Small area estimates of Subjective Wellbeing: Spatial Microsimulation on the Australian Unity Wellbeing Index Survey

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It must be emphasised that NATSEM does not have views on policy. All opinions are the authors’ own and are not necessarily shared by NATSEM.
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GENERAL CAVEAT

NATSEM research findings are generally based on estimated characteristics of the population. Such estimates are usually derived from the application of microsimulation modelling techniques to microdata based on sample surveys.

These estimates may be different from the actual characteristics of the population because of sampling and nonsampling errors in the microdata and because of the assumptions underlying the modelling techniques.

The microdata do not contain any information that enables identification of the individuals or families to which they refer.


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ABSTRACT

Subjective wellbeing is an indicator of how satisfied a person is with their life. It is becoming accepted as an indicator of happiness and overall wellbeing. This paper uses spatial microsimulation methods to estimate small area subjective wellbeing (SWB) in Australia. The procedure uses the Australian Unity Wellbeing Index survey and the 2011 Census data to derive small area estimates of SWB. Validation of the results shows that high and normal levels of SWB compare well to another source of SWB for small areas in the Murray Darling Basin, but levels of low SWB are not predicted as well, possibly due to the effect of local factors not available for the modelling on reducing SWB. Aggregate estimates compare well to HILDA estimates of SWB at a State level. These estimates are now available from the Australian Urban Research Infrastructure Network (AURIN) at the University of Melbourne.
1 INTRODUCTION

The growth of knowledge in measuring human progress along with life satisfaction and happiness has emphasized both subjective and objective aspects of wellbeing. Subjective wellbeing is an extension of psychological wellbeing or happiness and life satisfaction for individuals. It is based on a presumption that the presence of pleasure and absence of pain are the defining characteristics of a good life (Diener et al., 2012).

Research on subjective wellbeing (SWB) assumes that an essential ingredient of a good life is that the person is satisfied with their life. Subjective well-being is defined as a ‘person’s cognitive and affective evaluations of his or her life’ (Diener et al., 20023) as a whole. These affective evaluations include emotional reactions to events that can be either positive or negative. The cognitive judgments of satisfaction and fulfilment are about what someone thinks about their life in global terms (life as a whole) and in domain terms (in specific areas of life such as work, health, relationships, etc.). Thus, SWB is a broad concept that includes experiencing high levels of pleasant emotions and moods, low levels of negative emotions and moods, and high life satisfaction. Subjective wellbeing concerns the study of what lay people might call happiness or satisfaction (Diener et al., 2012; Argyle, 2001; Diener, 1984; Diener et al. 1999; Kahneman et al., 1999).

Research on SWB comprises the psychological analysis of how people evaluate their lives—both at present and for longer periods such as over the past year. These evaluations include people’s emotional reactions to events, their moods, and judgments they form about their life satisfaction, fulfilment, and satisfaction with life domains, such as marriage and work.

An individual’s moods, emotions, and self-evaluative judgments are not constant over the life time. SWB research examines the longer-term mean level differences that exist between individuals and societies. Different components of SWB reflect people’s evaluations of what is happening in their lives, yet the facets of SWB such as positive affect, negative affect, and life satisfaction can be studied independently (Diener et al., 2012; Andrews & Withey 1976, Lucas et al. 1996).

In terms of measuring SWB, this is normally done using a question in a survey. The question is normally about how satisfied the respondent is with their life – so the question asked in the Household Income and Labour Dynamics Survey of Australia (HILDA), an annual longitudinal survey, is:

“All things considered, how satisfied are you with your life?”

with a rating of 0 to 10. Another Australian survey that asks questions on SWB in Australia is the Australian Unity Wellbeing Index Survey (AUWI), run by Prof Robert Cummins of Deakin University. The question asked in the AUWI Survey is:

“Thinking about your own life and personal circumstances, how satisfied are you with your life as a whole? (0 completely unsatisfied 1 2 3 4 5 neither unsatisfied nor satisfied 6 7 8 9 10 completely satisfied)”
In both HILDA and the AUWI Survey, additional questions are asked about the respondent’s satisfaction in a number of domains of life. In the HILDA survey, such domains include satisfaction with the home in which the person lives, employment opportunities, financial situation, community, safety, health, neighbourhood, free time and personal relationships. In the AUWI survey, an additional domain of spirituality is included (so how satisfied are you with your spirituality), with a slight variation in few domains such as satisfaction with standard of living, achievement in life and future security along with health, safety, personal relationship and community, making in total eight domains. All these domains are ranked from 0 to 10. In both surveys, the results for all domains can then be summed to get a total score out of 90 (HILDA) or 80 (AUWI Survey). So there are two measures of wellbeing in each survey; a measure of General Life Satisfaction (GLS) or overall wellbeing which is ranked from 0 to 10, and a summary measure of wellbeing for a number of different dimensions in life that can range from 0 to 90 (HILDA) or 0 to 80 (AUWI Survey). Some international surveys on SWB use a scale of 1 to 100 rather than 0 to 10. In this paper, as we use all Australian data, our wellbeing indicators are shown on a scale of 0 to 10. However, we transform all reported results to a standard scale from 0 to 100 points.

In terms of the values for SWB, some of the research on individual wellbeing is about the stability of subjective measures of wellbeing. Research reveals that SWB has a mean of 75 points for Western countries and 65 points for non-Western countries, with consistent results across different countries (Cummins, 1995 and 2003).

The value for SWB is also stable over time. This has been termed the ‘homeostasis’ of SWB over time (see Cummins, 2009; Tanton et al., 2012). This means that there is a threshold value which, as this value is approached, the person tries to retain control. If this threshold is breached, the person will normally, over time, regain control and SWB will return to it’s normal value for that person. So homeostasis is operating as a protective factor for wellbeing, tending the person back to their normal level of wellbeing.

While all this work has been done on individual level SWB, area level subjective has also been looked at in some recent papers (see Ballas, 2010; Tanton et al, 2012). This work recognises that SWB is an important indicator of wellbeing for communities. Governments are also becoming interested in SWB. In the UK, the ONS is looking at how SWB can be used to monitor progress, inform policy design and policy appraisal (see Dolan et al, 2011). The reports from the UK have also recognised that local factors are relevant to wellbeing (see ONS, 2011).

At a community level, researchers are also starting to recognise the importance of SWB for community sustainability (see Scott, 2012; Hogan et al, 2013; Tanton et al, 2012).

Given the importance of SWB, the work in the UK on how area level SWB can be used in the policy process, and recent work on how SWB affects community sustainability, small area estimates of SWB become important. In Australia, there are some initiatives that use surveys to collect SWB for specific communities (see Community Indicators Victoria, 2013 and Hogan et al, 2013 for descriptions of surveys conducted in some communities in Australia), but these are not national.

This paper outlines a method for small area estimation of SWB in Australia using spatial microsimulation. This modelling is based on the NATSEM’s latest spatial microsimulation model. This model combines substantial geographic information from the latest 2011 Census with the rich variable detail of Australia’s national level sample survey that is dedicated to
collecting information on SWB - the Australian Unity Wellbeing Index Survey (AUWI). The model uses both these sets of data to derive small area estimates of SWB. The model is further used to reveal the gender differences, age variations, employment-unemployment variations and differences in wellbeing by family type at a small area level in Australia.

