# Project Proposal

# Indicators of unemployment

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Rationale

The Australian Bureau of Statistics (ABS) uses the internationally agreed standards in defining unemployment. To be classified as unemployed a person needs to meet the following three criteria (Abs.gov.au, 2019):

* Not working more than one hour in the reference week;
* Actively looking for work in previous four weeks; and
* Be available to start work in the reference week.

Gleeson (2019) states that unemployment impacts on the economic, social and mental health of not only the person who is unemployed but their family and community in the short-term and can have impact for decades to come. Additionally, the longer a person remains unemployed it can become more difficult to find employment as skills and abilities deteriorate over the time of unemployment. Hudson (2019) found that unemployment can cause a ripple effect across the economy. If more people are unemployed, fewer taxes are collected, and government spending will have to rise accordingly to pay more unemployment benefits, affecting the ongoing financial stability of the government.

Research has revealed several misnomers about unemployment and resulting factors such as crime and domestic violence. Janko and Popli (2015) in their analysis of Canadian data showed that there was not a relationship between unemployment and crime. Another study showed that gender-based unemployment played a part in the increase of domestic violence although did not increase domestic violence over all (Anderberg et al, 2013).

Our research aims to broaden the scope for factors that could affect unemployment in NSW. The unemployment rate in Australia for March 2019 is 5.0% (Tradingeconomics.com, 2019), while in NSW particularly, it is sitting at 4.3% for the same period (Taffa, 2019). To maintain NSW’s low unemployment and resulting high prosperity, detailed and region specific research can potentially unlock hidden characteristics about each area and if they impact unemployment rates. The outcomes of our research are targeted towards governmental policy makers and social welfare groups in NSW. Any new information can be used to assess existing services and their effectiveness, as well as highlight new areas where more services are needed.

**Our questions**

What factors predict unemployment rates in New South Wales? Of these factors, are there any that are unique or unexpected? What social demographics are related to unemployment? Does level of education affect unemployment and if so what level is the highest contributor?

Data Sources

Looking at data from the ABS and other sources, we are bringing together a range of information covering geographical, educational and biographical data.

Our unemployment data was obtained from the Australian Government Department of Jobs and Small Business, SA2 Data tables — Small Area Labour Markets, December quarter 2018. To create a list of indicators/variables we explored data from the ABS 2016 Census and a range of datasets from other areas of the ABS and non-ABS sources summarised in Table 1.

Table 1 – Sources of Data

|  |  |  |  |
| --- | --- | --- | --- |
| Indicator/variable | Description of dataset | Source | Geographic Level |
| Socio economic status | Socio- economic indexes for areas (SEIFA) 2016 | ABS | SA2 |
| Crime Statistics | Annual incident counts, rates per 100,000 population and ranks for selected offences (2011-2018) | Bureau of Crime and Statistics research (BOSCAR), NSW Department of Justice | LGA |
| Drug and alcohol? |  |  |  |
| Education Level | Census of Population and Housing: Reflecting Australia - Stories from the Census, 2016 | NSW Department of Education?  ABS | SA2 |
| Demographics  Age  Gender  Dwelling type  Household composition | Estimated Resident Population (ERP) by SA2 (ASGS 2016) Age and Sex, 2001 Onwards | ABS | SA2 |
| Race and Ethnic background | Ancestry, Migrant arrivals, Place of birth, Indigenous population | ABS | SA2 |
| Environment/Air quality data? |  |  |  |
| Access to employment? |  |  |  |
| Family Status | Marriages and divorces, Australia, 2016 | ABS | SA2 |
| Commute to work | Census of Population and Housing: Commuting to Work - More Stories from the Census, 2016 | ABS | SA2 |
| Whatever else we found |  |  |  |

To create a cohesive dataset for analysis we aimed to collect data for NSW for the year 2016 and at the SA2 level, a statistical geographic area a defined by the Australian Statistical Geographic Standard (ASGS) used by the ABS. An SA2 has an average population of 10,000 persons and can include one or more related suburbs that interact socially and economically (Abs.gov.au, 2018).

Using data at the SA2 level will allow us to analyse our variables for over 2000? geographical areas in NSW. We could then interpret any trends found for each SA2 to answer our research question. Data from the year 2016 was chosen as it was the year with the most data available. Coding examples of how we have acquired and merged our data are included in the appendices.

