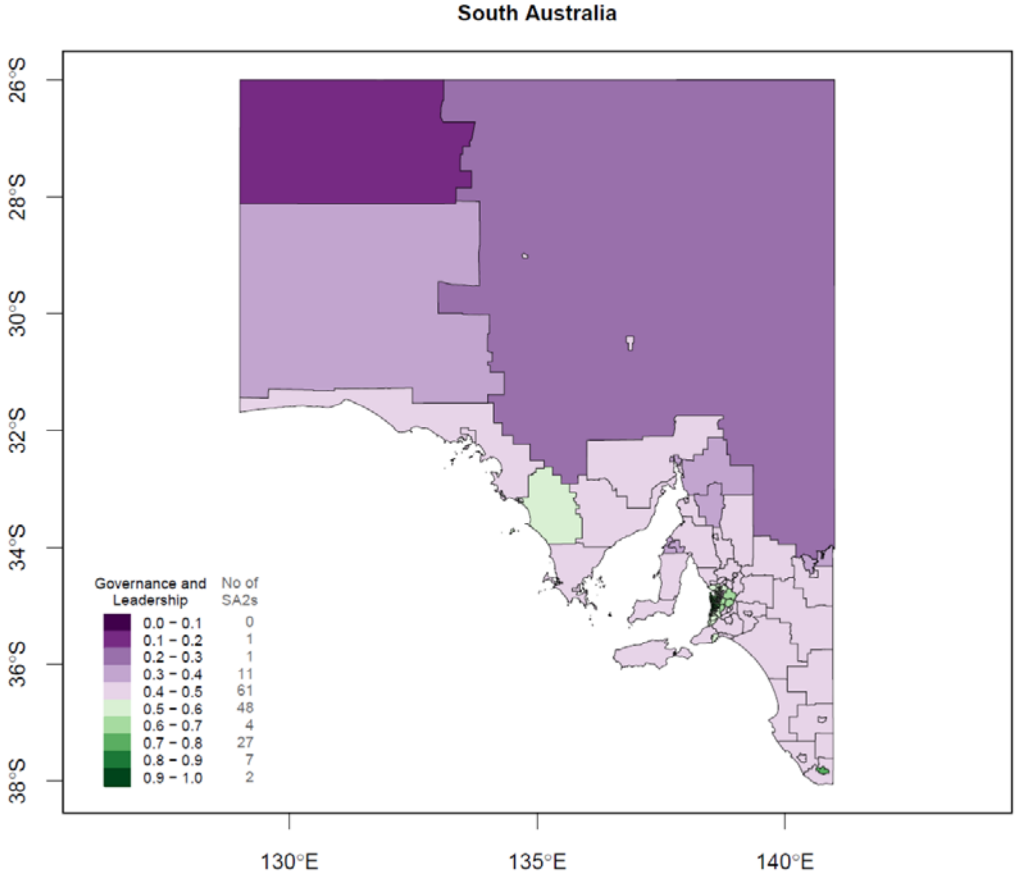

Greater Melbourne Region
Governance and Leadership
No of SA2s
0.0 – 0.1 0
0.1 – 0.2 0
0.2 – 0.3 0
0.3 – 0.4 0
0.4 – 0.5 0