In this paper, the next section outlines the method used for deriving small area estimates of SWB; Section 3 describes the datasets, data and benchmarks used in the estimation; Section 4 describes the results; Section 5 describes the validation; Section 6 discusses the results; and Section 7 provides some conclusions.

2 Methodology

This section describes the procedure for estimating small area wellbeing in Australia using a national level sample survey (AUWI) and the 2011 Census using the SpatialMSM model. The SpatialMSM model uses a generalised regression reweighting program from the Australian Bureau of Statistics (ABS) called GREGWT. The GREGWT algorithm uses a generalised regression technique to estimate weights for a household or individual from the survey, and iterates until the weighted aggregates of the survey data produces characteristics that closely resemble the census population characteristics for each small area (Bell, 2000; Tanton et al, 2011; Vidyattama et al, 2013). This procedure has been classified as a deterministic method because it uses formulae, similar to the iterative proportional fitting used by Anderson (2007) and Ballas et al (2005). This is different from the probabilistic method that pseudo-randomly selects households to fill an area (Voas and Williamson, 2000; Williamson et al, 1998), even though it is established that the results from different reweighting methods are more or less similar (Tanton et al, 2007).

The method uses small area Census tables to derive a number of benchmarks. These benchmarks are carefully chosen to be correlated with SWB, and the literature on this is shown in Section 3. The survey is then reweighted to these benchmarks using the SpatialMSM model. The method used for SpatialMSM is described in full in Tanton et al (2011).

The geographical unit of analysis for this study is the Statistical Area Level 2 (SA2). SA2s are part of the ABS Australian Statistical Geography Standard (ASGS). They replace Statistical Local Areas (SLAs) from the Australian Standard Geographic Classification (ASGC). SA2s are in general smaller than SLAs. There are 2214 SA2s which were part of the 2011 ASGS that are used for this analysis. SA2s generally have a population range of 3,000 to 25,000 persons, and have an average population of about 10,000 persons. SA2s in remote and regional areas generally have smaller populations than those in urban areas (ABS, 2011).

The SA2s are a general-purpose medium-sized area built from whole Statistical Area Level 1 (SA1s). While the Statistical Areas Level 1 (SA1s) have been designed as the smallest area of output for the Census of Population and Housing, replacing the Census Collection Districts (CCDs), they are not suitable for such analysis owing to the Australian Bureau of Statistics (ABS) confidentialising small cell counts in tables for smaller areas (such as SA1s). On average SA1s have a population of approximately 400 people, and most are designed to be within the
population range 200-800 people. There are 54,805 SA1s covering the whole of Australia without gaps or overlaps (ABS, 2011).

There are some areas where an estimate cannot be produced by SpatialMSM, since the estimation process does not achieve an acceptable error for the estimate. In SpatialMSM, ‘error’ is measured by the total absolute error (TAE) from all the benchmarks. The TAE has been used in a number of spatial microsimulation models as a criterion for reweighting accuracy (Edwards and Tanton, 2013; Anderson, 2007; Williamson et al, 1998) and has been assessed and supported by the results of other studies, such as Smith et al (2009) and Voas and Williamson (2000). The TAE is described further in the validation section.

3 DATA

3.1 DESCRIPTION OF THE DATASETS USED

The survey dataset used for this analysis was the Australian Unity Wellbeing Index Survey. This was because this is the only Australian survey explicitly on quality of life in Australia. The survey has been conducted in Australia since 2001. It is a telephone survey of approximately 2000 people, and has been conducted semi-annually and quarterly throughout its existence (currently semi-annually).

Certain groups of people are under sampled or not sampled at all due to the nature of the telephone survey used for AUWI Survey. First, it excludes people who do not speak English or who speak it poorly. In the 2006 Census, 2.8 per cent of people did not speak English well, or did not speak it at all. Second, it excludes people who do not have a landline phone. Between 12 and 15 per cent of households in Australia do not have a landline phone (Pennay and Bishop 2009), however this is only likely to affect the representativeness of results in certain subgroups (young people living away from home in particular). More recent research by Pennay and Bishop (2010) suggests that the number of households with only a mobile phone connection will continue to increase, with one third of 18-24 year olds opting not to use a landline when moving out of home. Mobile phone only households are younger, more likely to rent, live in a group household, have a bachelor degree or higher and are more likely to be employed.

The AUWI Survey has been done a number of times, and although some variables are common to all the surveys, there are a number of questions that are only asked in a handful of surveys. We have therefore chosen a survey that has as many variables as possible that are correlated with SWB and can be readily matched with Census 2011 variables.

Initially NATSEM considered simply using the most recent AUWI survey available, Survey 26, with the option of combining it with earlier surveys such as 25 and 24 to increase the sample size if necessary. These surveys have special feature questions on subject matters such as chronic health conditions, the impact of natural disasters, trust, climate change and internet usage. While these questions are interesting and are relevant to determining overall wellbeing, these are not matters that are readily comparable to questions on the 2011 Census.
Instead, NATSEM decided to use Survey 15 and 16 for reweighting (Cummins, 2006). The advantage of these surveys is that they have questions regarding rent and mortgage obligations, from which one can create a variable on housing tenure. Other research by Cummins (2006) has found that homeowners tend to be happier than renters, and homeowners without a mortgage are happier than with a mortgage. The variables on home ownership, rent and mortgage obligations can be readily matched to Census 2011 data.

The 2011 ABS Census of Population and Housing was used for the benchmarks in the reweighting process. In Australia, the Census is conducted by the Australian Bureau of Statistics once every five years, and information about the personal, family and dwelling characteristics of all Australians is collected. The Census has the advantage (in contrast to a sample survey like the AUWI survey) of providing data at a high level of spatial disaggregation, however it provides no information on SWB and quality of life that is available in the AUWI Survey. The 2011 Census was conducted on the 9 August 2011, and gives details of all people (including visitors) for each dwelling.

The Census provides information on both counts based on place of enumeration and counts based on place of usual residence (PURP). The Census count for Place of Enumeration is a count of every person in Australia on Census Night, based on where they were located on that night. This may or may not be the place where they usually live. This includes people classified as visitors, or in the Statistical Area level-1 (SA1s) of ‘off-shore’, ‘shipping’ and ‘migratory’ areas. Off-shore includes persons enumerated on an oil rig/drilling platform etc. Shipping includes persons enumerated on board vessels departing for an overseas port; and migratory covers all people who are in transit on long distance trains, buses and aircraft on Census Night (ABS 2006, p.171).

The Census count for usual residence is a count of every person in Australia on Census Night, based on the area in which they usually live. Each person is required to state their address of usual residence in a question on the Census form. Where sufficient information is provided, this enables the area in which they usually live to be identified and coded. Census counts compiled on this basis minimise the effects of seasonal factors such as the school holidays and snow season, and provide information about the usual residents of an area as well as internal migration patterns at the state/territory and regional levels.