Modelling

An individual that wants to work is either employed or not employed; this is a binary outcome. As such, as part of this project, a multivariate logistic regression on grouped data will be performed in order to help answer the research question.

The unemployment data is a proportion of the population that is unemployed for a particular SA2, which is the total number of unemployed over the population as a percentage. Each of the variables chosen will then be normalised as a proportion of the population within the SA2.

Issues

Some issues have already come to light in data merging since various datasets were gathered and processed by different members introducing inconsistent formats. We may also need to gather some new datasets during the project, but the datasets we finally want maybe not at the same level of granularity. Some non-ABS datasets were not available in an ABS structure at SA2 level, but instead at a more granular level of Local Government Area (LGA). Aggregation of these datasets will need to be performed by associating the LGA with the corresponding Mesh Block (equivalent ASGS structure) and summarising up to SA2 level. We also need to consider the reliability of the data from ABS as there were some false or nonsensical answers in the collection of census data (Hanrahan 2017). Finally, the result from the analysis and modelling might be completely different from our expectation - i.e., there can be no correlation between employment and other chosen variables in our model.

Summary

We hope that by choosing a wide variety of variables in our research model that there can be some new information found about factors affecting unemployment rates in NSW. By providing a snapshot of 2016 we can really focus in on the variables we discover and discuss specific reasons of why these particular factors affect unemployment for each unique SA2.

References

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Appendices

**Appendix 1 - Example of Australian Bureau of Statistics Census 2016 data extract R code**

|  |
| --- |
| **library**(rsdmx)  **library**(tidyverse)  *# getwd()*  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  *# Check to make sure the ABS folder is available*  *# and, if not, create it. Saving file to right*  *# location will fail without the required folder*  **if** (**!dir.exists**("../Data Files/ABS")) {  **create.dir**("../Data Files/ABS")  }  *# Get the ABS Census 2016 Data on Dwelling Type*  dwelling\_data <- **as.data.frame**(**readSDMX**(providerId = "ABS",  resource = "data", flowRef = "ABS\_C16\_T24\_SA",  key = "TOT.TOT+11+21+22+31+32+33+34+91+92+93+94+Z+NA.0+1+2+3+4+5+6+7+8+9.SA2",  key.mode = "SDMX", start = 2016, end = 2016))  **summary**(dwelling\_data)  **head**(dwelling\_data)  **str**(dwelling\_data)  *# MISSING 9 SA2 Codes*  dwelling\_data **%>% distinct**(ASGS\_2016)  *# Distinct dimension values*  dwelling\_data **%>% distinct**(DWTD\_2016)  ## Retrieve Metadata to help with decoding values.  ds\_url = "http://stat.data.abs.gov.au/restsdmx/sdmx.ashx/GetDataStructure/ABS\_C16\_T24\_SA"  dataStructure <- **readSDMX**(ds\_url)  codeList <- **slot**(dataStructure, "codelists")  *# Dwelling Type*  dwelling\_type <- **as.data.frame**(codeList, codelistId = "CL\_ABS\_C16\_T24\_SA\_STRD\_2016")  *# Get Required Data and put in meaningful*  *# descriptions*  dwelling\_data\_final <- dwelling\_data **%>% inner\_join**(dwelling\_type,  by = **c**(STRD\_2016 = "id")) **%>% select**(SA2\_CODE = ASGS\_2016,  DWELLING\_TYPE = label.en, obsValue)  *# getwd()*  **write\_csv**(dwelling\_data\_final, "../Data Files/ABS/Dwelling\_Type\_SA2\_2016.csv") |

