
README – Index of adaptive capacity

1 About

The index of relative adaptive capacity that was developed for the Commission’s report on Transitioning Regional Economies was created using the R programming language and statistical software environment. This folder contains the R scripts and data used to produce the index.

The approach to creating the index is based on principal component analysis (PCA) and is described in appendix E of the report. Indexes were created using single PCA and nested PCA approaches for functional economic regions (FERs) for 2016, and using the single PCA approach for Statistical Area Level 2 (SA2) regions¹ for 2016 and FERs for 2011.

Multiple R scripts are used to generate each version of the index. The structure of R scripts is described in section 2. R packages and versions that were used in running the scripts are listed in section 3. Data can be found in the ‘Inputs’ subfolder. Data tables and sources are described in section 4.

¹ The 2016 Australian Statistical Geography Standard (ASGS) includes updated SA2 regions that differ slightly from those under the 2011 ASGS. References to SA2 regions in this document refer to the SA2 boundaries under the 2011 ASGS.

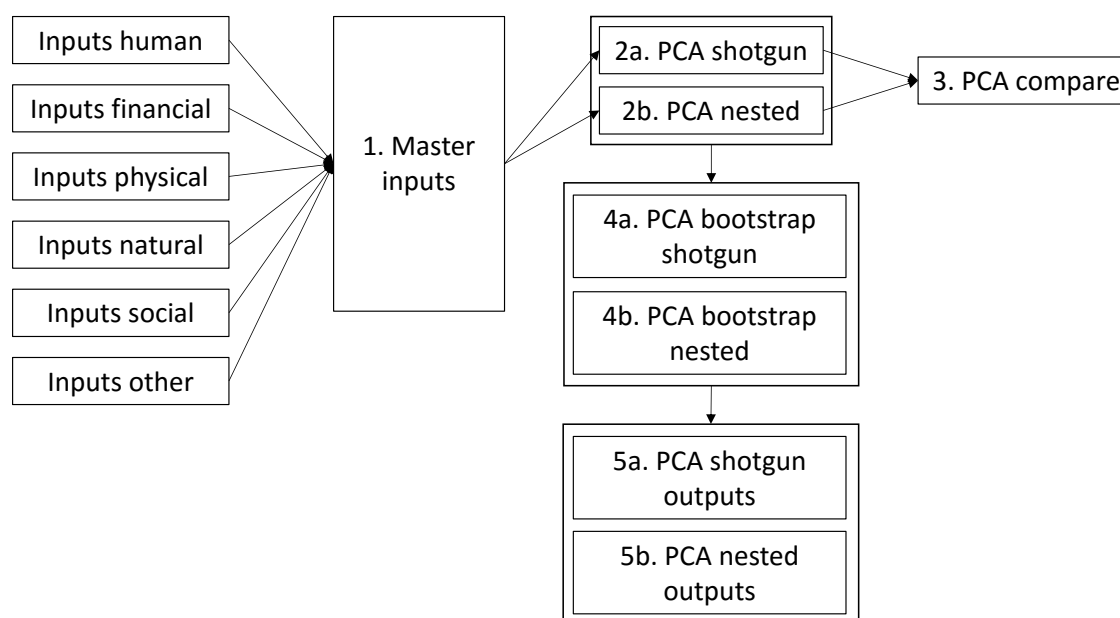
2 Structure of R scripts

Each version of the index (FER 2016, SA2 2016 and FER 2011) follows a similar structure to that in figure 1. The numbers in the figure indicate the order in which each R script should be run. Each script file name contains the year and level of geography to which it applies.

The following list briefly describes each R script.

1. ‘Master inputs’ sources and runs each of the ‘Inputs’ R scripts for each capital type to create the full inputs dataset used in creating the index.
2. ‘PCA shotgun’ and ‘PCA nested’ construct the index using single PCA and nested PCA approaches respectively. These scripts also map the FERs by index category and produce some of the outputs contained in appendix E.
3. ‘PCA compare’ calculates correlations and charts the differences between indexes created using single and nested PCA approaches.
4. ‘PCA bootstrap shotgun’ and ‘PCA bootstrap nested’ perform bootstrapping on indexes created using single and nested PCA approaches respectively.
5. ‘PCA shotgun outputs’ and ‘PCA nested outputs’ create the spreadsheets containing index values, contributions to the index and confidence intervals, as well as charts used in the report.