Typically in surveys, data are collected from the usual residents of a household, and visitors are excluded. Therefore, to match as closely as possible the survey, we have used benchmarks based on the counts for the usual address of the person. However in some special cases where we have used benchmarks on the family characteristics and the household dwelling classifications at a person level such as dwelling characteristics, household characteristics and household income and expenditure, we had to resort to person counts based on the place of enumeration as the usual residence data were not available – the Census only collected the location of their usual residence, not the dwelling characteristics and information on all the other householders to calculate household income in their usual residence. In this case we have confined the scope of our benchmarks to only people who were in their usual place of residence on Census night. People classified as visitors, or in the Statistical Areas-1 of ‘off-shore’, ‘shipping’ and ‘migratory’ areas were excluded. This is not exactly the same as the ‘Usual Residence’ population, as for this population, visitors are moved back to their place of usual residence rather than treated as being out of scope. Because of this there will be some slight discrepancies in our data, and to adjust for these, we have inflated the person counts
based on the place of enumeration in SA2s in our benchmark tables to match the counts for the usual address status of the persons.

Most benchmark tables are multi-dimensional, as they are cross-tabulations of the variables we benchmark to. While for the earlier versions of SpatialMSM, most of the benchmark variables have been sourced via special tables requested from the ABS, this difficulty has now been overcome by Census TableBuilder software in which the census data can be sourced directly from the Census files rather than through an ABS data request.

Most surveys, including the AUWI, do not collect information about persons living in non-private dwellings (eg, hospitals, boarding schools, prisons and nursing homes), whereas the Census does include this information. Given this inconsistency, information about non-private dwellings can either be deleted from or added to each data source in order to make them directly comparable.

In pre-2008 versions of SpatialMSM, persons in non-private dwellings existed (and were possibly non-excludable) in the Census benchmark table “labour force by age by sex” (a person-level benchmark table). However, more recently special data supplied by the ABS and TableBuilder have made it possible to remove the NPD population from this important benchmark table.

The Census data also contains information about ‘Other non-classifiable households’, which are not included in the AUWI Survey data. ‘Other non-classifiable households’ are described as those households that contain no persons aged over 15 years; that the collector deemed occupied but was unable to make contact with any occupants; or where the information supplied on the Census form was inadequate (ABS, 2011). This discrepancy between the two data sources has to be corrected to make the data as consistent as possible. In earlier versions of SpatialMSM, there was a practice to create a “pseudo” non-classifiable population by duplicating all household records on the Survey of Income and Housing (SIH), thereby giving these households exactly the same characteristics as the classifiable households. Later on this was considered to be an inadequate solution, and for the latest models special request benchmark tables from the ABS had excluded non-classifiable households (also see Cassells et al. 2010). For this Wellbeing SpatialMSM, we have been able to exclude the ‘Other non-classifiable households’ along with ‘Visitors only household’ in TableBuilder.

Visitors only household are households where all people enumerated are visitors. All households and family classifications in the Census are based on the relationships of people usually residing in the household. This applies when there is at least one person aged 15 years and over present. In these classifications, people temporarily absent are included, and visitors are excluded. The relationship of visitors to one another, or to any resident (including cases where all the people enumerated are visitors) is not further classified and the households containing only visitors are excluded from family variables and the internal migration variables (ABS, 2011).

Due to the nature of the collection of the Census data (non-interviewer assisted), the data contain fully and partially not-stated values. Since the AUWI Survey is a telephone survey, non-response households do not exist in the sample. In order to be able to benchmark the AUWI survey to the Census tables that contain ‘not stated’ values on different variables, the not stated values were redistributed amongst other known categories. This redistribution was
proportionate, based on the relative frequency of the true values of the known categories, so the not stated values were extrapolated out to other valid values (also see Cassells et al. 2010).

The AUWI Survey is a national sample of people aged 18 years or over and fluent in English. Interviewers asked to speak to the person in the house who had the most recent birthday and was at least 18 years old. An even geographic and gender split was maintained at all times through the survey. Because of this, the census benchmarks needed to be adjusted so as to match the age profile of the survey. Therefore in all Census tables, persons aged between 0 and 17 years were excluded.

### 3.2 Benchmarking Variables

The benchmarking variables are important, as they will determine the quality of the final estimates. The benchmarks have to be correlated to SWB, and an extensive literature review was used to identify these variables.

The variables to be used for reweighting need to be available on both the Census and the AUWI survey; and need to be defined in the same way on each data source. Sometimes aggregation of categories needs to be done to get comparable categories between the survey and the Census.

The first step was to examine the variables in previous AUWI surveys and compare them with questions from the 2011 census. The aim of this exercise was to identify similar questions in the AUWI Survey and the Census for reweighting. Along with standard demographic and socioeconomic characteristics of the population such as age, sex, income and household type, other variables in the Census have been analysed because they could potentially have an impact on SWB and have equivalents in the AUWI Survey. So, the aim is to look for variables or derived variables that are comparable between the survey and the Census, and have a demonstrated impact on SWB.

The next section compares a number of variables in the Census and the AUWI Survey that are similar, discusses the advantages and disadvantages of using these variables for the SpatialMSM model, and reports on the decisions to include or exclude each variable.

### 3.3 Demographic Variables

#### 3.3.1 Age

Every person in Australia at the time of the Census is required to report their age. The AUWI Survey also asks respondents for their age. It is helpful that neither database asked for age brackets, so we can create our own age groups for the benchmarks.

The relationship between age and life satisfaction is U-shaped: people in their late teens/early twenties are very happy, then SWB declines as responsibilities of marriage, children, jobs and mortgages start to put pressure on life satisfaction. Subjective wellbeing starts to increase in the 40 to 50 year age group as children grow older and move out, jobs get less stressful and the mortgages get paid off. Life satisfaction continues to increase after retirement age, and as
long as physical health and functioning is maintained, can keep increasing into the 80s (Cassells, et al. 2010).

This research uses ten year age groups, which is considered narrow enough to take into account the U-shaped life satisfaction profile. The age brackets start from 18-24, 25-34 and so forth with the final one being ‘95 and above’. These intervals have been chosen as two major milestones in terms of retirement options commence at age 55 and 65 (access to superannuation and access to the age pension, respectively) which allow people to make employment choices that affect their life satisfaction.

3.3.2 Sex/gender

Both the Census and the AUWI Survey ask about gender. Earlier AUWI surveys showed that women had higher life satisfaction levels than men, but men have closed the gap in recent years (Cummins et al, 2012).

3.3.3 Citizenship, country of birth and ethnic background

The Census asks three questions on this issue:

- In which country was the person born? The options given are Australia, England, New Zealand, Italy, Vietnam, Scotland, Greece, other (specify)
- What is the person’s ancestry? The options given are English, Irish, Italian, German, Chinese, Scottish, Australian, other (specify). Respondents can choose up to two options.
- Is this person an Australian Citizen, yes or no.

The AUWI Survey asks the following questions:

- In which country were you born? Every possible option is listed.
- What is your ethnic origin? Every possible option, including Antarctica and the Holy See, are listed; plus ‘inadequately described’ or ‘not stated’
- What is your citizenship? Again, every possible option is listed.