**Appendix 2 - Example of NSW Government Air Quality data download using R**

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| *# getwd()*  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  **if** (**!dir.exists**("../Data Files/NSWGovt/")) {  **dir.create**("../Data Files/NSWGovt/")  }  *## Download NSW Air Quality File if it doesn't*  *## already exist*  **if** (**!file.exists**("../Data Files/NSWGovt/AirQuality\_Data.xls")) {  aq = "https://airquality.environment.nsw.gov.au/aquisnetnswphp/tmp/tmp\_table\_21553\_1555911469.xls"  **download.file**(aq, destfile = "../Data Files/NSWGovt/AirQuality\_Data.xls",  mode = "wb")  }  *## Download NSW Air Quality Stations if it doesn't*  *## already exist*  **if** (**!file.exists**("../Data Files/NSWGovt/AirQuality\_Station\_Data.xlsx")) {  stations = **paste0**("https://datasets.seed.nsw.gov.au/dataset/",  "ee5fd225-ab54-49c4-8c91-930219018cd0/resource/",  "e09a1918-af2b-4375-ad04-00fabce72a10/download/",  "air-quality-monitoring-sites-summary.xlsx")  **download.file**(stations, destfile = "../Data Files/NSWGovt/AirQuality\_Stations\_Data.xlsx",  mode = "wb")  } |

**Appendix 3 - Example of Australian Bureau of Statistics Socio-Economic Indexes for Areas**

**data extract using R**

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| **library**(rsdmx)  *# getwd()*  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  **if** (**!dir.exists**("../Data Files/ABS/")) {  **dir.create**("../Data Files/ABS/")  }  data <- **as.data.frame**(**readSDMX**(providerId = "ABS",  resource = "data", flowRef = "ABS\_SEIFA2016\_SA2",  key.mode = "SDMX", start = 2016, end = 2016))  **write.csv**(data, "../Data Files/ABS/SEIFA\_2016\_Data.csv") |

**Appendix 4 - Example of Australian Bureau of Statistics Census 2016 data cleaning using R**

**(Dwelling Type)**

|  |
| --- |
| **library**(tidyverse)  **library**(data.table)  *# getwd()*  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  ## Read the raw data csv  raw\_data <- **read.csv**("../../Raw Data/Data Files/ABS/Dwelling\_Type\_SA2\_2016.csv",  quote = "\"")  **head**(raw\_data)  **str**(raw\_data)  *# Clean the data - Band Dwelling Type and*  *# create percentages - Note Total is not*  *# always the sum of the breakdown*  clean\_data <- raw\_data **%>% filter**(DWELLING\_TYPE **!=**  "Total") **%>% mutate**(DWELLING\_BAND = **case\_when**(DWELLING\_TYPE **==**  "Separate house " **~** "DWELLING\_HOUSE",  DWELLING\_TYPE **%like%** "Semi-detached, row or terrace house" **~**  "DWELLING\_SEMI", DWELLING\_TYPE **%like%**  "Flat or apartment" **~** "DWELLING\_FLAT",  DWELLING\_TYPE **%like%** "House or flat attached to a shop" **~**  "DWELLING\_FLAT", TRUE **~** "DWELLING\_OTHER")) **%>%**  **select**(SA2\_CODE, DWELLING\_BAND, obsValue) **%>%**  **group\_by**(SA2\_CODE, DWELLING\_BAND) **%>%**  **summarise**(Total\_Value = **sum**(obsValue)) **%>%**  **spread**(DWELLING\_BAND, Total\_Value) **%>%**  **mutate**(PERC\_DWELLING\_HOUSE = DWELLING\_HOUSE**/**(DWELLING\_HOUSE **+**  DWELLING\_FLAT **+** DWELLING\_SEMI **+** DWELLING\_OTHER),  PERC\_DWELLING\_FLAT = DWELLING\_FLAT**/**(DWELLING\_HOUSE **+**  DWELLING\_FLAT **+** DWELLING\_SEMI **+**  DWELLING\_OTHER), PERC\_DWELLING\_SEMI = DWELLING\_SEMI**/**(DWELLING\_HOUSE **+**  DWELLING\_FLAT **+** DWELLING\_SEMI **+**  DWELLING\_OTHER), PERC\_DWELLING\_OTHER = DWELLING\_OTHER**/**(DWELLING\_HOUSE **+**  DWELLING\_FLAT **+** DWELLING\_SEMI **+**  DWELLING\_OTHER))  *# Write cleaned data set to csv getwd()*  **write\_csv**(clean\_data, "../Data Files/ABS/Dwelling\_Type\_SA2.csv") |