Figure 1 Structure of R scripts^a



^a R scripts relating to nested PCA and ‘PCA compare’ applicable only to FER 2016 analysis.

3 R packages used

Table 1 R packages used^a

<i>Package</i>	<i>Version</i>
rgeos	0.3.23
rgdal	1.2.7
raster	2.5.8
sp	1.2.4
sf	0.4.3
data.table	1.10.4
tidyverse	1.1.1
ggplot2	2.2.1.9000 ^b
dplyr	0.5.0
tidyr	0.6.3
tibble	1.3.3
stringr	1.2.0
lubridate	1.6.0
units	0.4.4
RColorBrewer	1.1.2
openxlsx	4.0.17
xlsx	0.5.7
devEMF	3.4

^a Packages were installed from the Comprehensive R Archive Network (CRAN) unless otherwise stated.
^b Development version from Github that contains the `geom_sf()` function for creating maps from R `sf` objects.

4 Inputs

Table 2 Census data inputs^a

<i>File</i>	<i>Description</i>
Popn.Total	Population
HighestEd.WorkingAge	Highest education level of working-age people
Skill.WorkingAge	Skill level of employed working-age people
LFSP.WorkingAge	Labour force status of working-age people
AGE5P.Total	Age group
INGP.Total	Indigenous status
EETPmod.1524	Youth (aged 15–24) engagement in work and study
HIED.Total	Total weekly household equivalised income
TENLLD.Total	Tenure and landlord type
LowIncomeHousingStress	Productivity Commission estimates of renting/mortgaged houses paying more than 30 per cent of income in rent/mortgage
NEDD.Total	Type of internet connection
INDP.Total	1-digit industry of employment based on the Australia and New Zealand Standard Industrial Classification (ANZSIC)
VOLWP.Total	Volunteering
INDP2digit.Total.FER.Herfindahl	Productivity Commission estimates of Herfindahl index based on 2-digit ANZSIC industry of employment (FER-level only)
PURP.POWP.FER.matrix	Place of residence / place of work matrix (FER-level only)

^a These Census data tables were extracted by the Commission officer in-posted to the ABS. They are available as Excel files in the 'Census 171023' subfolder, with sub-subfolders by year and level of geography. Inputs are available for FERs and SA2s for 2016 and FERs for 2011 unless otherwise stated. Exact file names differ slightly across folders.

Table 3 Other inputs

<i>File</i>	<i>Description^a</i>	<i>Source</i>
SA2_to_FER.csv	Correspondence table of 2011 SA2s to FERs	Productivity Commission estimates
SA2names.csv	Correspondence table of 2011 SA2s to SA3s, SA4s, GCCSA and state or territory, including names and codes	ABS (2010)
SA2 to RA correspondence 1270055006_CG_SA2_2011_RA_2011.xls	Correspondence table of 2011 SA2s to Remoteness Areas	ABS (2010)
SA2.2016.SA2.2011 corresp.csv	Correspondence table of 2016 SA2s to 2011 SA2s	Productivity Commission estimates by officer in-posted to the ABS
sa2tophacorresp.csv	Correspondence table of 2011 SA2s to Public Health Areas (PHAs)	PHIDU (2017a)
sa2popcensus2011.csv	Census population, by SA2, 2011	ABS Census tables (table 2)
sa2poprpg2006_16.csv	Estimated resident population, by SA2, 2006 to 2016	ABS.Stat (ABS 2017a)
sa2popbyage2006-16.csv	Estimated resident population, by SA2 and age group, 2006 to 2016	ABS.Stat (ABS 2017a)
ABS_REGIONAL_ASGS_2011sa2_payments_2015-16_28092017101957396.csv	Selected government pensions and allowances, by SA2, 2015 and 2016	ABS.Stat (ABS 2017a)
patentstm_sa3_asgs2011_05102017160405102.csv	Patent and trademark applicants, by SA3, 2011 to 2015	ABS.Stat (ABS 2017a)
cabees_2011SA2_2012-13.csv	Counts of Australian businesses, including entries and exits, by 2011 SA2, 2012 to 2013	ABS.Stat (ABS 2017a)
cabees_sa2_ASGS2016_04102017125735686.csv	Counts of Australian businesses, including entries and exits, by 2016 SA2, 2012 to 2016	ABS.Stat (ABS 2017a)
PHIDU_SA2_Self_Assessed_Health_Modelled_Estimate_2011-13.csv	Estimate of self-assessed health as fair or poor health from the Australian Health Survey 2011-13, by SA2	Public Health Information Development Unit, Torrens University (2014), accessed from AURIN Portal (PHIDU 2017c)
PHIDU_SA2_Psychological_Distress_Modelled_Estimate_2011-13.csv	Estimated number of people aged 18 years and over with high or very high psychological distress from the Australian Health Survey 2011-13, by SA2	Public Health Information Development Unit, Torrens University (2014), accessed from AURIN Portal (PHIDU 2017b)