The main way in which a person’s citizenship, country of birth or ethnic background can affect life satisfaction is if the respondent comes from a Confucian country (Lau et al, 2005). These countries include Japan, China, Taiwan, Hong Kong and Singapore. Respondents raised in these countries tend to have a mean value of SWB of 65 points, instead of the 75 points reported by other respondents (see Lau et al, 2005). The proposed reason for this difference is not because people raised in these countries have lower levels of wellbeing, but the Confucian culture results in people responding more modestly regarding their satisfaction with elements of their lives.

It will not be feasible to include all three variables in SpatialMSM as it is highly likely that there will be some unusual combinations of country of birth and ethnic origin, for example a respondent might be born in Finland, claim Japanese ethnic origin and have Australian citizenship. These will cause SpatialMSM to have difficulties with reweighting. Items relating to ancestry and ethnic origin are less suitable for inclusion in the model. First of all ‘ethnic origin’ and ‘ancestry’ may not be directly comparable – respondents may not interpret these terms in
the same way. Secondly, the census allows a person to give two ethnic origins, which the AUWI Survey does not.

Of course, this does not mean that using country of birth as a benchmark is perfect – a person who was born in a Confucian country and moved to Australia as an infant or small child is more likely to adopt Australian values and perceptions than those of their Confucian parents. Ideally, this research would have preferred to use country of birth as a benchmark, however, this question was not consistently asked in all AUWI surveys. We therefore did not use a benchmark for Citizenship, Country of Birth or Ethnic Origin.

3.3.4 Family structure

A person’s family structure has an impact on their life satisfaction. People in couple relationships tend to be happier than single persons. Married couples are happier than couples in de facto relationships, unless the de facto couple have a large joint commitment such as buying a house together, in which case their SWB is indistinguishable from that of married couples. Couples with children at home tend to be less happy than couples without children (Cummins et al, 2012).

The Census has a number of derived variables for each person’s relationship in the household, family type and whether a household is a family or non-family household. If a person lives in a family household, they are classified according to their registered marital status, social marital status, relationship to others in the household (spouse, de facto, lone parent, child under 15, dependent student, non-dependent child, other related individual, unrelated individual living in family household, group household member or lone person.) Households are classified as family or non-family households, and families are defined as couple households with no children, couple households with a number of possible combinations of child types, lone parents with a number of possible combinations of child types, or other family types.

The living status or home structure question in the AUWI Survey gives the following options: living alone, single parent, living with partner, living with partner plus others, living with non-partner, living with parents, with one or more adults, with one or more children, with one or more unrelated adults, with children and partner.

There is some difference between household classifications in the AUWI Survey and the Census, which will require recoding of both sources. It is suggested that individuals within each database are classified according to their relationship in the household:

- Member of a couple only (marital or de facto)
- Member of a couple with children (marital or de facto)
- Single person household
- Single parent household
- Adult offspring living with parents
- Group household
This benchmark has been included in the model.

3.3.5 Urban/regional

AUWI surveys have found that the further people are from major city centres (especially Sydney), the happier they are. Some AUWI surveys have asked respondents if they live in major cities, small cities or country towns. An easier measure to use as an estimate of a person’s remoteness is their postcode, and ARIA status (Accessibility/Remoteness Indicator of Australia), which can be readily compared to Census data. This has not been included in the benchmarks. It was initially included by conducting the estimation separately by Capital City and remoteness area, but this gave worse results, so the estimation was conducted for the whole of Australia.

3.4 ECONOMIC VARIABLES

3.4.1 Employment

Employment has been shown to have an impact on life satisfaction levels. Unemployed people tend to be less satisfied with life than employed people. Hours worked also has an impact on satisfaction levels, however it is not the absolute number of hours worked that impacts satisfaction, but whether a person wants to work more or less hours than they actually work. That is, working hours mismatch affects satisfaction more than hours worked.

The official ABS classifications of employment as used in the Census are, broadly speaking, full-time employed (35 or more hours per week); part-time employed (less than 35 hours per week); unemployed and looking for full-time work; unemployed and looking for part-time work; and not in the labour force. Volunteer work is not classified as employment.

The AUWI Survey questionnaire operates differently. One question asks about the respondent’s work status, asking the respondent to nominate which options applied to them, namely full-time paid employment, full-time retired, semi-retired, full-time volunteer, full-time home or family care, full-time study, unemployed and none of these. Similarly, respondents were asked if they are engaged in part-time paid employment, part-time volunteering, part-time study, or casual employment.

There are some difficulties in matching AUWI survey responses with Census labour force classifications. The AUWI Survey does not clarify any formal definition of ‘full-time paid employment’, ‘part-time paid employment’, ‘unemployment’ or ‘casual work’ to respondents, allowing the respondents to answer according to their own understanding of what these terms mean. As a result, respondents may have given answers that are quite different to their standard ABS employment classification, meaning that labour force measures in the AUWI Survey may be different from those used in the census.

The SWB literature consistently shows differences between forms of labour force status, so it is important to examine the AUWI Survey responses to see if they can be reliably weighted against Census data. At a minimum, we can determine if a person is employed or not – there is unlikely to be much confusion as to the definition of paid employment (to the extent that
there might be confusion, for example family workers, they represent a small enough share of the population that they are unlikely to bias the results). One might consider separating the employed into full-time and part-time employed, but this is probably not necessary for the purposes of this project. As discussed earlier, hours mismatch has a detrimental effect on wellbeing, rather than full-time or part-time work. Furthermore, some of the detrimental effect of hours mismatch will be picked up in the income measure. Finally, without some measure of hours worked, it is not possible to reliably classify employed persons as part-time or full-time.

The ABS official definition of unemployed can be broadly summarised as a person not in paid employment, who is looking for work and able to start work within four weeks. The unemployment rate is the percentage of the labour force (those people in work and looking for work) who do not have a job. Using the outputs of AUWI Survey #26 as an example, if we calculate the percentage of people described as unemployed as a percentage of the labour force, the unemployment rate would be 10.5 per cent – about double the unemployment rate at the time. Furthermore, of the people who described themselves as unemployed, one person also stated they were in full-time employment, while nearly half also described themselves as full-time retired.

The survey does ask if respondents are currently looking for work. Some of these people are currently employed. However, an estimate of the unemployment rate of respondents can be calculated by dividing the number of people with no job, who are looking for work, by the number of people who responded with “No job-looking”, “Paid employment- looking” and “Paid employment - not looking”. This produces an unemployment rate of 6.5 per cent, which is reasonably within the ballpark of the unemployment rate of just above five per cent. This measure is used in this work as an estimate of unemployment, using the classifications employed, unemployed and not in the labour force.

3.4.2 Household income

Literature on the relationship between life satisfaction and income recognises that there is a weak, statistically significant positive relationship between the two, which is stronger at lower levels of income.

The Census asks each individual within a household to indicate their total pre-tax income in a series of income brackets. From this, an estimate of total household income (also in brackets) is derived. The AUWI Survey asks each respondent to give an indication of their total household income in brackets (as only one person per household is surveyed).