**Appendix 5 - Example of Australian Bureau of Statistics Census 2016 data cleaning using R**

**(Demographics)**

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| **library**(tidyverse)  **library**(janitor)  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  erp <- **read\_csv**("../../Raw Data/Data Files/ABS/ERP/ABS\_ERP\_ASGS2016\_25042019132433480.csv")  **names**(erp)  erp <- erp **%>% select**(**-c**("MEASURE", "Measure",  "SEX\_ABS", "AGE", "FREQUENCY", "Frequency",  "TIME", "Flag Codes", "Flags", "REGIONTYPE",  "Geography Level"))  erp <- erp **%>% rename**(sa2\_code = ASGS\_2016) **%>%**  **clean\_names**()  erp\_by\_sex <- erp **%>% group\_by**(sa2\_code,  sex) **%>% summarise**(total\_value = **sum**(value)) **%>%**  **spread**(sex, total\_value) **%>% clean\_names**()  erp\_by\_age <- erp **%>% group\_by**(sa2\_code,  age) **%>% summarise**(total\_value = **sum**(value)) **%>%**  **spread**(age, total\_value) **%>% clean\_names**()  erp <- erp\_by\_sex **%>% left\_join**(erp\_by\_age)  **write\_csv**(erp, "../Data Files/ABS/ERP\_SA2\_2016.csv") |

**Appendix 6 - Example of finding percent of SA2 area covered by parkland using R**

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| --- |
| **library**(tidyverse)  *# getwd()*  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  *# Create destination folder if it doesn't*  *# already exist*  **if** (**!dir.exists**("../Data Files/ABS/")) {  **dir.create**("../Data Files/ABS/")  }  *# Read the raw data csv*  mesh\_blocks <- **read.csv**("../../Raw Data/Data Files/ABS/Mesh\_Blocks/MB\_2016\_NSW.csv")  **str**(mesh\_blocks)  mesh\_blocks **%>% distinct**(MB\_CATEGORY\_NAME\_2016)  *# Find % of space allocated to Parkland*  *# for each mesh block*  open\_space <- mesh\_blocks **%>% filter**(STATE\_NAME\_2016 **==**  "New South Wales") **%>% select**(MB\_CODE\_2016,  MB\_CATEGORY\_NAME\_2016, SA2\_CODE = SA2\_MAINCODE\_2016,  AREA\_SQKM = AREA\_ALBERS\_SQKM) **%>% group\_by**(SA2\_CODE,  MB\_CATEGORY\_NAME\_2016) **%>% summarise**(SUM\_AREA\_SQKM = **sum**(AREA\_SQKM)) **%>%**  **spread**(MB\_CATEGORY\_NAME\_2016, SUM\_AREA\_SQKM,  fill = 0) **%>% mutate**(PERC\_OPEN\_SPACE = Parkland**/**(Commercial **+**  Education **+** `Hospital/Medical` **+** Industrial **+**  MIGRATORY **+** NOUSUALRESIDENCE **+** OFFSHORE **+**  Other **+** Parkland **+** `Primary Production` **+**  Residential **+** SHIPPING **+** Transport **+**  Water))  *# Write data to csv*  **write\_csv**(open\_space, "../Data Files/ABS/Open\_Space\_SA2.csv") |

**Appendix 7 - Example of Australian Bureau of Statistics Socio-Economic Indexes for Areas**

**data cleaning using R**

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| **library**(tidyverse)  *# Set directory to my the location where*  *# this file is*  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  *# getwd()*  seifa\_data <- **read\_csv**("../../Raw Data/Data Files/ABS/SEIFA\_2016\_Data.csv")  *# Review data - AsGS\_2016 field is an INT*  **head**(seifa\_data)  *# Summarise the data - obsValue has 48*  *# NA's but non of these have a*  *# SEIFA\_MEASURE == SCORE*  **summary**(seifa\_data)  seifa\_nas <- seifa\_data **%>% filter**(**is.na**(obsValue) **==** TRUE)  *# Create a clean data set for use - only*  *# want high level scores and remove*  *# records with an obsValue of NA*  clean\_seifa\_data <- seifa\_data **%>% filter**(SEIFA\_MEASURE **==**  "SCORE") **%>% select**(SA2\_CODE = ASGS\_2016,  SEIFAINDEXTYPE, obsValue) **%>% spread**(SEIFAINDEXTYPE,  obsValue) **%>% select**(SA2\_CODE, SEIFA\_Edu\_Occ\_Index = IEO,  SEIFA\_Economic\_Res\_Index = IER, SEIFA\_Rel\_SocioEco\_Adv\_Disadv\_Index = IRSAD,  SEIFA\_Rel\_SocioEco\_Disadv\_Index = IRSD)  *# Write Clean Data to disk*  **write\_csv**(clean\_seifa\_data, "../Data Files/ABS/SEIFA\_2016\_Data.csv")  *# Check for duplicates - nope none, only*  *# 1 record per SA2*  clean\_seifa\_data **%>% group\_by**(SA2\_CODE) **%>%**  **mutate**(total = **n**()) **%>% filter**(total **>**  1) |