0.5 – 0.6 31
0.6 – 0.7 92
0.7 – 0.8 0
0.8 – 0.9 101
0.9 – 1.0 50
37.2°S
37.4°S
37.6°S
37.8°S
38°S
38.2°S
38.4°S
144°E
144.5°E
145°E
145.5°E
146°E

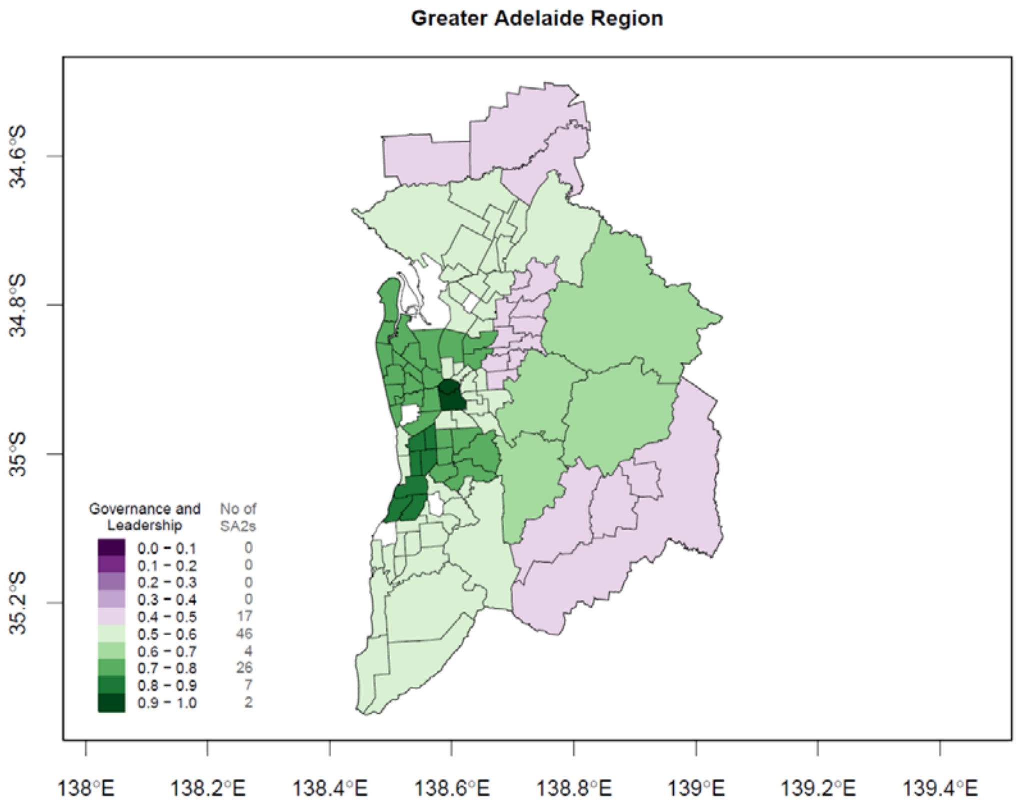
Appendix 5P (cont.)



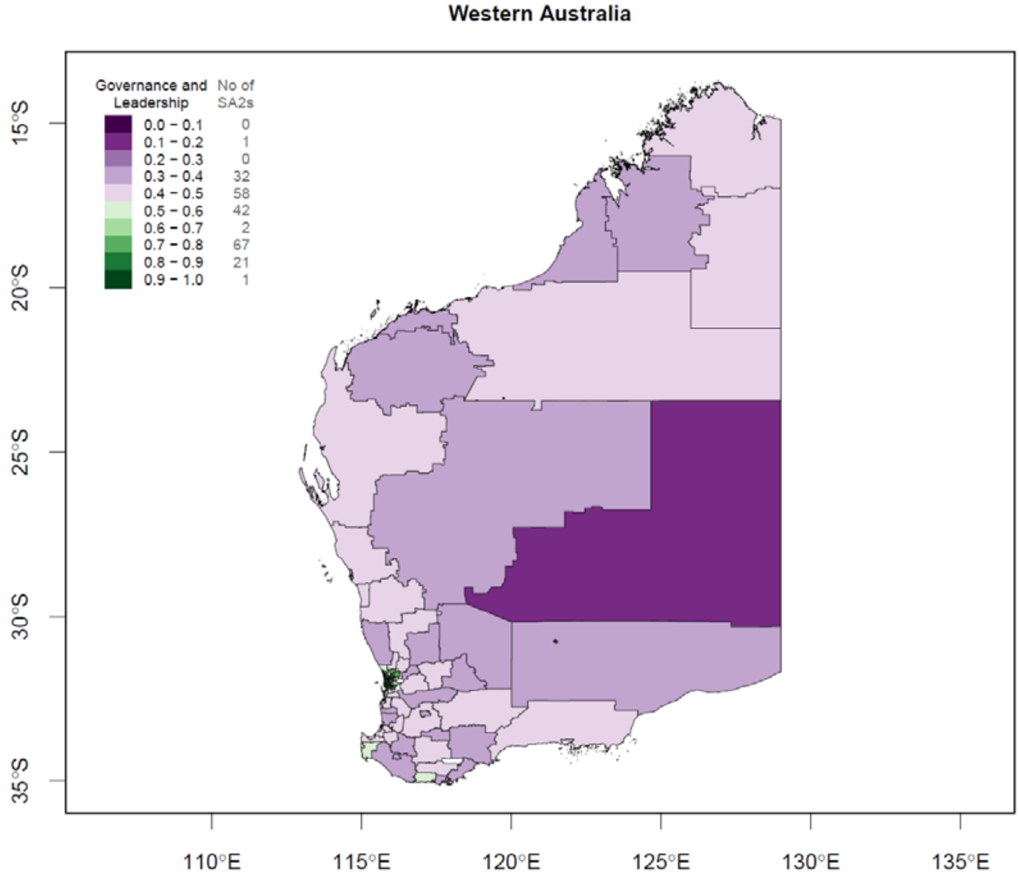


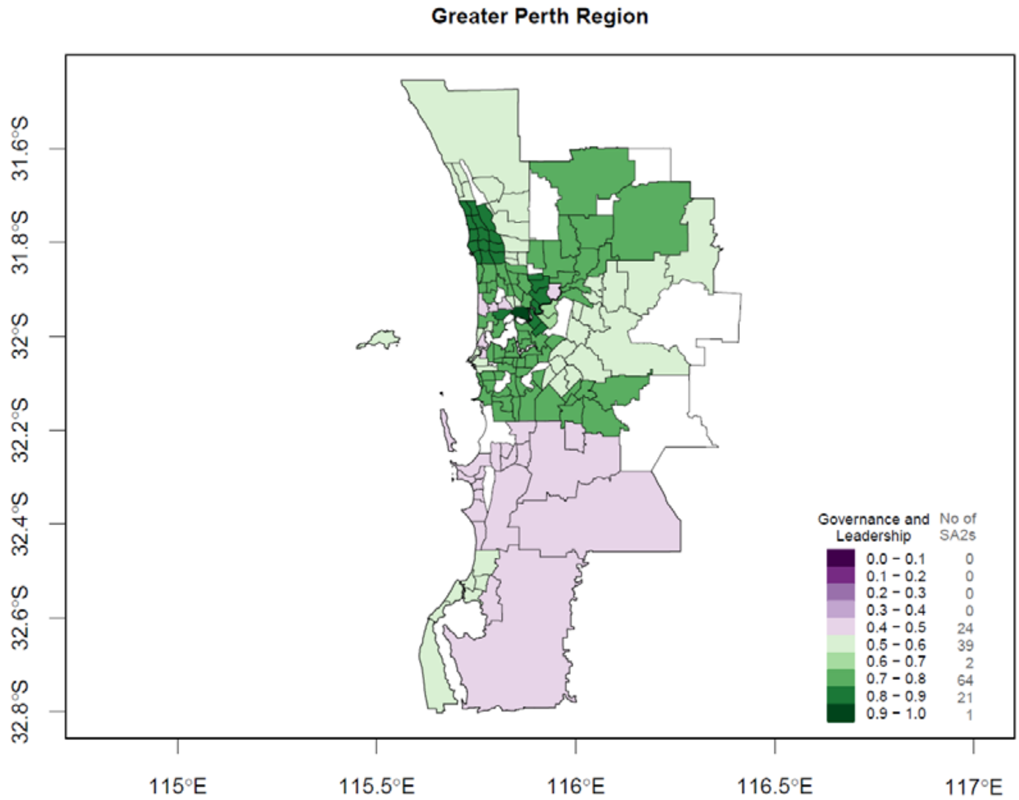
Appendix 5P (cont.)