These income brackets are different between the two sources. They also need to be adjusted for Consumer Price Index (CPI) to bring the brackets into 2011 dollar values to match the Census incomes. The brackets from the survey then need to be regrouped so they line up with the Census income brackets.

The AUWI Survey income brackets have a much higher top value compared to the Census. The highest income bracket on the AUWI Survey was $500K+, because this additional income has a statistically significant effect on wellbeing. The highest bracket on the Census is $260K+, so any
variation in the very high income brackets could not be captured. This is a minor source of variance compared with that derived from the lower income brackets, and household income has been included as a benchmark in the model.

3.4.3 Occupation

As with hours worked, occupation can have an impact on satisfaction, but it is occupational mismatch rather than the occupation itself that affects satisfaction. Both the Census and the AUWI Survey have questions on occupation. However, the AUWI Survey’s occupation options are broad and do not line up with standard ABS classifications for occupations, so it is not feasible to use occupation as a benchmark.

3.4.4 Housing tenure

Generally, people who rent their homes are less satisfied with life than people who own their homes, and homeowners are happier if they own their home without a mortgage. The relationship between the total amount of rent or mortgage paid and life satisfaction is complex; according to the results of AUWI Survey #16, what matters is a person’s comfort with their ability to pay rent or mortgage rather than the absolute dollar amount.

The Census asks about housing tenure - if the dwelling is owned outright, owned with a mortgage, being purchased under a rent-buy scheme, rented, occupied rent free, occupied under a life tenure scheme, or other. The AUWI Surveys #15 and #16 ask whether a person owns or has a mortgage on the place where they live, and if they pay rent where they live. The Census also asks how much the household pays in rent or mortgage as a continuous variable, while the AUWI Survey #16 asks how much rent or mortgage is paid each month in $500 brackets, topping out at $2000.

For this model, the respondents will be classified into four groups in the Census and the AUWI Survey: pays rent, pays mortgage, pays neither and other tenure type.

3.5 SOCIAL VARIABLES

3.5.1 Education

People with higher levels of education tend to be happier than people with lower levels of education. Most of this is due to the higher income and lower risk of unemployment that comes with higher qualifications; when income and unemployment are controlled for, the impact of education on wellbeing is mixed.

The Census asks each individual aged 15 and over for the highest level of schooling completed (Year 12 to Year 8 or below). It then asks if each person has completed a post-school qualification and if so, the nature of their qualification.

The AUWI Survey asks respondents what is the highest level of education they have achieved, and permissible responses vary from survey to survey. Broadly speaking, they fall into the following categories: primary, secondary, technical/trade or university.
Given the breadth of the Census question on education, the relatively narrow focus of the AUWI survey and the mixed evidence on the impact of education on wellbeing, the education variables are not included in the model.

3.5.2 Internet usage

Both Census and the AUWI Survey contain questions about internet access in the household. However, the wording of the questions is different: the Census asks if the internet can be accessed at the dwelling, whereas the AUWI Survey asks if the respondent uses the internet. Responses will not necessarily match; some people will live in a home with internet access but not personally use it, some people will not have internet at home but will use it at work. Also, there is no evidence that internet access is associated with higher levels of satisfaction, so this will not be used as a variable for the Wellbeing SpatialMSM.

3.5.3 Religion

The Census includes a question on religion, and simply asks people to nominate their religion. A handful of common options are given, and if people choose ‘other’ they are asked to specify their religion. The AUWI Survey also asks people about their religion, but in some surveys the wording is slightly different, asking about religious belief or spirituality.

This research would not attempt to reweight on the basis of religion for the following three reasons:

1) It appears from the distribution of responses in the Census that many people respond according to their ‘nominal’ religion rather than what they practice. So in the Census people identify themselves as Anglican or Catholic even though they only attend church for weddings and funerals. Seventy per cent of Census respondents reported themselves as having a religion of some sort; that is, they provided an answer to the question that was not atheist, agnostic or no religion. However, the AUWI Survey seeks questions regarding a person’s actual faith or practice, and survey results show that substantially less than seventy per cent of respondents reported religious faith. This discrepancy between nominal religion and religious practice means these questions may not be comparable.

2) The AUWI Survey offers respondents the choice of Buddhist, Christian, Hindu, Muslim, Jewish, no religion or other. In the 2011 Census, respondents are prompted to choose their denomination of Christianity, with Catholic, Anglican, Uniting Church, Presbyterian, Greek Orthodox, Baptist and Lutheran provides as options; along with Buddhism, Islam and ‘other, please specify’. Thirty one per cent of Census respondents did not profess to a religion; and 61 per cent identified as some sort of Christian, leaving only eight per cent of Australians identifying with other religions.

3) Although some research in other countries suggests a relationship between religion and life satisfaction, no such relationship appears to exist in Australia. The AUWI Survey has not found any evidence so far that religious people – nominal or practising – have significantly different life satisfaction than other Australians.

For these reasons, religion will not be used as a benchmark to estimate SWB.
3.5.4 Caring and needing care

AUWI Survey 17.1 was specifically focused on carers. It found that carers had substantially lower levels of SWB than the general population, so low, in fact, that the average SWB score for carers was at a level that suggests moderate depression.

The Census has three questions on whether the respondent requires care:

1) Does the person ever need someone to help with, or be with them for, self-care activities?
2) Does the person ever need someone to help with, or be with them for, body movement activities?
3) Does the person ever need someone to help with, or be with them for, communication activities?

For each question, the response options are Yes, always; Yes, sometimes; or no. Similar questions are asked in the AUWI Survey.

However, these are not about an individual’s caring responsibilities, rather they are about a person’s need for care. Despite the importance of caring responsibilities in a person’s wellbeing, it is not possible to match the AUWI Survey responses appropriately to Census responses, so caring responsibilities cannot be included in the modelling.

3.6 FINAL BENCHMARKS

A full list of benchmark variables used for the spatialMSM is shown in Table 2.

Note that Rent and Mortgage were not included in this list of benchmarks as there were technical issues matching the data between the two datasets; but Tenure is included.
Table 2 Benchmark variables and categories available for reweighting process