**Appendix 8 - Example of Exploratory Data Analysis of Australian Bureau of Statistics Census**

**2016 data**

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| **library**(tidyverse)  **library**(Hmisc)  **library**(corrplot)  *# getwd()*  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  *# read cleaned data set*  dwelling\_type <- **read\_csv**("../Data Files/ABS/Dwelling\_Type\_SA2.csv")  mesh\_blocks <- **read\_csv**("../../Raw Data/Data Files/ABS/Mesh\_Blocks/MB\_2016\_NSW.csv")  **str**(mesh\_blocks)  *# Get mesh block data at SA2 level*  sa2\_data <- mesh\_blocks **%>% distinct**(SA2\_MAINCODE\_2016,  SA2\_NAME\_2016, STATE\_CODE\_2016, STATE\_NAME\_2016)  *# No duplicate SA2 Codes*  sa2\_data **%>% group\_by**(SA2\_MAINCODE\_2016) **%>% summarise**(cnt = **n**()) **%>%**  **filter**(cnt **>** 1)  *# Some SA2's don't have any dwellings - positive*  *# skew*  dwelling\_type **%>% mutate**(TOTAL = DWELLING\_HOUSE **+** DWELLING\_FLAT **+**  DWELLING\_SEMI **+** DWELLING\_OTHER) **%>% ggplot**() **+**  **geom\_histogram**(**aes**(x = TOTAL), bins = 50)  *# 62 SA2's have no dwellings - 7 in NSW, a military*  *# base, centennial park, a NP, a cemetry, and*  *# Industrial area, Banksmeadow is whaves and*  *# industry*  dwelling\_type **%>% mutate**(TOTAL = DWELLING\_HOUSE **+** DWELLING\_FLAT **+**  DWELLING\_SEMI **+** DWELLING\_OTHER) **%>% filter**(TOTAL **==**  0) **%>% left\_join**(sa2\_data, by = **c**(SA2\_CODE = "SA2\_MAINCODE\_2016")) **%>%**  **select**(SA2\_CODE, TOTAL, SA2\_NAME\_2016, STATE\_NAME\_2016) **%>%**  **filter**(**between**(SA2\_CODE, 1e+08, 2e+08))  *# There are a couple of areas with high numbers of*  *# dwellings - Waterloo/Beaconsfield in NSW is high*  *# density*  dwelling\_type **%>% mutate**(TOTAL = DWELLING\_HOUSE **+** DWELLING\_FLAT **+**  DWELLING\_SEMI **+** DWELLING\_OTHER) **%>% filter**(TOTAL **>**  15000) **%>% left\_join**(sa2\_data, by = **c**(SA2\_CODE = "SA2\_MAINCODE\_2016")) **%>%**  **select**(SA2\_CODE, TOTAL, SA2\_NAME\_2016, STATE\_NAME\_2016) **%>%**  **filter**(**between**(SA2\_CODE, 1e+08, 2e+08))  *# Remove SA2's with no dwellings and only show NSW*  *# SA2's*  dwelling\_type\_filtered <- dwelling\_type **%>% mutate**(TOTAL = DWELLING\_HOUSE **+**  DWELLING\_FLAT **+** DWELLING\_SEMI **+** DWELLING\_OTHER) **%>%**  **filter**(TOTAL **!=** 0) **%>% inner\_join**(sa2\_data, by = **c**(SA2\_CODE = "SA2\_MAINCODE\_2016"))  *## DWELLING HOUSE Some areas in NSW have no houses -*  *## data may be slightly skewed*  dwelling\_type\_filtered **%>% ggplot**() **+ geom\_histogram**(**aes**(x = DWELLING\_HOUSE),  bins = 50)  *# Standardise data and confirm data has a long tail*  house\_std <- **scale**(dwelling\_type\_filtered**$**DWELLING\_HOUSE)  **qqnorm**(house\_std)  **abline**(a = 0, b = 1, col = "grey")  ## DWELLING FLAT There are 21 no flat SA2's in NSW -  ## industrial areas, offshore shipping, Rural areas  dwelling\_type\_filtered **%>% filter**(DWELLING\_FLAT **==**  0) **%>% select**(SA2\_CODE, SA2\_NAME\_2016, PERC\_DWELLING\_HOUSE,  PERC\_DWELLING\_FLAT, PERC\_DWELLING\_SEMI, PERC\_DWELLING\_OTHER)  *# Some areas in NSW have no houses - data skewed*  dwelling\_type\_filtered **%>% ggplot**() **+ geom\_histogram**(**aes**(x = DWELLING\_FLAT),  bins = 100)  *# Standardise data and confirm data is not normally*  *# distributed*  flat\_std <- **scale**(dwelling\_type\_filtered**$**DWELLING\_FLAT)  **qqnorm**(flat\_std)  **abline**(a = 0, b = 1, col = "grey")  ## DWELLING SEMI There are 19 no semi SA2's in NSW -  ## industrial areas, airport, offshore shipping,  ## rural areas  dwelling\_type\_filtered **%>% filter**(DWELLING\_SEMI **==**  0) **%>% select**(SA2\_CODE, SA2\_NAME\_2016, PERC\_DWELLING\_HOUSE,  PERC\_DWELLING\_FLAT, PERC\_DWELLING\_SEMI, PERC\_DWELLING\_OTHER)  *# Some areas in NSW have no houses - data skewed*  dwelling\_type\_filtered **%>% ggplot**() **+ geom\_histogram**(**aes**(x = DWELLING\_SEMI),  bins = 100)  *# Standardise data and confirm data is not normally*  *# distributed*  semi\_std <- **scale**(dwelling\_type\_filtered**$**DWELLING\_SEMI)  **qqnorm**(semi\_std)  **abline**(a = 0, b = 1, col = "grey")  *# Check correlation between variables*  dwelling\_matrix <- dwelling\_type\_filtered **%>% select**(DWELLING\_FLAT,  DWELLING\_HOUSE, DWELLING\_OTHER, DWELLING\_SEMI) **%>%**  **as.matrix**()  *# Show values - nothing really high*  **rcorr**(dwelling\_matrix, type = "pearson")  *# And a plot for good measure*  **corrplot**(**cor**(dwelling\_matrix), method = "ellipse") |