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Table 3 (continued)

<i>File</i>	<i>Description^a</i>	<i>Source</i>
phidu_data_pha_aust_compositerisk.xlsx	Estimated number of people aged 18 years and over with at least one of four risk factors from the 2014-15 National Health Survey, by PHA	PHIDU (2017d)
SA2_2016_investment_income_2011-15.csv	Estimates of personal income for small areas, investment income, by 2016 SA2, 2011 to 2015	ABS (2017b)
proprietatransformed.xlsx	Weighted average of median house and unit sale prices, by FER and SA2 for 2016 and, and by FER for 2011	Productivity Commission estimates using data from CoreLogic (unpublished)
nonresidbuild_2010-14.csv	Value of non-residential building (\$m), by SA2, 2010 to 2014	ABS.Stat (ABS 2017a)
buildingapp_sa2_asgs2011_04102017125232464.csv	Building approvals, by SA2, 2011 to 2016	ABS.Stat (ABS 2017a)
phidu_data_pha_aust_accessservices.xlsx	Estimated number of people aged 18 years and over who have difficulty getting to places needed with transport from the 2014 General Social Survey, by PHA	PHIDU (2017d)
protectedareas.csv	Protected areas, by SA2, 2012 and 2014	ABS.Stat (ABS 2017a)
phidu_data_pha_aust_communitystrength.xlsx	Estimated number of people aged 18 years or over, community strength variables from the 2014 General Social Survey, by PHA	PHIDU (2017d)
ABS 2011 homelessness 20490_2011 statistical area level 2.xls	Estimated number of homeless people, by SA2, 2011	ABS (2012)
FER shapefile (folder)	The Commission's functional economic region boundaries in ESRI shapefile format	Productivity Commission estimates
sa2_2011_aust_shape (folder)	SA2 boundaries in ESRI shapefile format	ABS (2010)
ste_2011_aust_shape (folder)	State and territory boundaries in ESRI shapefile format	ABS (2010)

^a SA2 refers to SA2 boundaries under the 2011 ASGS unless otherwise stated.

5 References

- ABS (Australian Bureau of Statistics) 2010, Australian Statistical Geography Standard (ASGS): Volume 1 - Main Structure and Greater Capital City Statistical Areas, July 2011, Cat. no. 1270.0.55.001, Canberra.
- 2012, Census of Population and Housing: Estimating homelessness, 2011, Cat. no. 2049.0, Canberra.
- 2017a, ABS.Stat, <http://stat.data.abs.gov.au/> (accessed 17 October 2017).
- 2017b, Estimates of Personal Income for Small Areas, 2011-2015, Cat. no. 6524.0.55.002, Canberra.
- PHIDU (Public Health Information Development Unit, Torrens University) 2017a, Population Health Areas: Correspondence Based on Statistical Areas Level 2, <http://phidu.torrens.edu.au/help-and-information/about-our-data/geographical-structures/pha-list> (accessed 8 November 2017).
- 2017b, SA2 Psychological Distress - Modelled Estimate, accessed from AURIN Portal, <https://data.aurin.org.au/dataset/tua-phidu-sa2-psychologicaldistress-modelledestimate-sa2> (accessed 18 October 2017).
- 2017c, SA2 Self Assessed Health - Modelled Estimate, accessed from AURIN Portal, <https://data.aurin.org.au/dataset/tua-phidu-sa2-selfassessedhealth-modelledestimate-sa2> (accessed 18 October 2017).
- 2017d, Social Health Atlases, <http://phidu.torrens.edu.au/social-health-atlases> (accessed 17 October 2017).