<table>
<thead>
<tr>
<th>Benchmark Variable Name</th>
<th>Categories available</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGEP- Age of the person (Concatenated age groups)</strong></td>
<td>Age of the person</td>
</tr>
<tr>
<td></td>
<td>1=18-24 years</td>
</tr>
<tr>
<td></td>
<td>2=25-34 years</td>
</tr>
<tr>
<td></td>
<td>3=35-44 years</td>
</tr>
<tr>
<td></td>
<td>4=45-54 years</td>
</tr>
<tr>
<td></td>
<td>5=55-64 years</td>
</tr>
<tr>
<td></td>
<td>6=65-74 years</td>
</tr>
<tr>
<td></td>
<td>7=75-84 years</td>
</tr>
<tr>
<td></td>
<td>8=85 and above</td>
</tr>
<tr>
<td><strong>LFSP</strong></td>
<td>Labour Force Status of Person</td>
</tr>
<tr>
<td></td>
<td>1=Employed – full-time and part-time</td>
</tr>
<tr>
<td></td>
<td>3=Unemployed</td>
</tr>
<tr>
<td></td>
<td>4=not in labour force</td>
</tr>
<tr>
<td></td>
<td>99=Not Applicable</td>
</tr>
<tr>
<td><strong>SEXP</strong></td>
<td>Sex of the person</td>
</tr>
<tr>
<td></td>
<td>1=male 2=female</td>
</tr>
<tr>
<td><strong>TEND</strong></td>
<td>Tenure type</td>
</tr>
<tr>
<td></td>
<td>1= Pays mortgage</td>
</tr>
<tr>
<td></td>
<td>2= Pays rent</td>
</tr>
<tr>
<td></td>
<td>3= Pays neither</td>
</tr>
<tr>
<td></td>
<td>3= Other tenure type</td>
</tr>
<tr>
<td><strong>HIND</strong></td>
<td>Weekly household income</td>
</tr>
<tr>
<td></td>
<td>1= below $199 ($1-$10,399)</td>
</tr>
<tr>
<td></td>
<td>2= $200-$299 ($10,400-$15,599)</td>
</tr>
<tr>
<td></td>
<td>3= $300-$399 ($15,600-$20,799)</td>
</tr>
<tr>
<td></td>
<td>4= $400-$599 ($20,800-$31,199)</td>
</tr>
<tr>
<td></td>
<td>5= $600-$799 ($31,200-$41,599)</td>
</tr>
<tr>
<td></td>
<td>6= $800-$999 ($41,600-$51,999)</td>
</tr>
<tr>
<td></td>
<td>7= $1,000-$1,249 ($52,000-$64,999)</td>
</tr>
<tr>
<td></td>
<td>8= $1,250-$1,499 ($65,000-$77,999)</td>
</tr>
<tr>
<td></td>
<td>9= $1,500-$1,999 ($78,000-$103,999)</td>
</tr>
<tr>
<td></td>
<td>10= $2,000-$2,499 ($104,000-$129,999)</td>
</tr>
<tr>
<td></td>
<td>11= $2,500-$2,999 ($130,000-$155,999)</td>
</tr>
<tr>
<td></td>
<td>12= $3,000-$3,499 ($156,000-$181,999)</td>
</tr>
<tr>
<td></td>
<td>13= $3,500-$3,999 ($182,000-$207,999)</td>
</tr>
<tr>
<td></td>
<td>14= $4,000-$4,999 ($208,000-$259,999)</td>
</tr>
<tr>
<td></td>
<td>15= $5,000 or more ($260,000 or more)</td>
</tr>
</tbody>
</table>
For the Wellbeing SpatialMSM modelling we have used the following five benchmark tables, which are cross tabulations of the above variables and recognised as highly correlated with SWB.

**Table 3 Benchmark tables used for Wellbeing SpatialMSM**

<table>
<thead>
<tr>
<th>No</th>
<th>Benchmark Table</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All household types</td>
<td>Household</td>
</tr>
<tr>
<td>2</td>
<td>Age by sex by labour force status</td>
<td>Person</td>
</tr>
<tr>
<td>3</td>
<td>Tenure by weekly household income</td>
<td>Household</td>
</tr>
<tr>
<td>4</td>
<td>Tenure type by household family composition</td>
<td>Household</td>
</tr>
<tr>
<td>5</td>
<td>Households by weekly household income</td>
<td>Household</td>
</tr>
</tbody>
</table>

### 4 Results

Once the weights are estimated for each small area (SA2) they are applied to the same AUWI survey data set to produce the required small are level synthetic estimates of SWB.

In aggregating SWB to an area level, homeostasis becomes a problem. This is because most individuals in an area have a level of SWB around 75. This means that there was little variation across areas, and any variation is masked in the average. Because of this, we used the method proposed by Tanton et al (2012), which looked at the proportion in an area with SWB below 70 (60 and below) in an area. Tanton et al (2012) found this to be an important ‘tipping point’ in homeostatic failure in SWB. We have also extended this to look at the proportion who have high levels of SWB (above 80).

Figure 1 shows a map of the proportion of people in each area with SWB 80 and above. The breaks in Figure 1 are based on natural breaks where the biggest gaps in the distribution are used to break up the distribution into 5 groups. The darker colour in Figure one represents a higher proportion of people who have SWB of eighty and above and the lightest areas the lowest proportion of people in that category.

It can be seen that areas with a higher proportion of people experiencing high SWB (80 and above) are in regional areas and on the outskirts of cities. These include areas to the North of Sydney and the North-East of Melbourne. Areas in the middle of the city have a lower proportion of people experiencing high SWB. There are also areas in regional Australia where a
A high proportion of people experience high SWB, including mining areas on the coast of Queensland; and areas in the mid coast NSW just North of Sydney.

Figure 1: Map of high Subjective wellbeing in Australia

A simple observation could be that high SWB seems to be related to high incomes, but this is not the case. Areas in the North Shore of Sydney and mining areas in Queensland certainly experience high incomes, but areas of regional NSW, which experience a high proportion of high SWB, do not experience high incomes.

Figure 2 shows areas where there is a high proportion of people experiencing SWB below 60. It can be seen that these are mainly remote areas in Australia, mainly in the NT and Northern WA. There are also areas in some capital cities. The mining areas in Queensland have a very low proportion of people experiencing low SWB. There are also a few areas in capital cities with a high proportion of people experiencing low SWB, but no real pattern to this in the capital cities.
Figure 2: Map of low Subjective wellbeing in Australia

Legend
Proportion of those with lifesatisfaction 60 and below (%)
- 2.85 - 13.61
- 13.62 - 15.46
- 15.47 - 17.37
- 17.38 - 20.64
- 20.65 - 34.37
- Missing

Overall, we have found that a high proportion of people experiencing high SWB seems to occur in some regional areas, but not remote areas; and some areas in capital cities. A high proportion of people experiencing low SWB occurs in remote areas, including the NT and WA, and are also scattered in cities. Regional areas of NSW, Victoria and Queensland do not seem to have many areas with a high proportion of people experiencing low SWB.

5 Validation

Validation of the results from spatial microsimulation is difficult because there are usually no reliable small area estimates to validate against. Some general methods of validation for a spatial microsimulation model can be found in Edwards and Tanton (2013). The SWB estimates obtained from our Wellbeing SpatialMSM are validated using a number of methods outlined in Edwards and Tanton (2013).

One way to validate our estimates is to compare them to areas that we know are reliable. These reliable estimates can either be achieved through aggregation to a larger area; or using another survey that had enough observations in an area to provide a reliable estimate.
The three methods we have used are testing the estimated benchmarks against the actual benchmarks from the Census; an aggregation method which aggregates our estimates to a larger area for which reliable survey estimates are available; and some testing against small area estimates of SWB from a survey of a number of communities in the Murray Darling Basin which provided reliable estimates of SWB for these communities only.