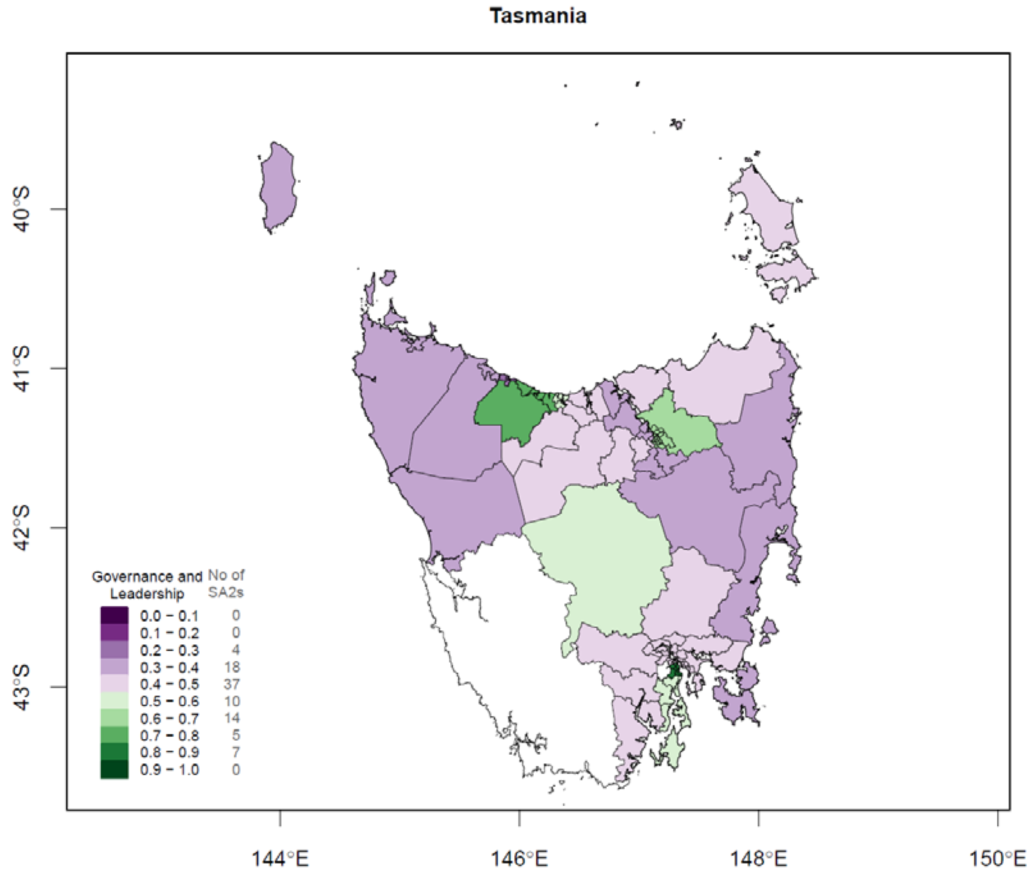


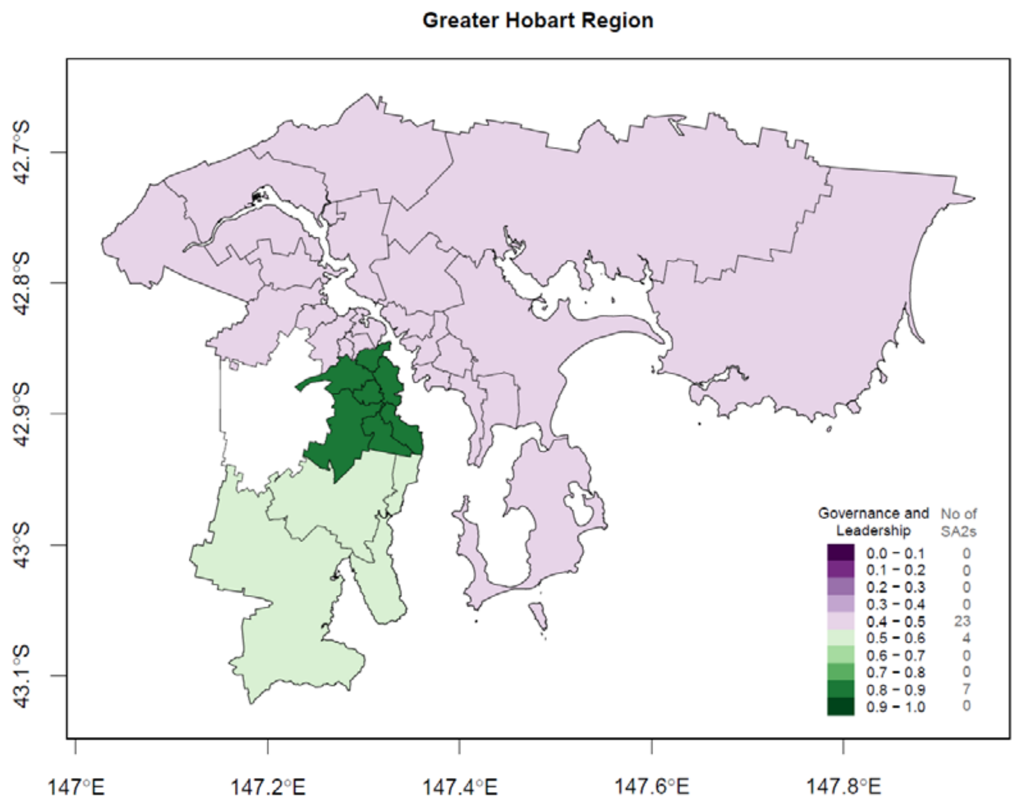