**Appendix 9 - Example of merging cleaned datasets for modelling using R**

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| **library**(tidyverse)  *# getwd()*  **setwd**(**dirname**(rstudioapi**::getActiveDocumentContext**()**$**path))  *# Read csv's*  dwelling\_type <- **read\_csv**("../../Clean Data/Data Files/ABS/Dwelling\_Type\_SA2.csv")  hh\_composition <- **read\_csv**("../../Clean Data/Data Files/ABS/HouseHold\_Composition\_SA2.csv")  place\_of\_birth <- **read\_csv**("../../Clean Data/Data Files/ABS/Place\_Of\_Birth\_SA2.csv")  seifa <- **read\_csv**("../../Clean Data/Data Files/ABS/SEIFA\_2016\_Data.csv")  mesh\_blocks <- **read\_csv**("../../Raw Data/Data Files/ABS/Mesh\_Blocks/MB\_2016\_NSW.csv")  *# Get mesh block data at SA2 level*  sa2\_data <- mesh\_blocks **%>% distinct**(SA2\_MAINCODE\_2016,  SA2\_NAME\_2016, STATE\_CODE\_2016, STATE\_NAME\_2016)  *# Join Datasets together*  model\_data <- dwelling\_type **%>% inner\_join**(hh\_composition,  by = **c**("SA2\_CODE")) **%>% inner\_join**(place\_of\_birth,  by = **c**("SA2\_CODE")) **%>% inner\_join**(seifa, by = **c**("SA2\_CODE")) **%>%**  **semi\_join**(sa2\_data, by = **c**(SA2\_CODE = "SA2\_MAINCODE\_2016")) **%>%**  **select**(**-starts\_with**("PERC\_")) |