The first method compares the estimated benchmarks from the model to the actual benchmarks from the Census. In theory, these should be very close. Areas where they are different will be areas where the reweighting procedure has not converged. The Total Absolute Error (TAE) is used to test the benchmarks. The total absolute error is the absolute difference between the benchmark and the estimate for each category of each benchmark, summed for each area. The formula is:

\[ \text{TAE} = \sum_p |(X_{cp} - X_{ap})| < \text{Pop}_{sla} \]

Where \( X_{cp} \) is the actual estimate for each benchmark \( p \) from the Census and \( X_{ap} \) is the modelled estimate for each benchmark. If the difference is more than the population in that area (\( \text{Pop}_{sla} \)), the area is rejected as having not converged.

Table 4 shows that overall, there were 105 SA2s excluded using the TAE criteria. This number represents less than 5 per cent of the entire SA2s in Australia. The population in most of the excluded areas is relatively small and thus less than 0.2 per cent of the population are excluded. This is a relatively a good indication that the model managed to get results for most areas in Australia.
Table 4 Number and proportion of excluded areas in the model

<table>
<thead>
<tr>
<th>Area</th>
<th>SA2 that cannot meet the threshold</th>
<th>Percentage of SA2</th>
<th>Percentage of population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Sydney</td>
<td>14</td>
<td>5.05</td>
<td>0.44</td>
</tr>
<tr>
<td>Rest of NSW</td>
<td>6</td>
<td>2.32</td>
<td>0.00</td>
</tr>
<tr>
<td>Greater Melbourne</td>
<td>7</td>
<td>2.52</td>
<td>0.00</td>
</tr>
<tr>
<td>Rest of Victoria</td>
<td>7</td>
<td>4.64</td>
<td>1.10</td>
</tr>
<tr>
<td>Greater Brisbane</td>
<td>8</td>
<td>3.40</td>
<td>0.00</td>
</tr>
<tr>
<td>Rest of Queensland</td>
<td>9</td>
<td>3.10</td>
<td>0.09</td>
</tr>
<tr>
<td>Greater Adelaide</td>
<td>7</td>
<td>6.42</td>
<td>0.00</td>
</tr>
<tr>
<td>Rest of SA</td>
<td>2</td>
<td>3.33</td>
<td>0.02</td>
</tr>
<tr>
<td>Greater Perth</td>
<td>18</td>
<td>10.65</td>
<td>0.00</td>
</tr>
<tr>
<td>Rest of WA</td>
<td>4</td>
<td>5.19</td>
<td>0.00</td>
</tr>
<tr>
<td>Greater Hobart</td>
<td>1</td>
<td>2.86</td>
<td>0.00</td>
</tr>
<tr>
<td>Rest of Tasmania</td>
<td>2</td>
<td>3.23</td>
<td>0.00</td>
</tr>
<tr>
<td>Greater Darwin</td>
<td>6</td>
<td>13.95</td>
<td>0.08</td>
</tr>
<tr>
<td>Rest of NT</td>
<td>2</td>
<td>8.33</td>
<td>4.47</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>12</td>
<td>11.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Other Territories</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Australia</td>
<td>105</td>
<td>4.81</td>
<td>0.19</td>
</tr>
</tbody>
</table>

While the TAE shows that we got results for most areas in Australia (ie, the model converged), it says nothing about the accuracy of these results. The next form of validation was to look at the accuracy of the results at an aggregate level, so to compare the aggregated Australian and State level estimates from our model to reliable State level estimates from two surveys. These surveys were the AUWI survey (which was used in the estimation process) and the HILDA survey (which is external to the estimation process). Looking at mean values of SWB first, it can be seen from Table 5 that there is not much variation between the States, but that the modelled estimates are close to the survey estimates. The HILDA estimates are generally slightly higher than the AUWI Survey and modelled estimates, which may be because HILDA uses a slightly different question.

Because there was not much variability in the average values, we also looked at the proportion with SWB 60 and below; 80 and above; and exactly 70. These results are also shown in Table 5. It can be seen that the aggregated model estimates were closest to the AUWI Survey estimates, probably because it was this survey that was used for calculating the small area estimates. The main States that showed a difference were WA and the ACT. In WA the proportion of people on the AUWI Survey estimated as having a value 60 and below or 80 and above was different to our modelled estimates; however the exactly 70 value was very similar. The HILDA values for Tasmania were also different; but for all other States the values were similar.

The values in WA may have been different because our spatial microsimulation model derives estimates for remote areas, which the surveys usually do not cover. Tanton et al (2011) found
that estimates of poverty from the SpatialMSM model were much higher for the NT than estimates from the ABS Survey of Income and Housing, possibly because the ABS sampling frame did not cover remote areas in the NT where higher poverty rates were experienced. This may be the same with these estimates. This may also explain the high ‘60 and below’ modelled estimate in the NT – the model is getting more people with low SWB in the remote NT communities that the surveys are not capturing.

All other estimates look reasonable against at least one of the other surveys – so the modelled estimate for ‘60 and below’ and ‘exactly 70’ in the ACT is different to the AUWI Survey result, but is similar to both the HILDA estimates.

### Table 5 Results from validation of the SpatialMSM estimates of SWB against other aggregate data sources

<table>
<thead>
<tr>
<th>Data Sources</th>
<th>NSW</th>
<th>VIC</th>
<th>QLD</th>
<th>SA</th>
<th>WA</th>
<th>TAS</th>
<th>NT</th>
<th>ACT</th>
<th>AUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HILDA W9</td>
<td>78</td>
<td>79</td>
<td>79</td>
<td>78</td>
<td>79</td>
<td>80</td>
<td>81</td>
<td>78</td>
<td>79</td>
</tr>
<tr>
<td>HILDA W8</td>
<td>78</td>
<td>79</td>
<td>79</td>
<td>77</td>
<td>79</td>
<td>80</td>
<td>80</td>
<td>77</td>
<td>78</td>
</tr>
<tr>
<td>AUWI Survey</td>
<td>77</td>
<td>77</td>
<td>76</td>
<td>77</td>
<td>75</td>
<td>76</td>
<td>79</td>
<td>79</td>
<td>77</td>
</tr>
<tr>
<td>Wellbeing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SpatialMSM</td>
<td>78</td>
<td>78</td>
<td>77</td>
<td>77</td>
<td>78</td>
<td>77</td>
<td>77</td>
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<tr>
<td>Average of life satisfaction</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HILDA W9</td>
<td>13.4</td>
<td>11.6</td>
<td>11.7</td>
<td>13.9</td>
<td>12.2</td>
<td>10.6</td>
<td>10.5</td>
<td>14.8</td>
<td>12.5</td>
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<tr>
<td>HILDA W8</td>
<td>13.1</td>
<td>11.1</td>
<td>11.7</td>
<td>14.8</td>
<td>10.9</td>
<td>11.8</td>
<td>5.5</td>
<td>16.4</td>
<td>12.2</td>
</tr>
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<td>AUWI Survey</td>
<td>17.0</td>
<td>16.3</td>
<td>16.2</td>
<td>15.7</td>
<td>19.9</td>
<td>15.6</td>
<td>12.2</td>
<td>6.1</td>
<td>16.6</td>
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<tr>
<td>Wellbeing</td>
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</tr>
<tr>
<td>SpatialMSM</td>
<td>15.3</td>
<td>15.1</td>
<td>15.9</td>
<td>15.9</td>
<td>14.8</td>
<td>16.3</td>
<td>17.1</td>
<td>14.5</td>
<td>15.4</td>
</tr>
<tr>
<td>Proportion with life satisfaction level of '60 and below'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HILDA W9</td>
<td>67.2</td>
<td>69.8</td>
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While these aggregate results are useful, they don’t say anything about how well our model predicts small area SWB. To do this, another source of small area SWB needs to be identified. Our SWB estimates were validated against a survey of sustainability (see Hogan et al, 2013) conducted in selected areas in the Murray Darling Basin. This survey used a very similar question as used in the AUWI Survey, the only difference being that the rating requested was 1 – 10, not 0 - 10. The geographic areas did not line up perfectly as the sustainability survey used Local Government Areas as the base geography, so we have looked at modelled estimates for postcodes within the LGA’s that the sustainability survey used.