Appendix 5P (cont.)



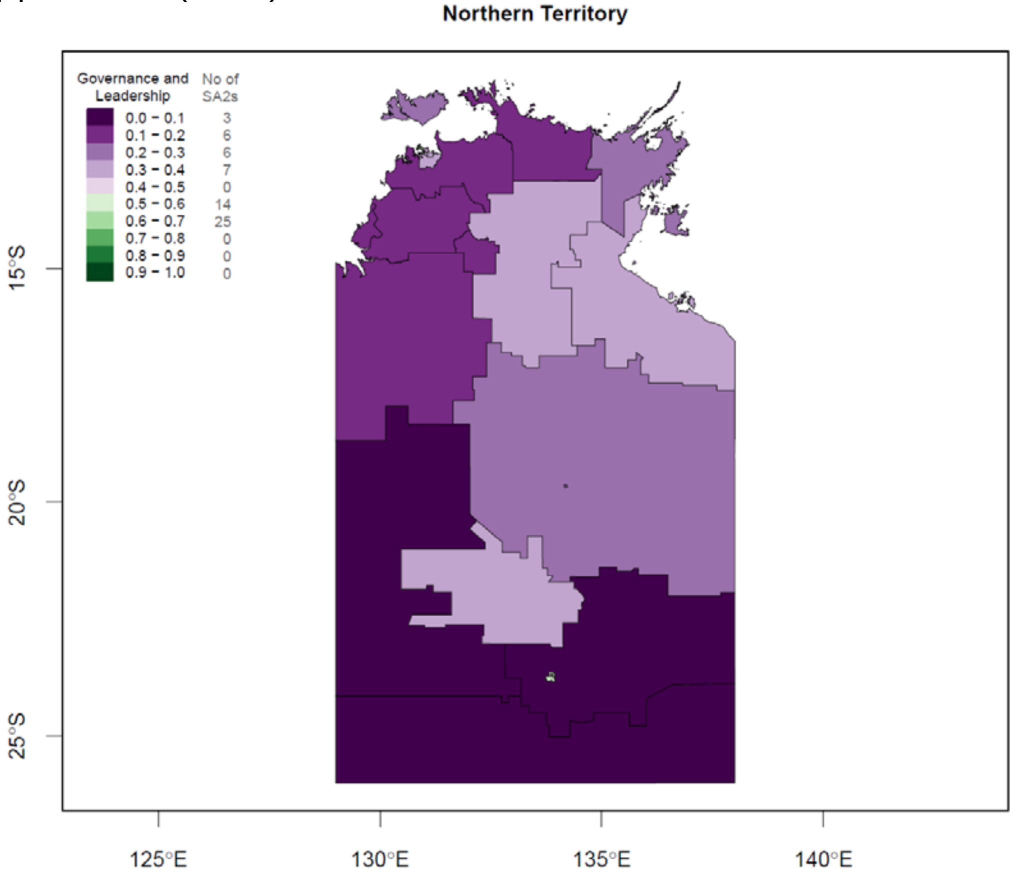


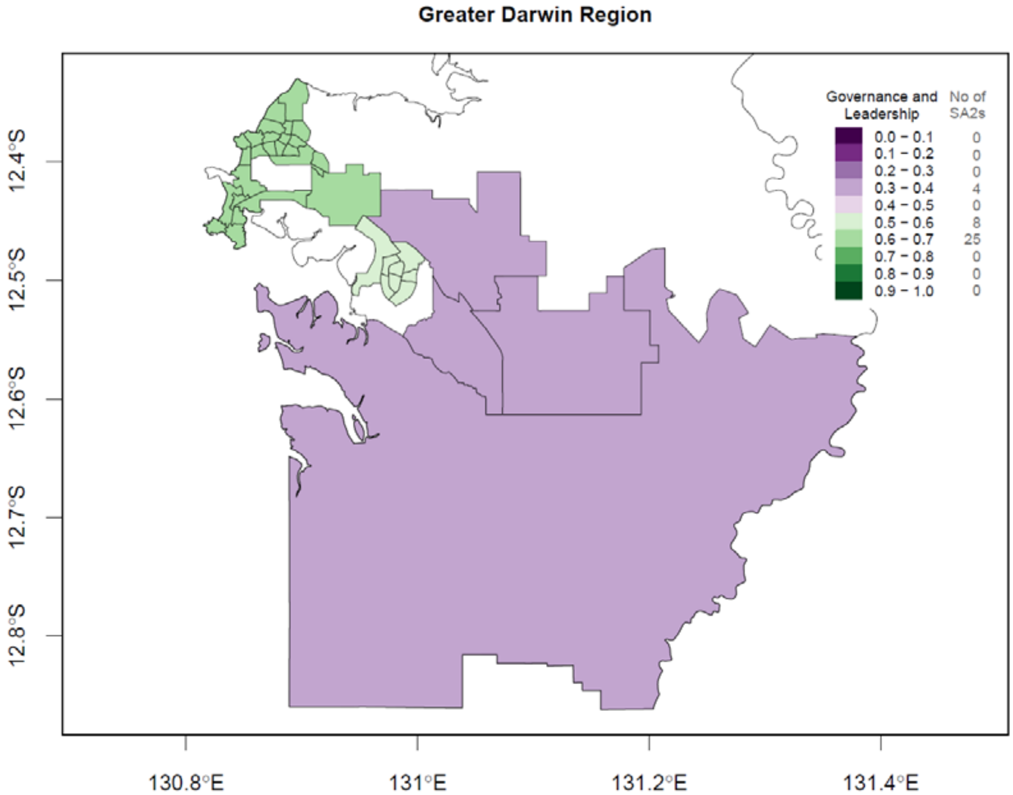
Appendix 5P (cont.)





Appendix 5P (cont.)





Appendix 5P (cont.)