We also compared the ranks for each of the indicators, as the spatial microsimulation method may provide better estimates of ranks compared to estimating proportions (see Tanton et al, 2011). When looking at maps of these indicators which split the distribution into a number of categories, the ranks are as important as the proportions.

The results are shown in Table 6. It can be seen that there are mixed results from this validation. The results for Tamworth, St George and Waikerie were similar; but there was a very high proportion of people with low SWB on the survey in Liverpool Plains, Narrabri and Walgett. Walgett also had a very low proportion of people with high SWB in the sustainability survey.

Generally, the estimates from the model were much more stable than the estimates from the survey. The proportion of people with life satisfaction 80 and above validated well when comparing the modelled estimates to the survey estimates, with Gunnedah/Warrumbungles being the only area that did not validate well for this indicator. The modelled estimates for the proportion of people with Life Satisfaction 60 and below were generally lower from our model, suggesting we may not be capturing some local level effects on low SWB in these areas – possibly the effect of the drought. Estimates of the proportion of people with life satisfaction at 70 were higher in our model, probably due to the lower estimates of people with low life satisfaction.

Looking at the ranks for each variable, we find some that are close; but then some that are very different. For example, Gunnedah/Warrumbungles had the lowest proportion of people with low life satisfaction in the survey; but the highest in the modelled data. This area also had the highest proportion of people with life satisfaction of 80 and above in the survey; but the second lowest proportion in the modelled data.

Part of what we are seeing in Table 6 is that the modelled estimates are much more stable than the survey estimates, and there may be a number of reasons for this. The main reason is that the model used to derive the modelled estimates uses regression coefficients and benchmarks of indicators that are fairly stable, so there is an inherent smoothing process in the model. The other reason is that the survey estimates take into account local variation in SWB, which the modelled estimates might not pick up as well if these variations are not to do with the benchmark variables.
We also tried to validate our SWB estimates against the Community Indicators Victoria database (Community Indicators Victoria, 2007). Community Indicators Victoria provides a community wellbeing indicator framework with local level data in the state of Victoria with the purpose of improving citizen engagement, community planning and policy making. Community Indicators Victoria presents data and reports on the wellbeing of Victorians using an integrated set of community wellbeing indicators. These indicators included a measure of SWB. However, we found some issues validating against the CIV data, and so these results are not published here.

Overall, the validation at an aggregate level was good; but the validation for small areas showed that our modelled estimates were not as good at picking up local factors that affect low SWB. This is not surprising, given that factors that affect low SWB in a community may be factors like a local firm closing down, and even a local tragedy – a car crash with teenagers. These factors are very hard to predict in a model. What we can say is that the model seems to
predict normal and high SWB well in most communities – there was only one community that had a very low proportion of people with SWB of 70 (Walgett) that the model could not predict. Again, this may be due to a local factor in this community.

The validation has shown that while high and normal SWB are estimated reasonably well, low SWB has not been. We would therefore caution against using the estimates of low SWB for detailed spatial analysis. While our model seems to be able to identify broad spatial trends in low SWB (so, for example, the fact that remote areas have a higher proportion of people with low SWB), it cannot estimate small area low SWB due to localised factors that can affect SWB that are not in the model. We would therefore recommend that researchers wanting to look at low SWB for a particular small area need to conduct a survey in the area to measure SWB.

6 Discussion of results

Overall, the validation has shown that the model seems to predict high and medium SWB reasonably well; but has problems predicting local level low SWB. Having said this, Figure 2 shows that the areas that have a high proportion of people experiencing low SWB are in remote areas, which is consistent with looking at the AUWI survey by ARIA classification.

What the model is able to do is show where, given factors that we know affect SWB, there will be high or low levels of SWB. What the model cannot do is take into account very local factors, like a car accident in an area which may have affected SWB. Previous variables estimated using the spatial microsimulation method like poverty or housing stress are not as affected by these local factors (see Tanton et al, 2009b).

Overall, the results do show a high proportion of people with high levels of SWB on the outskirts of capital cities; and in inner regional areas. There is a mix of SWB in inner city areas – most cities have a mix of areas with high and low proportions of people with high SWB.

The proportion of people with high SWB decreases in more remote areas, although mining areas in Queensland still experience a high proportion of people with high SWB.

Looking broadly at the results for low SWB, and recognising the issues in the validation, we see that remote areas have a much higher proportion of people experiencing low SWB. In particular, remote areas in the Northern Territory have a high proportion of people experiencing low SWB. Regional areas generally seem to have a lower proportion of people experiencing low SWB, and in capital cities there are pockets where a high proportion of people are experiencing low SWB.

7 Conclusions

Recently there has been a focus on indicators of wellbeing, life satisfaction and happiness as measures of a country’s progress due to the shortcomings of traditional economic measures in measuring human progress. While numerous surveys can provide estimates of SWB at a State or national level, it is too costly to run surveys estimating SWB for small areas. Spatial
microsimulation is a tool that can allow estimates of SWB to be modelled for small areas. This paper describes how the Australian Unity Wellbeing Index Survey has been reweighted using a spatial microsimulation model to estimate levels of SWB at a small area level.

The estimates show that higher SWB appears to be on the edge of capital cities, and in some regional areas. Areas with a high proportion of people experiencing low SWB are peppered in capital cities, but are also in remote areas.

Validation of the results shows that areas with a high proportion of people with high SWB seem to be modelled well, areas with a high proportion of people with low SWB are not modelled as well. This may be because we cannot include in our model external factors that can have a significant impact on low SWB, like natural disasters; or localised tragedies which can affect SWB.

What we can say with low SWB is that we have a measure of the risk of low SWB in an area. Assuming there were no other external factors in an area, our estimates can provide a broad picture of SWB in the area. This is a useful tool for analysing broad spatial trends in SWB, it cannot be used to calculate the level of low SWB in an area unless some local knowledge can provide additional information. If looking at a particular area, a researcher should not rely on these estimates, but should use a survey to identify the level of SWB.

The estimates of wellbeing have been made available to the Australian Urban Research Infrastructure Network, and will be available on the AURIN website.
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